CHAPTER 7

SUMMARY, CONCLUSION AND
POLICY IMPLICATIONS
This study tries to provide a complementary view of the phenomenon by seeking closely to the process of attaining a saturation level of food consumption, threshold level of income, clustering of Asian countries and convergence for total calories and amongst various food product classes. It seeks the consumption reactions to changes in the main determinants of food consumption: income, prices and total calorie intake. Since information on prices was not available, only the two other variables were considered for analysis.

This study proceeds by conducting three complementary analyses. The first part of the analysis estimates the parameters involved in finding the saturation level of asymptotic level of food consumption and threshold level of income for Asian countries. A panel data, aggregate pooled data and cross-sectional data was used to estimate the parameters of interest. The Ramsey’s RESET test for specification error of the model and Breusch-Pagan-Godfrey (BPG) test were used to specify the reciprocal transformation model. The second part of the analysis classifies countries on the basis of homogenous food consumed within Asia. Hierarchical clustering technique has been employed and different agglomerative methods were used to classify countries. The third part of the analysis examines the convergence or divergence in the food consumption for Asia, West Asia and East Asia and a comparison of convergence between East and West Asia. This study represents one of the most commonly used applications of Barro and Sala i Martin (1991, 1992) of the methodology to the analysis of convergence. Convergence has also been examined using a naive Residual Technique, one of the few applications of the methodology to analyse convergence and divergence.
The food consumption in Asian countries do not appear to have reached a plateau in many of the instances, there still exists differences in some of the food groups and even there exists national disparity. Food consumption may become progressively less influenced by further increase in income. Aggregate food consumption may increase but the speed may be slow in future, the principle factor influencing total consumption being growth in population. Moreover, food consumption patterns could not be expected to be completely similar among countries. The reason for such differences may be socio-economic, demographic factors and culture differences among them. The distribution of income is also unequal between major Asian countries. Reducing these income gaps will be very difficult because of the dependence of low-income regions on agriculture. There are large differences in quality of life indicators among different regions of the continent.

This section aims to bring together in summary from the results of asymptotic levels of consumption, threshold level of income and elasticity calculations for total calories and selected food products, together with some observations on recent consumption changes. In Asia, per capita income is relatively low as compared to other developed countries of the world except few exceptions. Increase in food consumption can be seen with an increase in income, but thereby population is also increasing. Looking to the relationship between income and food consumption overall there is a potential for total calories as well as major food categories to grow and hence yet not reached a plateau.

One of the dominantly consumed food category like cereals is at the top of the list of achieving maximum potential level of food consumption in the
fifteen different food categories and appears to have reached a saturation level and may not change greatly in the future. In the category of reaching a saturation level or very close to it are fruits, milk, pulses, potatoes, spices, sugar-crops and vegetables. Consumption of some other food categories like total calories, animal fats, eggs, fish, meat, nuts, oil-crops and stimulants seems to have reasonable prospect for expansion although at a lower rate. Especially in the case of animal products the analysis suggests that consumption is still well below saturation level and that appreciable increases are still possible. Supply difficulties if experienced with some food commodities like fish may divert some demand towards meat in future. Even increase in prices of some commodities may divert potential consumers to their demand to alternative products.

Nevertheless, it was considered that the saturation levels calculated in the present study could be useful, if used in conjunction with other substantiation, in making some assessment of the likely growth (or contraction) in the Asian countries for selected food categories. Thus it could be concluded that even after reaching a saturation level there are chances of increased consumption but will only be at the cost of decreased consumption of other food category. Estimated asymptotic limit of food consumption together with income elasticities for a recent period, give a very slight indication of saturation, while there is much potential for growth in the consumption with increase in income in Asian countries. For several food products in Asia, income elasticities are increasing and generally are below 0.11. This could mean that consumption per person may increase further in most instances. For some instances the elasticities have fallen during 1990 – 2005, especially cereals, pulses, oil-crops, potatoes, sugar-
crops and vegetables. This is the indication that the prospects for further consumption increase cannot be considered favourable.

Food consumption patterns of Asian countries have changed substantially due to economic growth and the concurrent adoption of a westernized lifestyle. There has been a change from tradition of consuming vegetable goods like cereals, potatoes, oil-crops, sugar-crops to increased consumption of animal goods like milk, meat, poultry and egg and fruit.

