CHAPTER 2

REVIEW OF LITERATURE

2.1 Asymptotic Limit of Consumption and Threshold Level of Income
2.2 Factor Analysis and Identification of Clusters of Asian Countries
2.3 Relevance of Convergence and Divergence of Food Consumption
2.4 Food Consumption and Econometric Applications
The econometric estimation of asymptotic limit of consumption, threshold level of income and examining convergence and divergence in different regions is enjoying a revival, due to recent econometric contributions. However, there have been also been significant advances in estimation of maximum potential level of consumption and examining convergence of food consumption. The reciprocal transformation model in estimation of parameters of interest and beta and sigma convergence for examining convergence in cross-sectional data represent methodological refinements of the traditional estimation methods. Their role in policy formulations is mainly determined by the fact how a reciprocal transformation model is specified and estimated.

This thesis reviews methodologies for estimating maximum potential level of consumption, threshold level of income, obtaining structure of food thereby clustering countries and examining convergence and divergence. It also reviews the factors which affect the consumption pattern of any country or region and identifies the variables responsible for change in consumption pattern at macro and micro level.

The changing demographic profiles, increasing income levels, urbanization, technology, globalization and a free flow of ideas from within and outside the country, has brought about a dramatic shift in consumer taste and preferences and ultimately effected the food consumption pattern (Kumar and Sarkar, 2008). Although the study of food consumption is approached with the integrated perspective recently (Petrovici et al., 2005), initially it comprised of fragmented studies (Ritson et al., 1986). Most of the studies are focused on determinants of change in food consumption (Senauer et al.,
There are studies which investigated disparities in food consumption on the basis of social class (Tomlinson and Warde, 1993). One of the distinctions that have emerged on the basis of economic and non-economic or cultural factors significantly shapes the food pattern (Marshall, 1995; Tangermann, 1986).

Some studies have outlined structural changes in food consumption in Western European countries (Young et al., 1998). Economic factors such as consumer disposable income, and food prices are considered as important influencing factors to affect food consumption patterns during the period 1960 to 1980 (Angulo et al., 2001). Some more factors can be health concerns (Ritson and Hutchins, 1995), advertising, and exposure to mass media information (Verbeke and Ward, 2001; Hawks et al., 2004). Hawks et al. (2004) has also considered cultural influences which can determine perceptions of attractiveness and resulting eating style and can influence consumer preferences.

Recent research has identified other variables responsible for determination of rate and composition of changes in food consumption such as demographic variables (Regmi and Dyck, 2001). Among these the most important is the shift of much of the world’s population from a rural existence, centered on farming, to urban life centered on non-agricultural occupations which in other terms can be termed as urbanization. There are several reasons, as studied by Regmi and Dyck (2001), for the difference in rural and urban food consumption one of which is different lifestyles in different regions. Urban and rural residents require different amount of
calorie intake, with fewer amount of calories required by sedentary urban lifestyle to maintain a given body weight.

Food preferences are changing with time and it has direct concern with food delivery mechanism. With increase in modern retailing there is an increase in access to processed foods or perishable meats, fruits, and vegetables (Regmi et al., 2008). Clark, et al. (1995) has given illustrations regarding decreased calorie consumption pattern per person related to urbanization with an examination of food consumption of Britain between 1770 and 1850, period considered as a rapid period of urbanization. Other than these, one of the topics of seeking heterogeneity in the patterns of food consumption patterns using cross-sectional data (Trail, 1998) and dynamic perspective, the international convergence in food consumption patterns is of growing interest. Blandford (1984) studied calorie intake as the basis to derive clusters of the Organization for Economic Co-operation and Development (OECD) countries using cluster analysis while European countries were under studied by Traill (1998) and reported evidence of increased homogeneity in patterns of consumption of food while Smith et al. (1999) reported the same for alcoholic beverages.

The implications of change in food consumption in any one region can be on production and trade in other countries (Gehlar and Coyle, 2001). Of many determinants like different economic factors - income growth and food expenditures, factors of production, transport costs, and trade policy changes used to explain shifts in trade patterns. Gehlar and Coyle (2001) has considered income growth and its impact on food consumption as the most important determinant in explaining changes in trade patterns over the
period from 1980 to 1995. They have considered consumption patterns to be function of many factors and which may not always directly related to income changes but can coincide with lifestyle changes with greater emphasis on convenience. Due to this factor there can be greater purchases away from home which can reduce preparation costs at the same time the mix of commodities consumed may change. This is the reason why in East Asia per capita consumption has actually dropped in Japan, Taiwan, and South Korea with the increase in per capita income which ultimately is responsible for the preferences for foreign brands or varieties as per capita consumption of that item may remain relatively flat.

Food consumption is the topic which is not only related to merely satisfy the hunger, but has been widely studied for health promotion, treating diseases, building relationships among people and enhancing family values and the most important part is to relate it to the economy of the country. Not only at macro but the topic is widely studied at micro-level. At the household and individual levels food consumption is an important factor that influences, and is influenced by, the national economy. With the development of the economy, food consumption patterns also change and affect the nutritional status of the people (Dien et al., 2004, p. 40). Along with the rising income, in most of the studies, improved access to greater variety of food results in changes in food consumption patterns and specifically for developed countries the preference is towards high-value processed products (Regmi et al., 2001). With increase in income it is expected that globally food demand will increase and with it, especially in developing countries, the food share of total budget is expected to decline. The statement was based on the fact that among 51 countries on average high income countries spend 16 percent
of their expenditures on food, while low-income countries spend 55 percent (ERS 1997). Further, the next section 2.1, throws some light on the literature of estimating maximum potential level of consumption and the cut off level of GDP.

2.1 Asymptotic Limit of Consumption of Food and Threshold Level of Income

In the past there have been evidences in the evolution of food consumption in European countries analyzed by several authors (Besch, 1993; Blandford, 1984; Frank and Wheelock, 1988; Gracia and Albisu, 2001; Meulenberg and Vianne, 1993; Ritson and Hutchins, 1991; Wheelock and Frank, 1989), outlining some of the important findings as follows: trend of decreased proportion of expenditure allocated to food, food consumption reached the maximum level in total food consumption, there was an increase in proportion of taking food away from home and there was a shift in the food consumption structure. These trends indicated that economic growth was common to all the European countries. The reason for consumption reaching the maximum level in the total food category was that people wanted to eat better as their daily intake requirements diminished and in wealthy countries generally quantity surpassed by quality concerns. The proportion of shift in food consumption structure was not homogenous for all the European countries, it varied depending on their cultural and historical evolutions. The last trend, of increase in proportion of food taking away from home, was almost common for all countries but it varied in its intensity among countries and labor circumstances.
Brunso et al. (1996) studied food consumers, from French, German, British and Danish, and classified them into five segments namely ‘uninvolved,’ ‘careless,’ ‘rational,’ ‘conservative,’ and ‘adventurous’. Important characteristics of ‘uninvolved’ segment were low degree of stability, low brand loyalty, and high susceptibility to price. ‘Careless’ consumers were interested in new products which required fewer efforts to cook the food while very opposite characteristics were noted for the segment ‘rational’ which included more receptive consumers to higher quality food products in terms of their characteristics, healthiness, freshness, and naturalness/ecology. ‘Conservative’ consumers were interested in looking and shopping with a resistance towards changing food habits and new products. There was an inclination towards self-fulfillment, creativity, and social events with the interest in product characteristics and price for those who belonged to ‘adventurous’ cluster. Hence there does not exist any typical nature of customer but their behaviour with respect to food consumption was dependent on the situation they faced. So with respect to European countries was concluded that there had been a saturation point in the markets of European Union with quantities consumed had reached a peak. New products and services were searched persistently by agri-food system which would add value. Gracia and Albisu (2001) had basically showed the similarities and dissimilarities that existed in different European countries on the basis of economic factors, lifestyle, and socio-demographic characteristics, just to name a few. Consumption pattern differ among countries although there were common trends.

Economic theory and consumer behaviour suggests three important factors responsible for annual variation in per capita expenditures which is
explained by neoclassical methods of estimating household demand for food. The three important factors are household real income, product price, and the prices of substitute products including nonfood products (Deaton and Muellbauer, 1980 and Gracia et al., 1998) and two more, added by Elsner and Hartmann (1997), as preferences and socio-demographic factors. The models that are based only on these three factors are quite powerful and impressive in predicting (Connor, 1994).

