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# Cohort Effect on Food Away From Home in Turkey: A Double Hurdle Approach

***In Beloved Memory of Dr. MEHMET FATİH TRAŞ***[1]

Türkiye'de Ev Dışı Gıda Tüketiminde Kuşak Etkisi: Double Hurdle Yaklaşımı

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## Abstract

The objective of this study is to examine age, cohort and year effects on food away from home (FAFH) expenditure of Turkish households, employing double hurdle approach for the period of 2002-2005. Results show that both the decision to participate in FAFH market and the actual FAFH expenditure of Turkish households change according to cohort, age and time. It is determined that the households with younger household heads have higher probability to participate in the FAFH market than the households with older household heads. Cohort effects for younger generations, on the other hand, are positive and significant in FAFH market participation while they have significant but negative effect on FAFH expenditures. Cohort effects for probability of market participation of FAFH for older generations are found to be positive but statistically insignificant. The findings also indicate that year effects play a positive role in FAFH market participation and FAFH expenditures.

***Keywords:*** *Food away from home, cohort effect, double hurdle, Turkey*

***JEL Codes:*** *C33, D12*

## Özet

Bu çalışmada 2002-2005 dönemi için Türkiye'de hanehalkı ev dışı gıda tüketimi üzerinde yaş, kuşak ve yıl etkileri ayrıştırılarak Double Hurdle modeli ile incelenmiştir. Türkiye'de hanehalkı ev dışı gıda tüketimi için hem pazara katılım kararının ve hem de ev dışı gıda harcama kararının yaş, kuşak ve yıla bağlı olarak değiştiği saptanmıştır. Türkiye'de hanehalkı reisinin genç olduğu hanelerin, hanehalkı reisinin yaşlı olduğu hanelere göre ev dışı gıda tüketimi için piyasaya

[1]Tragically, we lost Dr. Mehmet Fatih Traş on February 25, 2017, in spring of his life while this paper was under review for publication. He could not stand the world anymore.

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katılım olasılıklarının daha yüksek olduğunu belirlenmiştir. Bununla birlikte, kuşak etkisi ev dışı gıda tüketimi için pazara katılım olasılığı üzerinde genç kuşaklar için istatistiki olarak anlamlı ve pozitif etkili, ev dışı gıda harcaması eşitliğinde ise istatistiki olarak anlamlı olmakla birlikte negatif etkili olduğu görülmüştür. Yaşlı kuşaklar için ev dışı gıda tüketimine katılım olasılığı pozitif işaretli olmakla birlikte istatistiki olarak anlamsız bulunmuştur. Son olarak, yıllara bağlı olarak Türkiye'de hanehalkı ev dışı gıda tüketim piyasasına katılım ve tüketim düzeyi kararları pozitif yönde etkilenmektedir.

***Anahtar kelimeler:*** *Ev dışı gıda tüketimi, kuşak etkisi, çift eşik modeli, Türkiye*

***JEL Kodları:*** *C33, D12*

## Introduction

In recent decades, economies of developing countries have enjoyed an impressive growth performance and this performance has generally had decisive consequences on people's standard of living, such as higher women labor force participation, longer life expectancy, higher number of single-adult households, higher household income and diversification of household income sources in terms of women's contributions. This change in social structure leads to new constraints over the inputs of household production and increases value and opportunity cost of time and subsequently creates an incentive for substituting food-away-from-home (FAFH) consumption as a compensation tool of time (Prochaska and Schrimper, 1973). Moreover, family's increasing income also contributes to the incidence of FAFH consumption (Mutlu and Gracia, 2006). Adding all these effects together, newly adopted life style and socio-economic characteristics of households cause FAFH to be consumed more at every level of society ranging from households composed of nuclear family to households formed by single-adults (Byrne et al. 1996; Blisard, 2001).

Turkey is among countries exhibiting significant socio-demographical changes and forming "money-rich time-poor" individuals as a result of its economic growth performance. Indeed, FAFH consumption figures and its share in Turkish households' expenditure allocations exhibit a dramatically increasing trend. In 1994 the ratio of household expenditure allocated to FAFH was 2.9% while the same ratio had increased to 5.2%, in 2009 (Turkstat, 2010). People in similar segments of society exhibit similar consumption patterns, as well, income and consumption levels tend to change with age. Young adulthoods eat out but reduce their FAFH as they get older (Drescher and Roosen, 2010; Zan and Fan, 2010). Preference of Turkish households changes also as a result of their life-cycle stages. Therefore, it is important to investigate determinants, dynamics and

household preferences of FAFH consumption according to life-cycle stages in Turkey.

FAFH consumption decision is also given a great deal of attention in literature from a variety of aspects and a number of potential determinants such as age, education, sex, income, wealth, household size, race and urbanization have been suggested (Byrne et al., 1996; Jensen and Yen, 1996; Mutlu and Gracia, 2006; Angulo et al., 2007; Bai et al., 2010). At a country level there have also been several studies focusing on the consumption on FAFH in Turkey (Bozoğlu et al., 2013; Uzunoz et al., 2011; Akbay and Boz, 2005). But, no study has yet to considered cohort aspect of FAFH in Turkey. Nonetheless, a better understanding of FAFH consumption decision requires scrutinizing generational movements and age effect on consumption structures of households, because different generations are exposed to different economic environments and develops new consumption patterns in a rapidly changing economy. Cohort analysis is regarded as an appropriate tool in that respect, since it allows separating age, period and cohort effects (Deaton, 1997; Drescher and Roosen, 2010). Cohort is a unit that involves a group of individuals sharing the same characteristics that do not change from one survey to another (Deaton, 1985; Gardes et al., 2005). By means of cohorts, it is not possible to track the same individuals over re-sampling periods. However it is still possible to track the different individuals that have a common characteristic over time. While the age effect is referring to the impact of the age on consumption, year effect describes the impact of macro-economic conditions and historical events on consumption (Deaton, 1997; Harris and Blisard, 2000; Blisard, 2001; Kinsey and Wendt, 2007; Stewart and Blisard, 2008; Zan and Fan, 2010). Results of a cohort analysis can be particularly beneficial in determining for which specific groups a potential policy such as education programs has to be designed (Harris and Blisard, 2000; Norum, 2003; Zan and Fan, 2010). For this reason, in this study we attempt to examine the cohort, age and time effect on FAFH consumption in Turkey.

