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Research Article

The Analytical Method Based on Information Entropy for Urban Residents Food Consumption Gap

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Abstract: This study, taking the connotation of consumption structures for the point cut and combining the concepts of information entropy and an analysis of its meaning, the paper discusses the introduction of information entropy into energy consumption structures. Under the influences of energy occurrence conditions and levels of economic development, there are often large differences among food consumption structures of urban residents in different regions; it is difficult to measure the structure evolution by using a specific index.

Keywords: Food consumption structures, information entropy, urban residents

INTRODUCTION

Food is one of the major sources for human survival and nutrition acquisition, the demand for food is the most basic material need for human survival. The resident food consumption structures not only have close relations with the country's levels of economic and social development, but also serves as an important sign measuring the people's living standards and national health qualities in a country or a region (McCarthy *et al*., 2007). Since the adoption of reform and opening up policy, China has experienced a continuously rapid growth in economy, a continuous improvement of people's living standards, a significant reduction on the Engle coefficient for households and realization of overall well-off in social construction. In terms of macroeconomic developments, the consumer demand is the beginning and the end of all economic activities. Consumption structures influence and restrict the country's industrial structures through the resulted changes of demand structures.

The research on consumption structures is not only an important basis for studying consumption demand, guiding rational consumption and formulating relevant consumer policies, but also an index that reasonably adjusts industrial structures, formulates the policies for products supply and industrial developments. It is of great significance in the promotion of the coordinated development of China's food production and food consumption to guide reasonable adjustments of the agricultural structures and to provide farmers with advices for agricultural production, according to the changes of residents' food consumption demands and structures.

MATERIALS AND METHODS

The connotation of consumption structures: Consumption structures refer to the proportional relation of the consumption of various different kinds of consumption goods (including labor) in certain socio-economic conditions (Jensen, 2006). It is mainly represented by two forms, i.e., material objects and values. The material goods consumed by the people in consumption and their own quantitative proportions become the material object form; value form refers to currency proportional relations of all kinds of consumption goods in the course of consumption, specifically in the form of various living expenses. In fact, a consumption structure is an organic unity of both quality and quantity. The quality of consumption structures includes the qualities of consumer goods themselves, coordination situations of various kinds of consumer goods in living consumption, consumption environment and abilities for consumers themselves to enjoy all kinds of consumer goods and it also directly reflects the degrees of comfort and convenience and enjoyments and funs that people get psychologically and spiritually. The quantity of consumption structures is the unity of physical quantity and value quantity of all kinds of consuming objects. Proceeding from the prescriptivity of quality and quantity, a consumption structure can be defined as: the constitution of all kinds of consuming objects consumed by people in the process of living consumption and its coordination degree.

Evaluation of reasonable food consumption structures: Reasonableness, in the context of the comparison, is a relatively dynamic concept. At

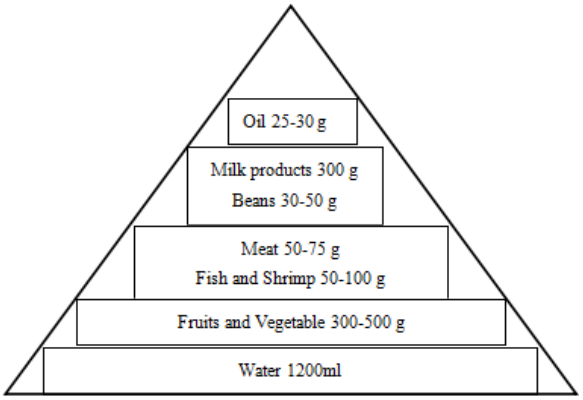

Fig. 1: Balanced diet pagoda diagram

different stages of economic development, the connotations and standards of reasonable food consumption structures will be different (Badrie *et al*., 2006). Taking the physiological needs for food consumption for the starting point and taking Chinese Residents' Dietary Guidelines for the standard, the paper conducts an evaluation on the reasonableness of food consumption structures. The dietary guidelines are the diet guiding principles based on the balanced diet theory and a declarative recommendation for reasonably selecting and matching food, aiming at optimizing dietary structures and reducing the incidences of diseases associated with dietary imbalances.

In order for the public to understand and implement the principle of dietary guidelines in their daily lives, experts specially prepared Balanced Diet Pagoda, which visually shows the recommended daily food varieties, reasonable intake amount and suitable amount of physical activities as shown in Fig. 1.

According to this standard, the standard of diet structures for Chinese residents is: calculated according to the average amount of foods needed by medium energy levels, about 118 kg of cereals, 15 kgs of beans, 146 kgs of vegetables, 110 kgs of fruits, 23 kgs of livestock and poultry meats, 28 kgs of aquatic products, 14 kgs of eggs, 110 kgs of milk and milk products are needed per person each year. Balanced Diet Pagoda presents a nutritionally desirable dietary pattern. There is still a certain distance between the recommended amount of food, especially the amount of dairy and soy foods and the current actual diet consumed by most of people, there may be even longer distances for some impoverished regions. But in order to improve the dietary and nutritional status of residents in China, this is indispensable. It should be seen as a goal to strive for and to achieve gradually.