In the earlier studies Adrian and Daniel (1976) studied the impact of socioeconomic characteristics of household and its constituents on consumption of protein, carbohydrate, fat, vitamin A, calcium, iron, thiamine and vitamin C. Socioeconomic factors considered included income, degree of urbanization, race educational attainment of the homemaker, stage of the household in the family life cycle, family size, meal adjustment and employment status of the homemaker. The study showed a positive impact on the consumption of all nutrients except carbohydrate. It was also revealed that the nutrient consumption responsiveness to income was relatively small.

Several studies have focused on specifying the influence of household income and other socioeconomic characteristics on nutrient consumption, but most of these have been limited to localized areas or particular groups of people (Babcock; Einstein and Horstein; Kel-say; Madden and Yoder). Generally, these studies noted significant variations in nutrient consumption with respect to income, education, and race. Saxon (1975) has used the model which explores the effects of prices and substitutes on the consumption of certain products. The results of some of the calculations made using models incorporated prices of substitutes as explanatory
variables. It has showed that a rise in the price of beef appeared to be a factor contributing to increased consumption of pork. The results revealed that prices of pork and chicken did not affect any of the elasticities for beef during the period 1963-1972 while the price of beef had significant effect on the consumption of both pork and chicken.

Saxon (1975) has further studied the saturation level of food particularly in Japan. During the period considered there were evidences of people approaching or reached a level of saturation in food consumption taken as a whole measured in calories. It revealed that this level of saturation level of food is being approached or has reached in most of the economically advanced countries. Estimation of the maximum potential level or asymptotic level of consumption is meaningful in conjunction with other evidence in making some assessment of the likely growth or contraction in the region of Asia. It is generally acknowledged that income and price are by no way the exclusive determinants of food consumption, although they are thought to be normally the easiest to measure. Other than income and price some additional factors influencing food consumption may be grouped, according to Saxon, under five headings. The headings goes (i) physical need (ii) availability (iii) changes in services (iv) tastes and (v) changes in geographical distribution of the population.

The author has used nine different models to analyze time-series data and three in analyzing cross-sectional model to at least 100 products and groups of products for the three time periods. Of the listed models, the double logarithm and semi-logarithm models generally gave the best fit as indicated by the value of the multiple correlation coefficient (R) and the t values for
the coefficients. The paper has given preference to double logarithm models, the reason being linear in the logarithms and yielding constant elasticities.

Huang (1985) examined the year-to-year variations in per capita consumption for the food category of beef, pork, chicken, turkey, eggs, milk and wheat flour for the period 1954-1983. The model used is able to explain about 97% of the annual variation in demand and is competent enough to match the turning points like peaks and troughs in consumption.

The economic determinant of change in per capita food consumption is long run is variation in real consumer income. In general there is a positive correlation between income and consumption levels. As per the study of Gil et al. (1995) with low income level, food consumption is relatively high and, as income grows, food consumption increases at a lower rate, up to a threshold which is difficult to surpass because of physical limitations, although it generally becomes more diversified. Keeping in mind the instances of total as well as animal products might reach a maximum as income grows. The regression based on reciprocal functional form was used to derive statistical estimates. Because as per Gil et al. (1995) all European countries, except Germany, showed an upward trend in the share of animal calories consumed over the period 1970 to 1980 however, it stabilized or even declined in the decade from 1980 to 1990. The study used regression analysis assuming a reciprocal functional form to estimate statistical estimates separately for both total as well as animal products.

To describe the relationship between income and average daily calorie intake, Petrovici et al. (2005) used the same reciprocal functional form. The
study has assumed that with an increase in income, the total food consumption as well as consumption of animal products will reach a maximum level. To estimate asymptotic level (maximum level) of per capita daily calorie consumption denoted by \(C\); per capita daily calorie consumption derived from animal products (\(Ca\)); per capita daily protein consumption (\(P\)); and per capita daily protein consumption derived from animal products (\(Pa\)), four equations were estimated using data for the year 2000. The gross domestic product (GDP) in purchasing power parity terms was used as independent variable for all the four equations. Other than reciprocal functional form, Petrovici et al. (2005) has used a log-inverse function, which also allows to estimate asymptotic limit of consumption. To compare the goodness-of-fit measure of the log-inverse model with the reciprocal model, the approach recommended by Wooldridge (2000) was followed. According to the recommended approach the fitted values \(\log y\) are estimated and then the dependent variable \(y\) is regressed on \(\hat{w}\) through the origin, where \(\hat{w} = e^{b\hat{y}}\). The squared sample correlation between \(\hat{y}\) and the actual \(y_i\) \((r^2)\) in the sample is comparable to R-squared in the corresponding reciprocal function. To specify the model, Ramsey-Reset test was used and the model was well specified with no omitted variables (Ramsey, 1969).

Senugal and Senugal (2006) explored the relationship between income and total calories and animal calories based on the income calories elasticity. Taking into consideration the physiological considerations that total calories and animal calories would increase upto a maximum potential level; the
most appropriate model was reciprocal function which used the equations
given as follows

\[ PC_t = \alpha_0 + \alpha_1(1/\text{PGDP}_t) + e_t \quad \ldots (2.1) \]
\[ PAC_t = \beta_0 + \beta_1(1/\text{PGDP}_t) + e_t \quad \ldots (2.2) \]

where

- \( PC_t \): per capita caloric consumption
- \( PAC_t \): per capita animal product consumption (calories/capita/day)
- \( \text{PGDP}_t \): real per capita GDP in US dollars, at 1990 domestic prices and exchange rates
- \( \alpha_0, \beta_0 \): the upper asymptotes (maximum potential consumption levels)
- \( \alpha_1, \beta_1 \): coefficient on the income variable
- \( e_t \): disturbance term

The model was tested for its validity and specification error before estimating the parameters of the variables using Durbin-Watson \( d \) statistic and Ramsey’s RESET (regression specification error test). Ordinary least square (OLS) was used to estimate equation (2.1) and (2.2) except, for the cases where there existed a positive correlation in the residuals, equations were estimated using generalized least squares (GLS). The models like eq (2.1) and (2.2) have built in them an asymptote or limit value that the dependent variable will take when the independent variable increases indefinitely (Gujarati, 2007). The income elasticities decreased in all countries for both total and animal products consumption over the period considered due to specific property of the reciprocal functional form (Senugal and Senugal, 2006).
Asymptotic limit of consumption is estimated not only in panel data but also in aggregate pooled data, cross-sectional data and clusters of Asian countries. To classify Asian countries on the basis of homogenous food structure there is a need to understand the method of identifying structure of food as well as methods of classification of Asian countries. To understand the same, the next section 2.2, on factor analysis and identification of clusters of Asian countries is described in detail.

2.2 Factor Analysis and Identification of Clusters of Asian Countries
Tracing back to the meaning and evolution of cluster, cluster analysis was first discussed in the social sciences during the 1930’s (Driver and Kroeber, 1932). At that time cluster analysis was considered to be “poor man’s factor analysis” (Tryon, 1939). Tryon’s major method of clustering was called key cluster analysis. The key cluster analysis was a method which was likely different from multiple group factor analysis and was designed to find directly, without rotation, oblique factors which pointed at clusters of variables. He proposed OTYPE analysis which was designed to find clusters with optimal homogeneity in terms of the cluster scores derived through key cluster analysis. Due to this reason it did not engrossed significant attention until the late 1950’s and early 1960’s. Sokal and Sneath (1963) stimulated the interest in the subject with the publication of Principles of Numerical Taxonomy with the focus on biological taxonomists. Reasons for grabbing attention were (1) clear discussion on number of different cluster analysis techniques (2) promotion of usage of computers in classificatory research and (3) advocating the radically empirical approach to biological taxonomy.
Along with this publication, usage of high speed computers stimulated the growth of interest which made the use of cluster analysis practical.

