

The Dynamics of Household Food Insecurity in Turkey

Özlem İPEK (<https://orcid.org/0000-0002-3711-3258>), Tarsus University, Turkey; ozlemipek@tarsus.edu.tr

Türkiye’de Hanehalkı Gıda Güvensizliğinin Dinamikleri

Abstract

Fundamental needs such as adequate food, clothing, and shelter are the foundation of social well-being. With the increasing world population, the number of undernourished people is also gradually increasing. This situation triggers increased concern that groups with different socioeconomic characteristics in developing countries will not have sufficient access to the food necessary for a healthy life. Consequently, the food insecurity issue has become a global topic of interest. Identifying the determinants of household food insecurity is important to develop policies to eliminate or reduce the significant inequalities in households’ access to food. This study seeks to identify the dynamics of households’ food insecurity in Turkey through Income and Living Conditions Longitudinal Microdata applying the random effects logit model. We found that as education level, health status, and income increase, the likelihood of food insecurity significantly decreases. The probability of food insecurity for males is 4% higher than for females. Education and income are the most influential variables of food insecurity. We also measured the average increase in food insecurity over the years compared to the reference year of 2014. Food insecurity has increased by more than 1.5 over the years in Turkey.

Keywords : Food Insecurity, Demographics, Random Effect Logit Regression, Panel Data, Turkey.

JEL Classification Codes : C25, D15, Q18.

Öz

Yeterli yiyecek, giyecek ve barınma gibi temel ihtiyaçlar, sosyal refahın temelidir. Artan dünya nüfusu ile birlikte yetersiz beslenen insan sayısı da giderek artmaktadır. Bu durum, gelişmekte olan ülkelerdeki farklı sosyoekonomik özelliklere sahip grupların sağlıklı bir yaşam için gerekli gıdaya yeterli erişiminin olmayacağı endişesini artırmaktadır. Bu bağlamda gıda güvensizliği sorunu küresel bir ilgi konusu haline gelmiştir. Hanelerin gıdaya erişimi arasındaki büyük eşitsizlikleri ortadan kaldırmaya veya en azından azaltmaya yönelik politikalar geliştirmek için, hanehalkı gıda güvensizliğinin belirleyicilerini tespit etmek önemlidir. Bu çalışma, Türkiye’deki hanelerin gıda güvensizliğini dinamiğini Gelir ve Yaşam Koşulları Panel Mikro verileri aracılığıyla rassal etkiler logit modelini uygulayarak belirlemeyi amaçlamaktadır. Çalışma sonuçlarına göre, eğitim düzeyi, sağlık durumu ve gelir arttıkça gıda güvensizliği olasılığının önemli ölçüde azaldığı bulunmuştur. Erkeklerin gıda güvensizliği olasılığı kadınlara göre %4 daha fazladır. Eğitim ve gelir, gıda güvensizliği üzerinde etkili değişkenlerdir. Son olarak, 2014 referans yılına göre yıllar itibarıyla gıda güvensizliğindeki ortalama artış da ölçülmüş olup, Türkiye’de gıda güvensizliğinin yıllar içinde 1,5 kattan fazla arttığı hesaplanmıştır.

Anahtar Sözcükler : Gıda Güvensizliği, Demografi, Rassal Etkiler Logit Modeli, Panel Veri, Türkiye.

1. Introduction

Access to adequate food is essential for people's physical and psychological development and social well-being. Insufficient access to food has adverse effects on human health and triggers increased poverty by creating socioeconomic and political instabilities. Hunger, malnutrition, and food insecurity problems have increased, particularly in developing countries. A United Nations Food and Agriculture Organization (FAO) report stated that approximately 690 million people, corresponding to 9% of the world's population, were undernourished in 2019. The number of undernourished people has increased by about 60 million since 2014 (FAO et al., 2020).

Although many sources have a similar definition of food security, the FAO defines food security as "economic or physical access to safe and nutritious food sufficient to meet the nutritional needs and food preferences of all people for a healthy and active life" (FAO, 1996). This definition includes four dimensions: accessibility, sustainability, availability, and usability (FAO, 1996). Availability is related to the availability of sufficient food and is connected to the general situation of the agricultural sector in meeting household food demand. Physical availability of food is associated with efficient agriculture, efficient trade infrastructure, and efficient food aid logistics (Sen, 1981; Bouis & Hunt, 1999). Availability is influenced by all cultural and socio-economic factors that determine where and how producers respond to the market, such as in-house production and foreign market purchases, market production, technology adaptation, and input availability (Bashir & Shilizzi, 2013). Sustainability refers to the possibility of individuals experiencing temporary or permanent loss of access to the resources required to consume sufficient food in unexpected situations such as income or price shocks, health shocks, economic recession, climate change, and natural disasters (Chambers, 1989; Watts & Bohle, 1993). Food access involves individuals' access to sufficient resources to obtain suitable foods for a balanced and nutritious diet (Schmidhuber & Tubiello, 2007). High food prices, low purchasing power, and low household real income are the main factors affecting access to food (Power, 2005; Rose, 1999). Besides these economic factors, the demographic characteristics of households are also essential for accessibility. Finally, usability covers all food safety and quality aspects of nutrition and health conditions, including hygiene conditions throughout the entire food chain (Barrett, 2010; Jones et al., 2013). It is accepted that food insecurity occurs when one or more of these four components are deficient (Barret, 2010; Sassi, 2018).