The micro data taken from Indore city is characterized on an aggregate by the households which are middle aged, graduates male heading with majority of service class families. On an average the families are headed by graduate males with a modal family size of four members and average family size of five members. This indicates the families are in general are male headed and there still exists a culture of joint family in the city. Most of the families are middle income-class and spend on an average Rs. 83,350 on food annually with an average 32 percent share of their income on food.

In general, the consumption of food has not yet reached a plateau at micro level there are some differences in different food categories. There is a general tendency of people in Indore to spend on other type of food items which may include ready to eat food items, packaged food items, meals taken away from home (not prepared at home) etc. As the percentage of working females has increased since last decade, the habit of eating out, using ready to eat food items (ready food items), and packaged food items has increased and hence reported highest asymptotic limit of consumption at micro level. A High level of threshold level for this food category is the indication of consumption of other food items by the higher-middle-income class families. The consumption of dairy products and edible oil (fats) are
also increasing with an increase in income and are appearing below the saturation level. Consumption of these food categories seems to have reasonable prospect for expansion although at a lower rate. Especially in the case of animal products the analysis suggests that consumption is still well below saturation level and that appreciable increases are still possible.

Clustering of Asian countries concludes that cluster analysis is more statistically vague than many other multivariate methods. There are a number of alternatives within the method itself. The choice of alternative techniques means that it is quite possible to produce a range of different results from the same data. According to Saunders (1994) any solutions found should not be seen as absolute truths, but as only one of a set of alternatives.

Regarding the configuration of cluster across classification methods, in general there is some similarity. However countries are positioned in different ways depending on the method. The use of metric data and the Euclidean distance enabled a large number of methods to be tested. Slight differences in the configuration of clusters were noticeable between the cluster solutions generated by hierarchical methods. More significant differences in the composition of clusters were outlined as a result of change of the hierarchical clustering agglomerative techniques. There were only hard-core clusters invariant to classification methods used, namely Maldives; Mongolia in the year 1995. The hard core cluster that emerged in 2005 were Maldives; Timor-Leste which were invariant to classification methods used.
While the clustering method does not arrive at complete agreement as to which consumption patterns are the most balanced consuming pattern, it is generally agreed that a balanced, diversified pattern of food consumption is beneficial to energy balance. The findings presented in this chapter show that only three percent of all countries in Asia fall into the balanced food consuming cluster which is likely to be the most healthful irrespective of the time frame. In sharp contrast, majority of the countries typically depend on staple food (cereals, oil-crops, sugar-crops etc.)

There is an extensive criticism on the cluster analysis. It was pointed by Alderfere and Blashfield (1984), that although the objective of cluster analysis is to seek structure, the algorithm is structure-imposing. Even a random data may be classified into clusters, as stressed by Everitt (1993). The risk of such classification was reduced by using several classification techniques with an increased likelihood that the identified hard-core clusters correspond to a natural configuration based on strong similarities of food consumption patterns.

The complete linkage method generated significantly different cluster solution with more homogenous groups in the year 2005. Nevertheless, no single method outperformed from the point of view of classification of countries on the basis of homogenous food consumption in the year 1995. As Milligan (1980) pointed out, no method is superior, the performance of classification being dependent on the nature of data and the research aims.

Comparisons of the cluster solution with other studies are limited by the differences in the sample of countries observed. Furthermore, time
comparisons are constrained by the changing configuration in the Asian geopolitical map (the transformation in the former Soviet Union and Kazakhstan, Kyrgyzstan, Turkmenistan, Uzbekistan). Given the expected convergence of food consumption patterns within Asian countries, future changes in the composition of clusters can be expected.

This study used indicators available at a country level, but this could, of course overlook variations at the regional level. Further research on regional level data may identify geographical areas with strong homogeneity in food consumption patterns. Data derived from FAO is subject to limitations outlined earlier. Further research can explore clusters based on data on per capita food consumption derived from representative household surveys conducted in each country or explore the effect of additional variables such as prices, availability of substitute food. Additionally, to test for changes in food consumption patterns time series data and tests related to the same may be explored and applied.