Blashfield and Aldenderfer (1978) have thrown light on the literature of cluster analysis revealing that the growth of interest in cluster analysis varied somewhat for different general scientific areas. During the 1960's, the literature grew in the areas of medicine and biological sciences and during 1970's it was cached by the social sciences, particularly anthropology and psychology. Cluster analysis has most frequently been employed as a classification tool. It has also been used by some researchers as a means of representing the structure of data via the construction of dendrograms (Hartigan 1967) or overlapping clusters (Arabie et al. 1981; Shepard and Arabie 1979). Cluster analysis is a statistical method for classification. Unlike other statistical methods for classification, such as discriminant analysis and automatic interaction detection, it makes no prior assumptions about important differences within a population. Cluster analysis is a purely empirical method of classification and as such is primarily an inductive technique (Gerard 1957).

Williams (1971) has defined cluster in such a way that the members of cluster does not require any internal relationship but it must be separated by some comparable negative relationship from all other elements that might be potential members of the cluster. Cattell and Coulter (1966) has given different terminologies and has defined hemostat, or stat for short, as a group defined entirely by internal similarities. Williams felt the first need of any clustering procedure which required definition of a numerical model enabling to translate intuitive concept of "likeness" into some measure
which has a convenient symbolic representation, and is amenable to numerical manipulation. Williams has given major classificatory strategies as nonexclusive and exclusive, extrinsic and intrinsic, hierarchical and nonhierarchical, divisive and agglomerative, monothetic and polythetic and serial optimization and simultaneous optimization strategy. Blashfield and Aldenderfer (1978) have discussed the existence of a large number of different cluster analysis methods mostly falling into two families: hierarchical agglomerative methods and iterative partitioning methods.

Sneath and Sokal (1973) have discussed single linkage, complete linkage and four types of average linkage methods. To minimize the variance within clusters, there are at least three different methods, according to Anderberg (1973) and Ward (1963). Ward proposed the clustering method which was a variant of the popular hierarchical agglomerative methods of cluster analysis. He introduced the way to use a hierarchical agglomerative method to optimize some “objective function”. The objective function which Ward used as an example was the error sum of squares within clusters. In other words, Ward’s method was concerned with the minimization of the variance within clusters, in so doing maximizing the variance between clusters.

According to Johnson (1967), the hierarchical clustering method proposed by Ward appeared useful, but he was apprehensive with some of the characteristics of Ward’s method. And then he discussed two alternative hierarchical methods and a theoretical rational for why he believed that the methods proposed by him were more desirable than proposed by Ward. Single linkage and complete linkage were the two methods proposed by Johnson. These methods were designed to be invariant under monotonic
transformations of the similarity matrix and to preserve the ultra metric inequality. Instead of using conventional names of single linkage and complete linkage, the author described them as the “minimum method” and the “maximum method,” because the two methods could be concisely described as minimizing or maximizing a particular function. In the computer program, Johnson described complete linkage as the “diameter method” while single linkage was called the “connectedness method.”

Clifford and Stephenson (1975) have introduced two methods which are concerned with optimizing information statistics for cluster structures. With the aim to study the variations on complete and average linkage methods (McQuitty, 1967) and another variation on complete linkage by Carlson (1972). Lance and Williams (1967a) have advocated a generic hierarchical agglomerative method which is based upon theoretical overview of these methods of flexible beta method.

In addition to the hierarchical agglomerative methods, hierarchical divisive methods have also been proposed in the biological sciences by Edwards and Cavalli-Sforza (1965) and have been used in ecology by Clifford and Stephenson (1975) and in anthropology by Peebles (1972) and Whallon (1972). Bezdek (1974a and 1974b), Ball (1965), and Friedman and Rubin (1967) focused on iterative partitioning methods which are generally recognized in literature and in statistics. Tryon (1939); Tryon and Baily (1970); Lorr and Radhakrishnan (1967); Jones (1968) and Wishart (1969) are the psychologists who have proposed a number of clustering methods whose logic is related to that of factor analysis.
To show relationships among objects at increasing levels of similarity, hierarchical cluster analysis is a general term for mathematical methods. It is a useful tool for classifying data because it produces a dendrogram that clearly emphasizes similarities and differences in the data (McInnis et al., 1990). Also, it is considered the most suitable method to study comparisons among diet samples, but has received little attention in food habits research (McInnis et al., 1990). To explore the degree of similarity in the evolution of the structure of calorie intake across European countries, cluster analysis was used (Gil et al., 1995). The aggregates of countries were derived on the basis of overall similarity of consumption across the entire set of products over the period from 1970 to 1990. The countries were grouped on the basis of same inertia in relation to their diet structure. Results obtained from this study were different from that found by Henson and Loader (1991) although a different set of countries was considered.

The methodology applied by Petrovici et al. (2005) included standardized z score variables and ensured equal weightage to each item, suitable when indicators with different measurement scales were included in the analysis. The methodology stressed on the hard-core cluster, defined as similarities in all the dimensions evaluated in terms of different classification methods with the key feature of being stable member irrespective of the classification method. To measure homogeneity in different dimensions there is an effort to identify underlying dimensions of food consumption pattern. Hence factor analysis was applied and factor scores were generated from the estimated factor structure. Factor scores were calculated using the relationship as given below:
\[ F_{jk} = \sum w_{ij} x_{ik} \quad \ldots (2.3) \]

Where \( F_{jk} \) is the factor score for the object \( k \) with regard to the factor \( j \); \( w_{ij} \) is the coefficient of the factor score corresponding to the relationship between variable \( i \) and the factor \( j \); \( x_{ik} \) is normalized value of variable \( i \) for the object \( k \). The coefficients of the factor score are similar to coefficients \( \beta \) in an equation where dependent variables represent the factors and the independent variables are the observed variables. These factor scores are saved as regression variables corresponding to each observation in the sample and then ultimately used in cluster analysis with the classification based on the homogeneity in the scores related to the dimensions of food consumption patterns. Punj and Stewart (1983); and Ketchen and Shook (1996) recommended to apply factor analysis with orthogonal rotation and resultant uncorrelated factor scores were further used as an input to cluster analysis addressing the issue of multicollinearity. Hierarchical classification method was employed to study homogeneity in food consumption patterns, as described by the contribution of main food groups to the dietary intake.

The country grouping reported by Petrovici et al (2005) is different from that by Henson and Loader (1991) while it is similar to Gil et al (1995) study. But if it is related to Gil et al (1995) the study employs a more detailed number of products. The results indicated that from 1970-1990 until 2000, there was stability in some clusters while there was seen a change in other with changing patterns in each country. The study identified some macro-environmental factors responsible for the disparity between the blocks of Eastern and Western Europe like low income, high inflation and food budget share. The study used large number of indicators and that is why it leads to a
reduction in the number of hard-core clusters. Also overall analysis of the study (Petrovici et al, 2005) suggested that to determine homogeneous countries in respect of their food consumption patterns a broad set of variables is to be observed. The results showed the heterogeneity of patterns of nutrient intake in Europe. The main disparity between the EU and the CEECs candidates to accession is related to the proportion of animal products in the nutrient intake (Petrovici et al, 2005)

Senugal and Senugal (2006) have used Hierarchical cluster analysis to determine the degree of similarity in the structure of caloric intake in 15 EU countries and Turkey for two years: 1970 and 2000. Of the two methods, successive mergers (agglomerative method) or a series of successive divisions (divisive method), first method with single linkage (the Nearest-Neighbour) was used to cluster the countries. The distances (similarities) between pairs of Clusters are used as the inputs to a Single Linkage Method and entities by merging nearest neighbours form a group from the individual where the term nearest neighbour connotes the smallest distance or largest similarity (Hair et al. 1997; Johnson and Wichern, 2002). The incorporated product groups into the analysis were cereals, potatoes, meat, fish, vegetable oils, animal fats, milk, eggs, vegetables, pulses, fruits and sugar.

Cluster analysis, unlike other methodologies, lacks in some parts. These shortcomings were discussed prominently by Punj and Stewart (1983). They have discussed some of the problems in using cluster analysis. The authors have thrown light on the way the cluster analysis was a set of methodologies that had developed outside a single dominant discipline. On the other hand, talking about various scaling methods (one of them - factor analysis) which
were developed within the discipline of psychology and the discipline could be looked for guidance in the use of these methods. Regression had tended to be the special province of econometricians, though used in a variety of disciplines, has developed a large body of literature on the technique. In contrast, no single discipline has developed and retained clustering methodology. Rather, numerous disciplines (econometrics, psychology, biology, and engineering) have independently approached the clustering problem.

