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Analysing purchasing behaviour: A consumer segmentation of fresh-meat shoppers in Germany

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ABSTRACT

Negative effects of heavy meat consumption have been critically discussed in politics, the public and science for a long time. As there is heterogeneity in consumer behaviour, targeted measures regarding behaviour management can hardly be implemented on the basis of an average consumption levels but should take into account different consumer segments. Therefore, this study performs a segmentation and characterisation of fresh-meat-shoppers based on household panel data provided by the GfK. A cluster analysis was performed based on the average per capita monthly purchasing shares of five different meat types. A multinomial logistic regression was used to characterize the different segments regarding sociodemographic aspects, people's attitudes towards food and meat shopping, total purchasing intensity and different shopping locations. The authors found a four-cluster solution, identifying a segment of poultry lovers (24 %), a segment of beef, lamb & speciality purchasers (17 %), a segment of mixed product eaters (15 %) and a segment of pork buyers (45 %). Households assigned to the largest cluster of "pork buyers" have an above-average monthly meat purchase while being price-sensitive. Future policy instruments such as meat tax could address this buyer segment in particular, and probably decrease overall meat purchases. However, it should not be neglected that "beef, lamb & speciality purchasers" also have an above-average monthly meat purchase, causing particularly negative environmental effects. As this buyer segment has a rather high income and reports to be less price sensitive, it might be a challenge to influence their purchasing behaviour by taxing meat products.

Keywords: Fresh meat, purchase intensity, household segmentation, fresh-meat shoppers, policy implications

1 Introduction

External effects of the consumption of animal proteins have long been addressed by scientists and non-governmental organisations, but are also present issues in society and politics (HENNING et al. 2006; WBAE 2020; WWF 2014). The demand for meat in particular is often controversially discussed. This is because increased meat consumption is associated with negative consequences for human health and adverse effects on the environment, resource conservation and animal welfare as a result of intensive animal husbandry (GODFRAY et al. 2018; SPRINGMANN et al. 2018; WILLETT et al. 2019)

Against the background of the negative impacts, various committees call for a transformation of animal production in Germany as well as more sustainable food systems in combination with a change in dietary

behaviour (BORCHERT KOMMISSION 2020; WBAE 2020). In the context of designing more sustainable food systems the Scientific Advisory Council for Agricultural Policy at the Federal Ministry of Food and Agriculture in Germany recently indicated the necessary reduction in the consumption of meat (WBAE 2020). Especially considering climate targets and the existence of a citizen–consumer dichotomy where the response behaviour in surveys deviates from the actual purchasing behaviour, political interventions are necessary to achieve a change in the dietary behaviour of the population (BUSCH et al. 2018; LEMKEN et al. 2018). Various instruments, differing regarding their restrictiveness and directional impulses have already been implemented in the past and others are currently being discussed. Among them information, education and nudging in order to raise awareness among consumers, taxes and subsidies to provide financial incentives as well as behavioural measures such as meat-free days, which have already been attempted to be established in various countries (BONNET et al. 2020; LEMKEN et al. 2018).

Buying intensity, patterns and shopping motives can vary considerably for different meat types or products and must be assessed differently especially against the background of climate effects (FONT-I-FURNOLS et al. 2014; GODFRAY et al. 2018; SPRINGMANN et al. 2018). Knowledge regarding the heterogeneous purchasing patterns and related determinants in the population is a basic prerequisite for assessing the effect of demand management by political instruments (GODFRAY et al. 2018). Conclusions about different groups of meat buyers in Germany can already be drawn from literature, also based on the theory of Sinus-Milieus (CORDTS et al., 2015). In this context, studies often conduct segmentation based on consumer attitudes, also (more rarely) in combination with the total meat purchase intensity (CORDTS et al. 2013; KAYSER et al. 2013; PIRSICH et al. 2020; WEINREICH et al. 2015). However, studies on consumer segmentation referring to purchasing intensity at more disaggregated level (e.g., different meat types or parts) are barely available for Germany. Against the background of the divergent climate effects of individual meat-types, however, such results could provide important indications for political decision-makers (APOSTODLIDIS et al. 2016).

