Food Expenditure Patterns of the Generation 50+: An Engel-Curve Analysis for Germany

Roland HERRMANN and Johanna BURZIG

Prof. Dr. Roland Herrmann and Johanna Burzig, M.Sc., Institute of Agricultural Policy and Market Research, Justus Liebig University of Giessen, Germany, Senckenbergstrasse 3, D-35390 Giessen.

E-Mail: Johanna.Burzig@gmx.de;
Roland.Herrmann@agrar.uni-giessen.de

Paper prepared for presentation at the EAAE 2011 Congress
Change and Uncertainty
Challenges for Agriculture,
Food and Natural Resources

August 30 to September 2, 2011
ETH Zurich, Zurich, Switzerland

Food Expenditure Patterns of the Generation 50+:
An Engel-Curve Analysis for Germany*

1 Introduction

A major trend in many industrialised countries is that of an ageing society. Population growth is either low or even negative. Consequently, the population pyramid changes towards a higher average age and a growing importance of the older population in absolute and in relative terms. In the former West Germany, the share of the population at the age of 65 (50) and above was 9.7 % (27.1 %) in 1950. The corresponding German value for 2010 is 20.6 % (40.7 %). Forecasts indicate that it will further increase to 34.0 % (52.4 %) in the year 2060 (DESTATIS 2009).

For a rather long time, in-depth studies on the older population were rare. More recently, however, large efforts have been made to study the economic, social and health-related situation and activities of the older population in Europe as well as the determinants affecting those. A case in point is the 'Survey of Health, Ageing and Retirement in Europe' (SHARE). The SHARE database contains a wealth of information on the generation 50+ across Europe.

Analyses on the basis of the SHARE data have provided a broad overview of the economic and social situation of the generation 50+ (Börsch-Supan et al., 2009), the health status within the older population and how it diverges according to education, income and wealth (Jürges, 2010; Rueda and Artazcoz, 2008). Some studies referred to food-related diseases like adiposity (Hofreuter, 2008; Lundborg *et al.,* 2006) and on what drives the differential distribution of obesity within the older population. Other work focused on the social and environmental situation of the elderly and its implications for well-being and the quality of life (von dem Knesebeck *et al.,* 2007) as well as on employment rates and retirement (Ogg and Renaut, 2007). The linkage between the quality of work, well-being and intended early retirement was investigated, too, for the younger cohorts within the generation 50+ (Siegrist *et al*., 2007).

Given the growing market segment of the elderly, it also becomes increasingly important to investigate their consumption patterns. Even with the SHARE data, there are only a few studies available that cope with consumption expenditures. Food expenditures are particularly interesting since food consumption is linked to health. Therefore, we will focus in this study on the food expenditure patterns of the generation 50+ in Germany by analysing the SHARE data.

The article is organised as follows. We will survey the related literature on consumption and food consumption expenditures by the German older population in Section 2 and relate our work to it. In Section 3, the conceptual model will be presented. The econometric evidence is presented and interpretations of the results are provided in Section 4. Conclusions and implications of the findings are elaborated in the final Section 5.

2 Survey of the Literature

Closely related to our work are two different strands of the literature: (i) the typical Engel-curve analysis which measures the influence of income on food consumption expenditures in general and for the older population; (ii) analyses of the linkages between income and food expenditures by age, particularly within the older population.

The estimation of Engel curves has a long tradition in agricultural economics (Working, 1943) and much effort has been made to improve the specification of Engel curves, either regarding the functional form of individually estimated Engel curves (Leser, 1963) or within demand systems (Lewbel and Pendakur, 2008). Most applications of Engel curves have been oriented at households rather than age groups within countries, but age variables have been introduced in a number of studies. Evidence for Germany, in particular for the generation 50+, is scarce. Individual studies indicate that food expenditures react positively to changes in income for different age groups and income elasticities of food expenditures range uniformly between zero and unity (Eschenbach, 1981, Section 4). More recent demand-system approaches do not include the reaction of food expenditures to income changes, but stress how food demand in product groups alters with a change in food expenditures. These expenditure elasticities seem to be relatively similar for older and younger households (Thiele, 2008, Table 4).