It was very often that the researchers, while working in parallel in these disciplines, have arrived at similar solutions but had given different names. This can be explained taking an example from the work of Blashfield (1978). He reviewed the literature on hierarchical clustering methods and found as many as seven different names for the same technique. This diversity of names for identical techniques had tended to prevent comparisons of algorithms across disciplines. It had also served to confuse the data analyst by implying a much greater number of available clustering methods than actually exists. Also confronting the potential user of cluster analysis is the problem of cluster definition. For determining the boundaries of clusters or deciding when observations should be included in one cluster or another, there are no clear guidelines. As the purpose and discipline of the researcher changes the preferred definition of a cluster seems to vary.

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Clustering algorithms also exists in various forms. Four primary hierarchical methods are available – single linkage, complete linkage, average linkage, and Ward's minimum variance method. Although there are several variations of the average linkage method, only one, simple average linkage,
is widely used (Punj and Stewart, 1983). In addition, two variants of the average method, the centroid and median methods have very undesirable properties (Aldenderfer 1977; Sneath and Sokal 1973) which recommend against their use. The weighted average linkage method has been shown to produce results very similar to those produced by the simple average method (Blashfield 1977). Ward's minimum variance method, average linkage, and several variants of the iterative partitioning method appear to outperform all other methods. Ward's method appears to outperform the average linkage method except in the presence of outliers (Punj and Stewart, 1983). One conclusion in several of the studies is that the choice of a similarity/dissimilarity measure, or distance measure, does not appear to be critical. Despite the considerable attention given such measures (Green and Rao 1969; Morrison 1967; Sherman and Sheth 1977), the selection of a similarity measure appears to be less important for determining the outcome of a clustering solution than the selection of a clustering algorithm.

To overcome these limitations of cluster analysis Punj and Stewart (1983) have recommended several decisions which affect the structure of a cluster solution. The decisions were grouped in the following broad categories: (1) Data transformation issues (2) Solution issues (3) Validity issues and (4) Variable selection issues. They emphasized that these decisions were not independent of one another with the reason that the choice of a means for addressing one of these issues may constrain the options available for addressing other issues. Taking the validity issues, the researcher had no assurance of having arrived at a meaningful and useful set of clusters even after the analysis of the data set was done carefully and having determined the final cluster solution. This problem was similar to that encountered with
a variety of other procedures ranging from factor analysis to regression analysis. To determine the extent to which the solution differed significantly from a random solution, there was some test or set of tests which were applied.

Milligan and Mahajan (1980) and Milligan (1981) reviewed several such methods for testing the quality of a clustering solution and found them wanting on a number of dimensions. A method suggested by Arnold (1979) appeared to overcome the problems of other methods. Arnold (1979) proposed using a statistic first suggested by Friedman and Rubin (1967) as a test of the statistical significance of a cluster solution. Numerous authors have recommended cross-validating cluster solutions (see, e.g., Sherman and Sheth 1977) and several methods of cross-validation had been proposed.

One of the more frequently used methods involved dividing the sample in half and carrying out clustering on each half. Descriptive statistics of the two sets of clusters were compared to determine the degree to which similar clusters had been identified. The problem with such an approach was that no objective measure of reliability was obtained.

There were several authors who recommended the use of discriminant analysis for cross-validation (Field and Schoenfeldt 1975; Nerviano and Gross 1973; Rogers and Linden 1973). But Punj and Stewart (1983) had commented that using discriminant analysis for validating cluster analysis had several drawbacks. The reason might be that the discriminant coefficients were the poor estimates of population parameters which required cross-validated for themselves. This procedure was not cost-
effective and the sample size available might not be sufficient for cross-validating both the cluster analysis and a discriminant analysis.

McIntyre and Blashfield (1980) discussed an alternative approach to cross-validation. They suggested the procedure which was relatively simple and was easy to implement on a computer. Further, the cluster analysis was useful only in the case if researcher was able to provide a demonstration that clusters were related to variables other than those used to generate the solution. Ideally, the number of variables required to classify individuals should be small. Not only that but it required that the implications drawn from the classification should be beyond the narrow set of classification variables and were required to be demonstrated. To understand the commonness of food consumption and its relevance the next section is elaborated in detail.

2.3 Relevance of Convergence and Divergence of Food Consumption
Topic of convergence has drawn attention for various variables like income, productivity levels, consumer behaviour and food consumption. According to the recent study (Rahman and Hossain, 2008), the literature of income convergence falls into two broad categories. One is based on cross section investigation that focuses mainly on a negative correlation between initial productivity levels and growth rates. The other is based on time series data that focuses on the asymptotic properties of the disparities in productivity levels between economies (Hobijn and Franses, 2000). One of the prominent empirical literatures exploring convergence along with new growth theory by Baumol (1986) falls in first groups, i.e. based on cross section data. To measure the impact of the initial level on the growth-rate of economy,
cross-country regression technique was used. To test convergence, Baumol (1986) initially plotted graph of productivity growth rate, 1870-1979 vs. 1870 level. An absolute level of GDP per work-hour in 1870 was taken on x-axis and growth rate of GDP per work-hour for 110 years on y-axis for Maddison's country showing a high inverse correlation. Further growth rate was calculated using the relation \( y_t = e^{rt} y_0 \) which was ultimately tending to produce spurious appearance of close relationship. When data was plotted on a graph of growth rate, 1950-80, GDP per capita vs. 1950 level for 72 countries it hardly constitute a close fit with \( R^2 \) value virtually equal to zero indicating the initially plotted graph with no tautology. The data for the period 1870-1979 was analyzed using regression and results showed a strong evidence of convergence, with the historically unprecedented growth in productivity, gross domestic product per capita and exports and the remarkable convergence of productivities of 16 industrialized countries Baumol (1986).

The work of Baumol (1986) was then questioned by De Long (1988). In his comment paper he pointed out that if properly interpreted, the results by Baumol were not more informative. The comments on Baumol study included weak interpretation of regression line regarding strength of forces making convergence since 1870 among industrial nations. The sample was selected with bias along with the measurement of independent variable with error. Due to these errors the appearance of convergence was questionable. Further it was recommended to use \textit{ex ante} sample of countries and not \textit{ex post} sample of countries to be used for a fair test of convergence. De Long (1988) found estimates of early GNP per capita for a wider spectrum of countries and showed that a less biased sample exhibits a little convergence.
In the reply paper of Baumol (1988) he has accepted that the inadvertently biased data was used which lead to virtual convergence. As a measure of convergence, coefficient of variation was plotted for the period from 1830 to 1913 for top 8, 9, 10 and 11 countries. Till 1860 all sample countries showed growing divergence (rising coefficient of variation). Convergence was showed in early 1880’s for top 8 countries while slower and later convergence is shown for the other top 9 and top 9 country sample. Further more formal regression analysis using both, a nonlinear relationship and a piecewise linear relation composed of two line segments was fitted to the RGDP data. The results revealed that among 1950 lower-income countries there was a divergence. And convergence was found among the higher-income ones.

Tracing back to previous studies, Barro and Sala-i-martin (1990) examined convergence patterns for economic growth across the U.S. states. The study was based on the analysis on a growth equation that derived, as a log-linear approximation, from the transition path of the neoclassical growth model for closed economies as per Solow (1956), Cass (1965), Koopmans (1965). The data was exploited on personal income back as far as 1840 and on gross state product since 1963. The study found clear evidence for the existence of convergence in the sense of poor economies tending to grow faster than rich ones in per capita terms. The neoclassical model with a limited role for diminishing returns and endogenous growth models with roughly constant returns to capital were considered to fit on facts on convergence. Barro and Sala-i-martin (1991) followed the same research strategy as in (1990) study with the closed economy framework and then considered how the model would be affected by open-economy elements that were important to U.S.
States and European regions. As per Mankiw et al. (1992); Barro and Sala-i-Martin (1995); and Jones (1998) convergence can be of two types either unconditional or conditional. The evidence of convergence for variables other than food consumption was examined on the data of state crop, livestock, and aggregate agricultural total factor productivity (TFP) (McCunn and Huffman, 2000). Methodology used to test the convergence was based on both, conditional convergence using $\beta$-convergence and unconditional convergence using $\sigma$-convergence. The results showed no-support for $\sigma$-convergence while $\beta$-convergence was supported.

