



## Examination of Consumption Expenditure Distribution among NUTS-2 Regions in 2007-2018 with GINI Coefficient

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### Abstract

In this study, the distribution of 12 main expenditure categories included in the consumer price index (CPI) among NUTS-2 (Nomenclature of Territorial Units for Statistics-2) regions is examined. The study covers the years 2007-2018. In the study, interregional consumption expenditure rates are identified with the Gini coefficient, which is a measure of inequality and the obtained consumption expenditure rates through the years are interpreted. The coefficients calculated for each expenditure category are important in terms of revealing the course of consumption behavior of households in Turkey over the years and reflecting the best and worst distribution at the NUTS-2 level. Findings regarding the expenditure categories show that the consumption behavior in Turkey in the relevant period is far from equal at the regional level. According to the findings, the expenditure category with the highest inequality at the NUTS-2 level is the food and non-alcoholic beverages category with an average Gini coefficient of 0.3031. The expenditure category with the highest equal distribution, on the other hand, is the education category with a Gini coefficient of 0.2307 according to the findings.

**Keywords:** NUTS-2, Consumer Consumptions, Consumer Price Index, Lorenz Curve, Gini Coefficient



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# Examination of Consumption Expenditure Distribution among NUTS-2 Regions in 2007-2018 with GINI Coefficient

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## I. Introduction

Economic policies aim to increase the welfare level of all individuals and social groups in an economy. At this point, the distribution of the total income in an economy in a certain period among individuals, households, social groups, regions, or elements of production defines income distribution by definition. Income distribution, which is one of the important indicators of the economy, is a factor that directs the consumption behavior of consumers to a great extent. Consumption behavior is an important indicator of household welfare. Consumption expenditures are also frequently used in income distribution calculations in the economics literature.

Numerical analysis of household consumer behavior at different income levels began to gain momentum in the late 1700s. In the 1790s, two researchers, David Davies and Frederick Eden analyzed the expenditure distribution of particularly poor families in England among food, fuel, rent, clothing, health, and other expenditure categories. Then, among the researchers who developed statistical techniques related to social data in the 1850s, Adolphe Quételet was the pioneer of studies examining individual behaviors through aggregated data. Inspired by previous researchers and Quételet, German statistician Ernst Engel analyzed the relationship between the income level of socio-economic classes living in Belgium and the expenditure categories in 1857. As a result of his research with 153 families, Engel came up with a consumption law. According to this, the poorer a family is, the higher the share it will allocate for food in its total expenditures. This was Engel's first general finding from the data regarding the budget of families. In 1895, Engel examined the expenditure categories according to income levels. The findings of this study revealed that as the income increases, the share consumers allocate for clothing in total expenditures increases, as well as the share they allocate for housing and fuel decreases (Stigler, 1954). These findings have been incorporated into economic theory as the Engel curve or the Engel's law.

Consumer spending from their budget for various expenditure categories varies in different income levels. In addition, the spending behaviors of households living in different geographical regions and having different

demographic characteristics also vary.<sup>1</sup> At this point, the interaction between theoretical thought and empirical studies and rapid advances in data acquisition provided an attractive opportunity to investigate household spending behaviors (Blundell, 1988). Many studies in economics literature examine the consumption expenditures of consumers, that is, the shares they allocate for different expenditure categories from their budgets. Houthakker's 1952 study, which is one of the studies that use the traditional approach to calculate expenditure elasticity values<sup>2</sup>, examines household expenditures on food, rent, clothing, and other expenditure categories in 30 countries and the relationship between these expenditures and family size. The findings show that expenditure elasticity values of households are similar but not the same. Giles and Hampton (1985) examined the expenditures of households in seven different expenditure categories in New Zealand and found that their expenditure elasticity was quite low. The authors compared their findings with the results they obtained from their studies for Australia, England, and the United States of America. The estimations made by Chung, Lee, and Brown (2002) using the expenditure data of Taiwanese households for the period 1996-1998 regarding ten commodity categories coincide with the findings of Giles and Hampton (1985). McDowell et al. (1997) examined household consumption expenditures from the aspect of income levels and found that especially food consumption expenditures vary to a great extent among different income levels. Djibuti et al. (2007), in their study for independent states including Russia, reveals the relationship between household expenditures and demographic and socio-economic factors. According to this study, tobacco expenditures of highly rich families are significantly higher than those of poor families.