Estimation of maximum potential level of food consumption and threshold level of income for the emerged cluster of Asian countries was done only for the cluster with large number of countries included in it. The asymptotic limit of staple food consumption for the considered cluster almost reached a maximum potential level. The cluster of Asian countries included major 31 countries which in actual sense represent Asia and depends mainly on cereals, oil-crops and sugar-crops and vegetables as their food which consumes about 82 percent of the total food consumed in Asia. The animal products like meat and eggs have showed that they are sensitive to fluctuation of income and attained a high threshold level of income.
From the results of the analysis of the third part presented in the section 6.3.1.1, it can be concluded that cross-country distribution of Asia food consumption between 1992 and 2005 did shrink, and the low calorie intake countries do grow faster than rich ones for specific food categories. The analysis demonstrates very limited evidence in favor of the existence of convergence throughout Asian countries. Taking the case of total calories, it can be interpreted that the positive coefficient of \( \beta \) is indicating that there is a convergence although it is not significant. The second concept of \( \sigma \)-convergence is also supporting the results of total calories and calories derived from some of the food products. There is a convergence upto year 2003 and the rate of convergence has slowed down in the recent years. Similarly the proportion of total calories from different food categories is also converging except for the proportion of calories from milk and nuts, with a slowed speed in the recent years. Taking the case of proportion of calories from vegetables, a high speed convergence can be observed after the year 2002 while that from cereals, meat, eggs and sugar-crops, can be seen upto year 2001 with a slow speed in the year 2002 and thereafter. Overall it can be said that there are traces of convergence in total food calories and calories from different food products and has been estimated within a narrow range of 2 per cent, except for fish and spices. Although this is very robust and strongly significant finding, it is emphasized that a speed of 2 per cent per year is very small. For example it suggests that it will take 13 years for half of the distance between the initial level of food consumption and the steady state to vanish, which is definitely slow. The results suggest that although a globalization process is evident in the agrifood business at the Asia level, country peculiarities (culture, climate, production patterns, habit
persistence, etc.) continue to inform consumption pattern, at least with respect to the broad categories shown here.

To further extend and explore this study, research can be conducted taking different aspects of convergence. Beta and sigma convergence is one way to measure convergence, but the same can also be conducted by applying co-integration test using Dickey Fuller test in Asian region. Other than co-integration technique one more method, not yet explored, can be the application of Frontier Models to examine convergence-divergence.

The results pointed out in the present study detect a high degree of convergence in some of the food categories in West Asia during 1992 to 2005. Although convergence may have slowed down recently, it is still significant and apparent in most of the important food groups. In all it can be concluded that consumption of calories derived from cereals, fish, oil-crops and vegetables is converging at 5 percent level of significance on the basis of beta-convergence. Sigma convergence on the basis of CV graphs is supporting the results of beta convergence in some cases only. Of all the food categories cereals consumption is the most consistent within the region of West Asia and its consumption is converging significantly. There are some differences in the result of beta and sigma convergence corresponding to the food category of spices. Spices, is showing convergence which is highly significant in West Asia during 1992-2005 according to $\beta$-convergence while $\sigma$-convergence is showing a different picture of constant increase in the CV graph with the interpretation that it is diverging with a very high range of coefficient of variation (above 170 percent). With the exception of the results of spices there can be seen a low significant
convergence in the food category of eggs, fruits and sugar-crops with a supporting CV graph. Rest of the food groups such as consumption of animal fats, meat, milk, nuts, pulses, potatoes are converging and the results are not significant according to beta-convergence. The only food item, stimulants, is showing a divergence in consumption with a negative value of beta. Overall it can be interpreted that there are traces of convergence in West Asia during 1992 to 2005 in total food calories and calories derived from different food categories, except one, with a varied speed of convergence. The speed of convergence is slowed down in recent years for most of the food items and ultimately has affected total food categories.

The results obtained, to certain extent, are in line with those in previous literature such as Gil et al. (1995) which indicated that there was no strong evidence of convergence in total calorie intake while convergence was observed, when derived from main food groups. 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. Senugal and Senugal (2006) found that all the $\beta$ coefficients are positive, with an indication of 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 those when the proportion of total calories from different food products were analysed.

Calories derived from milk and nuts are converging in West Asia while the same food category is showing a divergence in Eastern region of Asia. On the other hand calories derived from stimulants is diverging in West and
converging in East region of Asia (refer table 3). Only one of the food categories, spices, is showing convergence in both the regions but with a significant difference in the differential slope coefficient. Negative value of $\beta_2$ is indicating a high convergence in East region in comparison to that in West.

With the increasing convergence in food consumption, the benefits as well as problems associated with modern food delivery are becoming more universal. Globalization and income growth are resulting in increasing similarities worldwide in consumption and food delivery mechanism. Hence availability and access to an array of nutritious food products has improved. The convergence in total food consumption and some of the food items reflects consumption growth in middle-income countries due to rapid modernization, as well as to global income growth. The convergence trends were faster in the early 2000s but slowed somewhat in the recent years.