Therefore, the focus of this paper is a segmentation of fresh-meat-shoppers based on purchasing intensity for five different meat types in Germany. A two-step cluster analysis is carried out based on representative purchasing data of private households collected by Gesellschaft für Konsumforschung (GfK) for the year 2014. The purchased share of (1) pork, (2) beef and veal, (3) poultry, (4) mixed pork and beef products and (5) lamb and red meat of other species in relation to the average monthly total meat purchase per person were used as cluster variables. Subsequently, clusters were characterized by using a multinomial logistic regression, considering sociodemographics, total shopping intensity, shopping locations and several attitudinal statements.

Section 2 focuses on the sampling including the distribution of the purchase intensity and on the methodological approach including cluster analysis and the multinomial logistic regression. Results are presented in Section 3 and discussed in Section 4, also against the background of possible political implications. Section 5 contains concluding remarks.

2 Data set and methodological approach

2.1 Sampling

The study employs representative GFK ConsumerScan panel data. Using hand-held scanners, households reported the amount (g) and expenditure (€) of their fresh meat purchases on a daily basis. The data set covers information regarding different meat types summarised for the analysis as follows: (1) pork, (2) beef and veal, (3) poultry (chicken, turkey, goose other poultry meat) (4) pork and beef mixed meat products (5) lamb and red meat of further animal species (specialities). In addition, the date of purchase, retail outlet and production method (e.g. organic) are indicated for each observation. The dataset contains socio-demographic information including age, gender and occupation of the household's reference person, household size, net household income and the place of residence. In addition, participating households had to answer several statements regarding their food and meat purchasing behaviour within a five-point Likert scale.

The original unbalanced panel data set includes information on fresh meat purchases of 20,656 individual households for three years (2012-2014). In order to depict the most current purchasing behaviour, the authors analysed purchases of 14,631 households for the year 2014 and aggregated the purchase data to average monthly per capita purchases resulting in one observation per household. Due to missing values, the dataset used for the analysis consists of 11,487 households.

Information on the demographic distribution of the sample is presented in **Table 1** together with

descriptive statistics.

Table 1: Demographic distribution of the sample and variable descriptive statistics

Variable	Definition	N (Sample n=11,487)	Mean	SD
Age (Dummy)	Age of household reference person			
Young (29-39)		2,289	0.20	0.40
Intermediate (40-59)		4,830	0.42	0.49
Old (> 60)		4,368	0.38	0.49
Household size (Dummy)	Number of household members			
1 person		2,992	0.26	0.44
2 people		4,931	0.43	0.49
3 people		1,892	0.16	0.37
4 people and more		1,672	0.15	0.35
Net income (Dummy)	Household net income			
Low (< 1,000 to 1,999 €)		4,968	0.43	0.50
Intermediate (2,000 to 3,900 €)		5,619	0.49	0.50
High (4,000 to > 5,000 €)		900	0.08	0.27
Gender (Dummy)	Gender household reference person			
male		2,347	0.20	0.40
female		9,140	0.80	0.40
Occupation (Dummy)	Occupational group of the household reference person			
Employee		4,014	0.35	0.48
Worker/labourer		1,626	0.14	0.35
Civil servant		533	0.05	0.21
Freelancer		143	0.01	0.11
Farmer, Self-employed		12	0.00	0.03
Person of private means		4,777	0.42	0.49
Self-employed		382	0.03	0.18

Source: Original calculation.
Note: Affiliation to each category = 1.

Figure 1 gives an overview of the distribution of average monthly meat purchases, covering all meat types. The x-axis shows the cumulative shares of all households, the y-axis shows the cumulative shares of total monthly meat purchases from lowest to highest. The curve coloured in dark blue indicates the heterogeneous or uneven distribution of monthly fresh meat purchases. 70 % of all households bought 42 % of the total meat purchased. Thus, the last 30 % of households can be described as intensive buyers as they purchased 58 % of the total meat (GÜNTHER et al. 2006).