In studies using the Lorenz curve, expenditure elasticity values of all expenditure categories are calculated by using the estimation parameters obtained from the Lorenz curve (Chung, Lee, & Brown; 2002). The Lorenz curve was created in 1905 and it is a graphical representation of the wealth density among a group of households and is a measure of income inequality. Although the estimations made with the Gini coefficient provide accurate and precise data on income distribution, it is argued that the obtained estimations

<sup>1</sup>This difference in consumption expenditure is explained by income elasticity in microeconomic theory. Goods with positive income elasticity (normal goods) are goods for which demand increases as the income of the consumer increases, while goods with negative income elasticity (inferior goods) are those for which demand decreases as the income of the consumer increases. Therefore, the factor that determines the direction of demand here is the quality of the good. This is what Engel's analysis of commodity groups indicates.

<sup>2</sup>Studies using the traditional approach to estimate the elasticity of expenditure generate an appropriate functional form for each category of goods and thus obtain an elasticity value at any level of total expenditure (Chung, Lee, & Brown, 2002). This approach is based on the evaluation of the elasticity coefficients estimated from the Engel curves.

should be based on the tables obtained from the Lorenz curve (Fellman, 2012). The Lorenz curve is widely used to represent and analyze household consumption expenditures and income or wealth distribution (Akbay, 2005; Bhattacharya, 2007; Kakwani and Podder, 2008; Filiztekin and Çelik, 2010; Kabaş, 2010; Dutta and Panda, 2014; Lyon and Gastwirth, 2016; Zhang et al., 2019).

In 1987, the Household Income and Consumption Expenditures Survey was applied for the first time in Turkey to cover the whole country. This survey includes information showing that income and consumption expenditures vary in different regions, population strata, and rural and urban areas. The 1994 Household Income and Consumption Expenditure Survey was prepared separately to identify consumption expenditures and income distribution with a different method. With this survey, indicators related to consumption expenditures and income distribution in urban and rural areas throughout Turkey were obtained. However, in 2003, during the process of adaptation to the European Union (EU) and in order to form a basis for the harmonized index of consumer prices that has been implemented in 2003, it started to be applied with a new name, "Household Budget Survey" (TÜİK, 2018). In Turkey, Akbay and Bilgiç (2011) estimated the general consumption and food expenditures of households and the income elasticity of food subcategories. Their findings show that housing and rent expenditures have the highest percentage in total consumption expenditures with 29.1% and food consumption expenditures take second place with 22.6% in Turkey. Çağlayan and Astar (2012) estimated the determinants of household consumption expenditures separately in Turkey, using the 2009 Household Budget Survey data from the Turkish Statistical Institute (TURKSTAT). The findings indicate that consumption expenditures in rural and urban areas differ depending on various factors (such as age, gender, household size). The study in which Şengül and Sigeze (2013) examined the expenditure categories for Turkey between 2005 and 2009 shows that the expenditure elasticity values of food and non-alcoholic beverages, clothing and shoes, housing, water, electricity, fuel, furniture and household appliances, communication, alcoholic beverages, cigarettes, and tobacco are low. Expenditures for health, transportation, education, cultural activities and entertainment, restaurant, hotel, and pastry categories vary to a great extent depending on income level. Yereli and Şahin (2014), based on the Household Budget Survey data from the years 2002-2009, examined the budget shares of households for 12 different expenditure categories in Turkey. Housing and rental expenditures took the highest share according to expenditure ratios, while communication expenditures took the lowest. Yılmaz's (2014) study reveals the effect of inequality in income distribution on the distribution of consumption expenditures. For this purpose, Lorenz curves were created for total income and 13 expenditure categories from TURKSTAT 2008 household consumption expenditure data, and Gini coefficients for these Lorenz curves were calculated. According to the Gini coefficients, there are relatively unequal spending behaviors in Turkey.

