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HOUSEHOLD PRIVATE CONSUMPTION AND AGEING IN EUROPEAN COUNTRIES

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ABSTRAKT

Privátna spotreba domácností a starnutie v Európe

Tento článok sa zaoberá vyhodnotením dát, ktoré sa zaoberajú starnutím a privátnej spotreby domácností vzhľadom na vek. Privátna spotreba domácností v európskych krajinách je zaznamenaná v zisťovaní rodinných účtov. Kombináciou týchto dát spolu s demografickými projekciami vyhodnotíme efekt starnutia na privátnu spotrebu domácností, ktorá berie do úvahy rozdielnu privátnu spotrebu starších domácností a mladších domácností. Efekty starnutia na privátnu spotrebu sme vykonali ako na Európskej úrovni, tak aj na úrovni jednotlivých členských krajín, ktorých dáta boli k dispozícii.

KĽÚČOVÉ SLOVÁ
starnutie, privátna spotreba domácností, štruktúra spotreby, klasterova analýza

ABSTRACT

Household private consumption and ageing in European countries

This paper describes the data available on ageing and the structure of private household consumption with respect to age. At the European level structure of consumption is surveyed by Household Budget Surveys. Combining this data with demographic projections allowed us to quantify the effect of ageing on private consumption of households by extracting the difference in consumption of elderly households to households with younger members. This was done at the European level as well as on the level of selected member states.

KEYWORDS
ageing, private household consumption, structure of consumption, cluster analysis

JEL CLASSIFICATION: *J11, E21, D12*

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CONTENTS

INTRODUCTION

Within this paper we are going to present some features of expected demographic development and put them together with the information on the structure of consumption with respect to age. Putting this information together allows us to construct a statistical variable model able to follow the impact of ageing on consumption of households in European countries. This work was done and in a more elaborated form published under the 7FP project NEUJOBS. This paper contains some additional information about the problems authors were dealing with in performing the quantification.

The structure of the paper corresponds to the planed content with the first section describing the demographic development from the perspective of change in the age composition of the population. Second section deals with the structure of consumption employing the evidence from European Household Budget Surveys. Cluster analysis is used in both sections to make groupings of countries based on ageing and consumption patterns. Clustering countries together makes analysed patterns easier to comprehend. Based on these analyses we build a statistical data model able to quantify the effects of ageing on consumption of households. This model can be found in the last section of this paper.

1. DEMOGRAPHIC TRENDS

Most of recent studies dealing with ageing are pointing at the risks related to this trend. The perspective of this paper is therefore a little outside the main stream, looking at ageing as an opportunity for potential change in structure of production. The first determining factor when studying consumption of households is the number of people living in households – potential consumers. Within this section we are going to present some of the main trends in ageing of European (EU27) population, which are relevant from the perspective of studying changes in consumption. Main trends will be described using the projections calculated by one of the partners within the NEUJOBS project, the Netherlands Interdisciplinary Demographic Institute (NIDI).[1] Authors constructed two demographic scenarios, namely friendly and tough which are different in more demographic elements. The tough scenario assumed low fertility and high mortality while friendly scenario assumed greater increase of population. The friendly scenario is more probably and corresponds to reality.

The following table (Table 1) shows the projections of population in particular age groups together with the proportion of the age group on total population. The figures are for all EU27 countries pooled together.

[1] Details about the projections can be found in a working paper (Huisman, et al., 2013) published within the NEUJOBS project at www.neujobs.eu.

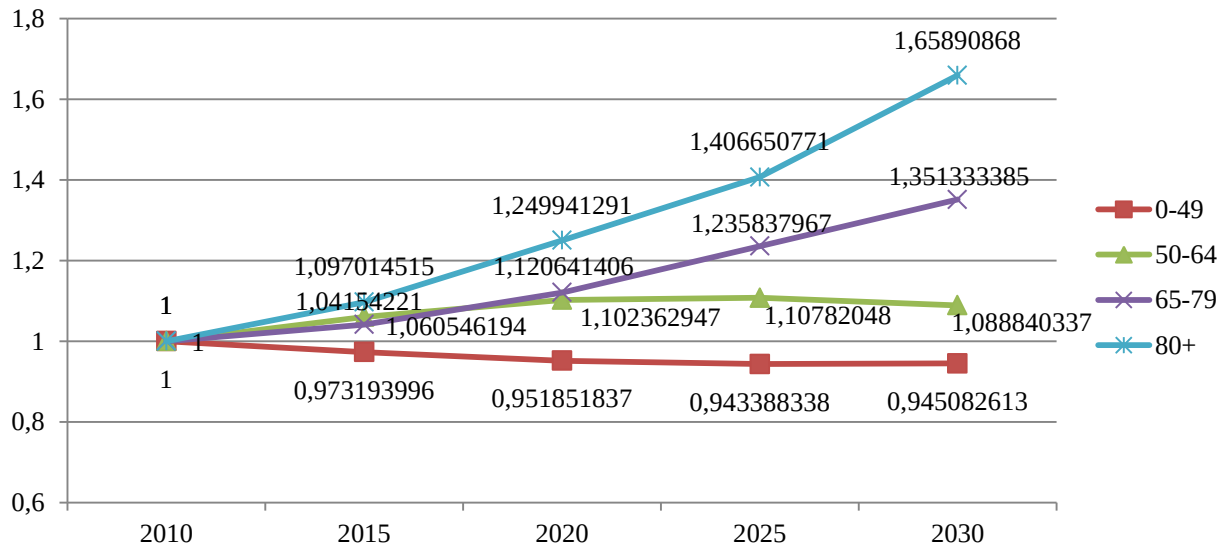
Table 1
The development of population EU27 up to 2030 (Friendly scenario)

Age group	*2010*	*2015*	*2020*	*2025*	*2030*
0-49	394 441 218	383 867 825	375 449 598	372 111 245	372 779 537
%	63.23	61.26	59.22	57.68	56.47
50-64	119 840 034	127 095 892	132 107 213	132 761 244	130 486 663
%	19.21	20.28	20.84	20.58	19.77
65-79	80 664 196	84 015 165	90 395 638	99 687 876	109 004 221
%	12.93	13.41	14.26	15.45	16.51
80+	28 845 498	31 643 930	36 055 179	40 575 542	47 852 047
%	4.62	5.05	5.69	6.29	7.25
Total	623 790 946	626 622 812	634 007 628	645 135 907	660 122 468
%	100.00	100.00	100.00	100.00	100.00

Source: (Huisman, et al., 2013).

In 2010 the overall population of EU27 was almost 624 million. This figure (Figure 1) is supposed to grow during the whole reference period from 2010 to 2030. According to the friendly scenario of NIDI projections overall EU27 population will grow up to over 660 million. The age group 0-49 presents the dominant age group, whose share on the population is going to decline from 63.23 % in 2010 to 56.47 %. This decline presents a clear evidence of ageing of the population. The proportion of the age group 50-64 shows an ambivalent trend in the period 2010 – 2030, with initial slight growth and later slight decline after 2020. In contrast the age groups 65-79 and 80+ show a clear growing trend. The graph bellow shows the index of change with the baseline year 2010.

Figure 1
Index of growth in age groups (Friendly scenario)



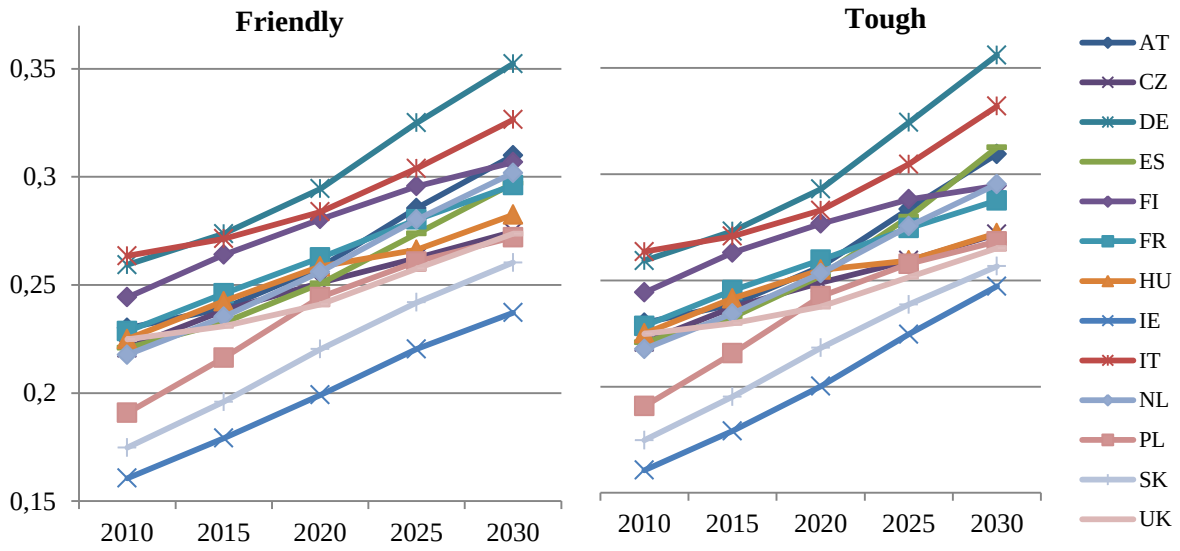
Source: (Huisman, et al., 2013).