An increasing number of studies has concentrated on consumption expenditures in the generation 50+, and several of these have included food expenditures. In the available studies which use SHARE data the focus was mainly on issues of health economics, social policy and labour economics. Typically, income and consumption expenditures are analysed statistically in a comparative view across Europe without explicitly modelling expenditures. Several contributions deal with the pre- and post-retirement period and centre around the so-called retirement-consumption puzzle. Quantitative work indicated, e.g. for the United Kingdom, that income and expenditures drop as a consequence of retirement (Banks *et al.,* 1998). Whereas it is seen as being not consistent with intertemporal utility maximization according to Modiglianis lifecycle model by some (Bernheim, 2001), other authors argue that the drop in expenditures does not necessarily imply a reduction in utility. Work-related expenditures may fall without a decline in food expenditures and consumption if the retired decide to spend more time on shopping and meal preparation. Empirical evidence suggests that this happened in the U.S. (Aguiar and Hurst, 2005), and in Italy (Battistin *et al.*, 2009).

Studies on Germany that use the SHARE database seem to contradict the validity of Modigliani´s lifecycle model. Most newly retired persons in Germany report a deterioration of their financial situation in the SHARE survey (Angelini *et al*., 2008). This hardship does, however, not show up in food-at-home (FAH) consumption of the newly retired and it seems that food away from home (FAFH) is partly substituted by FAH. The share of FAH in total food expenditures rises after retirement (ibid.). Browning and Madsen (2005) argue that households experiencing financial difficulties rather cut back the consumption of other goods than foods.

Interesting complementary analysis is performed by Bonsang *et al.* (2005) who compare the development of income, wealth and consumption inequality for the generation 50+. By using food consumption (FAH and FAFH) as the consumption variable, they show for Northern, Central and Southern Europe the uniform result that “consumption is more evenly distributed than income, and income less unequal distributed than wealth” (Bonsang *et al*., 2005, p. 326). According to the authors, the consumption path over the lifecycle tends to be smoothed by saving in younger for older ages. There are strong differences, however, as net income and, thus, consumption are more equally distributed in Northern (Scandinavian) than in the other European SHARE countries.

Studies on the determinants of food expenditures in the generation 50+ are rare. In one conference paper, Drichoutis *et al.* (2009) used SHARE data to elaborate the factors affecting the body mass index (BMI) and the percentage of food expenditures spent on FAFH within eleven European countries. The authors treat food expenditures as an exogenous variable and they concentrate on changes in the food-expenditure share used for FAFH and its interlinkages with the BMI.

To our knowledge, there is no Engel-curve analysis that explains food expenditures across households as a function of income, health-related and sociodemographic variables in the generation 50+. We intend to fill this gap. There are two more novel features of our analysis. We model FAH as well as FAFH expenditures, as the explanatory variables for the two categories may well differ. Moreover, we explicitly distinguish retired and non-retired persons. Retirement may affect food-expenditure patterns as suggested by recent studies on the consumption-retirement puzzle. The joint use of retirement and income variables has the additional advantage that conclusions for very different socioeconomic groups within the generation 50+ can be derived.

3 Methodology and Data

The methodology used for the Engel-curve analysis differs between FAH and FAFH expenditures. All households covered in the SHARE database have positive FAH expenditures, and multiple regressions are applied to explain these expenditures across households. An early attempt to model statistically laws of family expenditures was provided by Working (1943). Working suggested the following functional form of an Engel curve for food:

$$(1)\quad F / T = a - b \cdot log\, T$$

with F = expenditures for food and T = total expenditures. He expected and confirmed for the U.S. that the share of food expenditures declines with rising income. Leser (1963) compared different functional forms of the Engel curve and stressed advantages of the Working approach. Seale and Theil (1986) utilised data from different phases of the International Comparison Project and elaborated that Working's functional form performed very well, too, when applied to international cross-section data.

In the analysis of the share of FAH expenditures in the generation 50+, we follow the Working approach in principle and include additionally many possibly relevant personal and household characteristics apart from income. We estimated a model

$$(2)\quad \omega^{FAH} = f\,\{lnY^c,\ R,\ Z\}$$

where ω^{FAH} is the share of FAH expenditures in food expenditures, Y^c is per-capita income, R is a dummy variable for retirement with 1 = retired and 0 = not retired, and Z is a vector of other personal and household characteristics. The model allows to test the validity of the WORKING hypothesis concerning the income effect on the food expenditure share. The effect of retirement on ω^{FAH}, and in a separate regression on the natural logarithm of food-at-home expenditures per capita ($ln\ FAH^c$), allows to assess the hypothesis of a consumption-retirement puzzle. Additionally, the evidence on the Z variable will show how the share and the magnitude of FAH expenditures are affected by household size, education, the body mass index and other personal and household characteristics.