In this study, consumer price index (CPI) main expenditure categories are discussed in terms of total expenditure rates at the NUTS-2 level (Nomenclature of Territorial Units for Statistics-2), unlike other studies in the economics literature that discuss them in terms of income levels. In the study covering the 2007-2018 period, the distribution of each of the 12 main expenditure categories to the total consumption expenditures among the regions is identified using the Gini coefficient, which is an indicator of inequality, and the consumption expenditure rates over the years are interpreted. The empirical findings show that the expenditure category with the highest inequality at the NUTS-2 level in the specified period is the food and non-alcoholic beverages category, and the expenditure category with the highest equal distribution is the education category.

The study consists of four sections. After the introduction section, in which the theoretical and empirical literature is explained, the data are introduced and the method of the study is explained in the second section. In the third section, the findings of the analyses are given. The fourth section consists of the results and conclusion.

## II. Data and Methodology

In the study, the data used to measure the inequality of distribution of expenditure rates based on population are:

- i) Consumption expenditure rates based on NUTS-2 for 12 consumption expenditure categories from TURKSTAT for the period 2003-2018, "Distribution of expenditure categories based on Nomenclature of Territorial Units for Statistics-2"<sup>3</sup>,
- ii) Population data obtained from the population statistics from ADNKS (Address Based Population Registration) system of TURKSTAT.<sup>4</sup>

The Gini coefficient has been used to measure the inequalities of the distribution of expenditure rates based on population, and the Lorenz curve has been used for its graphical representation. The Gini coefficient was first used in 1912 by the Italian scientist Corrado Gini to identify the inequalities in income distribution. Today, this coefficient is also used in different fields in which inequality in distributions needs to be measured.

Besides various calculation methods, the Gini coefficient was defined by Brown in 1994 as follows (Brown, 1994; Öztürk and Aktar, 2009):

$$G = 1 - \frac{\sum_{k=1}^{n-1} (Y_{k+1} + Y_k)(X_{k+1} - Y_k)}{Y_k} \quad (1)$$

$Y_k$ =Expenditure category rates by region

$X_k$ = Population density of the regions by years

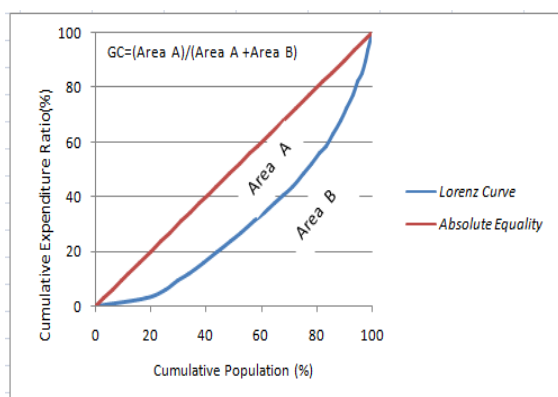
$k=1, \dots, n$

<sup>3</sup> [https://tuikweb.tuik.gov.tr/PreTablo.do?alt\\_id=1012](https://tuikweb.tuik.gov.tr/PreTablo.do?alt_id=1012)

<sup>4</sup> [https://tuikweb.tuik.gov.tr/PreTablo.do?alt\\_id=1059](https://tuikweb.tuik.gov.tr/PreTablo.do?alt_id=1059)

The Gini coefficient takes a value between 0 and 1. A value of zero indicates absolute equality and a value of one indicates absolute inequality. Accordingly, a Gini coefficient approaching zero indicates that inequality decreases, while a value close to one indicates that inequality increases.

The representation of the Lorenz curve and the Gini coefficient is as follows:



**Figure 1. Lorenz Curve and Gini Coefficient**

Source: Composed by authors

In this study, as shown in Figure 1, the cumulative population on the horizontal axis in the representations on the Lorenz curve, and the cumulative percentages of the spending rates within the general expenditure categories of various spending groups on the vertical axis are shown. The study also analyzes the relationships among these calculated coefficients and the income distribution coefficients calculated by TURKSTAT.

### III. Analysis and Findings

In the study, it is examined whether the ratio of 12 CPI main expenditure categories to general expenditure is evenly distributed among the regions between 2007-2018 in Turkey. For this purpose, Gini coefficients have been calculated for 12 expenditure categories in the study. The coefficients calculated separately for each year and each expenditure category are important in terms of revealing the course of household consumption behaviors over the years and reflecting the best and worst distribution for each year.