From this graph we can see that the most intensive growth is expected for the age group 80+, followed by the age group 65-79. These together will grow from 17.56 % of the population to 23.76 % of the overall population which is going to influence the shape of overall private consumption of the population.

In attempt to answer the question on the national differences in ageing we have restructured the analysis dividing the population only into two age groups: 0-59 and 60+. Based on this we are able to follow the change in proportion of population 60+ in the overall population. The graphs (Figure 2) below show the development of the proportion of 60+ in the population in selected EU27 countries. Figures are based on the NIDI projections and displayed for friendly (left) as well as tough (right) scenario.

F i g u r e 2

Change in the proportion of population 60+ in selected EU countries based on NIDI demographic projections



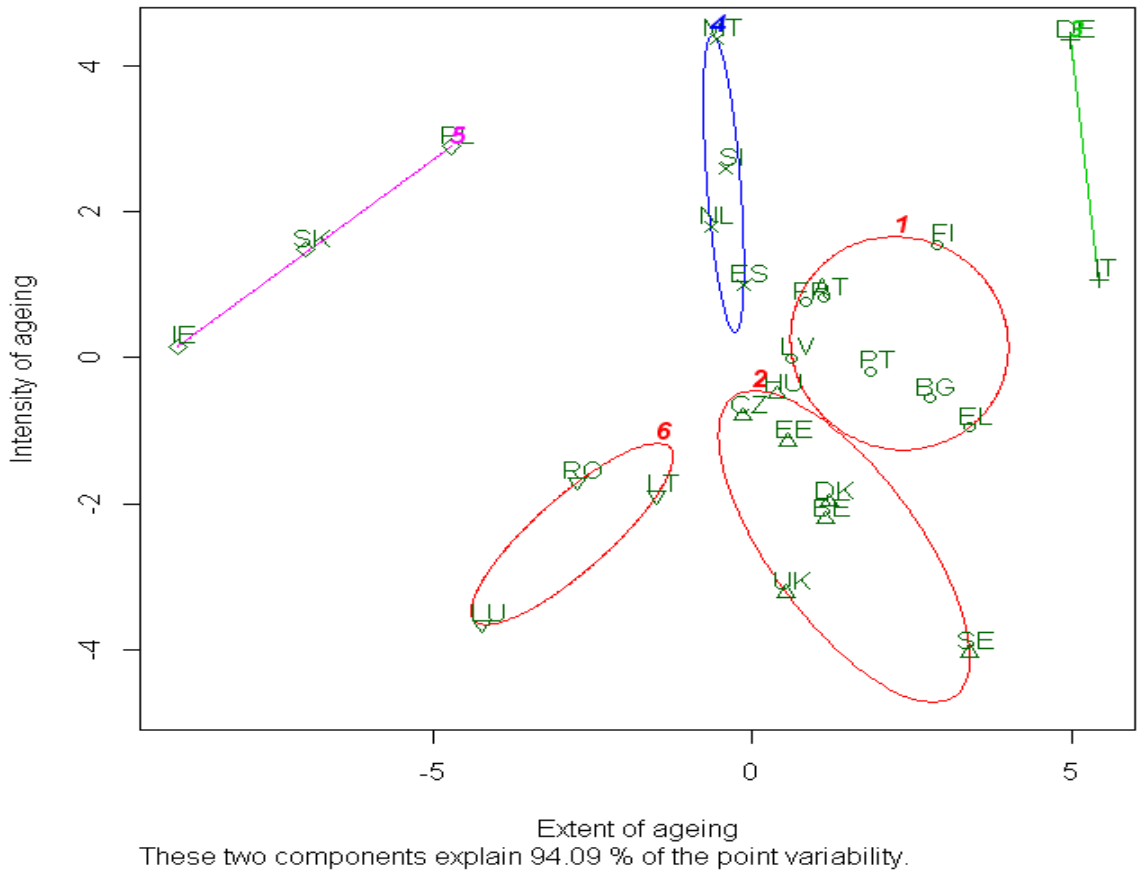
Source: (Huisman, et al., 2013).

On the first glance we can observe the uniformity of the ageing trend. All of the selected countries will face an increase in the proportion of the population 60+. Only relatively small differences in the proportions and the pace of its change exist. Ireland and Slovakia present the countries with the smallest proportion of population 60+. On the other end of the spectrum we can find Germany and Italy with high proportion of population 60+ with a significant further increase until 2030, with figures for Germany above 35 % in 2030. Finland presents a country with relatively high proportion of population 60+ but its further growth is expected to slow down with Finland converging towards the main group of countries. We can see that the differences between demographic scenarios changes in the proportion of population 60+ in selected EU countries are very small. That main reason why we will use the friendly scenario results in other part of this article.

These small differences in proportion of the population 60+ and its change in time can be entered into a cluster analysis as explanatory variables in order to group the countries based on the character of ageing of their population. Based on this information there are 10 explanatory variables, five times two, for each of the 5 years periods on 2 variables (proportion of the population 60+ and index of change in the population 60+ with the baseline value from 2010). We have used non-hierarchical clustering to identify 6 clusters of countries based on the extent and intensity of ageing. The following graph (Figure 3) shows the groupings of countries in a reduced 2 dimensional space.

F i g u r e 3

Clustering of EU27 countries based on the extent and intensity of ageing in the period 2010 – 2030



Source: Authors calculations using projections from (Huisman, et al., 2013).

BOX 1: CLUSTER ANALYSIS

Cluster analysis is a statistical method used to group statistical objects into clusters based on similarity of selected attributes. Objects in one cluster have similar characteristics and each cluster has the most different properties in comparison with other clusters. There are various methods of clustering using different algorisms to solve the optimization problem. Among the most commonly used clustering models are:

- Hierarchical clustering (Connectivity models) builds models based on distance connectivity between data objects.
- Non-hierarchical clustering represents each cluster by a single mean vector.

Hierarchical clustering (Connectivity models)

Connectivity models work with distances between data objects. Algorithms are connecting data objects based on their distance between them to create clusters. In the second step algorithm connects clusters with each other based on the proximity. Graphically the results can be displayed in a Dendrogram - a two dimensional diagram. Dendrogram not only displays the distance between two objects, but provides also an extensive hierarchy of all objects based on distance between them.

Non-hierarchical cluster analysis

Existing literature offers a lot of non - hierarchical clustering methods for insurance k- means clustering, distribution based clustering, density based clustering or fuzzy clustering. One of the most used non- hierarchical clustering methods is known also as the k-means cluster analysis. Before the first iteration, in this method, each object is represented by a vector. This algorithm is based on the search for k representative objects (medoids) among the observations of the dataset. These observations should represent the structure of the data. Consequently the closest objects get merged and a new "centroid" is represented by a new vector created by a combination of the vectors of the objects merged. Merging of the clusters is done based on the minimisation of the squares of the distances between the centroids. The end of the iteration process brings k clusters. Therefore the method is often referred to as the k-means clustering. This optimisation problem is hard to be solved polynomial and often leads to approximative results.