A different approach is chosen for the analysis of FAFH expenditures as there are many zero observations in the sample. A two-stage approach is utilised to analyse (i) the probability that FAFH expenditures exceed zero at the first stage; (ii) the amount of FAFH expenditures in case that these expenditures are positive. Tobit models have often been used for the analysis of such censored data. However, a strong assumption in Tobit models is that determinants of decisions at the first and second stage have to be identical. It has been argued in the literature that the two decisions are not necessarily driven by the same factors (Cragg, 1971; Maddala, 1992). A double-hurdle model can capture this argument and is utilised here.

The double-hurdle model, following Cragg (1971) and the application by Blundell and Meghir (1987), is defined as follows:

$$(3) \qquad y_i = y_i^*, \qquad \text{if } y_i^* > 0 \quad \text{and } D_i > 0$$
$$= 0 \qquad \text{otherwise.}$$

y_i is the ith observation of the dependent variable and y_i^* is the corresponding latent variable. D_i is a latent variable, too, and characterises the decision to purchase with $D_i > 0$ for $y_i > 0$. In our case, the dependent variable is the natural logarithm of FAFH expenditures per capita ($y_i = \ln FAFH^C$) and the latent variable D_i is the decision to participate on the FAFH market. We estimate

$$(4) \qquad y_i = \ln FAFH^C = f(\ln Y_i^C, R_i, Z_i^1)$$

and

$$(5) \qquad D_i = f(\ln Y_i^C, R_i, Z_i^2).$$

The latent variables y_i^* and D_i are explained by per-capita income, the status of being retired or not (R) and a vector of personal and household characteristics (Z^1 and Z^2 respectively). It is different from the Tobit model that the vectors Z^1 and Z^2 do not have to be identical in the two equations. The first stage of the model, equation (5), is estimated with a Probit model and the second stage, equation (4), with a truncated regression. Y^c and R are defined as above and again a vector of personal and household characteristics affects the dependent variable.

In Table 1, the variables entering the econometric estimations are defined and characterised by indicators of descriptive statistics.

Table 1 about here

4 Empirical Model and Results

4.1 Food-at-home expenditures

In the model specification for FAH expenditures two independent multiple regressions are estimated. In Model 1, the natural logarithm of FAH expenditures is chosen as the dependent variable ($\ln FAH^c$). In Model 2, the share of FAH expenditures in total food expenditures is used as the dependent variable in the model (ω^{FAH}). Independent variables are, as explained with equation (2), per-capita income in natural logarithm, retirement as well as personal and sociodemographic characteristics. Table 2 shows the regression results for monthly per-capita FAH expenditures.

Table 2 about here

In Engel-curve analyses, the impact of per-capita income is of major importance. It is striking that the income variable is statistically highly significant in both models. With a rising per-capita income, per-capita expenditures for food at home increase, too. As the income elasticity of FAH expenditures is 0.07 the income share of FAH expenditures declines with rising income. According to Model 2, the share of FAH expenditures in total food expenditures also declines with a rising per-capita income. This suggests that a one-percent increase in per-capita income raises per-capita FAH expenditures less than FAFH expenditures in percentage terms[1].

In order to gain insight into the consumption-retirement puzzle, the coefficient of the retirement dummy is crucial. Table 2 shows (i) that per-capita FAH expenditures are clearly rising when a person retires but (ii) the share of FAH expenditures in total food expenditures does not significantly change. Angelini *et al.* (2008) had derived the first result based on descriptive statistics of the SHARE data and our finding indicates that the result remains valid within a causality analysis that controls for many other determinants of FAH expenditures of the generation 50+. The second result is surprising. It is in contrast with Angelini *et al.* (2008) who had shown the opposite results based on descriptive statistics. According to our coefficient of the *RETIRED* dummy, FAFH expenditures were not partially substituted by FAH expenditures, as presumed by Angelini *et al*. We will explain our unexpected finding in the context of Table 3 when the determinants of FAFH expenditures are discussed.

Apart from the influence of income and retirement, Table 2 reveals that several personal and household characteristics drive the pattern of FAH expenditures within the older population. With a rising age, FAH expenditures per capita fall but the share of FAH expenditures in total food expenditures still rises. Analogously, FAH expenditures per capita decline but the FAH share in total food expenditures becomes larger as household size rises.