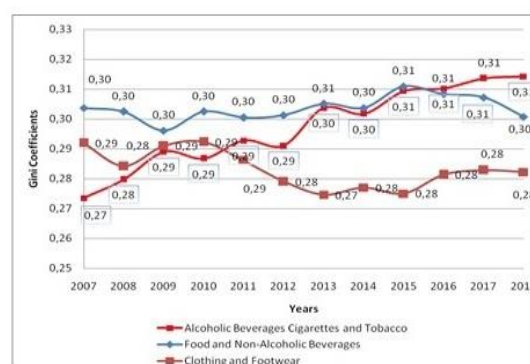
The Gini coefficients calculated for 12 expenditure categories and the course of these coefficients over the years (2007-2018) are presented below through tables and figures. In the study, 12 expenditure categories are presented with tables and figures in groups of 3.

The course of the Gini coefficients of a-) Food and Non-Alcoholic Beverages, b-) Alcoholic Beverages, Cigarettes and Tobacco, c-) Clothing and Footwear expenditure categories over the years are indicated in Table 1 and Figure 2.

**Table 1: Gini Coefficients of Expenditure Categories for Food and Non-Alcoholic Beverages, Alcoholic Beverages, Cigarettes and Tobacco and Clothing and Footwear by Years**

Year	Food and Non-Alcoholic Beverages	Alcoholic Beverages Cigarettes and Tobacco	Clothing and Footwear
2007	0,3037	0,2735	0,2919
2008	0,3025	0,2797	0,2842
2009	0,2961	0,289	0,291
2010	0,3025	0,2867	0,2923
2011	0,3005	0,2928	0,286
2012	0,3013	0,2911	0,279
2013	0,3051	0,3037	0,2746
2014	0,3037	0,3017	0,277
2015	0,3109	0,3093	0,275
2016	0,3083	0,3102	0,2814
2017	0,3072	0,3136	0,2828
2018	0,3007	0,3142	0,2822

Source: Composed by authors



**Figure 2. The Course of the Gini Coefficients of the Inequalities of Expenditure Rates at the NUTS-2 Regional Level between 2007 and 2018**

Source: Composed by authors

Table 1 and Figure 2 show the Gini coefficients of the three main expenditure categories and the course of these coefficients over the years. These expenditure groups are (a) food and non-alcoholic beverages, (b) alcoholic beverages, cigarettes, and tobacco, and (c) clothing and footwear. In the food and non-alcoholic beverages category, the lowest Gini coefficient (0.29, the best distribution) was in 2009, and the highest Gini coefficient (0.31, the worst distribution) was in 2015. In the remaining years, expenditures on food and non-alcoholic beverages were almost equally distributed among regions. It is noteworthy that the Gini coefficient of the alcoholic beverages, cigarettes, and tobacco category has increased continuously from 2007 to 2018, in other words, there has been a trend towards inequality between regions in this expenditure category over the years. Accordingly, in the alcoholic beverages, cigarettes, and tobacco category, the lowest Gini coefficient was observed in 2007 (0.2775), and the highest Gini coefficient was observed in 2018 (0.3142). It is seen that the Gini coefficients of the clothing and footwear category are lower than the other two main expenditure categories over the years. This finding shows that the

expenditures of the clothing and footwear category are relatively more evenly distributed compared to the other two main expenditure categories. In this expenditure category, the highest Gini coefficient (0.2923, the worst distribution) was in 2010, and the lowest Gini coefficient (0.2746, the best distribution) was in 2013. According to the findings, among the three main expenditure categories shown in Figure 1, the expenditure category with the worst distribution at the regional level by years (the highest average Gini coefficient) is alcoholic beverages, cigarettes, and tobacco.

Among other expenditure categories, the course of Gini coefficients of d-) Housing and rental, e-) Furniture and household appliances, f-) health expenditure categories by years can be seen in Table 2 and Figure 3.