It studied $\beta$ as well as $\sigma$ convergence. The $\beta$ convergence analysis reported that similar rate of $\beta$ convergence are consistent with the data for different countries in the US states and European regions for four sub periods 1950-60, 1960-70, 1970-80, 1980-85. While according to analysis of $\sigma$ convergence taking unweighted $\sigma$ standard deviations for the log of per capita GDP for 73 European regions, there is $\sigma$-convergence for regions within countries and not across countries. There is overall decline in $\sigma$ over time for each of the largest European counties. The estimated rates of $\beta$-convergence are similar for 73 regions of seven European countries applied to per capita GDP from 1950 to 85 to those found for United States. According to the report, the neoclassical model does not imply that convergence coefficient $\beta$ would be same in all times and places. The coefficient depends on the underlying parameters of technologies and preferences but not on differences in technologies or government policies that can be represented as proportional effects on the production function. These proportional effects have important influence on steady state output but not on the speed with which an economy approaches its steady state.
Therefore, regardless of variability in economies they exhibit similar rates of \( \beta \)-convergence.

De Long (1988) and Barro (1991) stressed on convergence hypothesis of neoclassical growth model while Barro and Sala-i-Martin (1991) used the same model for convergence across both regions of Western Europe and US states. Mankiw et al. (1992) augmented the Solow growth model by including accumulation of human as well as physical capital and results found were in line with that of Solow showing convergence. Convergence in all such studies was justified by finding a negative cross-section correlation between initial income and growth rates.

However, there were several problems that were faced while using cross-section results. There existed random, but potentially permanent, shocks to per-capita income. These problems lead researchers to formulate a time series notion of convergence (Siriopoulos and Asteriou, 1997). The concept was based on the assumption that an economy’s log per capita income possessed a unit root; Campbell and Mankiw (1989). Further Bernard and Durlauf (1995) defined stochastic convergence as co integration between two or more such series. There was not much evidence to suggest that the time-series convergence hold. Quah (1990) also found little evidence of convergence among large set of capitalist economies while Campbell and Mankiw (1989) and Bernard and Durlauf (1995) found likewise for sets of OECD economies.

After reviewing relevant literature, Siriopoulos and Asteriou (1997) had ultimately used Barro and Sala-i-Martin type of unconditional and
conditional beta-convergence equation to test convergence. The article considered the issue of convergence across Greek regions following the theoretical basis of the neoclassical model of economic growth. The findings do not support the convergence hypothesis for Greece. Breaking up the sample into three time periods showed no significant difference in the estimated convergence coefficients across sub-periods. The inclusion of north/south dummy variable in the regression equation provided evidence in favour of the hypothesis of the existence of dualism between the southern and northern regions of Greece.

Convergence condition for OECD countries was examined by Dowrick and Nguyen (1989) and explored the reasons for convergence, whether it could be explained by differences in the rate of growth of factor intensities or by total factor productivity (TFP). The methodology used included an alternative measure of the degree of dispersion of income levels, as the standard deviation of the logarithm of per capita GDP. It felt from 1950 to 1973 and slightly further by 1985. From these dispersion measures and from visual examination of OECD relative income levels, it was concluded that there has been substantial convergence within the OECD, at least up until 1973, and possible beyond. The results showed an evidence of income convergence among the OECD economies dominantly accounted by the differences in TFP catch-up and, in some cases, by differences in the rate of growth of factor intensities. Similarly Barro and Sala-I-Martin (1992, 1995) ended up with the result in favour of convergence on the basis of cross section approach of convergence. Taylor (1999) found that the period from 1870 to 1914 was an era of convergence for a group of seven countries. The study examined both unconditional (\(\beta\)-convergence) as well as conditional
(σ-convergence) convergence in an alternative setting of neoclassical model termed as ‘open-economy factor accumulation model’ that allowed capital and labor migration. The results were in favour of convergence with a speed of one percent per annum.

Manasan and Mercado (1999) adopted the classical approach to convergence analysis introduced by Sala-i-Martin (1996) to examine the dispersion of per capita incomes across a country’s regions. The models used to study include both δ-convergence and β-convergence. Symbolically the relationship can be defined as follows for δ-convergence:

\[ \delta t + T < \delta t \quad \ldots \ (2.4) \]

where \( \delta t \) is the time \( t \) standard deviation of \( \log(y_{i,t}) \), which is the logarithm of the region’s \( i \)'s GDP per capita at time \( t \). Here convergence for a group of economies is said to occur if the dispersion of the real per capita GDP level decreases. Overall, δ-convergence was evident for the entire 22 year span but variations are significant within sub-periods. Absolute β-convergence occurs if poor economies (regions) tend to grow faster than rich ones. Specifically, \( \beta > 0 \) in the following regression equation indicates absolute β-convergence:

\[ y_{i,t+T} = \alpha - \beta \log(y_{*,t}) + \epsilon_{i,t} \quad \ldots \ (2.5) \]

where \( y_{i,t+T} = \frac{\log(y_{i,t+T})}{T} \), the region \( i \)'s annualized growth rate of GDP between \( t \) and \( t+T \).
Martin and Mitra (2001) used panel data in their study of testing convergence that ended up with findings in favor of convergence. One of the recent studies by Bassino (2005) has also used the same concepts as that used in Barro and Sala-I-Martin (1992), but height is used instead of per capita income. Sigma convergence is measured as the coefficient of variation (standard deviation/average). Beta convergence is measured here as the relation between the growth rate of height during the period investigated and the initial level using the relation given in equation as follows:

\[
\frac{1}{T} \ln\left(\frac{H_{i,t\_T}}{H_{i,t\_T}}\right) = \alpha + \ln\left(H_{i,t\_T}\right) \left(\frac{1-e^{\rho T}}{T}\right) + D_i + \epsilon 
\]

... (2.6)

where \(H_{i,t\_T}\) is the average height in prefecture \(i\) at the beginning of the interval, \(T\) is the length of the interval, and \(D_i\) are regional dummy variables.

The other group of literature depends on time series data which reveals different conclusions with the evolution of convergence to be a difficult task. There is a proposal of new definitions of convergence for a group of countries with the meaning that each country has identical long-run trends by Bernard and Durlauf (1995, 1996). The trends can either be stochastic or deterministic in nature. Johansen’s cointegration techniques were used in testing for a century long time series data for 15 OECD countries as well as with a small sample of European countries with the rejection of convergence.
To overcome the problems of randomness with permanent shocks to per-capita income, Campbell and Mankiw (1989) and Bernard and Durlauf (1995) proposed a new definition along with a set of tests of the convergence hypothesis based on time series rather than cross-section methods. The research was different from most of the previous empirical work with the inclusion of testing convergence in an explicitly stochastic framework. The definition is used to define convergence for a group of countries and it is interpreted as each country has identical long-run trends, it can either be stochastic or it can be deterministic.

The definition of convergence is such that it allows using co-integration techniques in testing. The method has a provision of studying convergence by directly examining the time-series properties of various output series placing convergence hypothesis in an explicitly dynamic and stochastic environment. The notion of the new definition was- if the persistent parts of the time series are distinct then time series for per capita output of different countries can fail to convergence and the results showed a little evidence of convergence across countries. Bernard and Durlauf (1995) also pointed out one potential difficulty to identify convergence using unit root tests. It was presence of a transactional component in the aggregate output of various countries.

Examining convergence in a very different dimension was explored by Mooij (2003). Author had thrown light on the aspect of globalization in terms of convergence of income, media and technology. Expect this convergence lead to homogeneous consumer needs, tastes and lifestyles. For example, cross-border music channels such as MTV, increased travel, and
global communications had encouraged the notion of a ‘global teenager’ – that is, the notion that teenagers possess similar values, regardless of their country of origin. Levitt (1983) argued in his article that new technology would lead to homogenization of consumer wants and needs. The reason for this homogenization was the expectation of consumers for the preference of standard products of high quality and low price as compared to more customized, higher priced products. This argument was based on the assumption that consumer behaviour is rational.