In Turkey, for the period 2002-2009 household budget surveys are available in cross-sectional manner. However, only the surveys conducted for the period 2002-2005 deliver information about the exact age of household head, rather than the age interval. Accordingly, we employ birth cohorts covering household head that share the same year of birth and form pseudo-panel-data by using four consecutive cross-section survey studies from 2002 to 2005, in order for the decomposition of age, cohort and time effects.

Household budget surveys may include zero responses regarding consumption of a specific commodity in a significant proportion, even though they provide a wide variety of information on socio-economic

characteristics of households. It is known that, given a data set that involves zero responses in great number, conducting an ordinary least squares procedure for the estimation of the parameters leads to biased empirical results (Amemiya, 1984). In order to avoid bias in the estimate of coefficients, limited dependent variable models are used as the main empirical strategy. To this end, we attempt to analyze both the determinants of market participation and expenditure decisions of FAFH in Turkey using double hurdle model suggested by Cragg(1971), taking the possible interaction between market participation and expenditure decisions into consideration.

The paper is organized as follows. Section 2 presents information on data used and about how the cohorts are formed. Section 3 summarizes the empirical model used. Section 4 presents the empirical results. The last section discusses the results and concludes.

**1. Data and Variables**

The data used in this study includes four independent household budget surveys, conducted by the TurkStat for the period 2002-2005, and cover a total of 52419 households. Each household budget survey is conducted by random sampling in that particular year (2002, 2005, etc.) Therefore, the panel data which were built upon are not a fixed set of households sampled across the years. Five-year age bands cohorts were used, depending on the age of the household head, following the studies Browning et al. (1985) and Aristei et al. (2008). The analysis is restricted to those households headed by individuals aged between 20 and 82. Hence, households whose heads' are younger than 20 and older than 82 are excluded from the sample. This trimming leads to a sample size of 51961 households which are allocated to 12 five-year cohorts. Household budget surveys are often characterized by a significant proportion of zero expenditure response on FAFH in Turkey. This fact necessitates the use of double hurdle model, in this study, for the consistency of the empirical results (Maddala, 1983).

The study uses household monthly expenditure on FAFH as the dependent variable, while the occupation, the sex, the marital status and the education level of household head included as independent variables in the model. Total household expenditure added both linearly and with a quadratic term into a model as independent variables to reflect better the shape of the Engel curve in FAFH in Turkey. Household size obtained from household budget survey conducted by TurkStat, on the other hand, was adjusted according to the OECD scale for taking into account the effect of economies of scale on the consumption. OECD measure, which is 1 for the reference person of the household, 0.5 for household member aged 14 and over, 0.3 for household members less than age 14, is used (TurkStat,

2011). The study includes both the adjust household size and square of adjusted household size by OECD scale as independent variables to capture whether there exists economies of scale on FAFH consumption in Turkey or not.

To obtain the age effect on FAFH consumption in Turkey, 13 dummies are constructed using the 5 year age intervals of household heads. Age1 refers the dummy variable for the household head between the ages of 20-24. Similarly, age2 refers the dummy variable for the household heads between the ages of 25-29, and so on. Age13 is created for household head aged between 80 and 82 and this category was taken a reference variable. To account for the time effect 4 dummies are used in the usual way. Any trends in the data can be arbitrarily attributed to either the year effect or to a combination of age and cohort effects. This leads us to drop one column from both the age and cohort matrices of dummy variables, and the first and second year dummy variables (see Aristei et al., 2008 for details). Moreover, first two dummies which created for years 2002 and 2003 were dropped from this study. Summary statistics and definitions of the variables are presented in Table 1. While 68.4% of the total sample was recorded positive expenditure on FAFH, 31.6% of total sample reported null expenditure on FAFH according to the average of all of cohorts. The household monthly expenditure on FAFH is 131.82 TL for total sample, but 1267.65 TL for positive observations. The household size with the value of 2.37, which is standardized according to the OECD scale, is similar for both total and positive samples.

**Table 1. Variable Definitions and Descriptive Statistics**

| | | full sample | | positive consumption | |
|---|---|---|---|---|---|
| Dep. Variable | Definition | Mean | Std. dev. | Mean | Std. dev. |
| lnFAFH | Logarithm of monthly household expenditure on FAFH | 2.124 | 1.822 | 3.103 | 1.347 |
| Lnexp | log of total expenditure of household | 6.407 | 0.669 | 6.556 | 0.635 |
| Lnexpsqr | Logarithm of total expenditure square | 41.502 | 8.697 | 43.39 | 8.498 |
| Hsize | Household size | 2.365 | 0.842 | 2.371 | 0.777 |
| Hsizesqr | Household size squared | 6.307 | 5.334 | 6.227 | 4.856 |
| Educ | Equals 1 if household head is at least high school graduates, zero otherwise | 0.260 | 0.438 | 0.308 | 0.461 |
| Occupation | Equals 1, if household head is white collar, zero otherwise | 0.449 | 0.497 | 0.530 | 0.499 |
| Urban | Equals 1 if household head in urban area, zero otherwise | 0.665 | 0.471 | 0.686 | 0.464 |
| Marital | Equals 1 if household head is married, zero otherwise | 0.892 | 0.310 | 0.913 | 0.281 |

