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Differences in food product consumption in selected Asian countries

Abstract: The study of consumers' food preferences has not only sociological dimensions but also economic ones, e.g. regarding producers searching for new markets. It is also a good starting point for estimating the willingness of consumers to spend money on the consumption of individual products. In this paper, the authors attempt to compare these preferences on the Asian market for nine product groups. Due to the problem complexity (considerations of tradition, religion, geographical location and size of the continent), the study included selected countries of Central and Southeast Asia (i.e. China, Mongolia, Japan, India, Thailand, Indonesia, Kazakhstan, Uzbekistan, Tajikistan, Malaysia, Myanmar, the Philippines, Pakistan, Cambodia, Vietnam, Laos and Sri Lanka). The study covered the period 2011–2013, and consumption was defined as the arithmetic mean of three years. According to the research results, contrary to the European literature, food preferences in the surveyed Asian countries vary, sometimes even considerably. This is probably related, to a large extent, to the cultural and environmental conditions that prevail in the area in question. This is evidenced by the fact that several countries can be assigned into groups in terms of similarities in food preferences. The study uses Gradual Data Analysis (a measure of ar as an indicator of the dissimilarity of food preferences, overrepresentation maps in order to visualize these dissimilarities and assign countries into groups of similar dietary preferences).

Key words: food preferences, Asia, multidimensional data analysis, GradeStat, GCA algorithm, ar measure, overrepresentation map, grouping of objects

JEL classification: C38, C43, F18, O53, Q18

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Introduction

In Asian countries, rapid economic growth, urbanization and globalization have led to a shift in human diet away from staples and increasingly towards livestock and dairy products, vegetables, fruit, and also fats and oils. Asian diets have also diversified from the traditional dominance of rice towards a Western diet characterized by the increased consumption of wheat and temperate fruit and vegetables [Pingali 2006]. Globalization and the spread of supermarket chains and fast food restaurants are reinforcing those trends. As a consequence, Asian agriculture has significantly changed from its traditional cereal crop production, especially rice, towards a production system that is becoming increasingly commercialized and diversified [Pingali 2006]. As noted by Lipoeto et al. [2013], in South-East Asian countries, the rapid nutrition transition may be due to increasing food availability and food purchasing power rather than to a shift in food preferences towards modern Western foods.

Kearney [2010] studied changes in dietary patterns across the globe for the period 1963–2003 and argued that China is a prime example of a populous developing country exhibiting significant changes within this 40-year period, especially in vegetable oils, meat and sugar, whose consumption per capita has increased. In China, the preference for pulses, roots and tubers has declined. Globally, rice consumption per capita has increased slightly. This is due in large part to the decline in rice consumption in those countries that have predominantly rice-based diets (e.g. China and other East Asian countries). There has been a considerable increase in meat consumption worldwide, with the biggest increases seen in the developing countries (a threefold increase since 1963). A significant part of this rise was attributed to Asia in general and China specifically.

As noted by Delgado [2003], China is leading the way on meat consumption, primarily poultry and pork. India, as a South Asian country, has demonstrated a large increase in total milk consumption. Economic growth in some parts of Asia has been extremely rapid, which is important as food preferences depend on the budget of individual households [Regmi et al. 2001]. Within Asia itself there are big differences both in food consumption and the variety of food products depending on the country's economic condition and social development. Rice consumption is a good example – over 90% of the world's rice is produced and consumed in Asian Region by six countries (China, India, Indonesia, Bangladesh, Vietnam and Japan) comprising 80% of the world's production and consumption. Recently, Asian trends have shown that the production and export of rice have been increasing but its consumption has been decreasing. With growing prosperity and urbanization, per capita rice consumption has started to decline in middle- and high-income Asian countries like Japan, Taiwan and the Republic of Korea. Nearly 25% of the Asian population (in such countries as Afghanistan, North Korea, Nepal and Vietnam), however, are still

not wealthy enough and their demand for rice is not sufficiently satisfied [Abdullah et al. 2006].

On the basis of FAO data, the differences between two Asian countries (Thailand and China) can be observed (Fig. 1). Food consumption (kg per capita), especially for some groups of products are hugely disproportionate. In China, people eat noticeably more vegetables, wheat products and pork, while in Thailand they prefer rice, fruit and sugar.

