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# Inequality in Food Consumption and Diet Diversity: Evidence from Turkey

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## Abstract

Hunger is one of the devastating problems in the world. More than eight hundred million people are undernourished. However, hunger is one part of the food security problem. In addition to the undernourished people, two billion people also have health problems due to being overweight and obese. Therefore, food security needs to be discussed in the context of consumption distribution. This paper estimates food consumption inequality in Turkey. Using more than 150 thousand households' monthly expenditures and a quantile regression approach, this paper shows how food inequality changes throughout 2003-2017. In addition to food consumption inequality, we estimate diet diversity inequality and show the impact of income on it. Our study finds that food consumption inequality increased after the food crisis of 2007. Food consumption inequality is mostly intensified in rural areas. We do not find any differentiated income, education, or employment effects. Rich households have a more diversified diet than poor households. However, diet diversity increased for all households, especially in the last five years. Income has a negative impact on diet diversity in rich households, positive impact in poor households. Therefore, income decreases diet diversity inequality. Our results show the importance of food distribution in the discussion of food security policies.

**Keywords:** Food Security, Inequality, Diet Diversity, Malnutrition, Turkey
**JEL Codes:** D12; D31; D39

# Gıda Tüketiminde Eşitsizlik ve Beslenme Çeşitliliği: Türkiye'den Bulgular

## Öz

Açlık dünyadaki yıkıcı sorunlardan birisidir. Dünyada sekiz yüz milyondan fazla insan yetersiz düzeyde beslenmektedir. Ancak açlık dünyadaki gıda güvencesi sorunun sadece bir parçasıdır. Yetersiz düzeydeki beslenmeye ek olarak, dünyada iki milyar insan yüksek kilo ve obeziteye bağlı sağlık sorunları yaşamaktadır. Bu yüzden gıda güvencesi konusu tüketim dağılımı kapsamında değerlendirilmelidir. Bu çalışma Türkiye'de gıda tüketim eşitsizliğini hesaplamaktadır. 150 binden fazla haneye ait aylık harcamalar ve kantil regresyon yöntemi kullanılarak 2003-2017 döneminde gıda eşitsizliğinin nasıl değiştiği gösterilmektedir. Gıda tüketim eşitsizliğine ek olarak, beslenme çeşitliliğinin eşitsizliği de değerlendirilmiş ve bu konular üzerinde gelirin etkisi gösterilmiştir. Bu çalışma Türkiye'de 2007 gıda krizinden sonra gıda tüketim eşitsizliğinin arttığını bulmuştur. Gıda tüketim eşitsizliği özellikle kırsal alanlarda daha fazla yoğunlaşmaktadır. Ayrıca çalışma kapsamında gelir, eğitim ve işgücüne bağlı olarak eşitsizliğin değişmediği bulunmuş, sadece zengin hanelerin yoksul hanelerden daha çeşitli bir beslenmeye sahip olduğu gösterilmiştir. Ancak son beş yılda beslenme çeşitliliğinin bütün hane grupları için arttığı tespit edilmiştir. Gelirin beslenme çeşitliliği üzerinde zengin hanelerde negatif, yoksul hanelerde pozitif etki yaptığı bulunmuştur. Böylelikle gelirin beslenme eşitsizliğini azalttığı tespit edilmiştir. Çalışma bulguları gıda dağılımının gıda güvencesi politikaları tartışmalarında dikkate alınması gerekliliğine işaret etmiştir.

**Anahtar Kelimeler:** Gıda Güvencesi, Eşitsizlik, Beslenme Çeşitliliği, Beslenme Bozukluğu

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## 1. Introduction

The main topic discussed in inequality research is how income is distributed among individuals. Researchers focus on income inequality to understand the change of the world economy in the process of globalization (Anand & Segal, 2008). In addition to income inequality, there has been a growing interest in consumption inequality in recent years. Because as mentioned in Blundell and Preston (1998), income may not be enough to represent the household's long-term assets compared to the consumption. The consumption concept also has foundations in the classic economic theory that focus on the individual's utility (Attanasio, Hurst, & Pistaferri, 2014; Slesnick, 1994). Additionally, consumption expenditure constitutes one-third of GDP in most countries; therefore, understanding the consumption behavior may play a critical role in the policymaking process (Jappelli & Pistaferri, 2010).

Nondurable products are the main products chosen in the consumption inequality studies (Blundell & Etheridge, 2010; Krueger & Perri, 2006). Mostly, any specific importance has not been given to a subgroup of consumption. However, in our paper, we specifically select the food category and evaluate food consumption inequality because food products are different from other nondurable goods. One of the main reasons explaining this difference is that food is essential for human nutrition, and there is no substitute product of food considering its essentiality for health. Because food consumption inequality is directly related to the food security of any country, we discuss our topic in the context of food security literature.

The literature on food security is quite rich. Poverty, hunger, and access to food are the main topics discussed in international or national policy areas. In the current literature, the starting point is to understand how the households decide on food consumption (Clements & Si, 2018; Gerbens-Leenes, Nonhebel, & Krol, 2010; Unnevehr et al., 2010). Additionally, determining the level of the food security of a given household or an individual and then evaluating the factors that affect the food security levels are the topics evaluated in the current literature. In the food security literature, income (Kirk, Kilic, & Carletto, 2018), other assets (Rammohan & Pritchard, 2014; Sseguya, Mazur, & Flora, 2018), households structure (Lamidi, 2019), regional properties (Morioka & Kondo, 2017; Omidvar, Ahmadi, Sinclair, & Melgar-Quinonez, 2019), education of household members (Sseguya et al., 2018), participation to the off-farm and employment markets (Aryal, Mottaleb, & Rahut, 2018; Chege, Andersson, & Qaim, 2015; Dedehouanou & Araar, 2020; Dzanku, 2019; Ogutu, Godecke, & Qaim, 2019; Stifel & Minten, 2017) are the topics selected and discussed extensively.

In the food security literature, mostly the distribution of food is neglected. However, one of the main aspects of food security is directly related to food distribution. In today's world,

even though eight hundred million people are undernourished (FAO, 2019b), in the same world, the number of overweight or obese adults is close to two billion (WHO, 2017a). For instance, one-third of the population in Yemen or Uganda does not have enough food (FAO, 2019c). However, in the U.S., the same ratio is for the people who have health issues due to being overweight, obese, or having the same problems. Therefore, one part of the world has the problem of undernutrition, another part of the world has the problem of overnutrition (Moomaw, Griffin, Kurczak, & Lomax, 2012). The food distribution problem is not just between the rich and poor countries. There is also a distribution problem within a specific country. For instance, in Yemen, the prevalence of undernourishment is 34%, and in the same country, the prevalence of obesity is 14%. The issue is not just for poor countries. There is also a distribution problem of healthy food products in rich countries (Allcott et al., 2019).

Neglecting food distribution may cause applying inappropriate policies. For instance, an agricultural price support policy may decrease the market prices to help people access cheap foods. However, in the following time, because of the low-price policy, people may overconsume this specific product, and then there could be a health problem due to overnutrition. The policy may have a positive impact on one side, a negative impact on the other side of society. This issue is defined as the "*double burden of malnutrition*" that the underweight and overweight people may coexist in a given society. To over this problem, policymakers should consider the distribution problem of food (Sarmiento et al., 2014; WHO, 2017b).

In this paper, we evaluate food consumption inequality in Turkey. The period of 2003-2017 is selected. Turkey's economy grew in the selected period, and per capita income significantly increased. However, this period in Turkey was not a steady improvement. As Acemoglu and Ucer (2015) discussed, Turkey's economy rapidly and qualitatively grew at the beginning of the selected period; however, after 2007, the quality of growth decreased. Therefore, we expect that food distribution may differ between these two growth periods. The year 2007 has another importance in the context of food consumption. The years 2007-2008 were the beginning of the severe food crisis in the world. Therefore, we also provide evidence on the impact of food crises on food consumption inequality.

This paper uses the Household Budget Survey data, which is regularly collected in Turkey, and estimates food consumption inequality and its distribution for more than 150 thousand households. The methodology or approach that is followed by the Household Budget Survey is the one determined by UN classification. Therefore, we expect our paper's empirical strategy to be valid for other country budget surveys.