| | | | | | |
|---|---|---|---|---|---|
| age1 | Equals 1 if household head's age between 20-24, zero otherwise | 0.012 | 0.109 | 0.012 | 0.112 |
| age2 | Equals 1 if household head's age between 25-29, zero otherwise | 0.071 | 0.256 | 0.077 | 0.267 |
| age3 | Equals 1 if household head's age between 30-34, zero otherwise | 0.118 | 0.323 | 0.128 | 0.334 |
| age4 | Equals 1 if household head's age between 35-39, zero otherwise | 0.141 | 0.348 | 0.150 | 0.357 |
| age5 | Equals 1 if household head's age between 40-44, zero otherwise | 0.146 | 0.353 | 0.157 | 0.364 |
| age6 | Equals 1 if household head's age between 45-49, zero otherwise | 0.127 | 0.333 | 0.134 | 0.341 |
| age7 | Equals 1 if household head's age between 50-54, zero otherwise | 0.115 | 0.319 | 0.117 | 0.322 |
| age8 | Equals 1 if household head's age between 55-59, zero otherwise | 0.079 | 0.270 | 0.076 | 0.265 |
| age9 | Equals 1 if household head's age between 60-64, zero otherwise | 0.064 | 0.245 | 0.054 | 0.227 |
| age10 | Equals 1 if household head's age between 65-69, zero otherwise | 0.053 | 0.224 | 0.041 | 0.198 |
| age11 | Equals 1 if household head's age between 70-74, zero otherwise | 0.045 | 0.208 | 0.031 | 0.175 |
| age12 | Equals 1 if household head's age between 75-79, zero otherwise | 0.021 | 0.144 | 0.014 | 0.119 |
| age13 | Equals 1 if household head's age between 80-82, zero otherwise | 0.004 | 0.066 | 0.002 | 0.050 |
| year3 | Equals 1 if the year is 2004, zero otherwise | | | | |
| year4 | Equals 1 if the year is 2005, zero otherwise | | | | |
| sample size | | 51961 | | 35563 | |

### 1.1. Cohort Definition and the Interpretation

The data in household budget survey in Turkey is collected on a monthly basis and provide a variety of socio-economic characteristics of the households. Since every year's data set is collected in a cross-sectional manner, surveys do not trace the same households during the survey period. Cohorts are commonly used to solve this problem. By birth cohorts, which are aimed to track individuals that have the same year of birth in common, it is possible to distinguish generational effects resulting from being the same age at different points in time. In this context, this study is created 12 birth cohorts on the basis of household head's year of birth and tracked these for consecutive four years. The youngest birth cohort consists of those who were born between 1978 and 1982 (aged between 20 and 24 in 2002), while the oldest one contains the households headed by individuals born between 1923 and 1927 (aged between 75-79 in 2002 and 78-82 in 2005, respectively).

All observation cells corresponding to each cohort and are given in Table 2. As can be seen, numbers of cells corresponding to each cohort are sufficient for further analysis, except for cohort 1 and cohort 12. Table 2

also reports percentage of positive FAFH consumption responses and provides a better insight about the cohort effects in the sample. As can be seem in the last column of Table 2, FAFH market participation ratios for the entire sample are much higher and stable for the first five cohorts, ranging between 74% and 76%. In the following cohorts this ratio substantially decreases from 73% to 45%. These differences between FAFH market participation ratios for all samples suggest the presence of cohort effect.

As a preliminary investigation we present monthly total expenditures of the households in Figure 1. To obtain Figure 1, we track 12 birth cohorts' average total expenditures against the age of household's head. As an example, cohort 1 on the furthest left of the graph covers individuals born between 1978 and 1982 (at the ages between 20 and 24 in 2002). Average total expenditure of this cohort is tracked for the ages between 20 and 27 and connected with a line. Since cohorts are created on five years age intervals and tracked for four consecutive years, each cohort overlaps three ages with its adjacent cohort. For example, cohort 1 overlaps with the cohort 2 in the ages of 25, 26 and 27 and cohort 2 with cohort 3 in 30, 31 and 32, and so on.

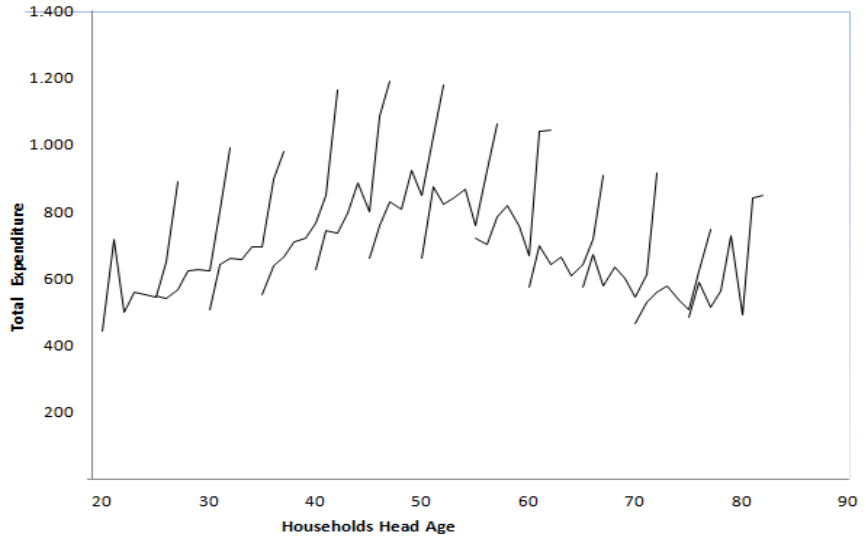
**Table 2. Five-Years Cohorts Definition and Number of Household in each Cohort in each Year**