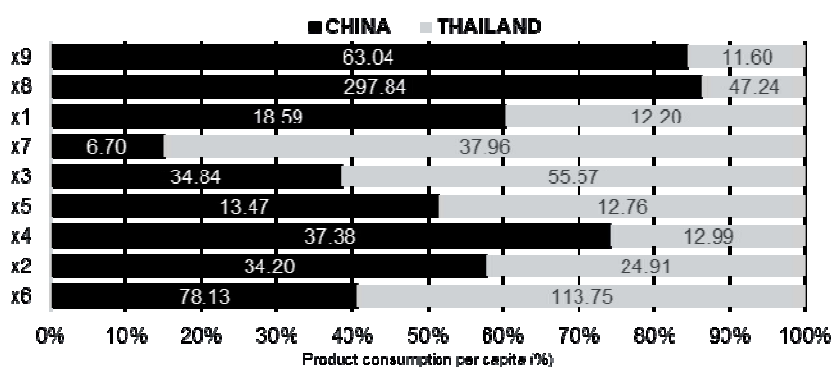


Figure 1

Comparison of product consumption (kg per capita, mean value), 2011–2013

Source: Own calculations on the basis on FAO Stat. nine product groups:

x1 – eggs, x2 – fish, seafood, x3 – fruit, other, x4 – pork, x5 – poultry meat, x6 – rice (milled equivalent), x7 – sugar (raw equivalent), x8 – vegetables, other, x9 – wheat and products.

It is believed that the observed changes in dietary patterns as well as the differences in food products' consumption between Asian countries (brought about as a consequence of the urbanization rate and its level) have significant effects on global food supply, markets and trade, and should be monitored by food producers in Europe and globally. The aim of the study was to compare Asian countries in accordance to food products consumption per capita in 2011–2013.

Research methods and data source

The data used in the study was supplied by the FAO website [FAO 2018] and concerns the quantity of annual consumption (expressed in kg per capita) in 17 Asian countries for nine groups of food products. Used in the paper country codes are according to standard ISO3166-1alpha-3 [2018]. The study covered the period 2011–2013, where consumption was defined as the arithmetic mean of three boundary years. In order to explore the differences and similarities in food preferences for these countries, the tools of multidimensional comparative analysis were used.

The dissimilarities in food consumption preferences can be measured with the use of the unlikeness of measures widely described in the literature [Zimmermann 1968, Jain and Dubes 1988, de Amorim and Mirkin 2012, Binderman et al. 2013]. In this case Minkowski's metrics are preferred, where for any parameter p the unlikeness of the Y object to the X object is measured as the distance d according to the formula (1):

$$d = \left(\sum_{i=1}^n |x_i - y_i|^p \right)^{\frac{1}{p}} \quad (1)$$

In this paper, an attempt was made to examine the dissimilarity of structures in the formulation of the measure ar , which is one of the gradual data analysis tools. The method of determining this measure is based on the Gini index. The Gini coefficient (G) is the doubled area $P(A)$ between the diagonal of the square representing the egalitarian distribution and the Lorenz curve (L) – see Figure 2.

By analogy with the Lorenz curve (L), we can show the unlikeness of the Y structure to the X structure in a broken-line figure connecting certain points. These

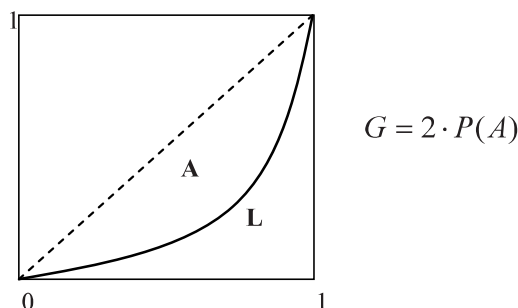


Figure 2
Lorenz curve – explanatory drawing
Source: Own preparations.

points have coordinates which, in this case, are cumulative structures of specific product groups. The measure of the dissimilarity of structure Y to structure X, also on the basis of analogy – this time with the Gini coefficient – is the measure ar . It turns out, however, that the value of this measure depends on the course of the curve determined by the order in which we set the discussed product groups. Figure 3 presents three different broken curves (connecting cumulative structures of the relevant product groups), showing the unlikeness of food consumption preferences between Thailand and China, whose course depends on the order in which the tested product groups were set.