In Turkey, reduction in agricultural land plays a significant role in limiting food supply, affecting food availability. Although Turkey's total population has gradually increased in recent years, the number of those in the agricultural sector has declined. The annual cultivated agricultural area also decreased by 14.63% between 2000 and 2019, with a gradually decreasing trend every year (TurkStat, 2021). Meanwhile, the population of Turkey has increased by 20%. This indicates that population growth and agricultural production do not move in parallel. This is one of the significant factors causing a decrease in households' access to farm products.

Moreover, intensive monitoring policies on imports of agricultural products and the decreasing agrarian population in Turkey have caused a decline in domestic production. These declines play a critical role in reducing food availability by increasing prices. Additionally, crises, natural disasters, epidemics, and climate change affect the sustainability of agricultural production. Like other countries, Turkey is also affected by global warming. Natural disasters such as climate change and drought pose significant threats to the sustainability of production.

The measurement and analysis of food insecurity is a significant issue for Turkey due to some reasons such as the potential to face some threats due to its geographical location (Öztürk et al., 2020), political instability, price instability in the prices of goods and services (Işık & Özbuğday, 2021), inefficiency in agricultural areas as a result of climate change (Ağacayak & Keyman, 2018) and a changing ethnic structure, especially with the significant increase in Turkey's Syrian population. Moreover, the COVID-19 epidemic has affected the entire world since March 2020 and has caused income and production to decrease and price increases. These kinds of shocks can potentially adversely affect food security and nutrition in the future. Furthermore, with a share of approximately 25%, food expenditure is the second-highest expense in Turkish household budgets, second only to housing expenditure. Meat and fish products essential for household nutrition are a significant share of food expenditure (TurkStat, 2020). Nutrition in Turkey's rural areas relies widely on grain. However, even in regions of intensive livestock farming, the consumption of meat, especially red meat, remains at limited levels (Kadioğlu et al., 2010).

Ultimately, higher food prices, income insufficiency, and unfair distribution are the main factors causing food insecurity in Turkey. Therefore, food insecurity in developing countries such as Turkey has continued to be a critical issue for researchers and policymakers. Determining the severity of food insecurity and its socio-cultural and economic factors will provide important clues for decision-makers in health, agriculture, production, logistics, and poverty policies.

Researchers have created representative variables based on different criteria in the literature because the food security variable cannot be measured directly. These measures are determined by the factors of food security or the possible consequences of food insecurity (Jones et al., 2013). One of these is the proxy variable based on self-reported household statements describing the nutritional status and whether there is a shortage of food availability in the household (Hamelin et al., 2002; Dastgiri et al., 2006; Egeland et al., 2010; Abafita & Kim, 2014; Alpizar et al., 2020). Also, food security is represented by calculating the per capita cost of calories (Iram & Butt, 2004; Amaza et al., 2006; Sultana & Kiani, 2011; Beyene & Muche, 2010; Asghar & Mohammad, 2013; Fisher & Lewin, 2013). Another proxy is food security indices generally created based on principal components analysis. These indices are intended to capture several components of household food insecurity status. It has been endeavoured to represent every dimension of food security in one indicator. However, due to the lack of data availability and data characteristics, which are generally based on cross-sectional data, some dimensions of food security were not able

to be included in the indices (Quereshi, 2007; Arene & Anyaeji, 2010; Demeke et al., 2011; Abafita & Kim, 2014). Especially in Turkey, an index that considers the complex nature of food insecurity cannot be created due to the lack of data. Therefore, in the present study, food insecurity is defined based on the self-reported statements of households. The indicator of food insecurity is created based on the survey question, "The ability to have a meal containing meat, chicken or fish for at least three days in one week when you desire or need (Equivalent food for vegetarians)". Meat, chicken, and fish are the primary protein sources having an important role in individuals' nutrition. With this question, households are defined as being food insecure in the case of a lack of one or more of the food securities dimensions: availability, sustainability, accessibility, and usability. Thus, unlike previous studies, it has been endeavoured to overcome the data-related problems regarding food insecurity in Turkey through this survey question.