| 2004 | | | 2005 | | | Total | |
|---|---|---|---|---|---|---|---|
| Age | Num | Pos (%) | Age | Num | Pos % | Total | Pos (%) |
| 22-26 | 230 | 72 | 23-27 | 350 | 78 | 1291 | 74 |
| 27-31 | 785 | 74 | 28-32 | 859 | 79 | 4661 | 76 |
| 32-36 | 1105 | 74 | 33-37 | 1080 | 80 | 6478 | 75 |
| 37-41 | 1256 | 74 | 38-42 | 1241 | 80 | 7757 | 75 |
| 42-46 | 1162 | 75 | 43-47 | 1175 | 79 | 7251 | 76 |
| 47-51 | 1077 | 72 | 48-52 | 1073 | 76 | 6478 | 73 |
| 52-56 | 938 | 69 | 53-57 | 871 | 76 | 5588 | 71 |
| 57-61 | 586 | 63 | 58-62 | 564 | 68 | 3822 | 65 |
| 62-66 | 496 | 58 | 63-67 | 516 | 63 | 3279 | 59 |
| 67-71 | 435 | 51 | 68-72 | 378 | 58 | 2650 | 52 |
| 72-76 | 299 | 45 | 73-77 | 251 | 59 | 1851 | 49 |
| 77-78 | 119 | 41 | 78-82 | 115 | 50 | 855 | 45 |

| Years of Birth | 2002 Age | 2002 Num | 2002 Pos % | 2003 Age | 2003 Num | 2003 Pos (%) |
|---|---|---|---|---|---|---|
| 1978-1982 | 20-24 | 157 | 75 | 21-25 | 554 | 70 |
| 1973-1977 | 25-29 | 805 | 77 | 26-30 | 2212 | 73 |
| 1968-1972 | 30-34 | 1209 | 76 | 31-35 | 3084 | 69 |
| 1963-1967 | 35-39 | 1412 | 75 | 36-40 | 3848 | 69 |
| 1958-1962 | 40-44 | 1347 | 78 | 41-45 | 3567 | 70 |
| 1953-1957 | 45-49 | 1204 | 77 | 46-50 | 3124 | 68 |
| 1948-1952 | 50-54 | 1040 | 74 | 51-55 | 2739 | 65 |
| 1943-1947 | 55-59 | 694 | 71 | 56-60 | 1978 | 60 |
| 1938-1942 | 60-64 | 583 | 60 | 61-65 | 1684 | 55 |
| 1933-1937 | 65-69 | 459 | 53 | 66-70 | 1378 | 46 |
| 1928-1932 | 70-74 | 360 | 47 | 71-75 | 941 | 46 |
| 1923-1927 | 75-79 | 185 | 45 | 76-80 | 436 | 44 |

Figure 1 shows that total expenditure behavior of Turkish households complies with life-cycle hypothesis, since it begins with an increasing trend in the early 20's (first five cohorts), reaches a peak in between 40 and 50 ages (cohort 6) and comes to an end with a declining pattern in the last six cohorts.

**Figure 1. Average Total Expenditure by Age and Cohort**

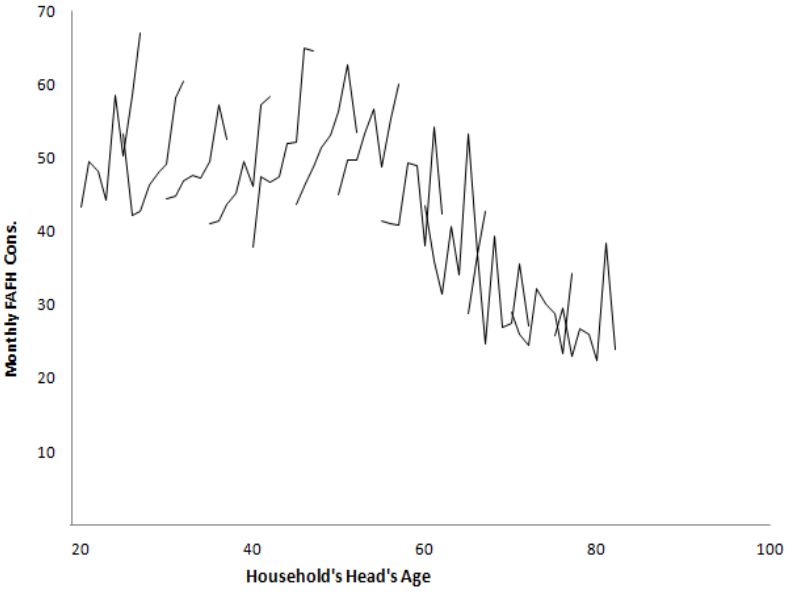


By using the same illustration as in Figure 1, we present graph of average FAFH consumption of cohort groups against the age of household's head. In Figure 2, vertical differences between cohorts at overlapping ages suggest generational effects. In other words, vertical distances between overlapped cohorts can be interpreted as generational differences in FAFH consumption since the gap between adjacent cohorts' overlapping ages demonstrates different tendencies of those who are at the same age but born in different years. On the other hand, differences on the same line can be attributed to age effect (Aristei et al., 2008).