This paper also contributes to the current literature with its empirical strategy. In addition to food consumption inequality, nutrition inequality is also estimated and evaluated by the quantile regression approach. This approach helps us consider the inequality distribution of the households in our dataset and shows how the results might change between different income groups. The other empirical contribution of the paper is the issue of seasonality. The seasonality of food products is a common problem in budget surveys (Kassie, Ndiritu, & Stage, 2014; Ogutu et al., 2019). We consider the seasonality issue by using monthly price indexes and estimating yearly food expenditures.

This paper finds that food consumption inequality increased in Turkey, even though income inequality decreased in the same period. Food consumption inequality notably increased after 2007 and continued to rise to the last year of 2017 considered in the paper. The level of food consumption inequality is especially high in rural areas or agricultural sectors. Food consumption inequality in rural areas significantly increased after 2007 and exceeded the level in urban areas. In the last section of the paper, we evaluate nutrition inequality and find that rich households have a more diversified diet than poor households. However, diet diversification increased for all households, especially in 2013-2017. Lastly, the quantile regression results show that income has a positive impact on diet diversity. Income effects change across households and play a decreasing role in diet inequality.

## 2. Data and Empirical Strategy

### 2.1. Household Budget Survey

We use the Household Budget Survey collected by the Turkish Statistical Institute. This cross-sectional dataset contains micro-level information of Turkish households. Like other countries' budget surveys, households' monthly expenditures are collected, and these values are mostly used to construct national consumer price indexes. Sampling units are households. Government officials visit selected households about eight times in a given month to collect their expenditure. The dataset consists of three main sections: household, individual, and consumption. The household section gives the details of house properties; the individual section gives personal information such as age, income, education; the consumption section provides monthly expenditure of households. The Household Budget Survey is one of the most useful datasets in the context of consumption inequality due to its sample size and the availability of a high range of variables. Additionally, because of its similarity to other countries' budget surveys, the paper's findings or empirical strategy may be generalized to analyze other countries' inequality measurements.

In this paper, we use the whole available data period of the Household Budget Survey consisting of 15 years between 2003/2017. There were 164,490 households surveyed in the selected period. However, we dropped the households where the household head was not defined or their employment status was not given. We focused on households that had less than ten individuals. Therefore, in the final pooled dataset, 162,470 households remained.

Household expenditures are collected monthly based in budget surveys, and government officials periodically change the households in a given period. This issue creates seasonal expenditure differences between households. To consider seasonal price and consumption differences, we used the monthly price index given in the dataset to bring all different monthly values to end-of-year values. We multiplied these end-of-year values by 12 to have yearly expenditures. Additionally, yearly Consumer Price Index (2003=100) was used to convert all monetary in real terms. To consider outliers, we winsorized the values bigger than 99th quantiles of income and expenditure and less than 1th quantiles of these variables to the 99th and 1th quantiles. We used the OECD equivalence scale (1 for household head, 0,5 for adults equal or older than 14, 0,3 for children under 14) to estimate per capita income and consumption expenditure.

### 2.2. Construction of Food Variables

The consumption section of the dataset includes monthly expenditure values for the goods consumed by households. Since a variable for total food expenditure is not identified in the data, the total food expenditure variable needs to be constructed by summing all food products. Generally, product codes in budget surveys are designed as foods having the code "01" following the UN COICOP classification procedure. However, considering only "01" codes neglects one essential expenditure item: food away from home. The "01" is the food expenditure of households at home. Additionally, there is an expenditure value for food away from home in the service section of the dataset. Therefore, we created two food variables (FOOD+ and FOOD) to consider food away from home expenditure. FOOD+ shows both expenditures on food at home and food away from home, where FOOD variable considers only food at-home expenditure. Because FOOD+ includes alcoholic beverages consumption away from home, we also included alcoholic beverages consumption at home – coded as "02" – in FOOD+ variable. Our additional estimates (available from the authors) show that adding alcoholic beverages do not significantly change our results. Consequently, FOOD+ contains at home and outside food expenditures, FOOD contains just food at home expenditures for our estimations in this paper.

In section 3.3., we grouped food products. We had to consider only food at home expenditure for the food diversity discussion. Because there is no product-specific expenditure for the food away from home in the dataset. Therefore, diversity arguments are for food at home expenditures only.

### 2.3. Inequality Measurement

The tools employed in evaluating consumption inequality are similar to those employed for income inequality discussions. The main ones are the Gini coefficient, mean ratios or premium estimates, and the variance of logs (Blundell & Etheridge, 2010; Fuchs-Schundeln, Krueger, & Sommer, 2010; Krueger & Perri, 2006; Sala-I-Martin, 2006). In this paper, we used the Gini coefficient and the premium estimates. The Gini coefficient is probably one of the most used tools in inequality discussions. The premium estimates are especially useful to show differentiated effects for a particular group in a given time. In this tool, consumption or income of any group is divided by other group's values, and these ratios are followed over time. For instance, in the gender premium of income estimates, male incomes are divided by female incomes. Then, if the premium increases, it is interpreted as the income of males being more positively affected than the income of the females in the selected period and, if the premium decreases, vice versa. Therefore, we used premium estimates to show how food consumption changed between different groups over time and discussed the differentiated effect on food consumption.

### 2.4. Diversity Estimation

We estimated conditional food shares of the products to show how the composition of food expenditure changed in the selected period. Additionally, we calculated the total, within, and between variances of food consumption using Clements and Si (2018)'s approach. The total variance is estimated as follows:

$$\sum_{i=1}^{n} w_i(logw_i - log\overline{W})^2 = \sum_{g=1}^{G} W_g(log\overline{W}_g - log\overline{W})^2 + \sum_{g=1}^{G} W_g\left[\sum_{i\in S_g} w'_i(logw'_i - log\overline{W}_g)^2\right] \quad (1)$$

$w_i$ is the budget share of the product $i.$, where there are 26 prodct groups, $log\overline{W} = \sum_{i=1}^{26} w_i logw_i$, $W_g = \sum_{i\in S_g} w_i$, $S_g$ is the set of goods belonging to group $g$ , $log\overline{W}_g = \sum_{i\in S_g} w'_i\, logw'_i$.

On the right side of the equation, the first part shows between, and the second part shows the within variances. The total variance is an inverse estimate. Therefore, if total variance increases, the household follows a specialized diet, if it decreases, households follow a more diversified diet. Total variance of diet diversity would be higher in poor households and would be lower in rich households. One of the advantages of Equation 1 is that it shows the sources of the total variance, whether it comes from between groups or within groups. This issue is crucial because considering only total estimates neglect a significant part of inequality, as mentioned in (Clements & Si, 2018).

We used the quantile regression approach (Greene, 2012) and estimated the following equation for the relationship of selected variables with diversity inequality:

$$Q[Variance|x,q] = \beta_{1,q} + \beta_{2,q} lnIncome + \beta_{3,q} OtherV + \delta_t + \varepsilon_q \qquad (2)$$

$Q$ and $q$ stand for the quantiles, $Variance$ shows the diet diversity and could be total, within, and between variances, $lnIncome$ is the natural logarithm of disposable income for the household, $OtherV$ is for the variables of gender, age, employment, household size, child, tenancy and education, $\delta_t$ is year fixed effect and finally $\varepsilon_q$ is the error term.

Quantile regression is a useful tool to consider inequality differences among households. There were three equations for total, within, and between variances. Therefore, we estimated three sources of the inequality variances by considering the distribution of household diversity values in the dataset.

## 3. Results

### 3.1. Food Consumption in Turkey

This section discusses the change in food expenditure over 2003-2017. Figure 1.a shows total food expenditure, Figure 1.b shows per capita food expenditure, Figure 1.c shows the share of food expenditure in total expenditure, Figure 1.d shows the general and food prices indexes.

Total food expenditure increased in Turkey (Figure 1.a). However, the variation constitutes different paths for the FOOD+ and FOOD variables. Food at home expenditure –presented as FOOD– is almost stable in 2005-2013. Nevertheless, after food away from home expenditure is included –presented as FOOD+–, the total food expenditure increases. This case shows that households increased their food away from home expenditure.