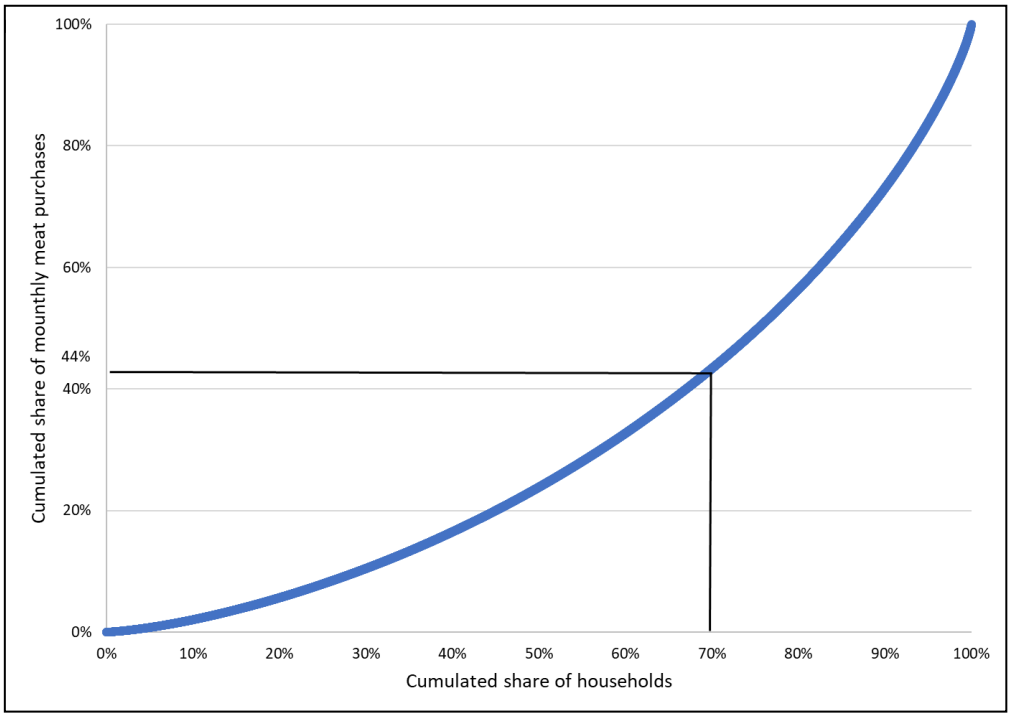

Figure 1: Purchasing intensity
Source: Original calculation.

Table 2 gives an overview of the distribution of average monthly meat purchases per capita for the individual meat types.

Table 2: Monthly per capita meat purchases of different meat types in kilograms

Meat types	Mean	Median	SD	Min	Max
Pork	0.88	0.64	0.89	0.00	20.95
Beef and veal	0.26	0.14	0.38	0.00	8.51
Poultry	0.43	0.30	0.50	0.00	8.57
Pork and beef mixed meat products	0.19	0.10	0.27	0.00	4.19
Lamb and red meat of further animal species (specialities)	0.03	0.00	0.11	0.00	4.83

Source: Original calculation.

2.2 Method

Among structure-discovering procedures, multivariate analysis methods are used to discover relationships between variables or between objects (BACKHAUS et al. 2018). The aim of this study is to identify buyer segments by analysing households' purchasing behaviour. Therefore, a cluster analysis is applied in order to identify clusters as homogeneous as possible in a set of heterogeneous objects. A group of objects or subjects with similar characteristics can be described as one cluster (CLEFF 2015). Standardized monthly purchasing shares of pork, beef and veal, poultry, mixed pork/beef products and lamb and further red meat types (specialities) were used in this study as characteristics to identify consumer segments (BACKHAUS et al. 2018).