Figure 2 shows that generational dynamics of FAFH consumption in Turkey differs from that of total expenditure in it's unlike hump shaped form. This formation of FAFH consumption does not comply with the life-cycle hypothesis which predicts a monotonic increase followed by a monotonic decrease in consumption. Up to the sixth cohort containing younger individuals, FAFH consumption pattern continues relatively higher and stable compared to the cohorts covering older ages. In particular, a substantial decrease beginning slightly from cohort 6, which corresponds to individuals born between 1953 and 1957, is apparent. This decrease in FAFH consumption of elderly consumers may be an implication of evolving nature of FAFH commodity from complementary to substitute good over time. To be more specific, Wang et al. (1995) argue that younger money-rich time-poor consumers consider consumption of FAFH commodity as a complementary good combined with time spent at work and hence they eat out more frequently, whereas elderly money-poor time-rich (retired, in particular) consumers tend to substitute household production, in which time spent away from labor market is involved as an input, for FAFH and therefore they eat out more frequently.

Figure 2 also gives relative position of each cohort compared to following ones. In particular, given the vertical differences in overlapping ages, cohorts containing younger individuals show an increasing FAFH consumption tendency compared to their adjacent cohorts. This might be an implication of the presence of generation differences in FAFH consumption in Turkey. This effect is particularly prominent between cohort 3 and cohort 4, as the individuals born between 1968 and 1972 (cohort 3) consume considerably more FAFH than the individuals born between 1963 and 1967 (cohort 4) in the ages of 35, 36 and 37 where these two cohorts intersect.

**Figure 2. Average Expenditure on FAFH by Age and Cohort**




## 2. Methodology

Household budget surveys include zero responses regarding consumption of a specific commodity in a significant proportion and not surprisingly expenditure on FAFH variable also exhibits this nature. The problem with this is that conducting an ordinary least squares procedure for the estimation of the parameters leads to biased empirical results (Amemiya, 1984). This problem can be solved through applying Double-Hurdle model (Cragg, 1971). This model is composed of two separate hurdles which are not necessarily a function of the same independent variables and both of which must produce a positive outcome for expenditure level. In this setting the first hurdle involves market participation decision about whether or not to consume on FAFH. Second hurdle is, then, the decision associated with the expenditure level of FAFH. Following Aristei et al. (2008) and Yen and Su (1995) this model can be written as follows:

Observed consumption:

$$y = d.y_2^* \tag{1}$$

Participation equation:

$$y_1^* = xa + u, \qquad u \sim N(0,1) \tag{2}$$

$$d = \begin{cases} 1 & if\ y_1^* > 0 \\ 0 & otherwise \end{cases} \tag{3}$$

Consumption equation:

$$y_2^* = x\beta + v, \qquad v \sim N(0, \sigma^2) \tag{4}$$

$$y = \begin{cases} y_2^* & if\ y_1^* > 0\ and\ y_2^* > 0 \\ 0 & otherwise \end{cases} \tag{5}$$

Here if $y = y_2^*$ then we observe a positive FAFH consumption provided that $d = 1$ (potential consumer) and $y_2^* > 0$ (actually consumer). This setting allows us to consider not only the individuals with positive FAFH consumption but also the effect of potential consumers who currently have zero FAFH expenditures. Moreover, error terms *u* and *v* in the equations are distributed as bivariate normal. In empirical applications, participation and consumption decisions are commonly assumed to be independent (Aristei et al., 2008). Hence we adopt Double Hurdle model with independent error terms as a follows:

$$(u, v) \sim BVN(0, \Sigma), \qquad \Sigma = \begin{bmatrix} 1 & 0 \\ 0 & \sigma^2 \end{bmatrix} \tag{6}$$

Double Hurdle model with independent error terms maximizes the likelihood function:

$$L = \prod_0 [1 - p(u > -\alpha' x)\, p(v > -\beta' x)] \prod_+ p(u > -\alpha' x)\, p(v > -\beta' x)\, f(y \mid \beta' x)$$

$$= \Pi_0 [1 - \Phi(\alpha' x)\Phi(\beta' x)/\sigma] \Pi_+ \Phi(\alpha' x) \frac{1}{\sigma} \phi(y - \beta' x)/\sigma] \tag{7}$$

Where, $\Phi$, $\phi$ and + denote cumulative distribution function, density function, zero consumption and positive consumption, respectively. Estimating parameters with maximum likelihood method, assuming the error terms are homoscedastic while they are in fact heteroscedastic leads to inconsistent estimates (Arabmazar and Schmidt, 1981). To overcome this problem, following Yen and Su (1995), the standard deviation is specified as follows:

$$\sigma_i = \exp(w_i \gamma) \tag{8}$$

Where, $w_i$ is a vector of exogenous variables which generate the heteroscedasticity and $\gamma$ is a column parameter vector. One advantage of

this specification is that standard deviation has the desired property of being strictly positive.

As we mentioned above the main aim of this paper is to investigate cohort, time and age effects on FAFH expenditure in Turkey based on the pioneer studying of Aristei et al. (2008) and Deaton and Paxson (1994). There are the linear relationship between age, birth and the time. The period in which each household is observed equals the summation of household head's birth's year and age. For this reason it is not possible to identify the effects of age, birth's year and time separately and estimating the time effect on FAFH expenditure requires a special specification. According to Deaton and Paxson (1994), one way of solving this problem is to assume that the time effects capture cyclical fluctuations that average to zero over the long run and excluding first two year dummies in the model estimation and specifying the remaining ones as (Aristei et al. 2008):

$$D_t = d_t - (t-1)\,d_2 - (t-2)\,d_1 \tag{9}$$

Where $d_t = 1$ is a dummy variable takes value of 1 in t time.