As Figure 1.b shows, per capita food expenditure increased in Turkey. In contrast to the stable total food expenditure presented in Figure 1.a, per capita food expenditure also increased in 2005-2013. Due to the household size changes, per capita food at home increased in the selected period. In the considered period, the average household size is 4.2, and this value decreases to 3.5. in 2017. One of the main reasons for this change is the number of children. The average number of children (whose age is less than 16) decreases from 1.3 to 0.9. The decrease in the number of children positively affected per capita food expenditures.

Per capita income in Turkey increased in the selected period. Therefore, consistently with Engel's Law, the share of food expenditure in total expenditure decreased during 2003-2012 (Figure 1.c). The share of non-food expenditures increased due to income growth, which caused a lower share of food expenditure. However, the decline stopped around 2012, and after that year, the share of food expenditure began to increase again. One of the leading causes of this case was that food prices have increased more than the non-food commodity prices (Figure 1.d). Food prices significantly increased starting from 2009 and accelerated after 2012.

**Fig. 1** Food Consumption in Turkey

The change in the food price in the Turkish market could be compared to international food prices provided by FAO (2019a). The selected period of 2003-2017 was when food prices increased significantly due to the food crisis in 2007, and other issues followed after that. However, food prices in the world began to decrease after 2011. On the contrary, the food price index increased significantly in Turkey. Therefore, the level of food prices in Turkey significantly contributed to the current inflation level and affected not only food expenditures but also non-food expenditures. In this respect, the increase in food prices probably affected food consumption inequality in Turkey.

### 3.2. Food Consumption Inequality

We evaluate food consumption and income inequalities with the Gini coefficients. Figure 2.a shows the inequality of per capita food expenditure, Figure 2.b shows the inequality of per capita yearly disposable income.

Food consumption inequality increased in Turkey over time (Figure 2.a). The Gini coefficient of food consumption increased from 0.29 in 2003 to 0.33 in 2017. The inequality increased for food at home and food away from home expenditures. The year 2007 and 2008 were the lowest points of food consumption inequality. These were the years of food crisis in

the world. However, the inequality level significantly increased in 2009 and continued to rise following this year.

Income inequality in Turkey decreased in 2003-2017 (Figure 2.b). It is worth noting that there was an increase in income inequality, probably resulting from the economic crisis of 2009. After 2009, it continued to decrease.

**Fig. 2** Food Consumption and Income Inequalities

Turkey is not a unique case experiencing an increase in food consumption inequality over time. Attanasio et al. (2014) and Attanasio and Pistaferri (2016) show that food consumption inequality increased in the U.S. beginning after 1980 and accelerated after 2000. The case in the U.S. is different from the one in Turkey. The consumption inequality in the U.S. increases with income inequality. However, food consumption inequality increases in Turkey, but income inequality decreases. De and Lastrapes (2017) show food consumption inequality in India. Their finding indicates that inequality increased from the mid-1990s to the mid-2000s in rural and urban areas. Nevertheless, the level of inequality decreased in 2007 and rapidly rose after this year. The drop in 2007 and then the rapid increase after this year constitute a similar pattern to the one observed for Turkey.

### 3.2.1. Role of Income and Other Assets

Several factors affect a household's food expenditures, including income levels and other assets. Figure 3 compares households by their per capita incomes. It also shows the education and employment premium. An increase in the premium implies that the gap between the selected households has increased, where a premium decrease entails a diminished gap.

Figure 3.a shows the ratio of rich households (the ones in the 90th quantile) to median households' (the ones in the 50th quantile) food expenditures. FOOD+ decreased in 2008, and after that year it increased again and stayed almost the same in the following years. Therefore, there is not much change in the difference between rich and median income households. However, the variable FOOD, which shows only food at home expenditure, indicates the differences between households decreased over time. That is because the rich households are spending more and more on food away from home.

We compare in Figure 3.b the food expenditure of households in the median income level with the poor households (households at the 10th income quantile). The first noticeable thing is FOOD+, and FOOD variables follow each other over time. The food expenditure of the

median income group increased more than it increased for the poorer households in 2012. Although it began to decrease after so, food expenditures of these two income groups changed similarly in this period, or slightly increased for the median income groups.

The difference in food consumption among income groups did not significantly change over time, as shown in Figure 3.a and 3.b. This case points out that the differentiated effect of income may be limited, and other factors may contribute to food consumption inequality among households.

In Figure 3.c, we compare food expenditures by the household head's education level. We divided high school degree households' expenditures of food by the food expenditures of the households whose head had not completed any degree of education. The food at home expenditure gap between the educated and non-educated households decreases. However, when food at home and food away from home is considered together with the FOOD+ variable, there is no such a significant change between these two groups over time.

We classify households based on their head's employment status in the survey month and compare the households' food expenditures through this classification (Figure 3.d). The ratio of food at home does not change throughout the period. However, the expenditure at restaurants, bars, and similar places is slightly getting higher for employed households, especially after 2008.

**Fig. 3** Income, Education and Employment Premiums of Food Consumption

This section evaluated the change in food consumption by the households' income levels, education, and employment status. Considering the changes in FOOD+ variables, these three variables did not have a differentiated effect on food consumption in 2003-2017. There is not much difference between the beginning and end of the period.

We did not find a significant differentiated effect of income, education, and employment on food consumption. This finding is different from the studies which focus on income and consumption inequality as a whole. Heathcote, Perri, and Violante (2010) show that income and consumption inequality increased over time in the U.S. One of the main factors creating inequality is education. According to their college premium estimate, the college degree significantly earned more than those who did not go to college, which created significant wage differences between these groups. The wage differences contributed to the inequality of income and consumption. Inequality created by education difference was not just found in the U.S. As

shown in Ding and He (2018), after the 1990s, the wage gap increased in China due to the educational differences, and this gap contributed to inequality.

Even though there may not be a differentiated effect on food consumption due to income level, education, and employment status, it does not necessarily mean that these factors do not contribute to food security in a given society. As shown in Kirk et al. (2018), agricultural income negatively or in some cases insignificantly affected food security in Rural Uganda. However, self-employment had a much more positive impact on child nutrition compared to other sectors. Therefore, in addition to the income and employment, the source of income or employment location may also create food expenditure differences. Considering the same country, Sseguya et al. (2018) emphasize the importance of social capital. They found that social capital, such as being a part of a group or trust was much more critical on food security than physical and financial capital.

Some demographic factors also affect food consumption inequality in addition to income, education, and employment status. Lamidi (2019) found a positive relationship between the number of children and food insecurity in Nigeria. Additionally, having a disabled older person in the household was an important risk for being food insecure of the households. Park, Saint Ville, Schwinghamer, and Melgar-Quinonez (2019) focused on elderly households in developed countries. The highest food insecurity levels were found in poor households living alone and had a low education level. Even though the impact of employment status was not clear, they found that income positively affected food security.

The studies in the literature, including ours, are mostly descriptive levels and do not interpret causal relationships. However, an endogeneity problem might occur due to selection bias and the simultaneous relationship between income, employment, education, and food security. Nevertheless, the findings in the literature point out the importance of income and other demographical factors. Consequently, with these findings, we conclude that income, education, and labor markets may have a differentiated impact, especially on food away from home expenditure.

### 3.2.2. Rural Areas and Agricultural Sector

Household's location and their employment sectors may create consumption differences between households. In the Households Budget Survey, there is only one location variable that shows whether the households are in rural or urban areas. However, this information is not available after 2013 due to a policy change on the definition of rural areas. Therefore, Figures 4.a, 4.b, and 4.e evaluated households based on rural or urban locations for 2003-2013.

We show food consumption inequalities in rural and urban areas in Figure 4.a and 4.b. The food consumption inequality in rural areas significantly increased after 2007 and exceeded the one in urban areas. Nevertheless, its level is significantly lower than in rural areas, food consumption inequality also increased in urban areas. Consistent with the finding in Figure 2.a, the years 2007 and 2008 are the periods that have the lowest level of food consumption inequality.

Figure 4.e shows the ratio of rural households' food expenditure to urban households' food expenditure. For all the periods, the ratio is less than one, which implies that the urban household food expenditure is higher than for rural households. Though there was not a significant change over time, after 2007, the decrease of FOOD+ with the increase of FOOD means that rural households increased their food at home expenditure more than urban households did.

We compare the households by their head employment status at the survey month in Figure 4.c and 4.d. Two sectors were selected. One is the agriculture sector, the other is the non-agricultural sector, which combines all the other sectors.