The dimensions of the graph to a big extent correspond to the two explored dimensions: proportions of 60+ in the population and the expected change of the proportion of 60+ during the period 2010 – 2030.[2] For this reason we have named the axes based on their close correspondence to extent of ageing (x-axis) and intensity of ageing (y-axis). The first two clusters shelter countries from the main peloton of EU27 from the perspective of ageing. The first cluster includes countries with average values in proportion of the population 60+ and relatively intensive growth of this proportion. In this group we can find Austria, Bulgaria, Greece, Finland, France, Latvia and Portugal. Second cluster groups countries with average extent of ageing and relative lower intensity of change in the proportion of 60+. In this group are Belgium, Czech Republic, Denmark, Estonia, Hungary, Sweden and the United Kingdom. Both of these first two clusters are grouping more than 4 countries meaning the heterogeneity within clusters is quite high. Sweden is an outlier within the second cluster with higher proportion of 60+ but one of the smallest changes expected in the period 2010 – 2030. Finland presents the country with the highest initial values of 60+ shares out of the first cluster, its growth also above the average of the cluster but lagging behind the countries of the third cluster

[2] Based on the average between friendly and tough scenario of NIDI projections (Huisman, et al., 2013).

in both dimensions. Third cluster groups Germany and Italy, countries with the highest extent and intensity of ageing.

Fourth cluster includes Spain, Malta, the Netherlands and Slovenia. These countries scored narrowly at the average proportion of 60+ in their population and are expect to experience an intensive growth in this proportion.

Fifth cluster groups countries with under average extent of ageing (proportion of 60+ below the average) and expected above average intensity of ageing. Such situation can be observed in Ireland, Poland and Slovakia.

Sixth cluster groups countries with below average extent of ageing and under average intensity of change in ageing. Lithuania, Luxemburg and Romania are in this group.

Cluster analysis helps us to see and comprehend differences in ageing between countries. These will be taken into account when looking at the structure of consumption and later quantifying the effect of ageing on total consumption of households in EU.

2. STRUCTURE OF THE DEMAND OF ELDERLY – CLUSTER ANALYSIS

After drawing a brief picture on ageing and its change in time in European countries second parameter which is drawing our attention in modelling the potential for silver economy is the structure of the demand of elderly. Special attention will be paid to the differences in the structure of consumption between age groups. The central source of information on structure of consumption is the European Household Budget Surveys (HBS). Despite the effort of Eurostat to unify these household budget surveys in the EU member states, their methodology and approaches differ substantially. Therefore we are not able to refer to one survey, but several surveys. International comparability of the information acquired also suffers by these methodological differences. Another weakness of HBS is its obsolescence with the latest figures published for 2005. Nevertheless HBS presents the most relevant and reliable source of information on structure of consumption available on the European level.

Following graph (Figure 4) shows the average[3] figures for mean consumption on 12 main items.[4] The figures present mean expenditures on particular items per 1000 Euro. The average is counted as a weighted average out of the data for countries where the information was available.[5] HBS collects data on households, not individuals as expenditures are organized within households. Mean expenditures are displayed based on the age of the reference person[6] of the household.

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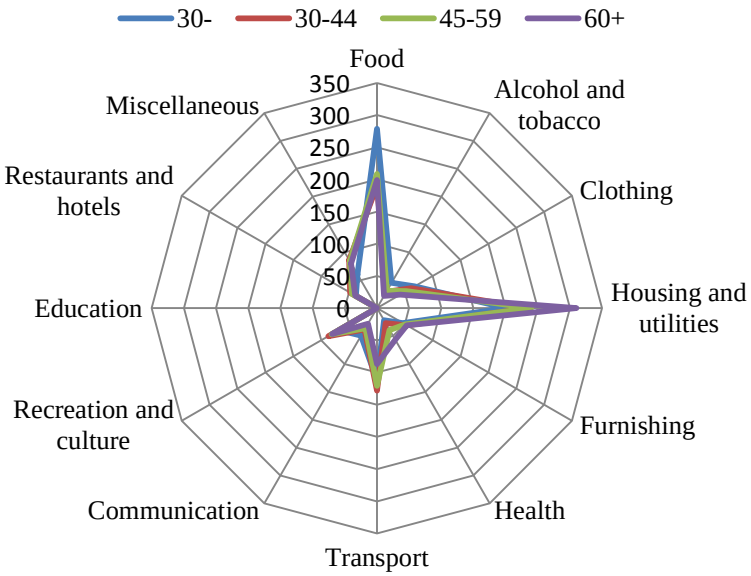
[3] The average is counted as a weighted average out of the data for countries.

[4] Classified using the COICOP statistical classification of individual consumption by purpose, graph shows the COICOP 1-digit items of consumption.

[5] Countries included into the calculation of the weighted average were: Austria, Belgium, Bulgaria, Cyprus, Germany, Denmark, Estonia, Spain, Finland, France, Greece, Hungary, Ireland, Lithuania, Luxembourg, Latvia, Netherlands, Romania, Sweden, Slovenia, Slovakia and the United Kingdom.

[6] For the definition of a reference person in HBS see: (European Commission, 2003 p. 20), at: http://ec.europa.eu/eurostat/ramon/statmanuals/files/KS-BF-03-003-__-N-EN.pdf

Figure 4
Mean expenditures on COICOP 1-digit level in European countries by age of the reference person



Source: Eurostat Database, table: hbs_str_t225.

Based on HBS the highest share of expenditures is spent on food, in case of households with younger reference persons, and on housing, in case of households with older reference persons. Food expenditures present 278.81 Euro out of each 1000 Euro in case of households with reference person younger than 30. Housing expenditures present 309.75 Euro out of 1000 Euro in case of households with the reference person above 60. Means used in creation of the graph above are displayed in the table below (Table 2).

Table 2
Mean expenditures on COICOP 1-digit level in European countries by age of the reference person

	30-	*30-44*	*45-59*	*60+*
Food	278.81	190.38	208.49	199.14
Alcohol and tobacco	45.47	29.67	31.22	22.07
Clothing	67.61	61.83	52.72	42.10
Housing and utilities	201.29	235.21	239.99	309.75
Furnishing	46.15	53.50	50.63	53.34
Health	21.68	26.64	39.23	56.60
Transport	111.54	128.32	120.67	86.69
Communication	49.25	38.26	36.03	27.80
Recreation and culture	68.25	87.38	81.15	80.06
Education	NA	NA	NA	NA
Restaurants and hotels	37.97	48.11	44.61	39.18
Miscellaneous	60.77	86.51	84.00	79.96

Source: Eurostat Database, table: hbs_str_t225.

From the table several clear trends in structure of spending in relation to age of the reference person of the household can be observed. Expenditures on food drop down with age. This is easy to understand if we realise that the size of households (in number of members)

drops down with increasing age of the reference person. Older people live in smaller households; therefore they do not spend so much on food. Size of the household can also explain the increase in relative expenditures on housing with increasing age of the reference person. The smaller the household the higher is its spending on housing when counted relatively per 1000 Euro.

Expenditures related to health are the only expenditures (besides housing) clearly growing with age of the reference person. Spending on most of the other items of consumption is declining with age and especially after the reference person reaches 60. This could be linked with the decline in income related with leaving the labour market towards retirement.

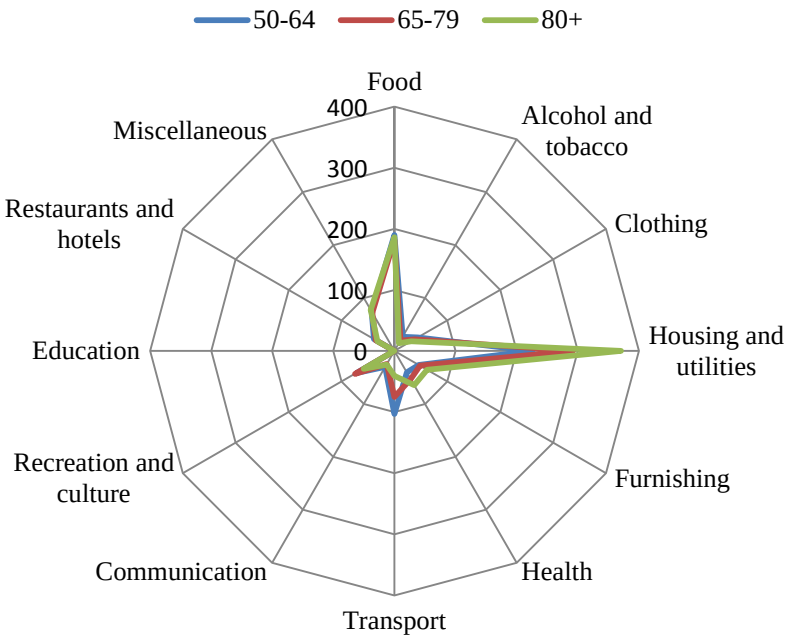
Clearly lower average expenditures of 60+ households on clothing, transport and communication could draw some concerns in relation to future expand in demand driven by private household consumption. The decline is not that clear in recreation and culture and restaurants and hotels what could create some support for the expectations behind the concept of silver economy.