This is equivalent to assume that trend in the data can be interpreted as a combination of age and cohort effect and are therefore predictable. This transformation makes time effect orthogonal to a time trend and implies all the year effects sum to zero (Aristei et al., 2008).

To get a better view of which characteristics explain FAFH participation and consumption decisions, we calculate four elasticities through marginal effects. The first elasticity gives the effect of independent variables on market participation probability and can be calculated from the marginal effect of market participation probability as follows:

$$\frac{\partial P\left(Y_1^* > 0\right)}{\partial X_j} = \phi(X\alpha)\alpha_j \tag{10}$$

Second elasticity is the elasticity of consumption probability and indicates the effect of independent variables on the probability of consumption if household is a potential consumer (d=1). Under the assumption that error terms are normally and independently distributed, this elasticity is derived from marginal effect of consumption probability given as:

$$\frac{\partial \mathrm{P}(Y>0)}{\partial X_j} = \Phi\left(X\beta/\sigma\right)\phi(X\alpha)\alpha_j + \Phi(X\alpha)\phi(X\beta)\sigma^{-1} \times \left[\beta_j - \left(X\beta/\sigma\right)\frac{\partial \sigma}{\partial X_j}\right] \tag{11}$$

Third elasticity of double-hurdle model is conditional elasticity of consumption. This elasticity calculated from the marginal responses to *x* of

conditional level of consumption in equation (12) and provides the effect of independent variables on the level of consumption for households with positive consumption.

$$\frac{\partial E(Y|Y>0)}{\partial X_j} = \beta_j + \left[\frac{\phi\left(X\beta/\sigma\right)}{\Phi\left(X\beta/\sigma\right)}\right]\frac{\partial\sigma}{\partial X_j} - \left[\frac{\phi\left(X\beta/\sigma\right)}{\Phi\left(X\beta/\sigma\right)}\right]\left[\beta_j - \left(\frac{X\beta}{\sigma}\right)\frac{\partial\sigma}{\partial X_j}\right]\times\left[\left(\frac{X\beta}{\sigma}\right) + \frac{\phi\left(\frac{X\beta}{\sigma}\right)}{\Phi\left(\frac{X\beta}{\sigma}\right)}\right] \quad (12)$$

Finally, the fourth is elasticity of unconditional level of consumption. This elasticity gives total effect of independent variables on consumption and can be directly calculated from adding up elasticity of consumption probability and conditional elasticity of consumption (Yen and Su, 1995).

$$E(Y) = P(Y>0)E(Y|Y>0) = \Phi(X\alpha)\Phi\left(\frac{X\beta}{\sigma}\right)\times\left\{X\beta + \sigma\left[\frac{\phi\left(X\beta/\sigma\right)}{\Phi\left(\frac{X\beta}{\sigma}\right)}\right]\right\} \quad (13)$$

## 3. Results

The results of estimated coefficients for Independent Double Hurdle model are presented in Table 3. We start with evaluation of specification of heteroscedasticity equation. Household size and log of total expenditure which are considered to cause heteroscedasticity problem are found to be statistically significant, confirming the identification of the heteroscedasticity equation and rejecting homoscedasticity assumption. Therefore, heteroscedasticity consistent standard errors are calculated for both models in this study.

As can be seen in Table 3 most of the estimated parameters are statistically significant and in parallel with theoretical expectations in both equations. While total household expenditure has a positive effect on both equations, square of total household expenditure has a negative effect on both probability of FAFH market participation and level of FAFH consumption in Turkey. Total household expenditure has particularly higher effect on the probability of FAFH market participation than the decision of FAFH expenditure in Turkey.

But the effect of total expenditure on market participation probability of FAFH and actual consumption are positive but decreasing as signaled by the negative coefficients on the *lnexpsqr* term and compatible with the theory.

Similarly, it is worth noting that the household size has a significantly positive effect, but square of household size has a negative effect on participation and expenditure decisions. The estimated parameters indicate

that the education level and the occupation level of household head and living in urban area influence significantly and positively on the participation and expenditure decisions of FAFH in Turkey. While the marital status of household head has a positive effect on the probability to participate on FAFH market, but has a negative effect on the decision of FAFH expenditure in Turkey.

Based on the reference that we defined as the oldest age group, we find that age of household head is highly associated with both FAFH market participation and expenditure decisions. In particular, the first 5 age groups have a significant and positive effect on participation equation, while the effect significant for the entire age groups in expenditure equation of FAFH in Turkey. This positive effect, however, dies away as household head grows older for the participation decision and reduced in magnitude in the actual expenditure decision.