Figure 4.c and 4.d show food consumption inequalities for the households in the agricultural and non-agricultural sectors. Especially the change in the agriculture sector is interesting. Gini coefficient increased from 0.28 in 2005 to 0.36 in 2017 for the households whose head is employed in the agriculture sector. The increase of food consumption inequality in the agricultural sector is consistent with the one in rural areas shown in Figure 4.a. The inequality level is lower in the non-agricultural sector. However, it increased regularly after 2008.

We compare the households whose head is employed in agriculture to those employed in the non-agricultural sector in Figure 4.f. To 2008, both food expenditure variables are less than 1. However, the FOOD variable, which considers only the food at home expenditure, exceeded one after 2008. It shows that food at home expenditures of agricultural sector households exceeds the non-agricultural sector households.

**Fig. 4** Food Consumption Inequality in Rural/Urban Areas and Agriculture/Nonagricultural Sectors

The main finding of this section is that food consumption inequality is higher in rural areas and the agriculture sector. It is assumed that rural households' socio-economic characteristics would be close to each other, and their food consumption level would be similar.

However, this assumption is not consistent with our findings. There are several reasons why this is the case.

First, the household who lives in a rural area or works in the agriculture sector is poorer than those who live in urban areas or work in non-agricultural sectors. Therefore, the food insecurity level of rural households is higher (Omidvar et al., 2019; Tibesigwa & Visser, 2016). In addition, Turkey is not the only country where food consumption inequality is high in rural areas. Santaeulàlia-Llopis and Zheng (2016) estimated food consumption inequality in China using a detailed individual-level dataset. They found that food consumption inequality was higher in rural areas than in urban areas in China. However, De and Lastrapes (2017) found that rural areas had a lower level of food consumption inequality in India.

There may be several reasons why food consumption inequality is higher in rural areas. Rammohan and Pritchard (2014) showed that the role of landholding was one crucial factor that affected food security. Therefore, the asset differences across rural households are probably one of the most critical factors that affect food distribution across households.

In addition to the assets, participation in the market channels affects food consumption, security, and food distribution. Chege et al. (2015) found that participation in the supermarket channel positively affected household nutrition. Additionally, Stifel and Minten (2017) showed that the distance to the market negatively affected consumption and consumption diversity of the household. Therefore, the distance of households to markets and their relationship with the markets as consumers and producers are important for their food consumption and food distribution in rural communities.

The other factor that affects food consumption in rural areas is off-farm income. Hoang, Pham, and Ulubasoglu (2014) showed that off-farm income helped households to escape from poverty and increased their consumption. Zereyesus, Embaye, Tsiboe, and Amanor-Boadu (2017) found that off-farm income increased the expectation of future food expenditures. Finally, Dzanku (2019) evaluated six African countries and found that off-farm income had a positive relationship with food availability and a negative relationship with food insecurity. The impact of off-farm income was found higher in female-headed and poor households.

Therefore, even though the people in the rural areas or the agriculture sector are assumed that they would have similar food expenditure, our findings and the studies in the literature show that may not be the case. Production assets of rural households, the distance to the market or cash cropping, the opportunity of off-farm employment, and regional differences

significantly affect rural household's food consumption and determine the food inequality in these areas.

### 3.3. Diet Diversity

This section discusses the composition of food at home expenditure and evaluates diversity inequality by households' income levels. Table 1 shows the share of food products in total food expenditures and how they change across income quantiles and over time. Figure 6 shows the change in total variance of diet diversity. Table 3 gives the quantile regression results of the impact of variables on the total, within, and between variances.

We estimate the conditional food shares by calculating the share of food products in total food expenditures (Table 1). Poor households are in the 10th quantile of the per capita yearly disposable income, and rich households are the ones in the 90th quantile. One of the main food products consumed highly in Turkish society is bread. The importance of bread in general nutrition habits could be seen in the food shares. In 2003-2007, the share of bread expenditure in total food expenditure was 15% for poor or median income households, 10% for rich households. At the end of 2013-2017, the share of bread slightly decreased for all income groups. The other expenditure item, which is as essential as bread, is fresh vegetables. The share is between 16% and 13% from poor to rich households, and it did not significantly change over time. One of the main differences between poor and rich households is in the expenditure share of meat and seafood category. Almost for all the products in this group, the share is higher for the rich households than it is for the poor households, and these differences did not significantly change over time. One exception is the category of poultry and egg. The share of poultry and egg in poor households' expenditures increased from 6% to 8% in 2003-2017.

**Table 1** Conditional Food Shares (%)

Figure 6 shows how the inequality of diet diversity changes across different income quantiles using total variance of diet diversity. As explained in the Data and Empirical Strategy section, the total variance of diet diversity is a reserve estimate. Therefore, if it is relatively high, it means that a household follows a more specialized diet, if it is relatively low, it means that a household follows a more diversified diet. Figure 6 shows that the total variance of diet diversity decreases from poor to rich households; it means the rich households follow a much more diversified diet than the poor households do. However, the total variance of diet diversity steadily decreased for all income groups, which shows the diet diversity significantly increased

over the last fifteen years in Turkey. The decrease of variance or increase of diversification mostly occurred during the last five years.

**Fig. 5** Diet Diversity Across Years and Income Levels

We show the impact of the selected variables on total variance and its components, within and between variances in Table 3. Here, the focus is on the income effect (Ln Income). We use quantile regression because of the diversity differences among the households and the assumption that these differences may be important at the effect evaluation.

**Table 2** Descriptive Statistics

Columns 1-3 of Table 3 show the impact of variables on total variance of diet diversity. The impact of income is positive for QR10, is negative for QR50 and QR90. If a household's total variance level is low or their diversity level is high (rich households), the impact of income is negative, which decreases the diversity or increases specialization in consumption. However, if a household's total variance level is high or their diversity level is low (poor households), the impact of income is positive, which increases the diversity in consumption. Consequently, income is a factor that increases diet diversity for the poor or median groups of households and a factor that decreases diet diversity for the rich households.

Columns 4-6 of Table 3 show the impact on within variance, Colum 7-9 show the impact on between variance. The sign of income variable does not change across different quantiles. In all quantiles, income has a positive impact on within, a negative impact on between variances. Therefore, when income level increases, diversification comes from the product groups, and specialization occurs within the product groups. Generally, the impact of income on nutrition inequality depends on the components of variances.

**Table 3** Impact of Income on Diet Diversity

The food consumption inequality in Turkey increased in 2003-2017. In the same period, income also increased. However, income inequality decreased. These two findings may implicate that income may have a limited role in food consumption inequality. Nevertheless, this section's result shows that income is a factor that decreases nutrition inequality. An increase in the household income level accompanies a more diversified diet for that household.

You, Imai, and Gaiha (2016) found that income decreased the inequality of diet diversity for China in 2004-2009 both in urban and rural areas. In their influential paper –that we followed the diversity estimation methodology–, Clements and Si (2018) also found that income increased diet diversity, and they emphasized the importance of between variance, which was assumed more important in the context of nutritional value. The other factor besides income on nutrition inequality is the credits. Annim and Frempong (2018) found that both income and credits positively affected dietary diversity. The impact of income on nutritional inequality through preference change is another topic discussed in the current literature. The main focus of this research is why rich households consume healthier products than poor households. Allcott et al. (2019) found that the arguments of food deserts and neighborhood effects may have a limited effect on nutritional distribution. Their main finding was that income and nutritional knowledge could play an important role in reducing nutritional inequality.

## 4. Discussion and Policy Implications

We analyzed the food consumption inequality in Turkey in 2003-2017, where an increase in per capita income accompanied a decrease in income inequality for the period in question. However, food consumption inequality increased despite the decrease in income inequality for the given period. The global food crisis in 2007-2008 coincides with Turkey's lowest level of food consumption inequality. However, after the global crisis, food consumption inequality significantly increased in Turkey.

To understand the underlying reasons for the substantial increase in food consumption inequality, we examined income level and employment status as the potential determinants. We evaluated whether the different income quantiles are favored or hurt in the period in question by using premium estimates. We found that the difference in food consumption between these selected groups did not change significantly over time for all the premium analysis implemented.