All dummy variables for higher levels of education (*SCHOOL*2, *SCHOOL*3, *SCHOOL*4) have significantly positive values in Model 1 and significantly negative values in Model 2. Apparently, elderly persons with a higher than the lowest education level realize larger FAH expenditures per capita than the reference group. Expenditures are highest at the highest education level, followed by the second highest. Moreover, a lower share of FAH expenditures in total food expenditures is associated with the second to fourth compared with the first education level.

Larger per-capita FAH expenditures and a lower share of FAH expenditures in total food expenditures occur for West German as opposed to East German households, in larger rather than smaller cities, and for married compared with unmarried persons. Individuals in the generation 50+ with a higher BMI do not spend more per capita on FAH, but the share of FAH expenditures in total food expenditures exceeds that of persons with a lower BMI. Those among the older population who save are characterised by lower FAH expenditures but do not significantly deviate from non-savers in terms of their FAH share in total food expenditures.

4.2 Food-away-from-home expenditures

In the generation 50+, FAFH expenditures may be zero in many cases either due to financial constraints of the household and/or the increased time budget for FAH consumption. It may also be that health reasons limit the participation in the FAFH market. Given the high number of zero observations, the two-step approach outlined in Section 3 was utilised when modeling FAFH expenditures. Results of the two-step approach are presented in Table 3. The first step covers the probit estimation of the probability that FAFH expenditures exceed zero. The second step is represented by a truncated regression for the natural logarithm of per-capita FAFH expenditures for those who consume food away from home.

The income variable is highly statistically significant and positive at both stages of the analysis. The probability to participate in the FAFH market rises with a growing per-capita income and the magnitude of per-capita FAFH expenditures does so, too. The income elasticity of FAFH expenditures is 0.14 and, thus, FAFH expenditures grow less than income

[1] The expectation is confirmed by the fact that the coefficient of the lnY^c variable is higher in the truncated regression of Table 3 than in Model 1 of Table 2.

in percentage terms. Despite this, a comparison with the corresponding elasticity of FAH expenditure reveals that FAFH expenditures grow faster than FAH expenditures with income growth. Hence, it is very consistent that the share of FAH expenditures in total food expenditures has declined (see Model 2, Table 2).

The retirement variable is also significant at both stages and it allows some interesting conclusions on how retirement affects the pattern of food expenditures. With retirement, the probability of positive FAFH expenditures increases but per-capita FAFH expenditures do decline. This suggests that more individuals within the generation 50+ consume food away from home when they retire but the amount of FAFH expenditures falls in per-capita terms. The finding from Table 2 with a positive coefficient of the *RETIRED* variable in Model 1 and an insignificant coefficient of the FAH share may be explained now. The fact that more persons among the elderly consume food away from home as they retire may compensate or even overcompensate the lower per-capita FAFH expenditures after retirement. Hence, the structure between FAH and FAFH expenditures remains largely unaffected despite higher FAH expenditures per capita after retirement. When the finding of Tables 2 and 3 are taken together, we can conclude that no general substitution of FAFH by FAH consumption occurred. The substitution might exist, however, in segments of the rather heterogeneous generation 50+.

Table 3 about here

Other personal and household characteristics drive the FAFH expenditure patterns in many ways. Clearly significant and positive coefficients at both stages occur for the variables *SCHOOL*2, *SCHOOL*3, *SCHOOL*4 and *WEST*. Apparently, the probability that persons have FAFH expenditures as well as the magnitude of these expenditures rises with higher education levels. Likewise, the probability of consuming food away from home and the level of FAFH expenditures are significantly higher in West than in East Germany. Moreover, being married raises the probability to have FAFH expenditures. It does not affect significantly the magnitude of FAFH expenditures per capita at the second stage. Living in large rather than small cities raises FAFH expenditures per capita but does not affect the probability to consume food away from home.

Highly significant is the negative impact of the variable *HHSIZE* at both stages. Persons in the generation 50+ living in larger households have a lower propensity to consume food away from home and lower FAFH expenditures per capita compared with their counterparts from smaller households. With an increasing *BMI*, the coefficients are also negative at both stages. In particular, persons with a higher *BMI* tend to spend less per capita for food away from home than persons with a lower *BMI*. If individuals save, they tend to reduce their FAFH expenditures as the significantly negative coefficient of the *SAVING* variable at stage 2 reveals.