In the literature, studies have generally been conducted with household cross-sectional data on low-income (Pankomera et al., 2009; Gebre, 2012; Abafita & Kim, 2014), lower-middle-income (Arene & Anyaeji, 2010; Iram & Butt, 2004; Amaza et al., 2006) and upper-middle-income countries (Sekhampu, 2013; Sultana & Kiani, 2011; Amrullah et al., 2019; Kharisma & Abe, 2020). Previous studies evaluated the problem of food insecurity at one point in time because of the use of cross-sectional data. Hence, they ignored intra-household dynamics over time. Most importantly, very few studies have been conducted in Turkey, despite the prevalence of food insecurity among households. In addition, many of them examine small sample groups due to the lack of data at the national level. Therefore, this study aims to analyse the impact of the socio-economic variables on households' food insecurity in Turkey through nationwide household survey data. We applied a random effect logit model using Income and Living Conditions Longitudinal Micro Data. Our main contribution to the literature is addressing these limitations and expanding our understanding of the dynamics of food insecurity in Turkey using recent longitudinal national data. To our knowledge, it is the first study to investigate the dynamics of food insecurity in households in Turkey. The study results are expected to provide crucial information to decision-makers, especially for long-term policies regarding agriculture, health, production, logistics, and poverty in Turkey and other middle-income countries.

The remainder of the paper is organised as follows: Section 2 provides the data sets and methodology; Section 3 provides the empirical results, and the last section presents the conclusion and discussion.

2. Data Set and Methodology

2.1. Data Set

In this study, we used the Income and Living Conditions (ILC) Longitudinal Micro Data Set to determine the impact of socio-economic variables that affect the food insecurity of households in Turkey. The data contains 4-year panel microdata, including overlapping records in 2014, 2015, 2016, and 2017. The data set clusters sampling in a two-stage. The

final sampling unit in the survey is defined as a household. The country-wide estimates can be produced from the annual panel research results. The data set used in the analysis is a four-year balanced panel and includes 11,863 households and 47,452 observations.

In many studies in the literature, empirical evidence has revealed many socio-economic variables determining food insecurity such as household income (Titus & Adetokunbo, 2007; Sidhu et al., 2008; Carter et al., 2010; Olabiyi & Mcintyre, 2014), household size (Feleke et al., 2005, Amaza, 2006; Titus & Adetokunbo, 2007; Sidhu et al., 2008; Pankomera et al., 2009; Tefera, 2009; Gebre, 2012; Fisher & Lewin, 2013; Asghar & Muhammad, 2013; Olabiyi & Mcintyre, 2014) education level (Ogundari, 2017; Rossi et al., 2017; Kidane et al., 2005; Amaza, 2006; Titus & Adetokunbo, 2007; Eneyew & Bekele, 2012; Gebre, 2012; Olabiyi & Mcintyre, 2014) , gender (Maziya et al., 2017; Amaza, 2006; Pankomera et al., 2009; Beaumier & Ford, 2010; Eneyew & Bekele, 2012; Magana-Lemus et al., 2016), marital status (Maziya et al., 2017; Carter et al., 2010; Sekhampu, 2013; Olabiyi & Mcintyre, 2014), dependent children (Magana-Lemus et al., 2016), age (Asghar & Muhammad, 2013; Magana-Lemus et al., 2016; Ogundari, 2017; Pankomera et al., 2009; Eneyew & Bekele, 2012; Carter et al., 2010; Gebre, 2012), and health (Carter et al., 2010; Olabiyi & Mcintyre, 2014; Fidler vd., 2012). The control variables used in the study are determined in parallel with the literature.

Regarding the availability, sustainability, accessibility, and usability of food, the lack of one or more components constitute food insecurity (Barret, 2010; Sassi, 2018). In the ILC survey form, the question of "The ability to meet a meal containing meat, chicken or fish for at least three days in a week when you desire or need (Equivalent food for vegetarians)" is used as the indicator of food security. If households answered yes to this question, they are considered "food secure"; if not, they are regarded as "food insecure". In the study, we have also used several categorical variables such as gender, marital status, dependent child, and educational level as demographic factors. In the survey, "The lowest monthly net income that a household should have to survive for a month" is defined as the income required for the household. We added a trend variable to the model to determine the dynamic structure of food insecurity over time. Table 1 provides the definitions and summary statistics of the variables used in the study.

Table 1 shows that almost 35% of households were subject to food insecurity in Turkey during the analysis period. Over the same period, both moderate and severe degrees of food insecurity were estimated to be 23.2%, and it was estimated to be approximately 18.9% in upper-middle-income countries, including Turkey (FAO et al., 2020). Moreover, food insecurity has tended to deepen due to the epidemic. Therefore, it must be addressed urgently and with great care.