One of the interesting findings of the paper is the high level of food consumption inequality in rural areas and the agricultural sector. Especially after the food crisis of 2007, food consumption inequality in rural areas and the agricultural sector exceeded the level in urban and non-agricultural sectors. Hence, rural areas or agricultural sectors experienced the most severe food consumption inequality in Turkey.

In the last section of the paper, we evaluated diet diversity inequality in addition to food consumption inequality. Our findings show that rich households had a more diversified diet than poor households. However, diet diversity increased in all income groups, especially in the

last five years. Additionally, income level had a positive effect on diet diversity in poor households, on the contrary, it had a negative effect on rich households. Consequently, income would decrease diet diversity inequality.

Food consumption inequality may create socio-economic disparities, especially when health is considered (Allcott et al., 2019). Additionally, these socio-economic disparities are not just for one generation, and it may continue for several generations (Aizer & Currie, 2014). The food consumption inequality of mothers negatively influences their children's health condition, which may create even further health issues in their adulthood. This potential to affect multiple generations solely constitutes a standalone ground to consider the policies regarding food consumption inequality as an essential issue.

Food consumption inequality may also create an unintended policy consequence. As mentioned in the introduction section, a policy that aims to decrease the number of underweight people in a given country may increase the number of overweight people and eventually create an unintended health problem (Moomaw et al., 2012; Sarmiento et al., 2014).

The food consumption inequality increased during the 2003-2017 period in Turkey, even though the economic growth and the decline in income inequality. Therefore, economic growth may not be enough to improve household food consumption status, and the policies need to consider these distribution issues. Another interesting finding is the high level of food consumption inequality in rural areas. In the literature or the discussion of international negotiations related to rural development, urban and rural areas are compared, and it is concluded that rural areas have several disadvantages, including a low level of income, lacking employment opportunities, health problems due to the sanitary issues or lack of enough infrastructure to build trade connections. However, this approach may not be enough to represent heterogeneity in rural areas. Rural areas do not consist of homogeneous households, even in the context of food consumption. There is a big difference in food expenditure among households in rural areas. Thus, in addition to the income distribution in rural areas, food distribution needs to be considered as a crucial part of the development policies.

Lastly, we would like to emphasize that there are many potential topics for future research. For instance, we have not reached any findings on any differentiated effect of income, education, or household employment on food consumption. However, it does not necessarily mean that these factors do not affect food consumption; it means their effect does not change over time. Additionally, as appeared in the food security literature, our discussion is limited in the context of casual interpretation. We believe that our findings would help the following research considering the endogeneity issues, mainly arising from selection bias and

simultaneous relationships of the variables. The other aspect that could be improved is the research unit of the analysis. This paper discussed household food consumption and its distribution between households. Due to the data limitations, we could not focus on the food distribution among individuals within the households. However, Brown, Ravallion, and van de Walle (2019) show that the household may not represent its members' welfare. Therefore, in the following studies, in addition to food consumption inequality, the distribution of food consumption within the household could be evaluated.

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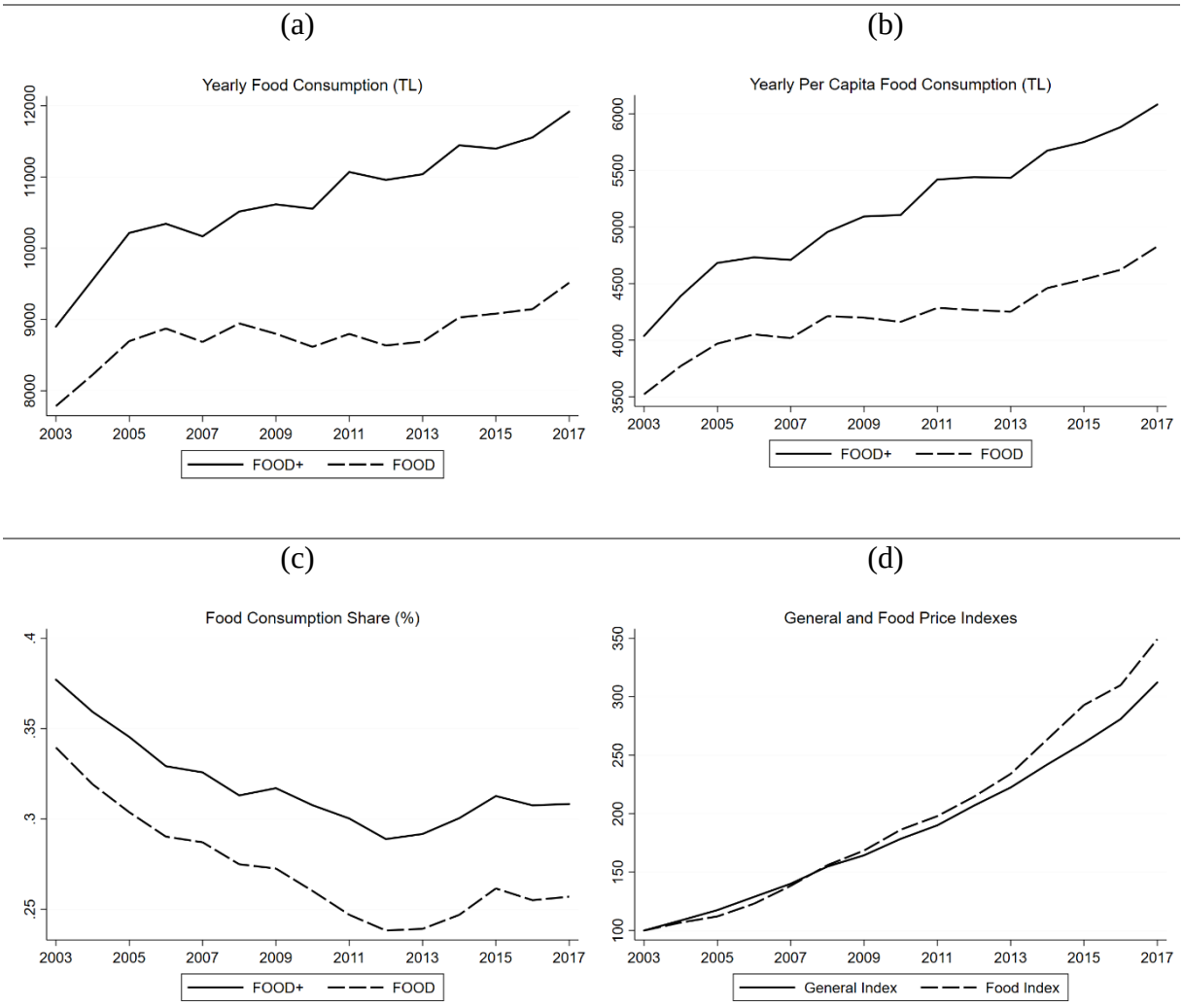
## Figures

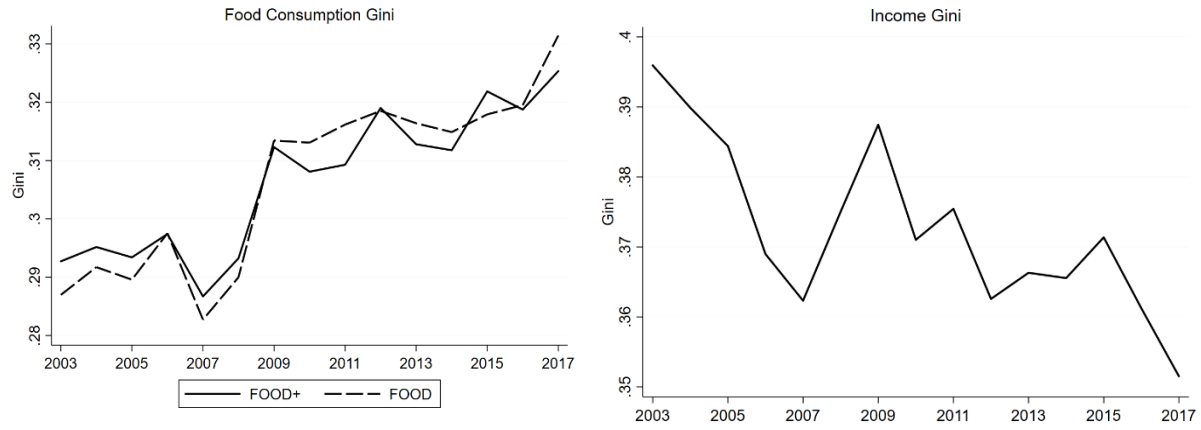
**Fig. 1** Food Consumption in Turkey




Note: The part of a, b, and c, of Figure 1 was calculated using the Household Budget Survey. We used the OECD equivalence scale to estimate per capita values in Figure 1.b. FOOD shows food at home, FOOD+ shows food at home and food away from home expenditures. We gathered the data in Figure 1.d from the TurkStat website (TurkStat, 2019). Observation number is 162,740. TL stands for Turkish Lira.