**Table 3. Estimated Coefficients for Independent Double-Hurdle Specification**

| | FAFH participation | | FAFH consumption | | Heteroscedasticity | |
|---|---|---|---|---|---|---|
| Variable | Parameter | t value | Parameter | t value | Parameter | t value |
| Constant | -1.532 | -3.334*** | -3.109 | -5.702*** | -0.041 | -0.826 |
| Lnexp | 1.592 | 12.707*** | 1.347 | 9.161*** | 0.024 | 3.422*** |
| Lnexpsqr | -0.070 | -7.317*** | -0.033 | -3.045*** | | |
| Hsize | 0.157 | 5.833*** | 0.225 | 5.953*** | 0.035 | 5.602*** |
| Hsizesqr | -0.036 | -8.902*** | -0.034 | -5.622*** | | |
| Education | 0.027 | 1.607* | 0.14 | 8.429*** | | |
| Occupation | 0.306 | 19.988*** | 0.615 | 36.695*** | | |
| Urban | 0.020 | 1.438 | 0.078 | 4.718*** | | |
| Marital | 0.097 | 4.439*** | -0.166 | -6.979*** | | |
| age1 | 0.369 | 1.716** | 0.890 | 3.446*** | | |
| age2 | 0.387 | 1.969** | 0.858 | 3.556*** | | |
| age3 | 0.379 | 2.006** | 0.782 | 3.331*** | | |
| age4 | 0.334 | 1.832* | 0.689 | 3.005*** | | |
| age5 | 0.298 | 1.686* | 0.611 | 2.722*** | | |
| age6 | 0.223 | 1.308 | 0.615 | 2.804*** | | |
| age7 | 0.190 | 1.154 | 0.631 | 2.944*** | | |
| age8 | 0.177 | 1.127 | 0.608 | 2.925*** | | |
| age9 | 0.101 | 0.678 | 0.476 | 2.389** | | |
| age10 | 0.093 | 0.666 | 0.459 | 2.420** | | |
| age11 | 0.076 | 0.598 | 0.449 | 2.562** | | |
| age12 | 0.105 | 1.012 | 0.340 | 2.311** | | |
| coh1 | 0.177 | 2.961*** | -0.074 | -2.350** | | |

| | | | | |
|---|---|---|---|---|
| coh2 | 0.162 | 2.950*** | -0.260 | -2.303** |
| coh3 | 0.088 | 2.545*** | -0.296 | -2.535** |
| coh4 | 0.116 | 2.748*** | -0.327 | -2.755* |
| coh5 | 0.133 | 1.891** | -0.260 | -1.436 |
| coh6 | 0.155 | 1.095 | -0.236 | -1.354 |
| coh7 | 0.176 | 1.310 | -0.161 | -0.960 |
| coh8 | 0.147 | 1.176 | -0.154 | -0.968 |
| coh9 | 0.131 | 1.152 | -0.051 | -0.352 |
| coh10 | 0.033 | 0.332 | -0.154 | -1.174 |
| coh11 | 0.068 | 0.827 | -0.203 | -1.898* |
| year3 | 0.208 | 9.515*** | 0.146 | 5.887*** |
| year4 | 0.539 | 17.120*** | 0.124 | 3.682*** |
| LogL | -84035.4 | | | |

*** significant at 1% level, ** significant at 5% level, * significant at 10% level

In an attempt to decompose generational effects from age effect, we use cohort dummies in order to asses FAFH market participation and consumption decisions of a group of individuals sharing the same year of birth. Given the data set used, cohort effect resulting from different years of births is found to be empirically evident in Turkey. The signs of the cohort coefficients estimated show that younger generation tends to participate and decide to purchase more in the FAFH market than older generation in Turkey, albeit this positive effect is decreasing and becomes insignificantly in older cohorts. Results also suggest that the effect of cohorts on for consumption decision of FAFH has negative signs. Besides, the effects of last two years on decision of FAFH market participation and the level of FAFH expenditure have a positive signs, indicating and increase in both decisions in comparison to the first two years in Turkey.

The elasticities of the continuous independent variables and the effect of dummy variables on the market participation and expenditure decision of FAFH in Turkey are presented in Table 4. The elasticities with respect to the continuous variables for both models were computed at sample means. The effects of dummy variables were obtained as these variables change from zero to one.

Most of the elasticities estimated are consistent with theoretical expectations. The elasticity of probabilities of FAFH market participation and expenditure level with respect to household expenditure is estimated to be 0.527 and 0.519, respectively. In other words, a 1% increase in the household expenditure (income) will raise the probability of FAFH market participation by 0. 527 percent while the same increase causes on the probability of FAFH expenditure by 0.519 percent. Rather than sample

average of income] All elasticities for household expenditure-squared have negative sing. This result confirms that as household expenditure rises, both FAFH market participation and level of expenditure decisions increase at a decreasing rate in Turkey.

FAFH expenditure is expected to rise by 1.26 percent as a result of an increase in total expenditure of actual consumers with positive FAFH expenditure (conditional elasticities). A percentage increase in total household expenditure for entire sample (total elasticities) increases FAFH expenditure by 1.78 percent. Both expenditure elasticities calculated for households with positive consumption only and entire sample indicate that FAFH can be considered a luxury good in Turkey as these elasticities exceed 1. In other words, FAFH expenditure is more responsive to changes in total household expenditure (income). Hence, it can be argued that a rise in the household expenditure (income) of the potential consumers and actual consumers causes a higher increase in the willingness of these households towards FAFH in Turkey.

FAFH participation and consumption decisions vary according to socio-demographic characteristics. Increase in the household size increases the probability of FAFH market participation and the probability of FAFH expenditure but at decreasing rate. Hence, effects of household size and squared household size verifies the presence of economies of scale structure in FAFH consumption in Turkey as the sign of *hsize* and *hsizesqr* are positive and negative respectively. This structure is also valid on conditional and unconditional level of consumption. The effect of educated of household head has conflicting signs. The probability of FAFH market participation is positively associated with education level of household head. On the contrary, this effect on the conditional and unconditional level of FAFH consumption appears to be negative in Turkey. Marital status has a positive effect on the probability of participation and actual consumption level of FAFH in Turkey, while the effect on conditional and unconditional level of expenditure on FAFH is negative. These results might be driven by the fact that married household heads represents a very large fraction of the sample and tend to increase consumption at home for the full sample. These results can be interpreted as probabilities of participation and of consumption of married consumers in the market will increase while the actual expenditure of married consumer on FAFH in Turkey does not tend to increase.

The households live in urban areas have a higher probabilities of FAFH participation and higher percentage of spending than the household live in rural areas. Urban households might have time constraints and they are more likely to participate and spend on FAFH than on their rural counterparts. This result shows that urbanization plays an important role in the determining the probability of FAFH participation and of FAFH

expenditure. Increasing urbanization causes to spend more time out and therefore more FAFH expenditure in Turkey.