With regard to the health variables, the expected result is evident that health problems reduce *FAFH* expenditures within the generation 50+. A clearly lower probability does exist, too, that food away from home is consumed if the health status is less than good, i.e. the dummy variable *HEALTHY* gets the value unity.

It has been shown by Halvorsen and Palmquist (1980) that the regression coefficients of dummy variables in semilogarithmic equations cannot be interpreted directly as relative changes of the dependent variables due to a status change. Therefore, we computed percentage changes of FAH^C and $FAFH^c$ from the regression coefficients according to Halvorsen and Palmquist in order to compare directly how important status changes in the dummy variables are affecting the food expenditure pattern in the generation 50+. Table 4 reveals the dominant influence of the variables *WEST, RETIRED, LARGECITY* and the education variables. A more detailed interpretation is provided in the final discussion.

Table 4 about here

5 Discussion

It was the objective of the article to elaborate determinants of food expenditure patterns for the generation 50+ in Germany on the basis of an Engel-curve analysis. Although the older generation represents a growing and economically important segment of the society, studies on the determinants of expenditure and food expenditure patterns have been surprisingly rare.

The estimated Engel curves suggest that expenditures for food away from home rises faster than for food at home when income grows by one percent. Point estimates of the elasticities are 0.07 and 0.13 respectively. Thus, both food expenditure shares fall with rising income. However, the FAFH (FAH) expenditure shares in total food expenditures increases (declines) with economic development.

The findings suggest further that the generation 50+ is a very diversified segment of the population that shows a strong variation in terms of the food expenditure pattern. The generation 50+ includes highly active professional people who are at the top of their career. It captures retired persons who may either be involved in a highly active living style or may be focused on activities at home. In the higher age groups of the generation 50+, the health status is a further major determinant of the activities of the elderly and it will determine food consumption and expenditure patterns. This diversity shows up explicitly in the findings of Section 4.

It is obvious that sociodemographic, personal and household characteristics strongly affect the food expenditure patterns. Major changes in consumption and time use seem to take place after retirement. Retirement increases per-capita FAH expenditures. It lowers per-capita FAFH expenditures, but raises the probability of FAFH consumption, and thus leaves the ratio between FAH and FAFH expenditures unaffected. It seems that the lifestyle changes with retirement and that no general consumption-retirement puzzle exists in the German generation 50+. It is necessary, however, to look at more detailed time-use data in future research to verify this conclusion.

Education and place of living matter a lot for food expenditure patterns of the generation 50+ in Germany. Compared to the basic education level, higher education strongly raises per-capita FAH expenditures by 16 to 21 % and it boosts FAFH expenditures by more than 50 % up to 128 % (*SCHOOL3*). Living in a large rather than a small city increases per-capita expenditures for FAH by 20 % and FAFH by 66 %. The strongest impact, however, of all dummy variables arises from the variable *WEST*. If a person of generation 50+ lives in West rather than East Germany, his per-capita expenditures will range by 47 % higher for FAH and by even 139 % higher for FAFH expenditures than for the East German benchmark person.

There is no doubt that the health situation of the elderly is also crucial for food expenditure patterns but in the opposite direction. All health-related variables indicate that $FAFH^c$ falls, by 20 % or more, if individuals face health-related problems.

Literature

Aguiar, M. and E. Hurst (2005), “Consumption versus Expenditures”, *The Journal of Political Economy*, Vol. 113, No. 5, pp. 919-948.

Angelini, V., A. Brugiavini and G. Weber (2008), "Consumption", in: Börsch-Supan, A. et al. (eds.), *Ageing and Retirement in Europe (2004-2007) – Starting the Longitudinal Dimension*, MEA, Mannheim, pp. 289-294.

Banks, J., R. Blundell and S. Tanner (1998), "Is There a Retirement-Savings Puzzle?", *The American Economic Review*, Vol. 88, No. 4, pp. 769-788.

Battistin, E., A. Brugiavini, E. Rettore and G. Weber (2009), "The Retirement Consumption Puzzle: Evidence from a Regression Discontinuity Approach", *The American Economic Review*, Vol. 99, No. 5, pp. 2209-2226.

Bernheim, B. D., J. Skinner and S. Weinberg (2001), "What Accounts for the Variation in Retirement Wealth Among U.S. Households?", *The American Economic Review*, Vol.91, No. 4, pp. 832-857.