Information on expenditures related to education was not reliable; therefore we left it out of the analysis.

Graph and table (Figure 5 and Table 3) below display the same figures when looking closely on the age groups of elderly population.

F i g u r e 5

Mean expenditures on COICOP 1-digit level in European countries by age of the reference person – elderly



Source: Eurostat Database, table: hbs_str_t225.

Table 3
Mean expenditures on COICOP 1-digit level in European countries by age of the reference person – elderly

	50-64	*65-79*	*80+*
Food	189.61	181.82	186.41
Alcohol and tobacco	26.78	19.57	14.73
Clothing	43.91	38.55	31.92
Housing and utilities	225.60	292.27	370.98
Furnishing	45.97	48.12	61.57
Health	40.59	53.20	64.49
Transport	102.92	75.31	40.89
Communication	30.05	24.82	25.51
Recreation and culture	71.77	74.67	58.13
Education	NA	NA	NA
Restaurants and hotels	38.92	34.96	32.18
Miscellaneous	74.58	72.09	77.88

Source: Eurostat on request, table: T225_SK_2013_March.

When looking closely on the consumption of elderly, trends familiar from comparison of 60+ households can be observed in a clearer form. The increase in relative mean spending on housing is much higher in case of the group 80+. In this age group the highest proportion of single households can be expected as well.[7] Transport expenditures drop to less than half between households with the reference person in the age groups 50-64 and 80+. Health expenditures grow with the age of the reference person. Spending on food remains nearly at the same level.

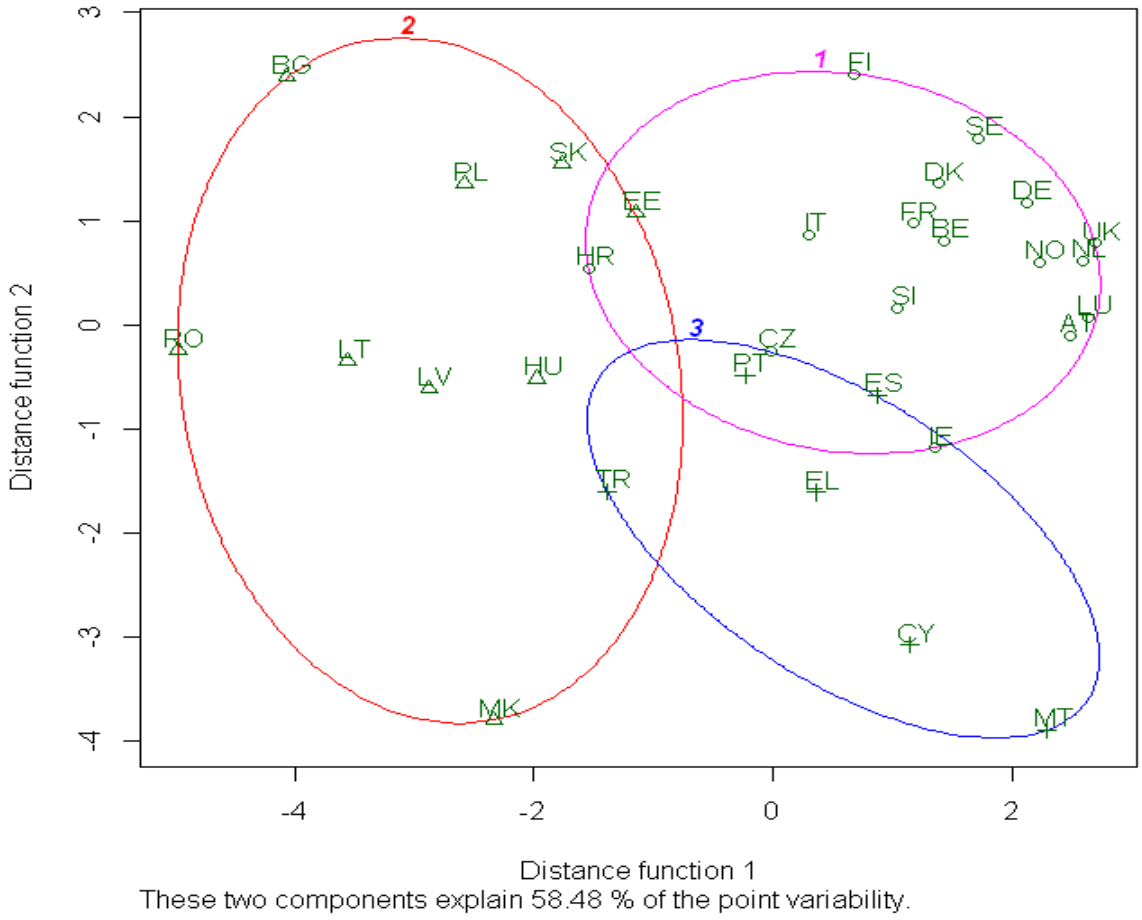
Evidence presented above is based on a weighted average of European countries. There are reasons to expect significant differences in the structure of consumption between countries. Economic factors, such as income of households or price level in the country, can play a role, as well as cultural and social differences between countries. When looking at international differences in consumption of households cluster analysis may help to group the countries based on similarities in the structure of consumption.

Relative (per 1000 Euro) mean expenditures of households with the reference person older than 60, on 12 COICOP 1-digit items entered the cluster analysis. Based on this, the analysis sorted countries into three clusters. These are displayed in the graph (Figure 6) below.

[7] Information on consumption is gathered on the level of households while the information on ageing is available from demographic projections projecting numbers of persons. For this reason in this section, it is often referred to a specific age group based on the age of the reference person in the household on which we have information on consumption. For more information on the link between demographic projections and information sources on structure of consumption please see the section on the projections of number of households (2.3.2).

F i g u r e 6

Clusters of countries based on the structure of consumption of households with the reference person 60+



Source: Authors calculations using table: hbs_str_t225 from the Eurostat Database.

Cluster analysis sorted European countries into three groups. First cluster groups the high income European countries, with original EU15 countries complemented with some more successful new member states and Norway and Croatia. Second cluster groups the low-income countries with new EU member states complemented with the Former Republic of Macedonia for which the data was gathered. Third (Mediterranean) cluster roofs some countries of southern Europe that differ from the countries in the first cluster, namely: Malta, Cyprus, Greece, Portugal, Spain and Turkey.

In the countries from the first (high-income) cluster lays the biggest part of the potential for silver economy as these countries are already advanced and advancing faster in terms of ageing and on the other side the structure of their consumption is relatively more oriented towards luxurious goods such as recreation or transport. As a perfect example in this respect can be used Germany, with high extent and intensity of ageing (see previous section) and the structure of consumption here is oriented more towards recreation.

In contrast, in countries from the second (low-income) cluster households with the reference person 60+ spend relatively less on restaurants, recreation, transport, clothing and furnishing. Their expenditures are relatively higher on food, health and communication.

In countries from the third (Mediterranean) cluster households spend relatively less on housing and relatively more on clothing, restaurants and furnishing.

When looking at international differences in consumption using more narrow categories (COICOP 2-digit level) countries create practically the same clusters.[8] Items can be followed on a more precise level. In countries from the first (high-income) cluster households 60+ spend relatively (per 1000 Euro) more on: alcoholic beverages, actual rentals for housing, maintenance and repair of the dwelling, furniture and furnishings, carpets and other floor coverings, tools and equipment for house and garden, purchase of vehicles, other recreational items and equipment, gardens and pets, recreational and cultural services, package holidays and insurance. On the other hand they spend relatively less on goods and services for routine household maintenance.