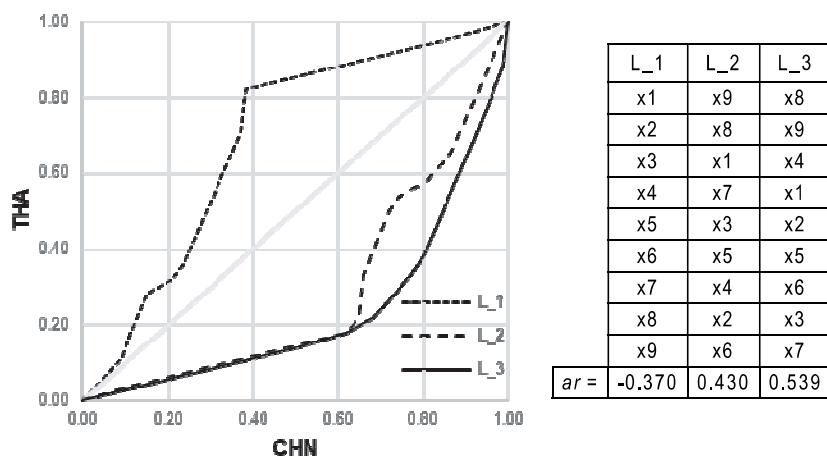


Figure 3

Broken curves of cumulative structure examples of products for three group orderings

Source: Own calculations.

It should be noted, however, that all analogies in this case end with the method of determining the measure ar . This measure cannot be equated in this case either with the notion of distance or with the doubled surface area between the square diagonal and the L curve. If the L curve passes through this diagonal, or (as happens with the curve L1), runs over it, the measure ar can also take negative values. Thus, ar should be understood only as a measure of unlikeness (in this case Thailand in relation to China) on the principle that if Thailand is dissimilar to China in the same way as in the case of L1, where $ar = -0.370$, then the dissimilarity of China to Thailand will amount to $ar = 0.370$.

In the gradual analysis of data, the unlikeness of structures can be visualized with the help of the so-called overrepresentation maps. A visualization of the structures of food preferences in three countries is shown in Figure 4: China, Japan and Thailand. In addition to the figure for the supplement, ar measures are given to determine the magnitude of these dissimilarities.

The overrepresentation map is a square with sides equal to 1, where Asian countries are represented in rows and product groups in columns. The colors show overrepresentation (black) or underrepresentation (white). The width of the row shows the percentage share of the consumption in a given country among the total in all tested countries, and the width of the columns denotes the average structures for product groups. From the map drawn it is easy to read that, among the compared countries, product x8 – vegetables is preferred in China but less so in Thailand. In Japan, more products are consumed: x1 – eggs, x2 – fish, seafood, x5 – poultry meat, x9 – wheat and products, and in Thailand: x3 – fruits, other, x6 – rice (milled equivalent), x7 – sugar (raw equivalent). The map is built on the basis of the GCA

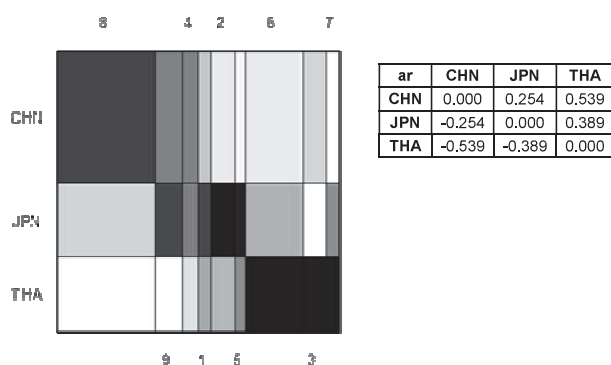


Figure 4

Overrepresentation map for consumption in years 2011–2013 (China, Japan and Thailand – an example)

Source: Own research on the basis of GradeStat software.

algorithm, which sorts rows and columns in order to obtain the largest color contrast along the diagonal of the map.

Results

As described above, the overrepresentation map was created to visualize the food preferences of all 17 surveyed Asian countries. The map is shown in Figure 5a. In addition, three groups of countries with more similar food preferences have been identified on the map. Groups have also been created using the GCA algorithm, which combines objects into classes on the principle of creating new objects in a way that ensures the greatest possible unlikelihood between the created groups – Figure 5b [Szczesny 2002, Kowalczyk et al. 2004, Koszela 2016].

The maps show that the first group included countries (Mongolia – MNG, Tajikistan – TJK, Uzbekistan – UZB, Pakistan – PAK and Kazakhstan – KAZ) in which consumers, compared with those in other countries, consume more product x9 – wheat and products, and much less x2 – fish and seafood, x4 – pork, x6 – rice (milled equivalent). In the second group, the general tendency of preferring x1 – eggs can be observed. This group has the greatest diversity in terms of dietary preferences. This is evidenced by the lack of such regularity in shades of gray for individual countries in this group. With caution, we can generalize preferences in this group by observing the map drawn for those countries (Figure 5b). In group 3, we can find countries in which x6 – rice (milled equivalent) is more popular and x9 – wheat and products is much less popular than in other groups.