**Fig. 2** Food Consumption and Income Inequalities

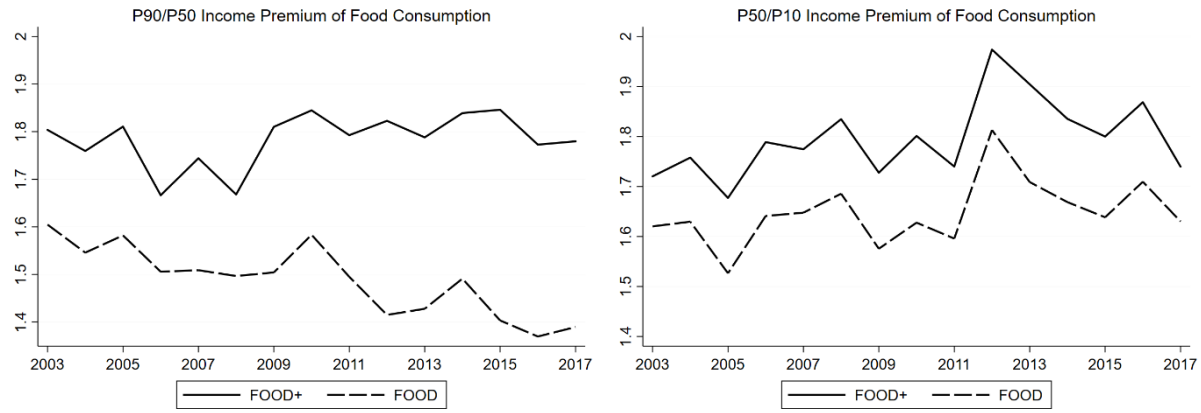
(a) (b)

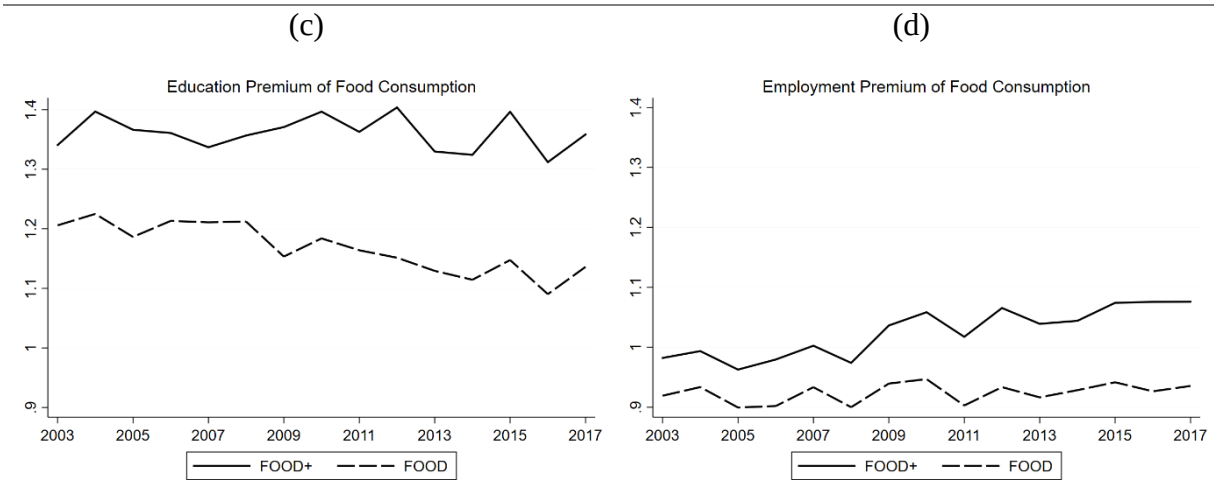



Note: FOOD shows food at home expenditure, FOOD+ shows both food at home and away from home expenditure. Income is the annual disposable income of the household. We used the OECD equivalence scale to estimate per capita values. The number of observation is 162,470.

**Fig. 3** Income, Education and Employment Premiums of Food Consumption

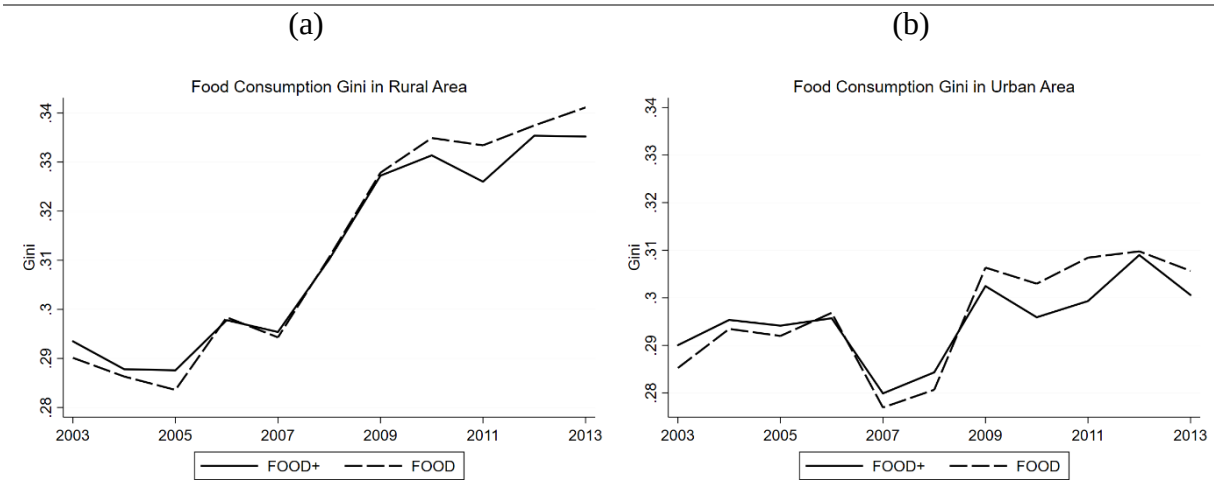
(a) (b)



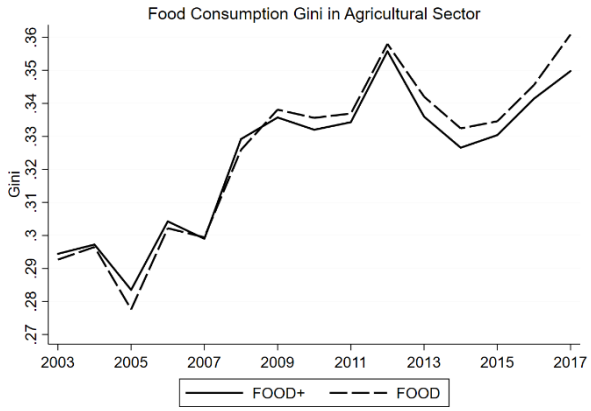



Note: FOOD shows at home, FOOD+ shows both at and away from home of food expenditure. P90, P50, P10 indicate income quantiles of the households. We considered per capita income levels. Observations are 16,241, 16,247, 16,254 in income 90th, 50th, and 10th quantiles, respectively. In the education premium, we divided high school degree of household's head food expenditure by the ones who do not have any formal education. In the employment premium, we divided the employment household's head by the unemployment ones.