There is a relevance of studying asymptotic limit of consumption in the light of convergence in the sense that if there is commonness in the consumption pattern in Asian countries then estimation of maximum potential level, if observed during a time frame, will be valid. It could be interpreted that the estimation of desired parameters would be meaningful if the homogeneity in terms of consumption is clear. The estimates of asymptotic limit of consumption of total food, cereals, spices, fruits and vegetables during 1990 to 2005 is valid for the whole region of Asia. The food groups have almost reached a saturation level and are not much affected with increase in income. They are showing a convergence pattern in Asian countries during the period considered. On the other hand calories derived from milk, stimulants, animal
fats, nuts, eggs, potatoes and meat are showing an increasing trend in the maximum potential level of consumption with the support of the fact that eggs being converging significantly while milk and nuts are diverging. This indicates that in Asia these food groups except for milk and nuts have not yet achieved a plateau and still are affected by the increase in income. As milk and nuts are diverging, there might be some regions or countries in Asia which may show a different trend of attaining maximum potential level of consumption. The calories derived from fish, oil-crops along with pulses and sugar-crops are showing a downward trend of asymptotic limit of consumption indicating that in Asia these food categories have almost reached a plateau and are showing a decrease in potential of consumption.

Other than some of the limitations of statistical analysis of reciprocal model already been mentioned, it needs to be emphasized that the elasticities derived for the various food products merely constitute a mathematically calculated set of relationships between specific variables during certain periods, the effects of other variables on the outcome not being taken into account. The results of these calculations can be very useful if employed with the carefulness in helping to depict in quantitative terms that have happened in the past and to help clarify the reasons for these developments. Care is needed to avoid attributing all the observed changes to variables included in models. The normal tests of statistical significance often give reasonable warnings of inadequate specification in the models, but this cannot be taken for granted. Owing to space limitations, the implications of the findings are not fully explored in this study, but needless to say, they could provide an important contribution in assessing policy towards nutrition, trade and food security, especially for predicting future food needs.
Bearing the limitation in mind, some of the implications of the analysis are described in this section. This study attempts to measure the asymptotic level of food consumption and threshold level of income at macro and micro level. Estimates of the maximum potential level of food are helpful in deciding whether food taken as a whole and different food categories measured in calories has reached a plateau or approaching to a saturation level or has a potential to increase in the region of Asia. The estimates are also supported with the evidence of convergence in Asia, West Asia and East Asia. In Asia, food consumption is slowly and progressively less influenced by further increase in GDP. Consumption of several food products appears to be very close to saturation level and may not change greatly in the future. The category includes fruits, vegetables, potatoes, pulses and sugar-crops, the consumption of which has reached a plateau. The consumption of milk and spices are the categories of food which is now probably approaching saturation level with the stabilized rate of consumption with income. In case of total calories derived from the food as a whole and animal fats, eggs, fish, meat, nuts, oil-crops and stimulants, the analysis suggests that consumption is still well below asymptotic level and that appreciable increases are still possible.

This study will provide information for government officers who are required to prepare, for policy purposes, demand projections and production targets for the basic food categories. This study may be treated as a document for the benefit of universities and other organizations interested in research into the food consumption pattern. The material presented in terms of estimated asymptotic limit of consumption and threshold level of income will be used together with the results of structure of food, clusters of Asian
countries and convergence in different food category, to help formulate policies for agricultural production in Asia at macro level and in Indore city at micro level and policies relating to imports.

The results may help the policy makers and traders for determining priorities of food consumption and marketing. For example similarity in some of the food groups which have not reached a saturation level in Asian countries imply large size of market and opportunities of scale economies for Asia in particular animal products like, eggs, fish and meat and oil-crops. The presence of convergence in most of food groups in Asia may be useful to both marketers and policy makers to plan similar strategies and action plan. For example, the similarity in food consumption patterns in eggs, fish, fruits, oil-crops, spices and vegetables may encourage further economies of scale based on standardization. Further attention is to be paid for the extent of marketing practices which may be adopted in the emerging markets, given the large size of these markets and their positive impact on trade flows following Asia enlargement. The similarity in the consumption patterns may further suggest that dietary aspirations from strongly similar countries may be used as a proposal for other countries with less understanding in this area. Absence of convergence for milk and nuts in Asian countries offers great opportunities for Asia (particularly for East Asian countries) in meaning of specialized on high prized and nutritional products trade.