Households 60+ in countries from the second (low-income) cluster spend relatively (per 1000 Euro) more on: food, non-alcoholic beverages, water supply and miscellaneous services relating to the dwelling and on electricity, gas and other fuels. Their expenditures are relatively lower in out-patient services.

Households 60+ in countries from the second (low-income) cluster spend relatively (per 1000 Euro) more on: food, non-alcoholic beverages, water supply and miscellaneous services relating to the dwelling and on electricity, gas and other fuels. Their expenditures are relatively lower in out-patient services.

In countries from the Mediterranean cluster households 60+ spend relatively more on tobacco and clothing.

Cluster analysis performed on the structure of consumption of households with the reference person 60+ grouped European countries into three clusters. The differences between high income countries and countries from the low income cluster can be explained using mostly economic factors as the structure of expenditures is to a big extent determined by the total resources available for consumption. Specifics of the Mediterranean cluster can be mostly explained by cultural factors, when no clear economic explanation is at hand. Mediterranean countries are in terms of structure of consumption closer to the high income European countries with some small, culturally determined, specifics such as higher expenditures on tobacco, restaurants and closing.

[8] The most significant difference is that Portugal creates a separate cluster out of the Mediterranean cluster in the way which raises questions about the reliability of data provided for Portugal.

BOX 2: PROPENSITY TO CONSUME BY AGE- CASE SLOVAKIA

Besides the structure of consumption also the decision whether to consume needs to be inquired. Due to the lack of comparable data on the European level we bring some evidence for Slovakia. This section analyzes the allocation of income and wealth of households between savings and consumption by age. Table 5 shows differences between income, expenditure, net wealth and propensity to consume by different age of reference person.

Table 4

Household's mean income, consumption, expenditure, net wealth, propensity to consume and fraction of households owning main residence by age of the reference person in € in 2009/2010

Age group	*Mean net income*	*Mean consumption*	*Mean net expenditure*	*Propensity to consume*	*Owning main residence, %*	*Mean net wealth*
16-34	12454	9502	11513	0.763	71.1	50300
35-44	13778	10430	12680	0.757	86.5	84900
45-54	14204	11131	12346	0.783	94.6	88900
55-64	11652	9032	10163	0.775	96.2	94800
65-74	7912	6327	7014	0.800	96.9	71600
75+	5730	4429	4842	0.773	94.0	76500

Source: Household Finance and Consumption Survey and authors calculations using Households Budget Survey.

As can be seen, the mean household income significantly varies between age groups. Mean income grows with age of the reference person until the age group 45-54, where it reaches its maximum at an average of 14.204 € per year. Since this age group mean household disposable income decreases, this is amplified by overrunning retirement age. After reaching retirement age households in the age group 65-74 consume the largest part of their income in average 0.8. There are no important differences between propensities to consume between other age groups. On the contrary, a part of the income spent on expenditures is decreasing with age. The largest part of income spend households in age group 16-34 around 92.4 % and the lowest part 75+ around 84.5 %.

Table 5

Fraction of households, which have particular type of assets and conditional mean value of assets in thousand € in 2009/2010

Assets	*Fraction, %*	*Mean value*
Real assets	96.0	61.8
Household main residence	89.9	55.9
Other real estate property	15.3	16.4
Vehicles	61.2	5.0
Self-employment business wealth	10.7	4.6
Real estate wealth	90.5	60.0
Financial assets	91.7	2.5
Deposits	91.2	2.0
Mutual funds	2.7	2.5
Bonds	1.0	N
Shares	0.8	N
Money owed to household	9.7	1.1
Voluntary private pension/whole life insurance	15.0	3.2
Other type of assets	0.9	N

Source: Household Finance and Consumption Survey.

From the above values of propensities to consume can be seen that households in each age group save part of their income, what proves growing mean net wealth with age. The main part of savings is in the form of real estate wealth. 90.5 % percent of households own some kind of real estate in average value of 60,000 Euro. From financial assets it is mainly deposits (91.2 % of households) and life insurances or private pension funds (15 %) in average value 2,000 Euro for deposits and 3,200 Euro for insurance.

3. QUANTIFICATION OF THE CHANGE IN CONSUMPTION CAUSED BY AGEING

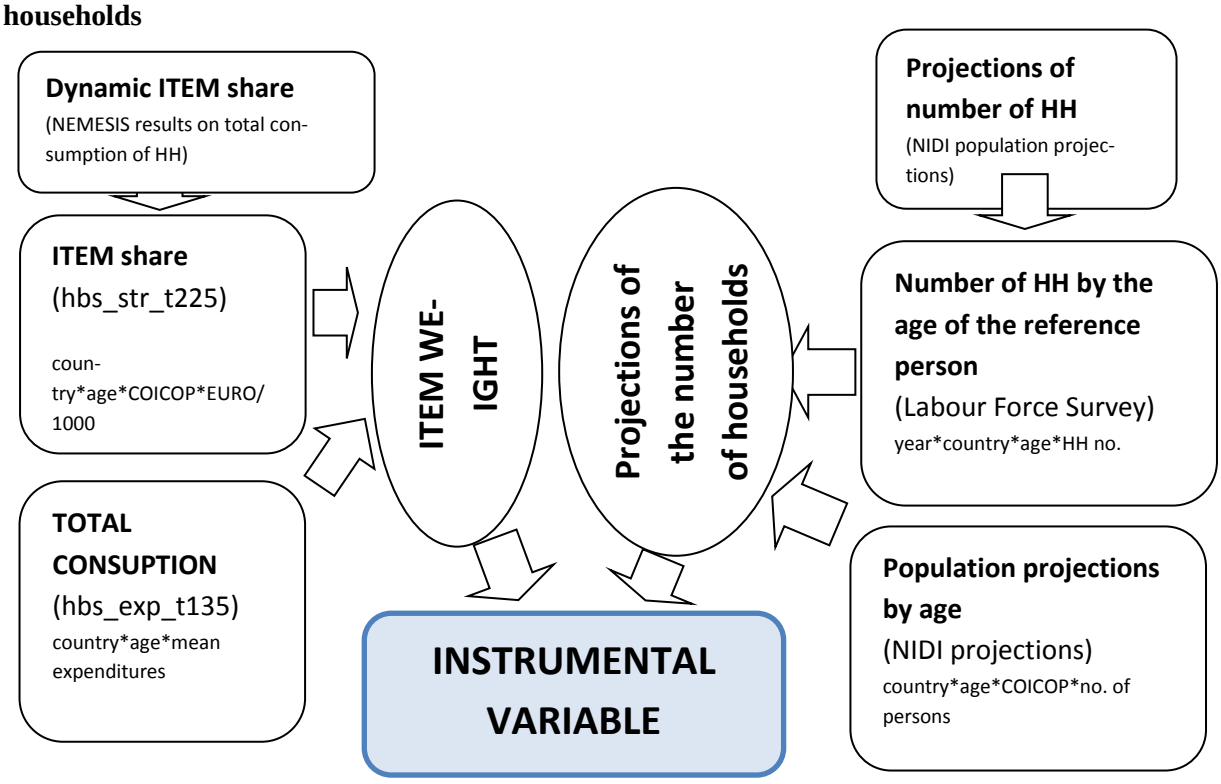
Based on the descriptive information provided in previous sections on the character of ageing and differences in the structure of consumption in European countries we may proceed to the quantification of the effect of ageing on the consumption of households. This section summarizes the evidence provided in the two previous sections by merging the information on demographic development with the information on the structure of consumption of elderly. Based on this we can quantify the expected change of overall consumption of households caused by ageing of the population. This will be in terms of items of consumption bringing evidence for those of the EU27 countries, where reliable data were provided.

In order to provide quantification of the effect of ageing on the consumption of households we have created a simple statistical data based model. Our calculations summarize information from 3 data sources. First is the above mentioned European Household Budget Survey (HBS) for which data are available in the Eurostat database from which we take the information on structure of consumption and mean spending of households. From the Labour Force Survey we use the numbers of households broken into age groups of the reference person and country. These will be put into a regression based model with the NIDI population projections to project the numbers of households by the age of reference person.

For simplification and data availability reasons households on the country level were split into 4 age groups based on the age of the reference person (30-, 30-44, 45-59, 60+). Scheme 1 displays the basic structure of the statistical model with related data sources.