The educated household heads, overall, spend more on FAFH in Turkey than the base category. Because they face greater time constraints than other households with less education level and have significantly high expenditure on food consumed away from home.

We find that all calculated age elasticities are positive and it can be inferred that the values of all type of elasticities are higher for all younger age groups, but are slightly decreasing as age of household head increase. Age elasticities show that younger household heads are more likely to participate in and spend on FAFH than older household heads in Turkey. Also the younger household heads who actually consume FAFH in Turkey tend to spend more on FAFH as the conditional and unconditional elasticities indicate in Table 4. What this means is that as the household heads' age progress they allocate an increasingly smaller portion of their budget to FAFH in Turkey. Their expenditure on FAFH may fall at retirement as they have less income compare to earlier years of their live and have more time than young aged households in retirement.

**Table 4. Estimated Elasticities for Independent Double-Hurdle Model**

| Variable | Probability of participation | Probability of consumption | Conditional level of consumption | Unconditional level of consumption |
|---|---|---|---|---|
| Lnexp | 0.527 | 0.519 | 1.264 | 1.783 |
| Lnexpsqr | -0.023 | -0.032 | -0.146 | -0.178 |
| Hsize | 0.052 | 0.043 | 0.208 | 0.251 |
| Hsizesqr | -0.012 | -0.021 | -0.147 | -0.168 |
| education | 0.009 | -0.001 | -0.247 | -0.248 |
| occupation | 0.101 | 0.094 | 0.463 | 0.557 |
| Urban | 0.007 | 0.015 | 0.042 | 0.057 |
| Marital | 0.032 | 0.022 | -0.271 | -0.249 |
| age1 | 0.122 | 0.116 | 0.722 | 0.838 |
| age2 | 0.128 | 0.121 | 0.692 | 0.813 |
| age3 | 0.126 | 0.118 | 0.620 | 0.738 |
| age4 | 0.111 | 0.103 | 0.533 | 0.636 |
| age5 | 0.099 | 0.091 | 0.460 | 0.551 |
| age6 | 0.074 | 0.067 | 0.463 | 0.530 |
| age7 | 0.063 | 0.056 | 0.478 | 0.534 |
| age8 | 0.059 | 0.051 | 0.457 | 0.508 |
| age9 | 0.033 | 0.026 | 0.333 | 0.359 |
| age10 | 0.031 | 0.023 | 0.317 | 0.340 |
| age11 | 0.025 | 0.018 | 0.307 | 0.325 |
| age12 | 0.035 | 0.027 | 0.205 | 0.232 |

| | | | | |
|---|---|---|---|---|
| coh1 | 0.059 | 0.049 | -0.185 | -0.136 |
| coh2 | 0.054 | 0.044 | -0.360 | -0.316 |
| coh3 | 0.029 | 0.019 | -0.394 | -0.375 |
| coh4 | 0.038 | 0.028 | -0.423 | -0.395 |
| coh5 | 0.044 | 0.034 | -0.360 | -0.326 |
| coh6 | 0.051 | 0.041 | -0.337 | -0.296 |
| coh7 | 0.058 | 0.048 | -0.267 | -0.219 |
| coh8 | 0.049 | 0.039 | -0.260 | -0.221 |
| coh9 | 0.043 | 0.034 | -0.163 | -0.129 |
| coh10 | 0.011 | 0.001 | -0.260 | -0.259 |
| coh11 | 0.023 | 0.013 | -0.306 | -0.293 |
| year3 | 0.069 | 0.060 | 0.022 | 0.082 |
| year4 | 0.178 | 0.168 | 0.001 | 0.169 |

Cohort elasticities do not reflect a regular pattern as to cohort groups and there exist differences between the coefficient signs of the participation and consumption equations. Later-born cohorts allocate a larger proportion of their budget on FAFH than early born cohorts, holding age and period effects constant. Later-born cohorts will continue to increase the probabilities of FAFH participation and consumption, but decrease the current proportion of budget allocated to food consumed away from home. This finding probably confirms that young generation is more likely to eat food away from home, even though will decrease their expenditure of FAFH for the sake of healthy foods choices.

**Conclusion**

The objective of this study is to examine the cohort effect on FAFH consumption in Turkey using a micro data set, the Turkish Household Budget Survey. Double hurdle model has been designed to independently capture the cohort, age, time effects and to explain the life-cycle patterns of participation and consumption decisions on FAFH in Turkey. The knowledge of how FAFH consumption have changed over time becomes relevant because demographic changes can predict the future consumption structure and enable politicians to develop strategies geared to different population groups in different life stages.

Overall, empirical results indicate that the socio-economic variables of the households are important in determining the probabilities of participation in FAFH market and consumption, and conditional and unconditional level of consumption of FAFH in Turkey. With regard to the

finding, the existence of significant age, period and cohort effects can be confirmed for FAFH in Turkey

Younger cohorts spend significantly more on FAFH than older cohorts. The period effects are consistent with the participation and expenditure of FAFH in Turkey.

Considering generation effect on FAFH consumption, dissimilarities resulting from different year of births are found to be significant. However, birth cohorts show that more recent generations tend to participate and decide to purchase more FAFH market in Turkey. This finding is not surprising in the sense that FAFH consumption in Turkey exhibits a stable nature across younger cohorts. The findings here should be evaluated within the framework of the methodology and data set used. The issue, for example, can be further inspected by considering geographical residential areas and characteristic of labor force. Future research can of course scrutinize that.

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