Table: 1
Summary Statistics

Dependent Variable	Variable	Definition	Mean	S.D.	Min	Max	
Socioeconomics Characteristics of Head of Household	Food Insecurity	If insecure=1, secure=0	0.35	0.48	0	1	
	Gender	If female=1, otherwise=0	0.47	0.50	0	1	
	Marital status	If married =1, otherwise=0	0.74	0.44	0	1	
	Age	Age is numerically measured	45.25	16.46	18	103	
	Dependent child	If the family has at least one dependent child=1	0.62	0.48	0	1	
	Education	No literacy		0.11	0.31	0	1
		Literate		0.06	0.25	0	1
		Primary school		0.36	0.48	0	1
		Secondary school		0.16	0.36	0	1
		High school		0.18	0.38	0	1
	Self-Reported Health	Higher education		0.14	0.34	0	1
		(1) Very Bad		0.01	0.11	0	1
		(2) Bad		0.11	0.31	0	1
		(3) Fair		0.24	0.43	0	1
		(4) Good		0.57	0.49	0	1
	logincome	(5) Very Good		0.07	0.25	0	1
		Log of the minimum needed income		7.98	0.53	5.52	11.41

2.2. Methodology

The food insecurity used as the dependent variable in the study as binary responses. We preferred the random effect logit model in the study to take in to account the possible endogeneity of some regressors and omitted variables (Barham et al., 2004; Greene, 2003; Guilkey & Murphy, 1993; Abuhayat, 2021). Latent model of food insecurity can be specified as:

$$F_{it}^* = \beta X_{it} + v_i + \varepsilon_{it} \quad i = 1, \dots, L; \quad t = 1, \dots, T \quad (1)$$

where $Foodinsecurity_{it}^*$ is a latent dependent variable; $Foodinsecurity_{it}$ is the observed binary outcome variable defined as:

$$F_{it} = \begin{cases} 1 & \text{if } F_{it}^* > 0 \\ 0 & \text{otherwise.} \end{cases} \quad (2)$$

The subscripts t and i refer to periods and households, respectively. X_{it} represents time-varying and time-invariant exogenous variables vector that influence F_{it}^* ; β illustrates a vector of parameters to be estimated; v_i is distributed normally with a mean of zero and a variance, σ_v^2 , represents the unobserved individual heterogeneity. The term v_i , and random error term ε_{it} has a logistic distribution with a mean of zero and a variance, σ_ε^2 .

The proportion of the total variance contributed by the panel-level variance component (ρ) can be defined as:

$$\rho = \frac{\sigma_v^2}{\sigma_v^2 + \sigma_\varepsilon^2}. \quad (3)$$

Zero ρ implies that the panel-level variance component is unimportant, and the panel estimator is no different from the pooled estimator.

3. Empirical Results

Before interpreting the analysis results, we conducted tests before establishing the empirical model to obtain consistent estimators. The first one was the multicollinearity test among the explanatory variables. For this, we estimated a pooled logit model with clustered standard errors within the head of household and then calculated the variance inflation factors (VIFs). A VIFs above 4 or 10 is commonly used as the threshold to indicate multicollinearity (O'brein, 2007). Our results show that VIFs range from 1.08 to 1.92 (see Table 2). This result is well beyond the commonly used thresholds, indicating no multicollinearity problem.

We applied the Wooldridge autocorrelation test for serial correlation in the second test. Since a serial correlation exists in error terms or distributions on the panel, do not have an identical distribution clustering over the panel variable (person id) provided to obtain consistent estimators. The Wooldridge test rejected the null hypothesis at the 0.01 level, claiming no serial correlation. For this reason, by clustering the panel variable with Huber/White/Sandwich variance-covariance matrix estimators, robust standard errors were produced (Wooldridge, 2020).

The test results support that the empirical model used in this study can capture unobserved heterogeneity between the households. Since the panel-level variance component of the random effect (σ_v) is both large and significant. We also applied the LR test to determine whether the panel-level variance component of the random effect (σ_v) is statistically equal to zero or not. As a result, the null hypothesis was rejected at the 0.001 significance level. According to this result, the panel estimator is different from the pooled estimator.

Finally, we applied Wald test statistics to determine the significance of the entire model. According to the test result, the model is statistically significant at a 0.001 significance level. The goodness of fit tests indicates that the proposed model fits the data set well.

The logit model estimation coefficients in Table 2 are not suitable for direct interpretation (İpek, 2020). Therefore, we estimated the odds ratio and marginal effects. The marginal effects in Table 2 show how the marginal change in the corresponding variable affects the probability of food insecurity while other variables are constant (Selçuk et al., 2021). The probability of food insecurity is 4% higher for males than for females. The results are consistent with expectations considering that men's daily nutritional requirements are higher than women's. Food insecurity for children, as well as adults, is a critical problem. Household food insecurity has significant adverse effects on children's development and health. We found that families with dependent children are 3% more likely to experience food insecurity. As expected, the likelihood of food insecurity decreases significantly as education level, health status, and income increase. The estimation results of the year dummies indicate that the probability of food insecurity has increased over the years, while

other variables are constant. Compared to 2014, the probability of household food insecurity has increased between 3.7% and 4.8% each year. Based on these results in Turkey, where food insecurity is already high, this issue will tend to increase in the future.