Empirically, Mooij (2003) explained that economic systems homogenisation would lead to homogenisation of consumer behaviour and was usually based on macro-developmental data, such as the numbers of telephones, television sets or cars per 1000 population. It was found that, even with these data, only a few cases were converging in European countries. In many other cases there were large consumption differences among countries that were either stable over time, or countries were actually diverging. The results revealed that as people become wealthier, their tastes diverge. The results were actually based on the findings of meta-analysis of time-series data of a large number of product categories across countries, using the coefficient of variation (CV), as well as the mean percent convergence or divergence per year. To further extend the analysis there was a comparison in three groups of countries in order to examine the varying influence of national wealth. First group was economically heterogeneous group which consisted of 44 countries worldwide, the second, economically more homogeneous group of 26 countries worldwide with GNP/capita more than $8000 and the third, economically homogeneous group of 15 countries in Europe. The article has discussed the myths surrounding global marketing and advertising that there
exists convergence of consumer behaviour, the existence of universal values and global communities with similar values. Although for some durable products and new technologies, at macro level (ownership of products per 1000 people), countries converge. But in the case of usage of these products the countries tend to diverge. With respect to time, there are stable or increasing differences between countries and which could be explained by culture. The model developed by Hofstede was able to explain most of the variation of consumption and consumer behaviour across countries and enabled marketing executives to quantify the effects of culture. The persistence of cultural variety of countries worldwide as well as in Europe implied that a successful advertising approach in one country did not automatically mean similar success in other countries.

Alvi and Rahman (2005) used data for the period 1929-2002 across U.S. regions and examined income convergence using unit root and cointegration techniques. Their findings do not support convergence in per capita incomes even with the inclusion of endogenous breakpoints. The study has emphasized on testing convergence across regions within a country with the reason of smaller differences in technology, factor mobility, taste, and culture, and institutions—factors, as already endorsed by both neoclassical and endogenous models. To investigate the issue of per capita income convergence across the regions of Bangladesh, one of very few studies (Hossain 2006), has attempted it using conditional $\beta$ convergence. While Rahman (2006) tested only conditional $\beta$ convergence during 1982-1997 across regions for a group of countries including Bangladesh based on panel data. Both the studies find convincing evidence of either $\beta$ or conditional $\beta$ convergences across regions in Bangladesh. Wu (2008) provides an
assessment of regional disparity in China and India, two Asian giants, and investigates whether there is any evidence of regional convergence during the period of rapid economic growth. The methodology is based on sigma-convergence and beta-convergence taking standard deviation of the logarithm of the gross regional product (GRP) per capita. The estimated values of beta are derived from the following non-linear regression

\[ \log y_{it} - \log y_{i0} = A - (1 - e^{-\beta t}) \log y_{i0} + \epsilon \]  

... (2.7)

where \( y_{it} \) and \( y_{i0} \) are income per capita at periods \( T \) and \( 0 \), respectively, and \( \epsilon_i \) is the standard white noise.

Trends in food consumption are studied since mid 80's. Blandford (1984) studied convergence of dietary patterns for OECD countries for the period from 1956-1978 and pointed out that the dietary patterns across the majority of the OECD countries had become increasingly similar by 1984. There is a reason why food consumption pattern of many countries becomes same as that of western-style foods because with the increase in income levels in developing countries, exposure to the global ‘urban’ eating pattern increases. Wheelock and Frank (1989) studied the same for nine developed European countries. Using the same data, Henson and Loader (1991) suggested that there are patterns in food consumption although those patterns are not entirely geographical. While one of the studies (Grigg, 1993), relates the convergence in food patterns to economic development and to concerns about health. Food preferences vary because of different reasons as it can be seen before World War II, cultural cross-fertilisation is the principal means (Connor, 1994). Further the reasons were extended to tourism, ethnic
intermarriage and other contacts which exposed individuals to a new national cuisine. Connor (1994) studied the increasing convergence of Northern American and Western European food-purchasing patterns. Except Connor (1994) none of the above mentioned studies addressed the sources which are responsible for convergence in food habits. Some of the factors like demographic, psychological, sociological, cultural, and nutritional characteristics usually omitted while studying food consumption and standard estimation techniques of economists (Steenkamp, 1993).

To explain most of the variation in per capita expenditures of major categories of food household income, product price and the price of substitute consumer products are the major variables (Connor, 1994). The study also signified five primary factors — (i) population change, (ii) income, (iii) relative prices of consumer products, (iv) other demographic characteristics e.g. ethnic pluralism, number of children, dual career families etc. and (v) preferences and attitudes such as customary cuisine habit, desire for variety, eating away-from-home, nutritional beliefs and concern for preventive health etc. as economic determinants of real household food expenditures in high income countries. The elaborated list can be explored from Senauer et al. (1992). Of these factors, (i) and (ii) has a great quantitative impact on real expenditures of all or major food groups. Factor (iv) and (v) has the least impact while factor (v), (iv) and (ii) has the greatest impact when considered expenditures on specific products.

There are various studies (Gil et al., 1995; Senugal and Senugal, 2006) which investigated the relationship between food consumption and economic development. In the former study sixteen European Union
countries including Norway were under consideration for over two decades from 1970 to 1990. While in the later one there was an investigation of food consumption and economic development in Turkey and European Union countries for the period from 1970 to 2000. To test for convergence or divergence in food consumption it was proposed and applied to the demand for food nutrients in OECD countries for the period from 1978 to 1988 (Herrmann and Röder, 1995). The analysis revealed that there were two methods of convergence one was absolute and the other relative convergence and the difference in the two methods do not follow the same trend.

The study also showed that in comparison to the income prices or availability the terms capturing convergence were the most important variables which indicated the importance of preferences in an international comparison of food demand. In all above mentioned papers, except Gil et al. (1995), there was no attempt to measure the process of convergence and whether convergence only affects total calorie intake or it extends to specific products. Herrmann and Röder (1995) provided a methodology to measure cross-country differences in food consumption and similar results were reported as that reported by the study of Gil et al. (1995).

The objective of the study done by Gil et al. (1995) was to analyse the evolution of food diets in some European countries and to identify a common European diet. The study used both $\beta$ and $\sigma$ convergence. It defined $\sigma$ convergence as a reduction in the cross-section standard deviation over time and had given a rough presentation of the evolution of the distribution of total calories across countries, even though it was time dependent. The
presence of beta-convergence was a necessary condition for sigma-convergence, but it was not a sufficient condition. The results indicated that there was no strong evidence of convergence in total calorie intake while convergence was observed, when derived from main food groups. The result could be interpreted as in European countries for the period from 1970 to 1990 that there was an indication of increasing similarity in diets however the speed of convergence had decreased in the last decade.

The study had also revealed that behind the convergence there were several forces like parallel trends in the determinants of food demand in European countries; the orthodox economic factors of household income, relative prices, demographic changes and the newer concerns by consumers about the nutritional impacts and preventive health possibilities of dietary habits (Connor, 1994). The increased vertical and horizontal integration in European firms; technological transfers, multinationalisation of food distribution and the evolving similarities in public policies are some other factors responsible for convergence.

Consumption differences were significantly observed among countries and regions in Europe despite continuous integration process carried on a parallel convergence (Gil and Gracia, 1998). The extent of differences and reasons behind such differences were the increase in per capita income and demand for food was not only for nourishment reasons but also for enjoyment, preference, ethics, culture, safety, prestige, impulse, and other factors. For better understanding social and demographic characteristics, as well as food consumer choice and behaviour was suggested to understand European food consumers.
Cross-sectional data sets were used to study diversity of food consumption patterns across countries to examine the similarities and differences in statistical indicators aimed at different aspects of food consumption (Traill, 1998). Using time series data the studies were carried out concerning convergence in food consumption patterns (Gil et al., 1995) along with pooled time series and cross-country data (Pollak and Wales, 1987). Some studies were focused on the export similarity index (Wohlken and Fillip, 1988) or the aggregate similarity index (Eisner and Hartmann, 1997) with the objective to quantify the degree of convergence in diets between countries.