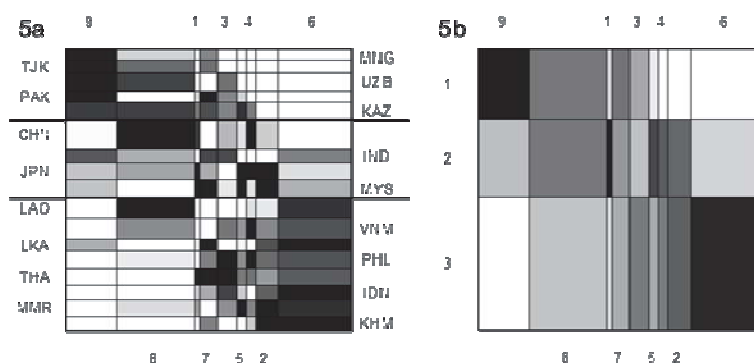


Figure 5
Overrepresentation map for consumption in nine product groups (for years 2011–2013).
Source: Own calculations with the use of GradeStat software.

For completeness, in Tables 1 and 2, are given values of measures ar – unlikeness of structures – between all examined 17 Asian countries and the magnitude of these dissimilarities between the newly formed groups.

By analyzing the Table of unlikeness indicators ar from Table 2, it can be seen that group 2 is more dissimilar to group 1 ($ar = 0.467$) than group 3 is to group 2 (0.306) respectively. For those reasons, the extreme groups 1 and 3 are the least similar (0.698).

Conclusions

The research has shown that food products’ consumption in Asian countries in 2011–2013 was largely different. On the basis of the calculation results, it can be observed that present dietary trends, despite the diversification of food products in the market, are similar in some countries. Our observation mainly allows us to divide countries into three groups, often geographically placed close to each other, but not necessarily so (Sri Lanka, for instance, is not in the same group as India despite their proximity). The most differences were found between the first (comprising Tajikistan, Pakistan, Mongolia, Uzbekistan and Kazakhstan) and third groups of countries (Laos, Sri Lanka, Vietnam, the Philippines, Thailand, Myanmar, Indonesia and Cambodia). Citizens of countries from the first group consume considerably more wheat products and also vegetables, while those from the third group consume more rice, fish and seafood.

Table 1
The unlikeliness measures α for the order of product groups set out by the overrepresentation map presented on Figure 5a for 17 Asian countries