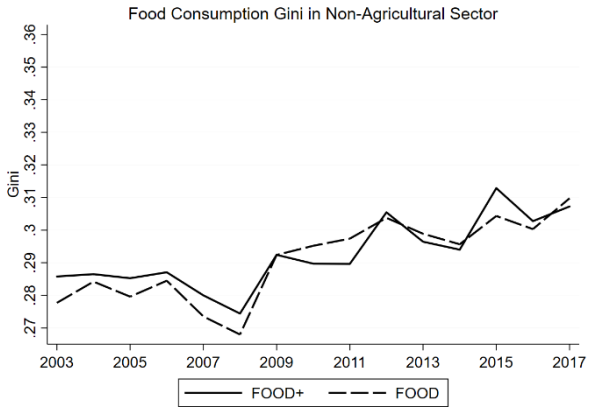
**Fig. 4** Food Consumption Inequality in Rural/Urban Areas and Agriculture/Nonagricultural Sectors



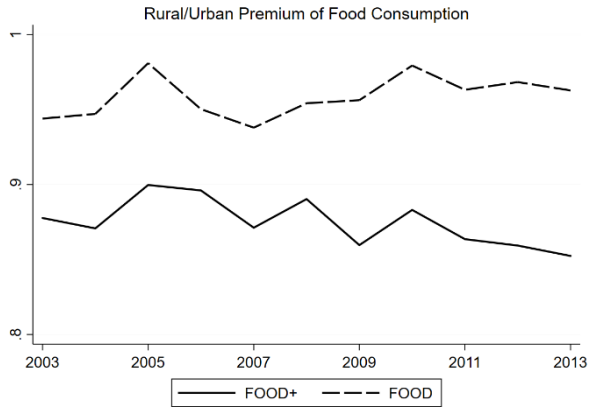
(c)



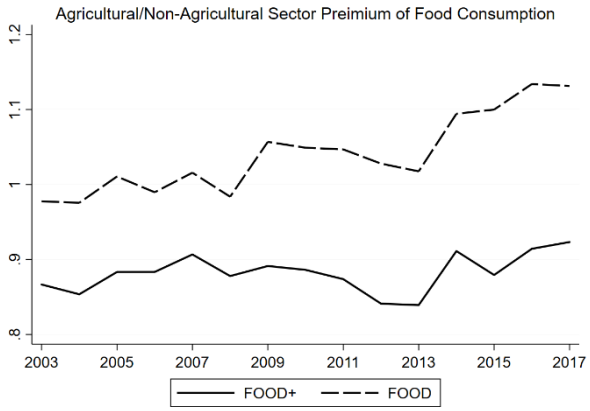

(d)




(e)

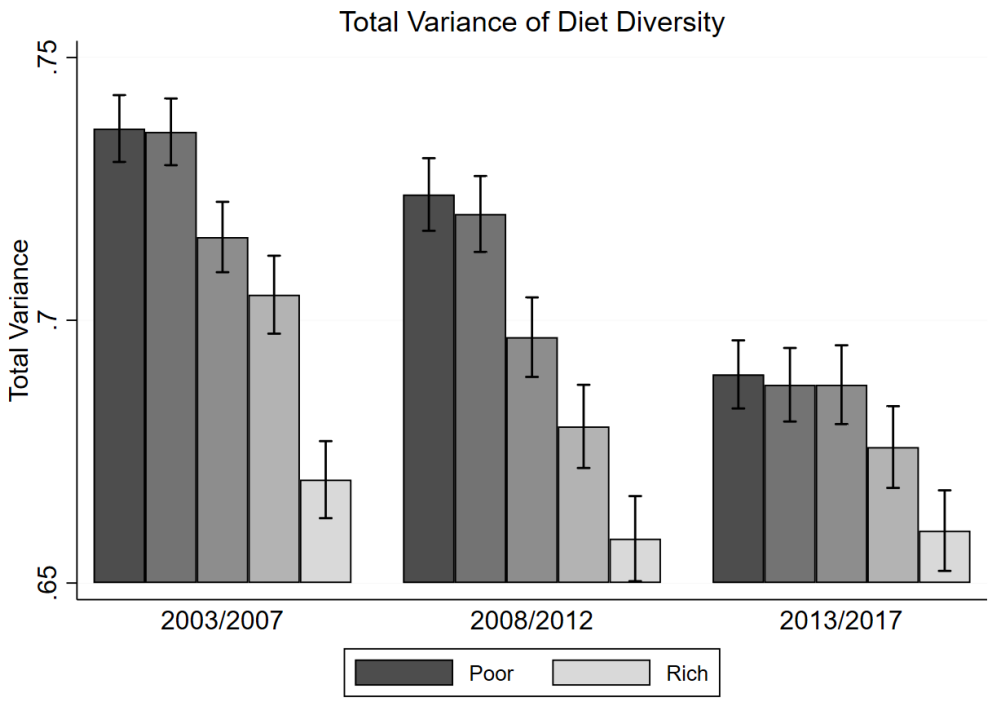



(f)




Note: FOOD shows food at home expenditure, FOOD+ shows both food at home and away from home expenditure. Estimations were made based on per capita values. Observations numbers are 35,166, and 81,969 for rural and urban areas, respectively. Agriculture shows if the head of household was employed in the agriculture sector in the survey month, non-agricultural shows if the head was employed in other sectors. Observation numbers are 23,428 and 88,380 for agriculture and non-agricultural, respectively.

**Fig. 5** Diet Diversity Across Years and Income Levels




Note: The total variance of diet diversity was estimated for all years using Equation 1. Households were grouped by their per capita yearly disposable income levels. Poor shows households whose income level is at 10th quantile, rich shows households whose income level is at 90th quantile. Observation number is 162,470.

## Tables

**Table 1** Conditional Food Shares (%)

| Group/Item | 2003/2007 | | | 2008/2012 | | | 2013/2017 | | |
|---|---|---|---|---|---|---|---|---|---|
| | Poor | Median | Rich | Poor | Median | Rich | Poor | Median | Rich |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| **1. Bread and Cereals** | **27.35** | **23.65** | **18.06** | **26.01** | **23.22** | **18.21** | **24.60** | **21.38** | **17.10** |
| Bread | 15.04 | 15.87 | 10.51 | 15.97 | 15.48 | 9.69 | 14.10 | 12.72 | 7.73 |
| Rice | 2.26 | 1.83 | 1.44 | 1.96 | 1.53 | 1.14 | 1.80 | 1.35 | 0.91 |
| Pasta and Bakery | 2.10 | 2.45 | 4.16 | 2.61 | 3.66 | 5.76 | 3.69 | 4.98 | 7.12 |
| Other Cereal | 7.94 | 3.51 | 1.95 | 5.48 | 2.54 | 1.62 | 5.02 | 2.32 | 1.35 |
| **2. Meat and Seafood** | **12.62** | **16.97** | **22.05** | **13.63** | **17.27** | **21.42** | **15.08** | **18.31** | **21.77** |
| Cattle | 2.20 | 5.49 | 8.50 | 2.02 | 5.13 | 7.69 | 2.56 | 5.44 | 7.85 |
| Sheep and Goat | 2.78 | 2.77 | 3.17 | 1.80 | 2.05 | 2.63 | 2.19 | 2.56 | 2.88 |
| Poultry and Egg | 6.36 | 6.19 | 5.78 | 7.91 | 6.72 | 5.78 | 8.41 | 6.98 | 5.97 |
| Other Meat | 0.58 | 1.44 | 2.65 | 1.00 | 1.96 | 2.93 | 1.01 | 1.88 | 2.76 |
| Fish and Seafoods | 0.70 | 1.09 | 1.96 | 0.90 | 1.42 | 2.39 | 0.90 | 1.45 | 2.31 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **3. Dairy** | **11.90** | **11.73** | **12.40** | **11.65** | **11.73** | **12.26** | **11.62** | **11.74** | **12.39** |
| Milk | 3.49 | 3.68 | 3.38 | 3.00 | 3.17 | 2.98 | 3.15 | 3.12 | 3.10 |
| Cheese and Yogurt | 8.36 | 7.95 | 8.87 | 8.54 | 8.38 | 8.90 | 8.36 | 8.40 | 8.84 |
| Other Dairy | 0.06 | 0.09 | 0.15 | 0.10 | 0.18 | 0.38 | 0.11 | 0.22 | 0.44 |
| **4. Oil and Fats** | **6.68** | **6.04** | **5.17** | **6.33** | **5.45** | **4.31** | **6.00** | **5.65** | **4.57** |
| Butter and Margarine | 2.35 | 1.59 | 1.33 | 1.69 | 1.45 | 1.21 | 1.68 | 1.89 | 1.65 |
| Olive Oil | 0.28 | 0.67 | 1.27 | 0.41 | 0.79 | 1.13 | 0.56 | 0.98 | 1.34 |
| Other Oil | 4.05 | 3.78 | 2.57 | 4.23 | 3.22 | 1.96 | 3.76 | 2.77 | 1.58 |
| **5. Fruit and Vegetables** | **26.10** | **26.77** | **26.45** | **27.61** | **27.14** | **26.63** | **28.18** | **27.82** | **26.80** |
| Fresh Fruit | 6.55 | 8.21 | 9.50 | 7.30 | 8.36 | 9.30 | 7.65 | 8.23 | 8.54 |
| Processed Fruit | 0.97 | 1.52 | 2.21 | 1.40 | 2.15 | 3.27 | 1.66 | 2.75 | 4.52 |
| Fresh Vegetable | 16.21 | 15.31 | 13.20 | 16.64 | 14.84 | 12.47 | 16.58 | 14.94 | 12.13 |
| Processed Vegetable | 2.37 | 1.74 | 1.53 | 2.27 | 1.79 | 1.59 | 2.29 | 1.90 | 1.61 |
| **6. Sweet Things** | **8.88** | **7.60** | **7.22** | **7.44** | **6.71** | **6.92** | **6.77** | **6.32** | **6.68** |
| Sugar | 6.16 | 4.14 | 2.69 | 4.02 | 2.57 | 1.52 | 3.37 | 2.04 | 1.16 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Jam and Marmalade | 0.42 | 0.66 | 0.91 | 0.61 | 0.85 | 1.16 | 1.03 | 1.31 | 1.46 |
| Chocolate and Other | 2.30 | 2.80 | 3.62 | 2.81 | 3.29 | 4.24 | 2.37 | 2.97 | 4.06 |
| **7. Beverage and Other Foods** | **6.47** | **7.23** | **8.65** | **7.33** | **8.47** | **10.25** | **7.76** | **8.78** | **10.69** |
| Coffee | 0.11 | 0.23 | 0.43 | 0.17 | 0.34 | 0.54 | 0.27 | 0.52 | 0.81 |
| Tea | 3.69 | 2.68 | 2.05 | 3.28 | 2.42 | 1.82 | 3.43 | 2.60 | 2.05 |
| Other Soft Drinks | 1.68 | 3.11 | 4.79 | 2.70 | 4.32 | 6.44 | 2.58 | 3.92 | 5.75 |
| Other Foods | 0.98 | 1.21 | 1.37 | 1.17 | 1.40 | 1.45 | 1.48 | 1.75 | 2.08 |