S c h e m e 1

Structure of the statistical model developed to quantify the effects of ageing on consumption of households



The model calculates an instrumental variable of average contribution of each item consumed by the type of households (based on the age of the reference person) to total consumption of households in the country. Instrumental variable is a product of item weight and population weight. Item weight is a product of relative spending of the type of household on each item and total average consumption of that type of household. The calculation can be formalized as follows:

$$IV_{gac} = (SC_{gac} * TC_{ga}) * HH\_p_{ga}$$

g – *country*
a – *age*
c – *item of consumption*
IV – *instrumental variable*
SC – *share of the item on total consumption*
TC – *total consumption*
HH _p – *projections of total number of households by age of the reference person*

Instrumental variable gives us an approximation of the total private household consumption in each of the countries. It is only an approximation of the macroeconomic indicator because of the differences in data sources. Household Budget Survey is not used within the system of National accounts, when comparing its figures with officially published, aggregated macroeconomic indicators figures differ because of this statistical discrepancy.

Based on the instrumental variable, shares on total consumption in the country can be counted for each combination of type of household based on age of the reference person and item of consumption the type of the household is spending on average.

The share is counted as follows:

$$IVS_{gact} = \frac{IV_{gact}}{IV_{gt}}$$

g – *country*
a – *age*
c – *item of consumption*
t – *time*
IV – *instrumental variable*
IVS – *instrumental variable share*

Instrumental variables and their shares are counted for each of the 5 year time periods (2005, 2010, 2015, 2020, 2025 and 2030) using the projections of numbers of households. Shares of instrumental variables tell us what proportion of the total consumption is spent by households with the reference person 60+ on what item of consumption (COICOP 2-digit).

BOX 3: STATISTICAL DISCREPANCY

Because our intention is, besides other, to prepare the data for an Input-output model of selected economies a more detailed look at the statistical discrepancy is in place. The discrepancy can be counted as the ratio of total private household consumption in the country according to the Input –Output tables and our approximation of total household consumption on the national level.

$$SD_{ga} = \frac{CIO_g}{IV_g}$$

SD – statistical discrepancy Household Budget Survey versus Input-Output table (consumption of households)
CIO – private consumption of households based on Input-Output tables

Statistical discrepancies together with overall consumption of households based on HBS and Input-output (IO) tables by countries are displayed in the table (Table 6) below.

Table 6
Statistical discrepancies between the HBS data and Input-output tables

Country	*Input-Output*	*Household Budget Survey*	*Statistical discrepancy*
AT	119000	107000	1.11
BE	133000	132000	1.01
BG	NA	20400	NA
CY	NA	8550	NA
CZ	42700	50100	0.85
DE	1130000	1130000	1.00
DK	80500	56800	1.42
EE	5700	5600	1.02
EL	136000	127000	1.06
ES	491000	398000	1.24
FI	65000	59000	1.10
FR	863000	730000	1.18
HU	NA	43700	NA
IT	764000	669000	1.14
LT	12100	11000	1.09
LU	NA	9470	NA
LV	NA	8410	NA
MT	NA	3640	NA
NL	217000	209000	1.04
PL	134000	136000	0.99
PT	85000	79000	1.08
RO	NA	37900	NA
SI	13800	17800	0.78
SK	25000	19900	1.25
UK	1030000	834000	1.24

Source: Authors calculations using Eurostat Database and Input Output tables.

The highest discrepancy can be observed in Denmark where figures from HBS are 42% above those from IO tables. Discrepancies are a result of national specifics in taxation, HBS methodology, and statistical definitions used.

3.1 Modelling a dynamic structure of consumption

The analysis of consumption showed that average income of households in a country plays an important role in shaping the average structure of consumption of households in the country. There is also evidence available to follow a clearly comprehensible pattern when households in countries with lower average income spend relatively more on "necessary" goods and services and households in countries with higher average income spend relatively more on "luxurious" goods and services. This clear relation determined also our efforts to predict future changes in the structure of consumption. As we have information on expected future development in average consumption of households from the NEMESIS model developed within the NEUJOBS project, we are able to follow expected future changes in the structure of consumption based on the change in the average consumption of households in countries.

We have used evidence available from HBS using the table published in the Eurostat database under the name "hbs_str_t225". This includes information on relative spending on COICOP items for 4 types of households, based on the age of the reference person, in every EU country. This information was complemented by the projected total consumption of households in countries up until 2025 available from the NEMESIS model. Total consumption in the country was disaggregated using the information on projected numbers of households and mean consumption of households from our statistical model. 12 regression equations were estimated for each of the COICOP 1-digit items of consumption. These equations can be formalized as follows:

$$C_{COICOP\ 1-12} = \alpha + \beta * (Country * Total\ consumption) + \beta * AgeGr + \varepsilon \qquad (1)$$

Where:

$C_{COICOP\ 1-12}$ – *relative consumption in one of the 12 COICOP 1-digit items*

α – *intercept*

β – *regression coefficients*

ε – *error term*

*(Country*total consumption)* – *interaction of country dummy variable and projected consumption per household*

AgeGr – *dummy referring to age group*

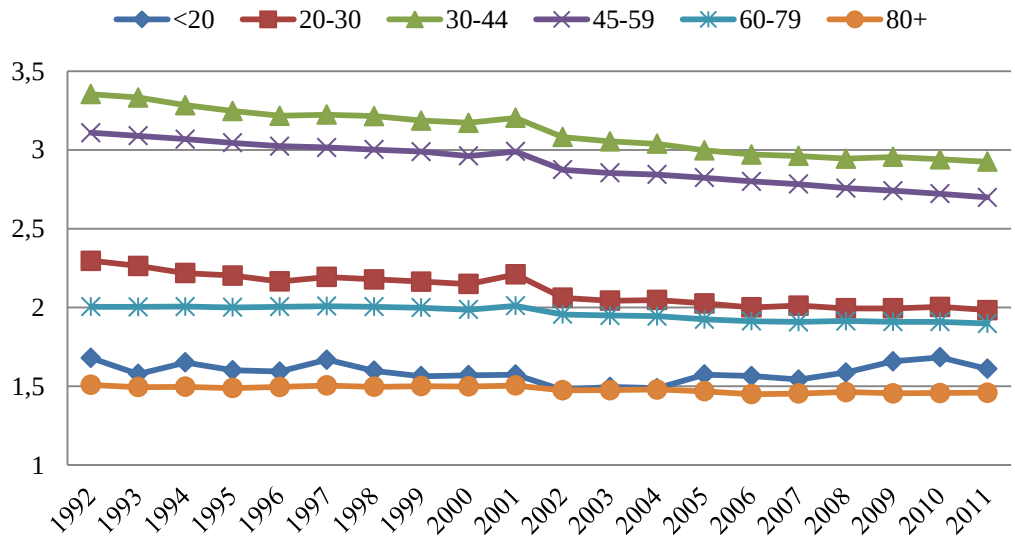
These equations were estimated on a dataset of figures aggregated on the level of country and 4 types of households based on the age of the reference person, gaining 27 * 4 = 108 observations. Equations were estimated for 12 COICOP 1-digit items for both scenarios (tough and friendly), thus 24 equations were estimated overall.

Equations in this form fitted the data quite well with values of adjusted R-squared varying from 0.78 to 0.98. Complete[9] results of each of the 24 equations can be found in the online annex.[10] Based on these estimates, values of future relative consumption on COICOP items were made dynamic, linking it to expected changes in average consumption in each country.

3.2 Projections of number of households

In this sub section the methodology and results of the prediction of the numbers of households by age of the reference person will be presented. Total number of households in each country were broken down into 4 groups based on the age of the reference person (lower than 30, 30-44, 45-59, over 60 years). It is obvious that households are not composed of members of the same age and the age of the head of household may not be the best indicator of the age composition of the household. Therefore, in the next step we have examined the dependence between development of the number of households by age of the reference person and evolution of the number of related population.

Figure 7
Average household size (number of persons) by age of the reference person[11]



Source: Authors calculations using the European Union Labour Force Survey.