Blundell, R. and C. Meghir (1987), "Bivariate Alternatives to the Tobit Model", *Journal of Econometrics*, Vol. 34, Nos. 1-2, pp. 179-200.

Börsch-Supan, A., K. Hank, H. Jürges and M. Schröder (eds.) (2009), *50+ in Deutschland und Europa – Ergebnisse des Survey of Health, Ageing and Retirement in Europa,* VS-Verlag für Sozialwissenschaften, Wiesbaden.

Börsch-Supan, A., A. Brugiavini, H. Jürges, A. Kapteyn, J. Mackenbach, J. Siegrist and G. Weber (eds.) (2005), *Health, Ageing and Retirement in Europe – First Results from the Survey of Health, Ageing and Retirement in Europe*, Mannheim Research Institute for the Economics of Ageing (MEA), Mannheim.

Börsch-Supan, A., A. Brugiavini, H. Jürges, A. Kapteyn, J. Mackenbach, J. Siegrist and G. Weber (eds.) (2008), *Health, Ageing and Retirement in Europe (2004-2007) – Starting the Longitudinal Dimension*, Mannheim Research Institute for the Economics of Ageing (MEA), Mannheim.

Bonsang, E., S. Perelman and K. van den Bosch (2005), "Income, Wealth and Consumption Inequality", in: Börsch-Supan, A. et al. (eds*.), Health, Ageing and Retirement in Europe – First Results from the Survey of Health, Ageing and Retirement in Europe*, MEA, Mannheim, pp. 325-331.

Browning, M. and E. Madsen (2005), "Consumption", in: Börsch-Supan, A. et al. (eds.), *Health, Ageing and Retirement in Europe – First Results from the Survey of Health, Ageing and Retirement in Europe,* MEA, Mannheim, pp. 318-324.

Cragg, J.G. (1971), Statistical Models for Limited Dependent Variables with Applications to the Demand for Durable Goods. *Econometrica*, Vol. 39, No. 5, pp. 829-844.

DESTATIS (Statistisches Bundesamt Deutschland) (2009), „Ergebnisse der 12. koordinierten Bevoelkerungsvorausberechnung", available at: http://www.destatis.de/bevoelkerungspyramide/ (accessed…).

Drichoutis, A. C., P. Lazaridis and R. M. Nayga, Jr. (2009), "Body Weight Outcomes and Food Expenditures Among Older Europeans: A Simultaneous Equation Approach", paper presented at 113th EAAE Seminar, "A Resilient European Food Industry and Food Chain in a Challenging World", 3-6 September, Chania, Crete, Greece.

Eschenbach, J. (1981), *Lebensmittelnachfrage und privater Verbrauch ausgewählter Haushalte in der Bundesrepublik Deutschland - Eine Auswertung der Einkommens- und Verbrauchsstichprobe 1973*, Köhler, Gießen.

Halvorsen, R. und R. Palmquist (1980), “The Interpretation of Dummy Variables in Semilogarithmic Equations”, *The American Economic Review*, Vol. 70, No. 3, pp. 474-475.

Hofreuter, K., E. Mnich and O. von dem Knesebeck (2008), „Soziale Ungleichheit und Adipositas bei älteren Menschen in Deutschland – Ergebnisse der SHARE–Studie“, *Adipositas*, Vol. 2, No. 3, pp.123-126.

Jürges, H. (2008), “Health Inequalities by Education, Income and Wealth: A Comparison of 11 European Countries and the US”, *Applied Economics Letters*, Vol. 17, No. 1, pp. 87-92.

Knesebeck, O. von dem, M. Wahrendorf, M. Hyde and J. Siegrist (2007), “Socioeconomic Position and Quality of Life among Older People in 10 European Countries: Results of the SHARE Study”, *Ageing and Society*, Vol. 27, No. 2, pp. 269-284.

Leser, C. E. V. (1963), “Forms of Engel Functions”, *Econometrica*, Vol. 31, No. 4, pp. 694-703.

Lewbel, A. and K. Pendakur (2008), “Estimation of Collective Household Models with Engel Curves”, *Journal of Econometrics*, Vol. 147, No. 2, pp. 350-358.