A two-step cluster analysis including a hierarchical clustering with a subset of 500 households followed by K-means clustering was performed to identify different buyer segments. In a first step, a single-linkage analysis based on the nearest neighbour method was performed in order to eliminate outliers (BACKHAUS et al. 2018). Seven respondents were eliminated as their purchasing behaviour differed clearly from the rest of the sample. The optimal number of clusters was conducted using Ward's method, which is based in the squared Euclidian distance. This involves forming clusters that are as homogeneous as possible and combining those objects that increase the variance within a group as little as possible. Based on the resulting dendrogram, four clusters were found to be the optimal number (BACKHAUS et al. 2018). All households were then allocated based on the non-hierarchical K-means algorithm using the specified number of clusters number (HAIR et al. 2019). A subsequent discriminant analysis verified the cluster-solution (BACKHAUS et al. 2018).

In order to characterize the individual buyer segments a multinomial logit regression was conducted with cluster type as dependent variable and considering socio-demographics, total shopping intensity, shopping locations and attitudinal statements towards meat and food shopping in general as independent variables. Within the calculation, relative effects are given in relation to the reference category (as a reference cluster). To enable a better interpretation of the estimated coefficients, average marginal effects were calculated in addition for all four clusters. Goodness of fit was assessed based on a deviance likelihood ratio-test and various Pseudo-R2-measures (Cox and Snell, Nagelkerke and McFadden) (BACKHAUS et al. 2018).

3 Results

3.1 Description of segments

Based on the standardized monthly purchasing shares of five fresh meat types, four different clusters of fresh meat buyers are identified: 1. Poultry lovers (24 %), 2. Beef, lamb and speciality purchasers (17 %), 3. Mixed product eaters (pork and beef) (15 %), 4. Pork buyers (45 %).

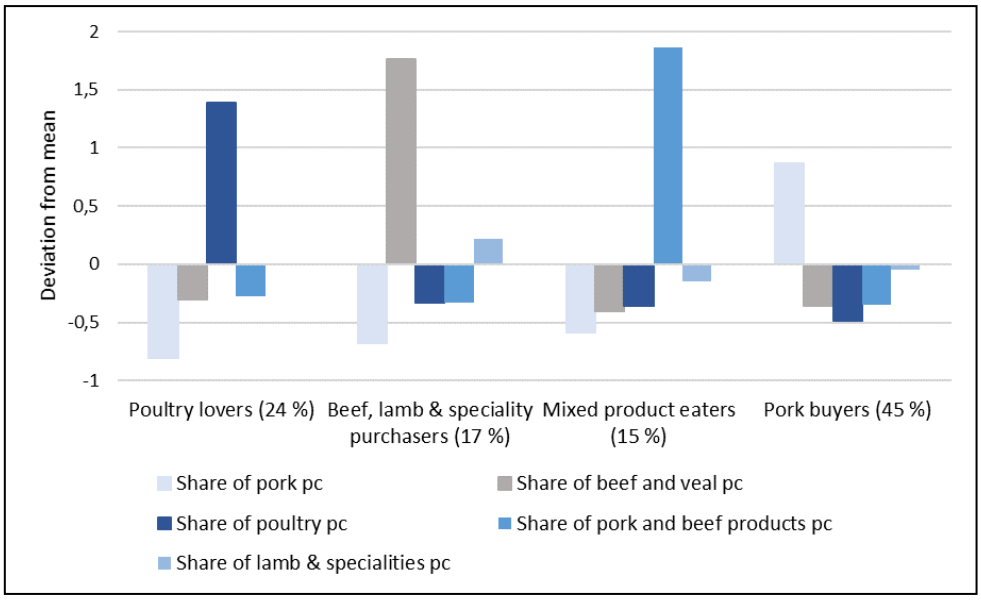

Figure 2: The four identified segments and their mean deviation from then total samples mean
Source: Original calculation

Figure 2 shows the standardized mean share of the total monthly meat purchases per capita for five different meat types. Each bar illustrates the deviations of the purchasing share from the total samples' mean in a positive or negative direction. The average monthly purchasing quantity of meat in total together with further statistical key figures is shown in **Table 3** for each consumer segment.