Not: Households were grouped based on their per capita yearly disposable income levels. Poor households whose income level is at 10th quantile, rich households whose income level is at 90th quantile. Observation number is 162,470.

**Table 2** Descriptive Statistics

| Variables | Definition | Mean | Standard Deviation | Minimum | Maximum |
|---|---|---|---|---|---|
| Ln Income | Natural logarithm of disposable income | 10.37 | 0.68 | 8.38 | 12.23 |
| Gender | Gender of the household head | 0.88 | 0.33 | 0.00 | 1.00 |
| Age | Age of the household head | 48.38 | 14.21 | 15.00 | 99.00 |
| Employment | Employment dummy for household head | 0.69 | 0.46 | 0.00 | 1.00 |
| Household Size | Household size | 3.75 | 1.73 | 1.00 | 10.00 |
| Child | Child dummy | 0.55 | 0.50 | 0.00 | 1.00 |
| Tenancy | Tenancy dummy for the house | 0.22 | 0.42 | 0.00 | 1.00 |
| Primary School | Primary school dummy for household head | 0.58 | 0.49 | 0.00 | 1.00 |
| High School | High school dummy for household head | 0.17 | 0.38 | 0.00 | 1.00 |
| University | University dummy for household head | 0.12 | 0.33 | 0.00 | 1.00 |

**Table 3** Impact of Income on Diet Diversity

| Variables | Total Variance | | | Within Variance | | | Between Variance | | |
|---|---|---|---|---|---|---|---|---|---|
| | QR10 | QR50 | QR90 | QR10 | QR50 | QR90 | QR10 | QR50 | QR90 |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| Ln Income | 0.0177*** | -0.0104*** | -0.0149*** | 0.0355*** | 0.0209*** | 0.0105*** | -0.0073*** | -0.0272*** | -0.0381*** |
| | (0.0011) | (0.0012) | (0.0043) | (0.0009) | (0.0006) | (0.0010) | (0.0007) | (0.0009) | (0.0045) |
| Gender | 0.0076*** | 0.0071*** | 0.0266*** | 0.0036** | 0.0045*** | 0.0042** | 0.0022* | 0.0034** | 0.0271*** |
| | (0.0022) | (0.0022) | (0.0069) | (0.0018) | (0.0013) | (0.0019) | (0.0013) | (0.0017) | (0.0073) |
| Age | 0.0003*** | 0.0005*** | 0.0021*** | 0.0001 | -0.0001** | -0.0001* | 0.0003*** | 0.0005*** | 0.0020*** |
| | (0.0001) | (0.0001) | (0.0002) | (0.0000) | (0.0000) | (0.0001) | (0.0000) | (0.0000) | (0.0002) |
| Employment | -0.0031* | 0.0029 | 0.0496*** | -0.0087*** | -0.0081*** | -0.0054*** | 0.0039*** | 0.0101*** | 0.0473*** |
| | (0.0018) | (0.0018) | (0.0065) | (0.0013) | (0.0010) | (0.0015) | (0.0010) | (0.0013) | (0.0067) |
| Household Size | 0.0157*** | 0.0259*** | 0.0442*** | 0.0088*** | 0.0117*** | 0.0153*** | 0.0067*** | 0.0135*** | 0.0267*** |
| | (0.0005) | (0.0006) | (0.0021) | (0.0004) | (0.0003) | (0.0004) | (0.0003) | (0.0004) | (0.0020) |
| Child | -0.0075*** | -0.0206*** | -0.0192*** | 0.0074*** | -0.0029*** | -0.0064*** | -0.0077*** | -0.0164*** | -0.0175** |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | (0.0018) | (0.0019) | (0.0073) | (0.0014) | (0.0010) | (0.0017) | (0.0010) | (0.0014) | (0.0071) |
| Tenancy | 0.0103*** | 0.0087*** | -0.0516*** | 0.0124*** | 0.0151*** | 0.0121*** | -0.0004 | -0.0051*** | -0.0693*** |
| | (0.0015) | (0.0016) | (0.0057) | (0.0013) | (0.0009) | (0.0014) | (0.0009) | (0.0012) | (0.0056) |
| Primary School | 0.0323*** | 0.0236*** | 0.0161* | 0.0286*** | 0.0189*** | 0.0089*** | 0.0110*** | 0.0075*** | 0.0038 |
| | (0.0025) | (0.0027) | (0.0084) | (0.0018) | (0.0014) | (0.0022) | (0.0014) | (0.0019) | (0.0092) |
| High School | 0.0091*** | -0.0181*** | -0.0811*** | 0.0252*** | 0.0035** | -0.0120*** | -0.0021 | -0.0178*** | -0.0781*** |
| | (0.0029) | (0.0031) | (0.0103) | (0.0022) | (0.0016) | (0.0026) | (0.0017) | (0.0023) | (0.0111) |
| University | -0.0125*** | -0.0354*** | -0.1003*** | 0.0126*** | -0.0088*** | -0.0249*** | -0.0094*** | -0.0237*** | -0.0821*** |
| | (0.0032) | (0.0034) | (0.0119) | (0.0024) | (0.0018) | (0.0030) | (0.0018) | (0.0025) | (0.0121) |
| Constant | 0.1198*** | 0.6117*** | 0.9339*** | -0.2530*** | 0.0575*** | 0.3243*** | 0.1690*** | 0.5008*** | 0.8661*** |
| | (0.0112) | (0.0118) | (0.0402) | (0.0087) | (0.0064) | (0.0102) | (0.0066) | (0.0089) | (0.0429) |

Note: This table shows the impact of selected variables on diet variances by estimated quantile regression. QR10 shows 10th quantile, QR50 shows median quantile, QR90 shows 90th quantile. Observation number 162,470. We included year dummies in all equations. Robust standard errors are in parentheses:*** p<0.01, ** p<0.05, * p<0.1.