The concept and meaning of information entropy: Entropy is a state function based on the second law of thermodynamics to describe the non-reversibility of a spontaneous process (Unusan, 2007). Initially the concept of entropy is defined by means of heat transfer between objects, but this definition can only describe the irreversibility of macroscopic processes and unable to reflect structural change features within the system. In order to explain the microscopic mechanism of an irreversible process, Boltzmann eventually gives the following form of entropy function:

$$S = K_B LnP$$

where, K_B is the Boltzmann constant and p is the probability of a certain state for the system. The statistical physics meaning of this function is that a macroscopic system is composed of a large number of microscopic particles, the direction of its spontaneous evolution is the change from a state of small probability to a state of large probability. Since the states of motions of the particles are independent from each other, therefore, in the absence of outside interventions, the system will spontaneously evolve toward the direction of the maximum chaos, until an equilibrium is reached. This is the principle of entropy increase, i.e., the entropy increase of an isolated system is always non-negative.

RESULTS AND DISCUSSION

The introduction of information entropy in the food consumption structure of urban residents: Energy consumption system is a non-linear and open system that has extensive material, energy and information exchanges with the outside world. As time goes on, under the influences of external "disturbances" and internal "fluctuations", the successions and changes of the structures happen to the food consumption structures, showing spontaneous and irreversible evolution characteristics, thus fully complying with the scheduled assumption of the dissipative structure system. Therefore, we can introduce the concept of information entropy to describe the characteristics of its structural changes. At present, the application of information entropy in urban areas mainly focuses on the changes of land-use structures, because land areas are the same in dimensions, resulting an easy application. While energy is completely different, the differences not only exist in the physical states, but also in dimensions which are extremely inconsistent, so it is impossible to use a simple and definitive amount to describe the dynamic evolution rules of food consumption structures. Canonical Correlation Analysis is shown in Fig. 2.

Here, the first problem that needs to be solved is the unification of dimensions. Assuming that there are

Table 1: Canonical correlation coefficients and testing

Canonical variable number	Canonical correlation coefficient	Wilk's	Chi-SQ	DF	Sig
U1, V1	1.000	0.000	46.527	30.000	0.000
U2, V2	0.992	0.000	33.834	20.000	0.027
U3, V3	0.950	0.013	17.425	12.000	0.134
U4, V4	0.888	0.131	8.120	6.000	0.229
U5, V5	0.616	0.620	1.912	2.000	0.384

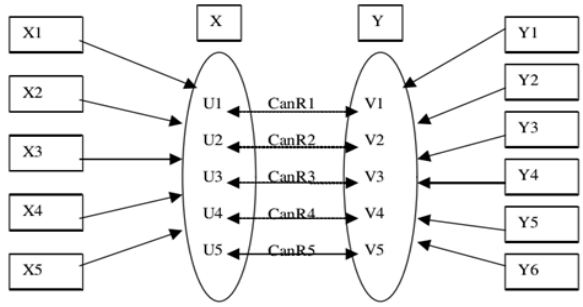

Fig. 2: Sketch of canonical correlation analysis

m types of energy consumed in an economy, firstly by the conversion of heating value, they are converted into standard coal. According to the principles of information theory, referring to the Shannon formula, the information entropy of energy consumption structures can be defined as follows:

$$S = -\sum_{i=1}^{M} \mathrm{P}_i$$

As can be seen from the analysis Table 1 of the model structure, the absolute load value of disposable income per capita (Y2) in the first pair of canonical variables U1 is the largest, showing that the most important variable affecting the structure of food consumption is the income per capita, this coincides with Economics, in which the residence income is the first factor affecting the consumption. The loads of vegetables (Y2), dairy products (Y4), sea foods (Y5) and dried and fresh fruits (Y6) in V1 are larger, indicating that the per capita disposable income is mainly used for the consumption of vegetables, dairy products, sea foods, dried and fresh fruits and that the changes in income are mainly reflected by the changes in vegetable and aquatic products (Bai *et al*., 2007). It indicates that the first thing to be changed is the consumption of vegetables and aquatic products for urban residents after their incomes are raised, indicating the large changes of vegetables and aquatic products in the food consumption structures of urban residents. Income changes do not reflect the changes in the consumption of grains, meats, poultry and eggs, mainly because the consumption of grains, meats, poultry and eggs by urban residents has leveled off, the income growth does not have a significant impact on consumer expenditures on grains, meats, poultry and eggs.

CONCLUSION

A city is a typical dissipative system, which has extensive exchanges of materials and energy with surrounding areas and in the course of these exchanges of materials and energy, the structures and functions continue to strengthen, the degree of order continues to enhance. The input and output of energy is the most basic contact way between a city and its external environment and the changes of food structures are the most important external performances of evolution of industry structures and the changes of environmental quality.

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