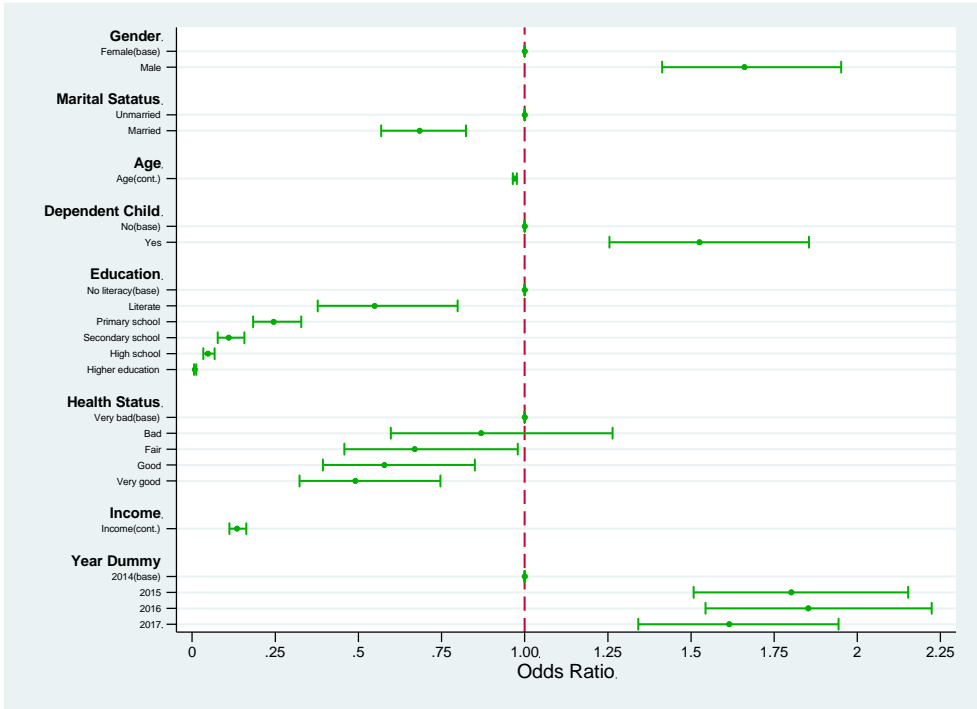
Table: 2
Random Effect Panel Logit Model Estimation Results

Variables	Coef.	Robust Std Err.	Marginal Effect	Std. Err.	VIFs
Male	-0.507***	0.082	0.040***	0.006	1.08
Married (Yes)	0.380***	0.094	-0.030***	0.008	1.13
Age	0.030***	0.003	0.002***	0.000	1.92
Dependent Child (Yes)	-0.422***	0.100	0.033***	0.008	1.37
No literacy	Base category				1.64
Literate	0.600**	0.191	-0.053**	0.017	
Primary school	1.406***	0.149	-0.123***	0.013	
Secondary school	2.205***	0.181	-0.191***	0.015	
High school	3.041***	0.178	-0.256***	0.014	
Higher education	4.761***	0.202	-0.363***	0.014	
SRH: Very Bad	Base category				1.42
SRH: Bad	0.140	0.191	-0.011	0.015	
SRH: Fair	0.401*	0.194	-0.032*	0.016	
SRH: Good	0.548**	0.197	-0.044**	0.016	
SRH: Very Good	0.711***	0.214	-0.057***	0.017	
Income	-17.309***	0.034	-0.158***	0.007	1.35
2014	Base category				1.10
2015	-0.589***	0.091	0.046***	0.007	
2016	-0.617***	0.093	0.048***	0.007	
2017	-0.479***	0.095	0.037***	0.007	
cons	-17.310***	0.769			
$\ln\sigma_v^2$	2.729***	0.035			
σ_v	3.914***	0.068			
ρ	0.823***	0.005			
Model Diagnostics			The Goodness of Fit Tests		
Number of obs	47452		BIC	12483.41	
Number of groups	11863		AIC	12475.34	
Wald $\chi^2(17)$	1720.15***		Pseudo R ²	0.290	
LR test of $\rho = 0$	16000***		Mc Fadden R ²	0.290	
Log pseudo likelihood	-19333.591		Cox-Snell R ²	0.283	
Wooldridge F(1, 11862)	24.718***		Cragg-Uhler R ²	0.415	

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Figure 1 shows the odds ratios of the model prediction results. Here, green circles represent the estimated odds ratios, and horizontal green lines represent the confidence interval. The reference value of the odds ratio is 1, and if the estimated odds ratio is greater than 1, it indicates that the probability of food insecurity increases. If the estimated odds ratio is less than 1, the probability of food insecurity decreases. The odds ratios interpret according to the base category. The analysis shows that food insecurity increases by approximately 1.5 in households with dependent children. Over the years, the probability of food insecurity has almost doubled in 2015 and 2016 and increased by more than 1.5 in 2017, compared to 2014. In addition, as the education level increases, the probability of food insecurity decreases.