ar	MNG	TJK	UZB	PAK	KAZ	CHN	IND	JPN	MYS	LAO	VNM	LKA	PHL	THA	IDN	MMR	KHM
MNG	0.000	0.115	0.159	0.096	0.370	0.552	0.496	0.612	0.659	0.724	0.762	0.669	0.754	0.792	0.757	0.816	0.861
TJK	-0.115	0.000	0.043	0.006	0.280	0.472	0.434	0.564	0.629	0.665	0.727	0.639	0.729	0.775	0.736	0.796	0.850
UZB	-0.159	-0.043	0.000	-0.029	0.250	0.452	0.415	0.560	0.630	0.654	0.726	0.637	0.731	0.779	0.739	0.805	0.859
PAK	+0.096	-0.006	0.029	0.000	0.222	0.403	0.384	0.489	0.546	0.599	0.653	0.580	0.651	0.672	0.670	0.725	0.780
KAZ	-0.370	-0.280	-0.250	-0.222	0.000	0.217	0.235	0.381	0.474	0.471	0.571	0.518	0.588	0.626	0.624	0.683	0.767
CHN	-0.552	-0.472	-0.452	-0.403	-0.217	0.000	0.054	0.171	0.269	0.285	0.369	0.353	0.391	0.430	0.449	0.485	0.600
IND	-0.496	-0.434	-0.415	-0.384	-0.235	-0.054	0.000	0.070	0.150	0.198	0.258	0.239	0.271	0.292	0.325	0.350	0.447
JPN	-0.612	-0.564	-0.560	-0.489	-0.381	-0.171	-0.070	0.000	0.094	0.147	0.208	0.239	0.228	0.240	0.318	0.333	0.477
MYS	-0.659	-0.629	-0.630	-0.546	-0.474	-0.269	-0.150	-0.094	0.000	0.058	0.121	0.161	0.140	0.136	0.239	0.250	0.398
LAO	-0.724	-0.665	-0.654	-0.599	-0.471	-0.285	-0.198	-0.147	-0.058	0.000	0.050	0.066	0.071	0.103	0.145	0.147	0.279
VNM	-0.762	-0.727	-0.726	-0.653	-0.571	-0.369	-0.258	-0.208	-0.121	-0.050	0.000	0.039	0.016	0.020	0.114	0.119	0.267
LKA	-0.669	-0.639	-0.637	-0.580	-0.518	-0.353	-0.239	-0.239	-0.161	-0.066	-0.039	0.000	-0.025	-0.022	0.065	0.052	0.189
PHL	-0.754	-0.729	-0.731	-0.651	-0.588	-0.391	-0.271	-0.228	-0.140	-0.071	-0.016	0.025	0.000	-0.005	0.101	0.107	0.252
THA	-0.792	-0.775	-0.779	-0.672	-0.626	-0.430	-0.292	-0.240	-0.136	-0.103	-0.020	0.022	0.005	0.000	0.107	0.116	0.257
IDN	-0.757	-0.736	-0.739	-0.670	-0.624	-0.449	-0.325	-0.318	-0.239	-0.145	-0.114	-0.065	-0.101	-0.107	0.000	-0.010	0.134
MMR	-0.816	-0.796	-0.805	-0.725	-0.683	-0.485	-0.350	-0.333	-0.250	-0.147	-0.119	-0.052	-0.107	-0.116	0.010	0.000	0.167
KHM	-0.861	-0.850	-0.859	-0.780	-0.767	-0.600	-0.447	-0.477	-0.398	-0.279	-0.267	-0.189	-0.252	-0.257	-0.134	-0.167	0.000

Source: Own calculations with the use of GradeStat software

Table 2

Unlikeness measures ar for the product group order determined by the overrepresentation map set out in Figure 5b for the three created groups

ar	Group 1	Group 2	Group 3
Group 1	0.000	0.467	0.698
Group 2	-0.467	0.000	0.306
Group 3	-0.698	-0.306	0.000

Source: Own calculations with the use of GradeStat software

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Różnice w preferencjach żywieniowych w wybranych krajach Azji

Abstrakt: Badanie preferencji żywnościowych ma poza aspektem socjologicznym, także aspekt ekonomiczny, np. ze strony producentów i szukania przez nich rynków zbytu dla produkowanej żywności. Jest także punktem wyjścia do szacowania skłonności konsumentów do ponoszenia wydatków na poszczególne produkty żywnościowe. W pracy podjęto próbę porównania tych preferencji na rynku azjatyckim odnośnie 9 grup produktowych. Z powodu złożoności problemu (względy tradycji, religii, położenia geograficznego i wielkości kontynentu) w badaniu uwzględniono 17 wybranych krajów Azji środkowej i południowo-wschodniej (Chiny, Mongolia, Japonia, Indie, Tajlandia, Indonezja, Kazachstan, Uzbekistan, Tadżykistan, Malezja, Myanmar, Filipiny, Pakistan, Kambodża, Wietnam, Laos i Sri Lanka). Badanie przeprowadzono w latach 2011–2013, a wyniki uśredniono dla każdego kraju dla każdej grupy produktowej na przestrzeni trzech lat. Wyniki badań wskazują, że wbrew obiegowej opinii Europejczyków, preferencje żywnościowe w krajach azjatyckich rozpatrywanego regionu różnią się, czasem nawet znacznie. Decyduje o tym zapewne, w dużej mierze, aspekt kulturowy oraz warunki środowiskowe, które przeważają nad bliskością sąsiedztwa pomiędzy państwami. Świadczy o tym wynik podziału państw na grupy pod względem podobieństw preferencji żywnościowych w badanym okresie. W obliczeniach posłużono się metodami gradacyjnej analizy danych (miarą *ar* jako miarą niepodobieństwa preferencji żywieniowych, mapami nadreprezentacji w celu wizualizacji tych niepodobieństw oraz podziału państw na odpowiednie grupy krajów o zbliżonych preferencjach żywieniowych).

Słowa kluczowe: Preferencje żywieniowe w Azji, wielowymiarowa analiza danych, Grade-Stat, algorytm GCA, miara *ar*, mapy nadreprezentacji, grupowanie obiektów

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