**Table 2: Gini Coefficients of Housing and Rental, Furniture and Home Appliances, and Health Expenditure Categories by Years**

Year	Housing and Rental	Furniture and Home Appliances	Health
2007	0,2382	0,2879	0,2600
2008	0,2329	0,2967	0,2665
2009	0,2278	0,2770	0,2728
2010	0,2238	0,2797	0,2731
2011	0,2271	0,2740	0,2771
2012	0,2352	0,2700	0,2779
2013	0,2438	0,2608	0,2679
2014	0,2499	0,2578	0,2557
2015	0,2519	0,2701	0,2385
2016	0,2554	0,2742	0,2469
2017	0,2507	0,2755	0,2627
2018	0,2422	0,2749	0,2765

Source: Composed by authors



**Figure 3. The Course of Gini Coefficients of Inequalities of Expenditure Rates at NUTS-2 Level Regions between 2007-2018**

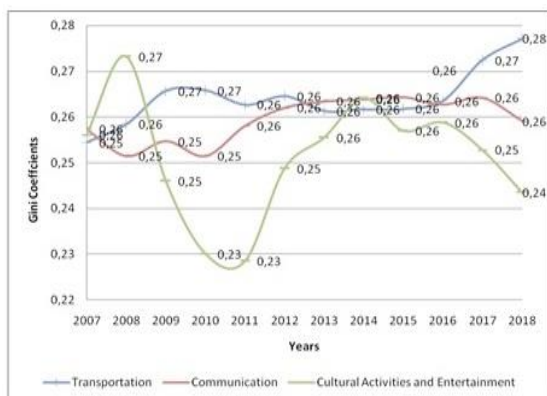
Source: Composed by authors

Table 2 and Figure 3 show the Gini coefficients of (d) housing and rent, (e) furniture and household appliances, and (f) health expenditure categories and the course of these coefficients over the years. In the housing and rent expenditure category, the year with the lowest inequality between regions is 2010, and the year with the highest is 2016. In addition, the findings show that the inequality in the interregional consumption expenditure rates of this group between 2012 and 2016 was higher than in other years and that inequality started to decrease after 2016. In the furniture and household appliances category, the lowest Gini coefficient was 0.258 in 2014 and the highest Gini coefficient was 0.297 in 2009. When the Gini coefficients of health expenditures are examined, it is seen that the best distribution occurred in 2015 (0.239). The inequality among regions, which has increased continuously after 2015, went up to 0.278 in 2018. Among the three main expenditure categories shown in Figure 3, the best distribution by years was in the housing and rent category, and the worst distribution was in the furniture and household appliances category.

**Table 3: Gini Coefficients of Transportation, Communication, Cultural Activities and Entertainment Expenditure Categories by Years**

Year	Transportation	Communication	Cultural Activities and Entertainment
2007	0,2544	0,2574	0,2561
2008	0,2585	0,2515	0,2732
2009	0,2657	0,2547	0,246
2010	0,2658	0,2515	0,2301
2011	0,2627	0,2581	0,2285
2012	0,2646	0,262	0,2487
2013	0,2613	0,2634	0,2555
2014	0,2617	0,2638	0,2641
2015	0,2618	0,2643	0,257
2016	0,2635	0,2627	0,2588
2017	0,2724	0,2642	0,2528
2018	0,2772	0,2591	0,2435

Source: Composed by authors



**Figure 4. The Course of Gini Coefficients of Inequalities of Expenditure Rates at NUTS-2 Level Regions between 2007-2018**

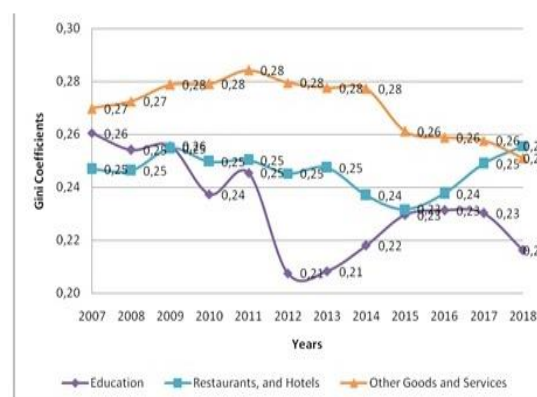
Source: Composed by authors

In Table 3 and Figure 4, (g) Transportation, (h) communication, and (i) cultural activities and entertainment expenditure categories are shown. According to this, the lowest Gini coefficient in the transportation category was 0.2544 in 2007, and the highest Gini coefficient was 0.2778 in 2018. When we look at the general course, it is seen that the expenditure rates at the level of the regions in the transportation category have a similar distribution, but there is a trend towards inequality in 2017 and 2018. In the communication expenditure category, the best distribution was in 2008 and 2010, and the worst distribution was in 2015. In the cultural activities and entertainment expenditure category, it is seen that the inequality among the regions is high over the years. According to the findings of this category, the lowest Gini coefficient (best distribution) was 0.2285 in 2011, and the highest Gini coefficient (worst distribution) was 0.2732 in 2008. The findings show that among the three expenditure categories in Figure 3, the best distribution by years is in the cultural activities and entertainment category. It has been observed that the average Gini coefficients in the transportation and communication categories are quite close to each other over the years. This finding shows that the distribution at the regional level is almost equal in these two main expenditure categories.