[9] Estimates were tested using the Breuch-Pagan and Cook-Weisberg test for heteroscedasticity. This was positive when estimating COICOP 4- relative expenditures on housing and utilities. In this case, for tough and friendly.
[10] www.ekonom.sav.sk/neujobs/WP/annex_estimates.txt
[11] Figures display information for EU countries where data was available including: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Germany, Estonia, Greece, Spain, France, Hungary, Ireland, Italy, Lithuania, Luxemburg, Latvia, Malta, Netherlands, Poland, Portugal, Romania, Slovakia and United Kingdom.

As we can observe from the graph (Figure 7) above the average number of persons living in one household shows a declining trend. When excluding the households with the reference person under 20 years, which present an unconventional type of a household, the size of households drops down with increasing age of the reference person. If the reference person is over 80 the average size of the household drops below 1.5.

In order to perform the prediction linear regression equations were estimated for each age group in each country for two (NIDI) scenarios (friendly, tough). The dependent variable was the number of households by age of the reference person and explanatory variables were the projected numbers of population in the 4 age groups. To ensure the best fit to the data equations were adjusted one by one selecting the best combination of explanatory variables. Equations below correspond to the results from estimation for Austria's friendly and tough demographic scenarios.

$$NH_{AT,<30,t} = -495560 + 1.062 * POP_{20-24,t} + 0.499 * POP_{25-29,t} \quad (2)$$

$$NH_{AT,30-44,t} = 383643 + 0.776 * POP_{35-39,t} + 0.207 * POP_{40-44,t} \quad (3)$$

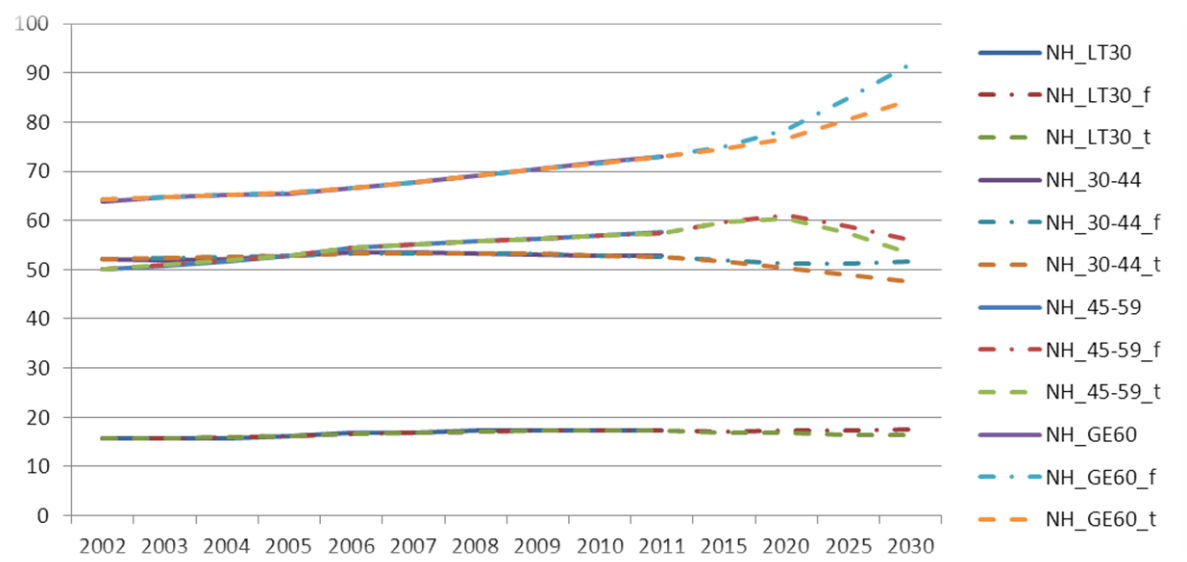
$$NH_{AT,45-59,t} = -58820 + 1.226 * POP_{45-49,t} + 0.606 * POP_{55-59,t} \quad (4)$$

$$NH_{AT,60+,t} = 223138 + 0.497 * POP_{60+,t} \quad (5)$$

$NH_{g,a,t}$ – *number of households in specific country, age group*
T – *time*
g – *specific EU country*
a – *specific age group of reference person*
$POP_{a,t}$ – *population by age in time t*

Equations above display also the coefficients estimated on data for Austria using the tough scenario from NIDI projections. Each equation was adjusted separately therefore not all equations predicting the number of households 60+ include only the age group 60+. In some countries 5 years age groups were used (eg. 60-64, 65-69, …) in other countries these were aggregated as in case of Austria. The results are displayed in the graph (Figure 8) below.

Figure 8
Estimated and actual[12] number of households by age of the reference person in millions



Source: Eurostat and own calculations.

Graph above shows projections of numbers of households by age of the reference person for countries where data was available (Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Germany, Estonia, Greece, Spain, France, Hungary, Ireland, Italy, Lithuania, Luxemburg, Latvia, Malta, Netherlands, Poland, Portugal, Romania, Slovakia and United Kingdom). Countries Denmark, Finland, Sweden and Slovenia were omitted due to the lack of data. Based on the graphical results and values of adjusted R2 which are in most cases higher than 0.9, only in few cases are the values of the adjusted R2 lower than 0.8, it is possible to see high degree of correlation between compared series. In the graph real figures for 2002 – 2011 can be observed together with the predictions for 2015 – 2030. Predicted period is available only in 5 year time periods, which can optically boost the observed trends in comparison to the previous period 2002 – 2011. According to the predictions, the population aging will have a significant impact on Europe's household by age of the reference person distribution. The number of households with head of household aged over 60 years in 2030 will significantly increase in both scenarios. Number of households aged 45-59 years reached its peak in 2020 and then will be gradually reduced to the level of the year 2006. In contrary, in the two youngest groups will be either stagnation or decline in the number of households.

In the second step we have multiplied the number of households by age of the reference person by mean consumption expenditure by age of the reference person and calculated its share on the total private consumption. From the NEMESIS model we have predicted values of the final consumption of households and multiplying this consumption by previous shares we get size of final consumption of households by age, which are presented for the aforementioned countries in the table 1.

[12] Real figures are until 2011.

4. RESULTS OF THE QUANTIFICATION

Combining information from various data sources shares on total consumption of households were counted for households 60+ and below 60 on COICOP 2-digit level. To make the results more comprehensive this paper reports the results on 12 main COICOP items of consumption. In a more narrow form were these data used as an input into the macroeconomic analysis based on an Input Output model. Shares were counted on the data for 2005 which present the last publically accessible round of European HBS. Based on the 2005 figures projection of the change in the shares was done based on expected demographic changes. The prediction brings figures for 2010, 2015, 2020, 2025 and 2030.

Shares counted for Germany as a perfect example of a high income country will be presented. In contrast evidence for Slovakia will be presented as Slovakia presents one of the low income countries with different consumption patterns.

Table 7
Shares on total consumption of households in Germany in % (based on friendly demographic projections)

	2005		*2010*		*2015*		*2020*		*2025*		*2030*	
	60-	*60+*	*60-*	*60+*	*60-*	*60+*	*60-*	*60+*	*60-*	*60+*	*60-*	*60+*
Food	7.55	3.61	7.25	4.45	7.27	4.40	7.24	4.41	6.53	5.18	5.95	5.75
Alcohol and tobacco	1.24	0.46	1.29	0.46	1.29	0.45	1.28	0.45	1.15	0.53	1.04	0.59
Clothing	3.34	1.40	3.60	1.07	3.56	1.06	3.52	1.05	3.20	1.24	2.94	1.38
Housing and utilities	19.20	10.48	18.84	11.27	18.93	11.18	18.88	11.22	17.27	13.15	16.04	14.61
Furnishing	3.62	1.82	3.64	1.71	3.65	1.71	3.65	1.72	3.38	2.01	3.20	2.23
Health	1.84	1.82	1.80	1.66	1.86	1.67	1.90	1.69	1.83	1.96	1.81	2.18
Transport	9.80	3.48	9.91	3.43	9.91	3.40	9.88	3.41	9.05	4.00	8.42	4.44
Communication	2.17	0.72	2.43	0.90	2.35	0.86	2.27	0.83	1.87	1.01	1.49	1.12
Recreation and culture	7.25	3.84	7.71	3.34	7.68	3.30	7.62	3.29	6.89	3.88	6.29	4.31
Education[13]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Restaurants and hotels	2.83	1.43	3.12	0.84	3.12	0.84	3.11	0.85	2.88	0.99	2.72	1.10
Miscellaneous	7.92	3.38	7.25	3.11	7.46	3.19	7.63	3.28	7.53	3.74	7.63	4.17
Total	*67.49*	*32.51*	*67.64*	*32.36*	*67.86*	*32.14*	*67.73*	*32.27*	*62.20*	*37.80*	*58.03*	*41.97*

Source: Authors' calculations within the project.