Table 3: Monthly fresh meat purchases per capita and cluster in kilograms

Buyer Segment	Mean	Median	SD	Min	Max
1 Poultry lovers	1.66	1.29	1.31	0.06	14.72
2 Beef, lamb & speciality purchasers	1.80	1.53	1.31	0.12	14.40
3 Mixed product eaters	1.42	1.19	0.91	0.06	7.20
4 Pork buyers	1.99	1.66	1.39	0.06	20.95
Total	1.80	1.47	1.32	0.06	20.95

Source: Original calculation.

The first cluster includes 2,700 households (24 %) showing a higher share of poultry lovers compared to the total samples' mean. The share of all other meat types and especially pork purchases is below the average of the entire sample. Members of the cluster have the second lowest mean monthly fresh meat purchases per person (1.66 kg). 1,900 households (17 %) were assigned to the second cluster which was characterized as "beef, lamb & speciality purchasers" as members showed an above average a share of beef, lamb and speciality purchases. The average monthly meat purchasing level was above the average for all households. In contrast, the lowest average monthly fresh-meat purchase volume was found for households assigned to the third segment, "mixed product eaters". The segment was the smallest, including 1,707 households (15 %). "Pork buyers" made up the largest segment. 5,173 households (45 %) buy an above-average share of pork products and also show the highest total meat purchases on average. The share of poultry meat purchases is particularly low here, in contrast to the first cluster.

In order to verify the results a discriminant analysis was conducted. Results indicated, that 98.32 % of the cases were correctly assigned. Eigenvalue and Cannon Correlation were sufficient. Thus, a particularly good delineation of the individual segments was achieved.

3.2 Explanation of cluster membership

Each of the identified segments was further characterized (Table 4) by using a multinomial logistic regression. Explanatory variables cover sociodemographics, the residence of living, total fresh meat purchase, shopping outlet as well as five attitudinal statements towards food and meat shopping. The significant coefficients indicate the (decreased or increased) likelihood of cluster affiliation in percentage points when multiplied by 100. A highly significant deviance likelihood ratio-test ($\chi 2$ (df=72) = 2130) and a McFadden Pseudo-R^2 of 0.072 confirm the quality and explanatory power of the model.

Results in **Table 4** show, that an age above 60 was highly significant for poultry lovers, decreasing the chance of belonging to this cluster by four percent points. Whereas a female household reference person significantly increased the likelihood of cluster membership. The variable household size (2 or 3 people) was also highly significant for poultry lovers however, in a negative sense. So, does the occupation of a worker compared to being an employee. In contrast, an urban residence increased the probability of cluster membership by six percent points. An increase in monthly total meat purchases per capita by one kilogram significantly lower the possibility of cluster membership by five percent point. Also, households in this cluster tend to prefer the purchase at the discounter, as this variable was also highly significant.

An old age group significantly increased the chance of belonging to the second cluster beef, lamb & speciality purchasers, so did a female household reference person. Intermediate and high incomes also increased the likelihood of cluster membership. Whereas household sizes above one person significantly decreased the possibility, so did the occupation as a worker compared to being employed. The variable "urban residence" was highly significant for beef and lamb purchasers. People in this segment tent to value quality while shopping fresh meat, as they look for quality, like to spoil themselves with good food and don't pay attention to the price.

The chance to belong to the segment of mixed product eaters decreased with an age above 40 by 8 percent points. An age above 60 decreased cluster membership by significantly by 13 percent points and

therefore had a rather high effect. Intermediate to high net income however increased the chance of being classified as a mixed product eater. However, a household-size of four people and more increased the chance of membership, so did living in urban areas. Quality of food was not the important purchase criterion for households in this cluster. However, a chance in total monthly meat purchase lowered the chance of cluster membership significantly.

The chance of belonging to the largest segment of pork buyers was high for male intermediate and old age groups living in households with more than one member. Working as a labourer compared to being employed increased the probability of cluster membership. The variables urban and town residence were highly significant in a negative sense. Also, pork favouring households placed price above quality. An increased monthly fresh meat purchases per person by one kilogram increased the chance to be classified as a pork buyer, so did the variable purchases at butcher shops.