**Table 4: Gini Coefficients of Education, Restaurants, and Hotels, and Other Goods and Services Expenditure Categories by Years**

Year	Education	Restaurants and Hotels	Other Goods and Services
2007	0,261	0,247	0,270
2008	0,254	0,246	0,273
2009	0,256	0,255	0,279
2010	0,237	0,250	0,279
2011	0,246	0,250	0,284
2012	0,208	0,245	0,280
2013	0,208	0,247	0,278
2014	0,218	0,237	0,277
2015	0,230	0,232	0,261
2016	0,231	0,238	0,259
2017	0,230	0,249	0,258
2018	0,216	0,256	0,251

Source: Composed by authors



**Figure 5. The Course of Gini Coefficients of Inequalities of Expenditure Rates at NUTS-2 Level Regions between 2007-2018**

Source: Composed by authors

Figure 5 and Table 4 show (j) education, (k) restaurants and hotels, (m) other goods and services expenditure categories. In the education category, the inequality at the regional level by years was the lowest in 2018 (0.2163). The worst distribution occurred with 0.2605 in 2007. In the restaurants and hotels expenditure category, the best year was 2015 and the worst year was 2018. In other goods and services, 2015 has the best distribution, while 2010 has the worst distribution. Among the three expenditure categories in the graph, the best distribution among regions by years is seen in the education expenditure category. Other goods and services category has the worst distribution.

#### IV. Conclusion

In the study, the ratio of the 12 main expenditure categories under the CPI to the total consumption expenditures was identified with the Gini coefficient among the regions at the NUTS-2 level. In the study covering the years 2007-2018, the Gini coefficient calculated for each main expenditure category based on years shows the good and bad distribution characteristics of consumption behaviors by to the expenditure categories. According to this, a Gini coefficient approaching zero indicates that inequality decreases, while a value close to one indicates that inequality increases.

According to the empirical findings, the highest average Gini coefficient of 0.3031 among the 12 main expenditure categories over the years was in the food and non-alcoholic beverages category. This finding shows that the expenditure category with the highest inequality among regions is food and non-alcoholic beverages. Considering that food expenditures are the most important expenditure category closely related to household incomes and its share in total expenditure is considered, it is significant that the inequality between regions is high in this expenditure category. The worst distribution in this category occurred in 2015. Another expenditure category with high inequality is alcoholic beverages, cigarettes, and tobacco. According to the findings, the level of inequality in this category has continuously increased after 2013. In the clothing and footwear category, it is seen that the inequality among regions is high with an average of 0.2825. The following expenditure categories are furniture and household appliances, health, transportation, and communication categories (average Gini coefficients 0.2745; 0.2672; 0.2631; 0.2605, respectively, over the years).

The expenditure category with the highest equal distribution among the regions over the years is the education category with an average Gini coefficient of 0.2307. Considering that the share of education expenditures in total expenditures is quite low, it is an expected finding that the distribution in the education category at the level of regions is relatively high. In this category, the best distribution was in 2012 and the worst distribution was in 2007. Another expenditure category where inequality is relatively low compared to other expenditure categories is housing and rent. According to the findings, the best distribution of housing and rental expenditures between regions is the period between 2007-2011. In this category, it is noteworthy that inequality has gradually increased from 2012 to 2018. The other expenditure category that follows the education category towards equal distribution is restaurants and hotels. While the best distribution was in the restaurant and hotels category in 2015, the worst distribution was seen in 2018.

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## APPENDIX

### Appendix 1: Representation of the Lowest and Highest Gini Coefficients (GK) calculated over the Years on the Basis of Expenditure Categories with the Lorenz Curve