Lundborg, P., K. Bolin, S. Höjgard and B. Lindgren (2006), “Obesity and Occupational Attainment among the 50+ of Europe”, in: Bolin, K. and J. Cawley (eds.), *The Economics of Obesity*. (Advances in Health Economics and Health Services Research, Vol. 17), Elsevier, pp. 219-251.

Maddala, G. S. (1992), *Introduction to Econometrics*, Second edition, Prentice Hall, Englewood Cliffs, NJ.

Ogg, J. and S. Renaut (2007), “The Influence of Living Arrangements, Marital Patterns and Family Configuration on Employment Rates among the 1945-54 Birth Cohort: Evidence from Ten European Countries”, *European Journal of Ageing*, Vol. 4, No. 3, pp. 155-169.

Rueda, S. and L. Artazcoz (2008), “Health Inequalities among the Elderly in Western Europe", *Journal of Epidemiology and Community Health*, Vol. 62, No. 6, pp. 492-498.

Seale, Jr., J. and H. Thiel (1986), Working’s Model for Food in the Four Phases of the International Comparison Project. Dedicated to the Memory of Holbrook Working. *Economics Letters*, Vol 22, No. 1, pp. 103-104.

Siegrist, J., M. Wahrendorf, O. von dem Knesebeck, H. Jürges and A. Börsch-Supan (2007), “Quality of Work, Well-being and Intended Early Retirement of Older Employees; Baseline Results from the SHARE Study”, *European Journal of Public Health*, Vol. 17, No. 1, pp. 62-68.

Thiele, S. (2008), „Elastizitäten der Nachfrage privater Haushalte nach Nahrungsmitteln - Schätzung eines AIDS auf Basis der Einkommens- und Verbrauchsstichprobe 2003“. *Agrarwirtschaft (German Journal of Agricultural Economics),* Vol. 57, No. 5, pp. 258-268.

Working, H. (1943), “Statistical Laws of Family Expenditure”, *Journal of the American Statistical Association*, Vol. 38, No. 221, pp. 43-56.

Appendix

Table 1: Description of the Dependent and Independent Variables

Variable	Definition	Reference group in case of dummy variables	Mean	Std. Dev.
Dependent variables				
FAH^C	monthly per-capita expenditures for food at home in €		207.59	102.2091
ω^{FAH}	share of monthly expenditures for food at home in total food expenditures in %		86.19	13.4541
$FAFH^C$	monthly per-capita expenditures for food away from home in €		40.52	57.9546
Independent variables				
AGE	age in years		64.36	9.4183
MALE	dummy for male	female	0.47	0.4989
BMI	body mass index in kg/m²		26.57	4.4082
MARRIED	dummy for married person	not married person	0.76	0.4267
HHSIZE	household size		2.07	0.8217
Y^C	monthly per-capita income in €		1355.91	1204.471
SCHOOL2	dummy for second level of education	lowest education level	0.21	0.4109
SCHOOL3	dummy for third level of education	lowest education level	0.05	0.2221
SCHOOL4	dummy for highest level of education	lowest education level	0.14	0.3422
RETIRED	dummy for retired person	not retired	0.52	0.4996
SAVING	dummy for saving money	not saving money	0.61	0.4868
WEST	dummy for the region West Germany	East Germany	0.79	0.4040
LARGECITY	dummy for large city	small town	0.40	0.4908
HEALTHY	dummy for health status less than good	health status good and better	0.45	0.4971
SYMPTOM	dummy for two and more than two symptoms	less than two symptoms	0.38	0.4853
DEPRESSION	dummy for depression	no depression	0.38	0.4844

Source: Own computations, with SHARE data, Wave 1, for Germany.

Table 2: Regression Results for FAH Expenditures [a)]

Independent variables	Dependent variable Model 1 ($\ln FAH^{C}$)	Model 2 (ω^{FAH})
AGE	-0.0055*** (-3.54)	0.2189*** (4.85)
MALE	-0.0509* (-2.23)	-0.4561 (-0.68)
BMI	0.0013 (0.55)	0.2467*** (3.58)
MARRIED	0.0630* (2.33)	-1.6085* (-2.04)
HHSIZE	-0.2034*** (-14.08)	2.9911*** (7.08)
$\ln Y^{C}$	0.0748*** (4.93)	-2.4105*** (-5.45)
SCHOOL2	0.0645** (2.46)	-3.5747*** (-4.67)
SCHOOL3	0.0798(*) (1.77)	-6.1595*** (-4.67)
SCHOOL4	0.0841** (2.52)	-5.3423*** (-5.48)
RETIRED	0.0844** (2.95)	0.1226 (0.15)
SAVING	-0.0441* (-2.15)	0.8955 (1.49)
WEST	0.1682*** (7.09)	-5.4173*** (-7.81)
LARGECITY	0.0791*** (3.90)	-1.1566* (-1.95)
Constant	5.2233*** (31.24)	83.2118*** (17.03)
R^2	0.1659	0.1670
$\overline{R}^2$	0.1601	0.1612
F	28.61***	28.83***
n	1 884	1 884