The studies earlier focused either on cross-country comparisons of general trends in food consumption, or the degree of similarity of the consumption structures and convergence in the structure of food consumption. Some of the studies focuses on cross-country comparisons of international aspects of food consumption patterns or simply describe long-term trends in the food consumption of different countries. Between 1965 and 1982 based on a modification of the Export Similarity Index introduced by Finger and Kreinin (1979) the convergence or divergence of food consumption patterns among OECD countries was investigated by Wohlken and Filip (1988). According them the OECD countries with similar income growth rates showed a convergence process. While testing of hypothesis of international convergence in food consumption among OECD countries has been done by many empirical studies, Elsner and Hartmann (1997) has studied and applied the same to West and East European Countries and has tried to fill the breach. It has tried to discuss the main determinants of food consumption,
changes in the factors and trends in food consumption since the beginning of transition and tried to identify the convergence of food consumption between Eastern and Western Europe. Authors have tried to test for convergence on all levels as well as the structure of food consumption, i.e. comparing similarity of food consumption for all products in one country, as well as for one product across all CEECs.

In each of the case the consumption level or structure in the EU were used as reference points. They outline the development of per capita consumption of specific products, or measure total food consumption in terms of daily per capita caloric intake. By comparing the consumption of animal versus vegetable products measured in terms of their respective share in caloric, protein or fat intake, structural aspects are covered (Blandford 1984; Wheelock and Frank 1989; Grigg 1993; Gil et al. 1995). The results of these studies show that there was an increase in average per capita food consumption for developed economies in between 1960-1990, although the rate at a lower growth rate during the 80s than in earlier decades. In general food consumption and income showed a positive correlation but only little potential for further growth was left due to the reason of high level of saturation. In the developed world the rate of population growth is relatively low, hence total food consumption in these countries is not likely to experience a great increase in the future. The results of Blandford (1984) revealed that the convergence in dietary structure existed despite considerable variation in the proportion of consumer expenditure devoted to food. The result indicated that homogeneity in consumption patterns among countries does not require income and relative price similarity in the respective countries. Same kind of result was supported by Gil et al. (1995).
Talking regarding structure of food demand an increasing health consciousness has led to relative fall in meat consumption in the OECD countries and there is little doubt regarding consumer attitudes affecting food consumption patterns in the developed economies.

Elsner and Hartmann (1997) not only analyzed convergence in the consumption levels but also the structure of food consumption. For this purpose, several indicators were calculated and a pooled regression analysis was run. Due to non-availability of time series data for a sufficiently long period, an assessment of the future development of food consumption in Eastern Europe cannot be based on time series analysis. However, with the occurrence of proof of convergence of food consumption between the EU and the Central and Eastern European Countries since the beginning of the transition process, it might provide some indication of development of the food demand in the CEECs in the future.

Initially Elsner and Hartmann (1997), in his discussion regarding determinants of food consumption, has given more emphasis on increasing importance to socio-demographic factors as well as preferences along with the regular determinants like consumer income, product price and the prices of complementary and substitute goods. Consumer preference was given little emphasis in the production-oriented centrally planned economies and due to which products were of poor quality and there was limited variety. Also, due to heavy subsidization of consumption of food, it was relatively cheap and some of the economic factors, prices and income, were unable to restrict individual’s choice of food consumption. Hence in socialist era one of the main influencing factors of food expenditure patterns was availability.
of products (Henson and Sekula, 1994). But there occurred pronounced change in the food sector with the transition from socialist system to a market economy and resulted in removal of consumption subsidies in almost all CEECs, declination in real income, privatization of food processing industries and distribution systems, introduction of quality standards and sanitary controls and liberalization of trade.

With a variation in the extent of degree of completion of these processes in different countries, changes in all the countries have been pronounced and has the impact on the level and structure of food demand and is expected to continue in future. Some of the prominent factors like price and income were becoming major determinants of food consumption with the end of the socialist era. Other relevant factors being declination of calorie share of animal products and the total capita calorie consumption in most of the CEECs, availability of many products that could not be purchased in the past, significant rise in trade and foreign direct investment in food industry and increasing relevance of the distribution sector of the CEECs. There was significant rise in trade with western countries in the 90s. In addition, foreign direct investment (FDI) from OECD countries in the food industry and in the distribution sector has become increasingly relevant (Connor 1994; Hartmann and Wandel 1997 and Traill 1997). These factors have triggered demonstration effects that suggested convergence of food consumption.

Empirical analysis used by Elsner and Hartmann (1997) includes analysis based on food consumption data and based on bilateral trade data. Analysis based on food consumption was carried out in two different ways, first, on
consumption of specific food commodities in all CEECs using Weighted Relative Deviation (WRD) of consumption between EU-15 and the CEECs and Pooled Regression Analysis, both of the methods applied to study the consumption of specific food commodities in all CEECs. Second, to study the structure of food consumption in specific CEECs.

To study the later Consumption Similarity Index was also used. Analysis based on bilateral trade data used Grubel Lloyd Index. The change in WRD is used to investigate one of the possibilities of testing of convergence or divergence of food consumption for one specific product or with respect to all products and one specific country. There is an indication of convergence (divergence) with a decrease (increase) of the WRD. To study the similarity in overall food consumption structures between two countries or regions, consumption similarity index is used while; the index does not provide any information regarding the similarity of product-specific consumption. As such for analysis new methods are applied, the results indicate initial convergence, although this does not hold for all CEECs or all food commodities.

Angulo et al. (2001) has provided a complementary point of view to existing literature on convergence in food demand patterns, which has mostly concentrated on the evolution of quantities consumed, budget shares or calorie intake shares. To test for country homogeneity, a cross-country covariance framework was used. This testing was done prior to calculating income and calorie elasticities, and to examine if they converge. To detect the convergence in food demand elasticities, one of the preliminary but complementary approaches to the main objective, the food consumption
behaviour from the countries with statistically significant parameters between one pair of countries were estimated. It was decided, on that basis of the identical parameters, the food consumption behaviour from those countries is comparable and was concluded that the utility and demand functions are more or less similar. Still, there was not much evidence seen of country homogeneity. To check whether there is a convergence process taking place with regard to reactions to changes in total calorie intake and income (elasticities). The stochastic definitions for both long-term elasticities fluctuations and convergence were chosen among the different methods used to measure convergence.

These definitions were based on recent developments in unit roots tests and cointegration. Following Bernard and Durlauf (1995), the convergence was defined in elasticities as follows: if $e_{ij}$ denoted total calorie (income) elasticity for product $i$ in country $j$ and $e_{ik}$ the total calorie (income) elasticity for product $i$ in country $k$, countries $j$ and $k$ converge in calorie (income) elasticity for the product $i$ if the long-term forecast of these elasticities for both countries are equal at a certain time $t$. The study has used a natural way to test for convergence by testing for cointegration with the cointegrating vector [1, -1]. The elasticities of group of two countries are said to contain a common trend but no convergence if both elasticities are cointegrated, but with a cointegrating vector different from [1, -1]. The first step to test for convergence was to show that all calculated elasticities had unit roots and were integrated of the same order. To test it the Augmented Dickey-Fuller test (ADF) was implemented (Said and Dickey, 1984). First, for each series the presence of two unit roots I (2) was tested against I (1). In case of rejection, the null of a unit root is tested against stationarity. In all cases, the
first difference for the series was calculated because the null hypothesis of one unit root, so as to achieve stationarity, was failed to reject. Further to test for cointegration, the Maximum Likelihood (ML) approach of Johansen (1988) and Johansen and Juselius (1990) was used. Main aim to apply the test of cointegration is to determine the number of cointegration relationships between demand elasticities corresponding to any pair of countries and for each product. In many cases the null hypothesis of no cointegration was rejected with the interpretation that at least there are several long-run equilibrium relationships. In order to determine whether such relationships can be described as convergence processes, a further step is required. As mentioned above, convergence can only be achieved if the cointegrating vector is [1, −1]. Johansen and Juselius (1990) developed several methods to test specific hypotheses with respect to the size and relative characteristics of the $\beta$ and $\alpha$ coefficient. The tests indicated that convergence in calorie intake elasticities was more frequent than that of income elasticities.

Previous to this the studies generally have used a single set of indicators, such as food intake or the structure of food consumption, to measure consumption variability (Petrovici et al., 2005). Overall trend of convergence in dietary structure was reported by these studies, yet divergence was reported with regard to consumption of specific foodstuffs only. Convergence in the per capita protein and fat demand along with divergence in consumption of individual foods was reported by Herrmann and Roeder (1995). They made first step of associating convergence or divergence with long-running changes in preferences or with habit formation by controlling income, prices and other explanatory variables. The authors
applied OLS with pooled data and explained cross-country differences in per capita food consumption with standard economic determinants and with convergence or divergence of preferences. Petrovici et al. (2005) has tried to explore the diversity of food consumption pattern in Europe. It addressed the issues of similar dietary patterns and the extent to which those were same within clusters of countries regardless of the set of indicators selected to describe those patterns. It also investigated the extent of consistency of the clusters across classification methods. Uniqueness of the study lies in the inclusion of wide set of indicators aimed at evaluating food consumption and to include Central and Eastern European Countries (CEECs) that joined the European Union (EU) States in 2004 or are expected to become members by 2007.