Figure: 1
Odds Ratios of the Model Estimation Results



4. Conclusion and Discussion

According to the FAO 2020 report on food insecurity and nutrition, if the previous decade's trends continue, the world will not reach Zero Hunger by 2030. It also states that most indicators will not be able to meet global nutrition targets despite some developments. (FAO et al., 2020). Moreover, the report highlights that the consequences of the COVID-19 pandemic will more severely affect food insecurity and nutritional status, especially for the most vulnerable population groups. (FAO, 2020).

While the world population has gradually increased, the rural population, agricultural areas, and the accessibility to production have diminished due to unsound agriculture policies. Moreover, the decrease in domestic production has created upward pressure on domestic prices and increased the share of food consumption expenditures in household budgets. As a result, the consumption of fundamental and nutritious nutrients such as meat, fish, and grain products is decreasing. Import-based agricultural policies, which are a short-term solution to these problems, have led to a deepening of food insecurity. This situation increases households' food insecurity and deepens the socioeconomic inequality between

households. For this reason, it is crucial to identify the determinants of household food security to understand the causes of disparities in access to food among households and develop policies to eliminate or at least reduce them.

The findings of this study show that it is crucial to develop implementations that lead to improved education levels and increase households' income-earning capacity, which are the significant determinants of food insecurity. A year dummy is used in the study to determine the effect of years. We estimated that food insecurity increased by more than 1.5 times each year compared to the reference year of 2014. Over the years, these significant increases in food insecurity indicate that the effectiveness of traditional agricultural policy and tools in Turkey is gradually decreasing. Turkey should immediately consider a new agricultural policy to ensure food security and tackle the food insecurity problem. Especially in recent years, with the increase in agricultural imports, the self-sufficiency of fundamental foods has been decreasing.

Moreover, foreign dependency has been a rising trend regarding food security. Therefore, there should be a focus on the livestock sector and meat production. The efficient use of local resources should be supported by governments as well. Likewise, to reduce the impact of food prices on food security, price stability in staple foods should be ensured, and speculative price movements should be prevented. Additionally, the migration of people engaged in agriculture from rural to urban areas also negatively affects agricultural production. Policies to avoid migration and to increase the number of qualified farm workers should be implemented by policymakers. Finally, it is a fact that socioeconomic and cultural diversity among households has increased due to a changing ethnic structure, especially with the significant increase in Turkey's Syrian population. Different dietary customs among these households can affect food availability generally. Therefore, including the ethnicity variable in the household level data set provides more information about the determinants of food insecurity. This update will contribute to future studies in Turkey.

References

- Abafita, J. & K.R. Kim (2014), "Determinants of household food security in rural Ethiopia: An empirical analysis", *Journal of Rural Development/Nongchon-Gyeongje*, 37(1071-2016-86950), 129-157.
- Abu Hayat Md. S.I. (2021), "Dynamics and determinants of participation in integrated aquaculture - agriculture value chain: Evidence from a panel data analysis of indigenous smallholders in Bangladesh", *The Journal of Development Studies*, 57(11), 1871-1892.
- Ağaçayak, T. & F. Keyman (2018), "Water and food security in Turkey in a changing climate", *IPC Policy Brief*, March.
- Alpizar, F. et al. (2020), "Determinants of food insecurity among smallholder farmer households in Central America: recurrent versus extreme weather-driven events", *Regional Environmental Change*, 20(1), 1-16.
- Amaza, P.S. et al. (2006), "Determinants and measurements of food insecurity in Nigeria: Some Empirical Policy Guide", *Poster Paper in International Association of Agricultural Economists (IAAE) 2006 Annual Meeting*, August 12-18, Queensland, Australia.