[a)] Variables are defined in the text. t-values are presented in parentheses.
***, **,*, (*) Statistically significant at the 99.9%-, 99%-, 95%- and 90%-level.
Source: Own computations.

Table 3: Results of the Double-hurdle Model for FAFH Expenditures [a)]

Probit Analysis (1st stage)		Truncated Regression (2nd stage)	
Independent variables	**Dependent variable** (Prob ($FAFH^c \neq 0$))	**Independent variables**	**Dependent variable** (ln $FAFH^C$)
AGE	-0.0339***	*AGE*	0.0004
	(-6.77)		(0.12)
MALE	-0.0933	*MALE*	0.0158
	(-1.24)		(0.32)
BMI	-0.0133(*)	*BMI*	-0.0133**
	(-1.71)		(-2.45)
MARRIED	0.2813***	*MARRIED*	0.0737
	(3.21)		(1.25)
HHSIZE	-0.1597***	*HHSIZE*	-0.3953***
	(-3.39)		(-11.48)
$ln\ Y^C$	0.2276***	$ln\ Y^C$	0.1380***
	(4.66)		(4.36)
SCHOOL2	0.3582***	*SCHOOL2*	0.1887***
	(4.07)		(3.49)
SCHOOL3	0.3935**	*SCHOOL3*	0.3575***
	(2.49)		(4.06)
SCHOOL4	0.5601***	*SCHOOL4*	0.2350***
	(4.65)		(3.55)
RETIRED	0.3315***	*RETIRED*	-0.1534**
	(3.59)		(-2.57)
SAVING	0.0075	*SAVING*	-0.0833*
	(0.11)		(-1.93)
WEST	0.5661***	*WEST*	0.3779***
	(7.65)		(6.93)
LARGECITY	-0.0332	*LARGECITY*	0.2203***
	(-0.5)		(5.22)
HEALTHY	-0.2836***	*HEALTHY*	-0.0982*
	(-3.8)		(-1.99)
SYMPTOM	0.1274(*)	*SYMPTOM*	-0.1134*
	(1.69)		(-2.25)
DEPRESSION	-0.0847	*DEPRESSION*	-0.1371**
	(-1.23)		(-2.98)
Constant	1.1457*	Constant	3.4985***
	(2.13)		(9.76)
Pseudo R^2	0.1290		
Chi^2	294.83***	Wald chi^2	435.25***
n	1 955	n	1 423

[a)] Variables are defined in the text. t-values are presented in parentheses.
***, **, *, (*) Statistically significant at the 99.9 %-, 99 %-, 95 %- and 90 %-level.
Source: Own computations.

Table 4: A Comparison of the Relative Importance of Sociodemographic, Personal and Household Characteristics for Per-capita FAH and FAFH Expenditures [a)]

Characteristics	Percentage change of FAH^c	Characteristics	Percentage of $FAFH^c$
WEST	+ 47.3	*WEST*	+ 138.7
RETIRED	+ 21.5	*SCHOOL3*	+ 127.8
SCHOOL4	+ 21.4	*SCHOOL4*	+ 71.8
SCHOOL3	+ 20.2	*LARGECITY*	+ 66.1
LARGECITY	+ 20.0	*SCHOOL2*	+ 54.4
SCHOOL2	+ 16.0	*SAVING*	- 17.5
MARRIED	+ 15.6	*HEALTHY*	- 20.2
MALE	+ 11.1	*SYMPTOM*	- 23.0
SAVING	- 9.7	*DEPRESSION*	- 27.1
		RETIRED	- 29.8

[a)] All sociodemographic, personal and household characteristics are defined as in Table 1 and the effects of a status change are measured compared to the reference groups as defined there. The percentage changes are computed with the method of Halvorsen and Palmquist (1980) for all regression coefficients of Tables 2 and 3 which were significant at least at the 90%-level.