The food consumption and dietary pattern was studied with respect to the breakdown of calorific, protein, and fat consumption in the observed countries for the year 2000. Blandford (1984) used the structure of calorie intake in the classification. However, using such classification there was a possibility of hiding variation in food consumption. Herrmann and Roeder (1995), and Elsner and Hartmann (1997) reported the results wherein higher convergence was suggested when patterns of calorie intake, relative to consumption of specific food products, were used. The use of variety of indicators to analyze the consumption patterns was to improve the classification and to overcome some of the limitations of the previous studies (Petrovici et al., 2005).

As mentioned earlier the study (Senugal and Senugal, 2006) is aimed to give a comprehensive overview of food consumption trends in Turkey and the
European Union (EU) to examine the relationship between food consumption patterns and economic development in the regions. The study seeks to identify the common consumption pattern between Turkey and EU if Turkey enters the EU using Beta convergence. Data used cover total calorie intake and the proportion of total calories from animal products, cereals, potatoes, pulses, vegetables, fruits, meat, sugar, milk, vegetable oils, animal fats, eggs and fish. Beta convergence occurs when consumption in the lower calorie-intake countries grows faster than that of the higher calorie-intake countries. Data was analysed for 15 countries of the European Union and Turkey for periods 1970 to 2000 using Cross-section regression which was performed separately and together. Equation for convergence was estimated using non linear least squares. There is an indication of Beta-convergence if \((1 - e^{-\beta T})\) is positive or \(\beta > 0\).

Senugal and Senugal (2006) studied the same and found that all the \(\beta\) coefficients are positive, this indicated that consumption in countries with lower calorie intakes in 1970 has increased more quickly than in countries that began the period with higher intakes. The results obtained were same as that occurred when analysing the proportion of total calories from different food products. However, the average rate of growth was different for food subgroups and it was found for the sub food category of potatoes and fruits that the relationship was not statistically significant. The overall results implied that there is a convergence in diet structure across European Union countries. The convergence process is statistically significant for total calories, if Turkey joins EU, while the convergence for animal products, pulses, meat and animal fats is not statistically significant. Results regarding speed of convergence showed that it has diminished for total calories and
individual products. Although convergence for fruits in EU countries is not observed, the data for Turkey suggests that there is convergence. Using the same data sources for the periods from 1970 to 1990 Gil et al. (1995) studied Beta convergence for 15 EU countries, and found no convergence for total calories, potatoes, vegetable oils and fish and convergence increased between EU countries from 1990 to 2000.

Recent study by Regmi et al. (2008) has examined the convergence trends across high-income, upper middle-income, and lower middle-income countries and has tried to find evidence of convergence in food expenditure patterns, food delivery mechanisms, and food attributes. The study addresses the issue with the intention to study the occurrence of convergence in food demand with very different food cultures and historical food preferences. Similarities and evolution in food delivery systems were statistically examined in food retailing and foodservice sectors across high-income and middle income countries. Product label claims were used to examine the consumer demand for different product attributes among high and middle-income countries. The tool used for testing convergence was that defined by Barro and Sala-i-Martin (1992) using $\beta$-convergence.

2.4 Food Consumption and Econometric Applications
Several studies have focused on specifying the influence of household income and other socioeconomic characteristics on nutrient consumption, but most of these have been limited to localized areas or particular groups of people (Babcock (1972); Einstein and Horstein (1970); Kelsay; Madden and Yoder)
Gracia and Albisu (2001) revealed in their study that food consumption in quantity terms was held up, although the diet was changing. Despite consumers were not willing to eat more, their food demand was shifting among different products. The consumption patterns and trends in Europe were affected by the situation of the agri-food industry and the distribution channels in each country of Europe. It had found some of the determinants of European food consumption were consumers, food manufacturers and retailers. Wherein it has explained in detail several issues related to European food consumers like despite the globalization food process, Europe can not be considered a homogeneous block with respect to food culture.

It had also talked about consumer characteristics like rising income, aging population, smaller household, and women labour participation etc. had caused high demand for more added-value food products. At the time of so-called information-society and with the increased demand for more information regarding food, according to Davies (1998) consumers were increasingly relying on labels. Reasons, as mentioned by him, were consumers eat more processed food; the ingredients of the products were no longer what consumers expect, shopping was done hurriedly; interest in health was increasing day-by-day; claims were more complex, so people asked for more special diet. Despite keeping well informed through telephone, e-mail, internet sites, in-store touch screens, bar code scanners, radio linked to in-store computers, etc., the product label was far the most powerful means of informing consumers about the attributes of products and required proper loading (Hunt, 1998). One of the studies (Jensen and Basiotis, 1993) had discussed about different food attributes like healthy and
nutritive values, appearance, taste, convenience, packaging, and safety, which affected or influenced consumption decisions. Even more knowledge and thereby more critical towards food had made consumers more conscious (Wheelock, 1992).

Along with it Gracia and Albisu (2001) had also discussed impact of preferences, lifestyles, and eating patterns on food consumption. Lifestyle, the way of living and the amount that consumer spent their time and money, determine food consumption patterns and consumers could be segmented on the same basis. Steenkamp (1997) studied different schemes to detect European consumer segments and five major lifestyle segments were identified such as ‘fast fun lovers,’ ‘controlled elitists,’ ‘neotraditionalists,’ ‘traditionalists,’ and ‘explorers’. Traditional food was preferred by ‘traditionalists’ because on average old people fit in to this group while ‘neotraditionalists’ were more receptive to their own regional products. The group which was open to global products and brands and high-quality products was that of ‘controlled elitists’ and ‘fast fun lovers’ and ‘explorers’ were open to new products. To measure lifestyle related to food, Grunert et al. (1993) developed an instrument and was applied to different European countries and found that there was a high quality consciousness among French consumers whereas health and environment was felt important aspect for Germans (Bredahl and Gurnert, 1997; Brunso et al. 1996). Adrian Daniel (1976) studied impact of socioeconomic factors on consumption of selected food nutrients in the United States.

There had been studies that current consumption was influenced by values of some of the lagged variables and consumers do not immediately react to the
changes in income and prices immediately, but it takes place gradually (Gracia et al., 1998). The source of these lag variables was tried to be explained by Brown (1952), Houthakker and Talylor (1970), and Philips (1983). Since there existed some memories of the previous level of income and prices, at the initial stage consumer adjusted slowly with change in income and prices. The consumption habit produced the lag effect in consumer demand also habits, customs and levels associated with previous consumption exerted a stabilizing effect on current consumption (Gracia et al., 1998). The paper was based on the objective of evaluating the dynamic relationships and the long-run food demand structure in Spain for which the Generalized Addilog Demand System (GADS) developed by Theil (1969) was used. The dynamic behaviour was introduced into the model using the same approach developed by Anderson and Blundell (1982 and 1983). The use of general dynamic model approach to analyse food consumer behaviour was not new but was first studied by Gracia et al. (1998) to study it in Spain. The paper was focused on the inertia of reaction to the changes in income and prices and the persistence of habits. The result suggested that the autoregressive specification fitted better the data which implied that Spanish food consumers do not change their behaviour until they realize that effectively income and prices had changed. Results also suggested that Spain was a potential meat market because as income increased, Spanish consumers tend to buy relatively more meat and less from other products, specially fats and oils and dairy products.

All the researches mentioned above, suffered from the limitation that they were conducted to meet the marketing requirement(s) of the countries other than Asia. Academically, Asia lacked a major study which profiled the
Asian countries with respect to the consumption of food. Some work of note had taken place in the Asian context; but only at the country or region-specific level. As such, growing need was felt to conduct an academic study of the Asian countries with respect to their food consumption pattern and to provide a maximum potential level of consumption and threshold level of income of the countries. The current study attempts to fill in the gap amongst the countries of Asia.