- Amrullah, E.R. et al. (2019), "Who suffers from food insecurity in Indonesia?", *International Journal of Social Economics*, 46(10), 1186-1197.
- Arene, C.J. & R.C. Anyaeji (2010), "Determinants of food security among households in Nsukka Metropolis of Enugu State, Nigeria", *Pakistan Journal of Social Sciences*, 30(1), 9-16.
- Asghar, Z. & A. Muhammad (2013), "Socio-economic determinants of household food insecurity in Pakistan", *MPRA Paper* 21510, University Library of Munich, Germany.
- Baltagi, B.H. (2001), *Econometric analysis of panel data*, 2nd ed. New York: John Wiley & Sons.
- Barham, B.L. et al. (2004), "The dynamics of agricultural biotechnology adoption: Lessons from series rBST use in Wisconsin, 1994-2001", *American Journal of Agricultural Economics*, 86(1), 61-72.
- Barrett, C.B. (2002), "Food security and food assistance programs", *Handbook of Agricultural Economics*, 2, 2103-2190.
- Barrett, C.B. (2010), "Measuring food insecurity", *Science*, 327(5967), 825-828.
- Bashir, M.K. & S. Schilizzi (2013), "Determinants of rural household food security: a comparative analysis of African and Asian Studies", *Journal of the Science of Food and Agriculture*, 93(6), 1251-1258.
- Beaumier, M.C. & J.D. Ford (2010), "Food insecurity among Inuit women exacerbated by socio-economic stresses and climate change", *Canadian Journal of Public Health*, 101(3), 196-201.
- Beyene, F. & M. Muche (2010), "Determinants of food security among rural households of Central Ethiopia: An empirical analysis", *Quarterly Journal of International Agriculture*, 49(892-2016-65219), 299-318.
- Bogale, A. & A. Shimelis (2009), "Household level determinants of food insecurity in rural areas of Dire Dawa, Eastern Ethiopia", *African Journal of Food, Agriculture, Nutrition and Development*, 9(9), 1914-1926.
- Bouis, H. & J. Hunt (1999), "Linking food and nutrition security: past lessons and future opportunities", *Asian Development Review*, 17(1-2), 168-213.
- Carter, K.N. et al. (2010), "What are the determinants of food insecurity in New Zealand and does this differ for males and females?", *Australian And New Zealand Journal of Public Health*, 34(6), 602-608.
- Chambers, R. (1989), "Editorial Introduction: Vulnerability, Coping and Policy", *IDS Bulletin*, 20, 1-7.
- Dastgiri, S. et al. (2006), "Determinants of food insecurity: a cross-sectional study in Tabriz", *Journal of Ardabil University of Medical Sciences*, 6(3), 233-239.
- Demeke, A.B. et al. (2011), "Using panel data to estimate the effect of rainfall shocks on smallholders food security and vulnerability in rural Ethiopia", *Climatic Change*, 108(1), 185-206.
- Egeland, G.M. et al. (2010), "Food insecurity among Inuit preschoolers: Nunavut Inuit child health survey, 2007-2008", *Cmaj*, 182(3), 243-248.
- Eneyew, A. & W. Bekele (2012), "Causes of household food insecurity in Wolayta: Southern Ethiopia", *Journal of Stored Products and Postharvest Research*, 3(3), 30-43.
- FAO (1996), *The State of Food and Agriculture*, FAO Agriculture Series No: 29, Rome.

- FAO, IFAD, UNICEF, WFP & WHO (2020), *The state of food security and nutrition in the World 2020 Transforming food systems for affordable healthy diets*, Rome, FAO.
- Feleke, S.T. et al. (2005), "Determinants of food security in Southern Ethiopia at the household level", *Agricultural Economics*, 33(3), 351-363.
- Fiddler, T. (2012), "Food security in a northern First Nations community: an exploratory study on food availability and accessibility", *International Journal of Indigenous Health*, 8(2), 5-14.
- Fisher, M. & P.A. Lewin (2013), "Household, community, and policy determinants of food insecurity in rural Malawi", *Development Southern Africa*, 30(4-5), 451-467.
- Gebre, G.G. (2012), "Determinants of food insecurity among households in Addis Ababa city, Ethiopia", *Interdisciplinary Description of Complex Systems*, 10(2), 159-173.
- Greene, W.H. (2003), *Econometric Analysis* (5th ed.), Upper Saddle River, NJ: Prentice-Hall.
- Guilkey, D.K. & J.L. Murphy (1993), "Estimation and testing in the random effects probit model", *Journal of Econometrics*, 59(3), 301-317.
- Hamelin, A.M. et al. (2002), "Characterization of household food insecurity in Quebec: food and feelings", *Social Science & Medicine*, 54(1), 119-132.
- İpek, E. (2020) "The Costs of Disability in Turkey", *Journal of Family and Economic Issues*, 41, 229-237.
- Iram, U. & M.S. Butt (2004), Determinants of household food security. *International Journal of Social Economics*, 31(8), 753-766.
- Işık, S. & F. Özbuğday (2021), "The impact of agricultural input costs on food prices in Turkey: A case study", *Agricultural Economics* (Czech Republic), 67(3), 101-110.
- Jones, D.L. et al. (2013), "Nutrient stripping: the global disparity between food security and soil nutrient stocks", *Journal of Applied Ecology*, 50(4), 851-862.
- Kadioğlu, B. et al. (2010), "Kırsalda seslenme kültürü (Erzurum ili örneği)", *Alnteri Zirai Bilimler Dergisi*, 18(1), 20-27.
- Kharisma, V. & N. Abe (2020), "Food insecurity and associated socioeconomic factors: Application of Rasch and Binary Logistic Models with household survey data in three megacities in Indonesia", *Social Indicators Research*, 148(2), 655-679.
- Kidane, H. et al. (2005), "Causes of household food insecurity in Koredegaga peasant association, Oromiya zone, Ethiopia", *Agrekon*, 44(4), 543-560.
- Magaña-Lemus, D. et al. (2016), "Determinants of household food insecurity in Mexico", *Agricultural and Food Economics*, 4(1), 1-20.
- Maziya, M. et al. (2017), "What factors determine household food security among smallholder farmers? Insights from Msinga, KwaZulu-Natal, South Africa", *Agrekon*, 56(1), 40-52.
- O'Brien, R.M. (2007), "A caution regarding rules of thumb for variance inflation factors", *Qual Quant*, 41(5), 673-90.
- Ogundari, K. (2017), "Categorizing households into different food security states in Nigeria: the socio-economic and demographic determinants", *Agricultural and Food Economics*, 5(1), 1-20.
- Olabiya, O.M. & L. McIntyre (2014), "Determinants of food insecurity in higher-income households in Canada", *Journal of Hunger & Environmental Nutrition*, 9(4), 433-448.