Cluster analysis on the structure of consumption, in the previous section of this paper, displayed Germany as an example of the first group of countries named high-income countries. The fact that incomes of households in this country are higher determines also the structure of consumption of elderly in this country (Table 7). It is oriented more towards expenditures on recreation and food does not present such a high share on total consumption of households as in countries with lower average incomes. This fact, together with the extent and

[13] Information on education expenditures was not reliable in the HBS.

expected intensity of ageing, makes this country one of the most important areas from the perspective of potential for silver economy. As can be seen from the table, the share of consumption of households 60+ on total consumption of German households in 2005 was 32.51 %. The importance of purchasing power of elderly Germans will grow in general. Their spending on every item will grow because of the projected growth in population 60+. The share of elderly households will rise up to 37.8 % in 2025 and 41.97 % in 2030.

Slovakia brings an example of a different group of countries. It is representing the countries from the second cluster of low income countries. Households in these countries spend relatively more out of each 1000 Euro on food and less on recreation or transportation. The following table (Table 8) brings the shares on total consumption in Slovakia broken by age group of the reference person of the household and item of consumption.

T a b l e 8
Shares on total consumption of households in Slovakia in % (based on friendly demographic projections)

	2005		*2010*		*2015*		*2020*		*2025*		*2030*	
	60-	*60+*	*60-*	*60+*	*60-*	*60+*	*60-*	*60+*	*60-*	*60+*	*60-*	*60+*
Food	18.51	6.35	18.37	6.71	18.08	7.00	17.33	7.78	16.66	8.47	16.18	8.96
Alcohol and tobacco	2.22	0.55	2.18	0.59	2.14	0.61	2.05	0.68	1.98	0.74	1.93	0.78
Clothing	4.54	0.83	4.44	0.93	4.40	0.97	4.28	1.08	4.16	1.18	4.07	1.26
Housing and utilities	22.01	9.12	22.32	9.17	21.91	9.58	20.61	10.61	19.39	11.53	18.44	12.16
Furnishing	3.22	0.92	3.16	1.00	3.13	1.05	3.03	1.16	2.93	1.27	2.85	1.34
Health	1.86	1.03	1.79	1.17	1.76	1.22	1.74	1.36	1.75	1.49	1.77	1.58
Transport	7.05	0.87	6.66	1.12	6.59	1.16	6.48	1.30	6.40	1.43	6.37	1.53
Communication	3.47	0.69	3.28	0.82	3.25	0.85	3.18	0.95	3.12	1.04	3.10	1.10
Recreation and culture	4.89	0.96	4.56	1.15	4.52	1.20	4.45	1.34	4.39	1.47	4.35	1.56
Education[14]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Restaurants and hotels	3.93	0.30	3.25	0.52	3.24	0.54	3.25	0.61	3.27	0.67	3.31	0.73
Miscellaneous	4.67	1.28	4.65	1.34	4.59	1.39	4.39	1.55	4.20	1.69	4.05	1.78
Total	*77.08*	*22.92*	*75.46*	*24.54*	*74.39*	*25.61*	*71.55*	*28.45*	*68.98*	*31.02*	*67.16*	*32.84*

Source: Authors' calculations within the project.

In Slovakia the share of consumption of households with the reference person over 60+ on the total consumption will grow from 22.92 % in 2005 to 32.84 % in 2030, which is a more intensive growth than in case of Germany. Despite the fast growth, this figure for Slovakia will stay under the value of Germany for 2030 and will reach values comparable to German share of 60+ households on total consumption for 2005. In conclusion, consumption of 60+ households will in 2030 present a lower share on total consumption in Slovakia than in Germany. Estimated changes in the shares only take into account the demographic change and expected change in total consumption of households; acquired figures therefore present the

[14] Information on education expenditures was not reliable in the HBS.

estimation of the effect of ageing. These could be potentially used to adjust results of macroeconomic projections which did not take into account this factor, or as an input into a macroeconomic model.

On the European level the data allow to pool the information on consumption for the whole EU27.[15] The results for shares on consumption on the European level are displayed in the table (Table 9) below.

Table 9
Shares on total consumption of households in European countries in % (based on friendly demographic projections)

	2005		*2010*		*2015*		*2020*		*2025*		*2030*	
	60-	*60+*	*60-*	*60+*	*60-*	*60+*	*60-*	*60+*	*60-*	*60+*	*60-*	*60+*
Food	9.74	4.35	9.53	4.72	9.50	4.83	9.45	4.95	9.11	5.39	8.74	5.82
Alcohol and tobacco	1.72	0.55	1.74	0.55	1.72	0.56	1.69	0.58	1.61	0.63	1.54	0.68
Clothing	4.47	1.21	4.42	1.17	4.38	1.20	4.37	1.23	4.23	1.34	4.08	1.45
Housing and utilities	18.99	9.28	19.00	9.80	18.85	10.01	18.56	10.22	17.61	11.14	16.62	12.03
Furnishing	4.16	1.60	4.05	1.59	4.02	1.62	3.98	1.66	3.85	1.81	3.74	1.96
Health	1.92	1.26	1.74	1.37	1.74	1.40	1.76	1.44	1.80	1.57	1.90	1.70
Transport	9.98	2.65	9.71	2.68	9.63	2.73	9.59	2.79	9.30	3.06	9.05	3.31
Communication	2.27	0.67	2.35	0.70	2.30	0.71	2.23	0.72	2.06	0.79	1.88	0.84
Recreation and culture	6.71	2.36	6.69	2.31	6.61	2.34	6.51	2.39	6.22	2.62	5.95	2.82
Education[16]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Restaurants and hotels	4.61	1.21	4.55	1.17	4.55	1.20	4.57	1.23	4.47	1.34	4.36	1.46
Miscellaneous	6.88	2.48	6.68	2.46	6.58	2.53	6.50	2.60	6.30	2.82	6.13	3.04
Total	*72.34*	*27.66*	*71.37*	*28.63*	*70.77*	*29.23*	*70.09*	*29.91*	*67.39*	*32.61*	*64.77*	*35.23*

Source: Authors' calculations within the project.

The share of consumption of households with the reference person over 60 on total consumption will grow from 27.66 % in 2005 to 35.23 % in 2030. The overall figures appear to be closer to the pattern known from the first cluster of high income countries when looking at the relative consumption on various items of consumption. Based on this, we may conclude that this draws a promising picture for silver economy with goods and services targeting elderly population in Europe.

Increase in the proportion of elderly population will drive the consumption on items which are relatively more often consumed by elderly. This is namely the consumption related to housing and consumption on health care and food. Consumption of elderly on more luxury items such as recreation, traveling, or restaurants differ significantly among countries. In countries with higher incomes, represented mainly by the EU15, elderly spend relatively more on these items. In European countries with lower income, represented mainly by the EU new member states, elderly spend relatively less on these items. The effect of ageing on the share

[15] For Sweden we have used average figures on structure of consumption in order to gain the EU figures.
[16] Information on education expenditures was not reliable in the HBS.

of the consumption of these luxury items on the total consumption of households will therefore be twofold. In countries with higher incomes elderly spend relatively (but also absolutely) more on recreation, restaurants and transport. The demand for silver economy goods and services also has a strong geographical aspect. The core of demand driving silver economy is in the high income countries.

Regardless of the changes in the structure of consumption, further increase in the proportion of elderly, which is expected based on available demographic projections, will increase the importance of elderly consumption within identified items. On a more narrow level, differences between the consumption of elderly and the rest of the population would be revealed within each of the identified items of consumption. In other words, there are reasons to expect that, for example, food products bought by elderly differ on average from the food products bought by the rest of the population. HBS and the COICOP classification do not allow us to follow these differences on this lower level. Some qualitative data gathering would be more appropriate in exploring these differences in consumption.

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