- Öztürk, M. et al. (2020), "Food insecurity in the age of neoliberalism in Turkey and its neighbors", in: *Food Insecurity (77-95)*, Routledge.
- Pankomera, P. et al. (2009), "Household food security in Malawi: measurements, determinants and policy review", *Conference on international research on food security, natural resource management and rural development*, University of Hamburg, Tropentag, October 6-8, Hamburg.
- Power, E. (2005), "Individual and household food insecurity in Canada: position of dietitians of Canada", *Canadian Journal of Dietetic Practice and Research*, 66(1), 43-46.
- Qureshi, S. (2007), *Creating an index to measure food security: Identifying the components and determinants and testing usefulness*, Heller School for Social Policy and Management, Brandeis University.
- Rose, D. (1999), "Economic determinants and dietary consequences of food insecurity in the United States", *The Journal of Nutrition*, 129(2), 517S-520S.
- Rossi, M. et al. (2017), "Influence of sociodemographic characteristics on different dimensions of household food insecurity in Montevideo, Uruguay", *Public Health Nutrition*, 20(4), 620-629.
- Sassi, M. (2018), *Understanding Food Insecurity Key Features, Indicators, and Response Design*, Springer.
- Schmidhuber, J. & F.N. Tubiello (2007), "Global food security under climate change", *Proceedings of the National Academy of Sciences*, 104(50), 19703-19708.
- Sekhampu, T.J. (2013), "Determinants of the food security status of households receiving government grants in Kwakwatsi, South Africa", *Mediterranean Journal of Social Sciences*, 4(1), 147-153.
- Selçuk I.S. et al. (2021), "How Housing Conditions Affect Health: Findings from the Turkish National Household Panel Survey", *Housing Policy Debate*, <https://doi.org/10.1080/10511482.2021.1942132>
- Sen, A. (1981), "Ingredients of famine analysis: availability and entitlements", *The Quarterly Journal of Economics*, 96(3), 433-464.
- Sidhu, R.S. et al. (2008), "Food and nutritional insecurity and its determinants in food surplus areas: the case study of Punjab state", *Agricultural Economics Research Review*, 21(347-2016-16789), 91-98.
- Sultana, A. & A. Kiani (2011), "Determinants of food security at household level in Pakistan", *African Journal of Business Management*, 5(34), 12972-12979.
- Tefera, M.M. (2009), "Causes of rural household food insecurity: a case from Kuyu district, central Ethiopia", *Journal of Sustainable Development in Africa*, 11(4), 286-304.
- Titus, B. & G. Adetokunbo (2007), "An analysis of food security situation among Nigerian urban households: Evidence from Lagos State, Nigeria", *Journal of Central European Agriculture*, 8(3), 397-406.
- TurkStat (2017), *Income and Living Conditions Longitudinal Micro Data*.
- TurkStat (2020), *Household Budget Survey Statistics*.
- TurkStat (2021), *Database, Agriculture, Land Use Statistics*.
- Watts, M.J. & H.G. Bohle (1993), "The space of vulnerability: the causal structure of hunger and famine", *Progress in Human Geography*, 17(1), 43-67.

İpek, Ö. (2022), "The Dynamics of Household Food Insecurity in Turkey", *Sosyoekonomi*, 30(53), 195-208.

Wooldridge, J.M. (2002), *Econometric analysis of cross section and panel data*, Cambridge, MA: MIT Press.

Wooldridge, J.M. (2020), *Introductory econometrics: a modern approach*, 7th ed. Boston: Cengage.