Table 4: Probability of cluster membership

	Poultry lovers	**Beef, lamb & speciality purchasers**	**Mixed meat eaters**	**Pork purchasers**
Age (base: young)				
Intermediate (40-59)	-0.015	0.005	-0.083***	0.093***
	(0.011)	(0.010)	(0.011)	(0.014)
Old (< 60)	-0.044***	0.043***	-0.132***	0.133***
	(0.014)	(0.013)	(0.013)	(0.017)
Gender (base: male)				
Female	0.047***	0.034***	-0.007	-0.074***
	(0.010)	(0.008)	(0.009)	(0.013)
Net income (base: low)				
Intermediate (2,000 – 3,999 €)	0.025**	0.052***	0.020***	-0.056***
	(0.010)	(0.008)	(0.008)	(0.012)
High (>4,000 €)	0.023	0.136***	0.052***	-0.106***
	(0.017)	(0.018)	(0.012)	(0.021)
Household size (base: 1 person)				
2 people	-0.041***	-0.028***	0.013	0.056***
	(0.012)	(0.011)	(0.009)	(0.014)
3 people	-0.045***	-0.052***	0.013	0.085***
	(0.015)	(0.013)	(0.011)	(0.018)
4 and more people	-0.022	-0.072***	0.038***	0.055***
	(0.016)	(0.014)	(0.012)	(0.020)
Occupation (base: employee)				
Worker/Labourer	-0.049***	-0.038***	0.004	0.083***
	(0.012)	(0.011)	(0.009)	(0.015)
Civil servant	0.006	-0.036**	0.023	0.008
	(0.020)	(0.015)	(0.016)	(0.025)
Freelancer	0.066*	0.047	-0.025	-0.088**
	(0.040)	(0.034)	(0.026)	(0.044)
Farmer/ Self-Employed	-0.056	0.008	0.064	-0.015
	(0.118)	(0.114)	(0.110)	(0.150)
Person of private means	-0.015	0.016	0.003	-0.003
	(0.012)	(0.011)	(0.009)	(0.014)
Self-employed	0.044*	0.034	-0.015	-0.062**
	(0.024)	(0.022)	(0.017)	(0.028)
Residence (base: village)				
Small town (5,000 to 49,999 inhabitants)	0.015	0.006	0.021**	-0.042***
	(0.011)	(0.010)	(0.009)	(0.014)
Urban (50,000 to > 500,000 inhabitants)	0.059***	0.040***	0.025***	-0.124***
	(0.012)	(0.011)	(0.009)	(0.015)
Fresh meat purchases (on average per month and capita)	-0.050***	0.016***	-0.041***	0.075***
	(0.005)	(0.003)	(0.004)	(0.005)
Purchases at discounter (on average per month and capita)	0.104***	-0.051***	0.035***	-0.089***

	(0.006)	(0.006)	(0.006)	(0.008)
Purchases at butcher shops (on average per month and capita)	-0.110***	0.057***	-0.035**	0.088***
	(0.018)	(0.003)	(0.014)	(0.016)
Attitudinal statements				
When buying food, I always look for quality, even if it is more expensive…	0.010**	0.030***	0.011***	-0.028***
	(0.004)	(0.004)	(0.003)	(0.005)
When it comes to food, I pay more attention to the price than to the brand…	-0.004	-0.022***	0.004	0.023***
	(0.004)	(0.004)	(0.003)	(0.005)
I like to spoil myself with good food…	-0.005	0.016***	-0.006*	-0.005
	(0.004)	(0.004)	(0.003)	(0.005)
In my spare time I am involved with animals…	-0.005*	0.000	0.005**	0.000
	(0.003)	(0.002)	(0.002)	(0.003)
When buying food, the issue of cholesterol plays a role…	0.004	-0.003	-0.005*	0.004
	(0.003)	(0.003)	(0.003)	(0.004)

Notes: Coefficients indicate average marginal effects of multinomial logit regression. Standard errors are reported in parenthesis Test statistic: LR (Likelihood ratio) test: $\chi 2$ (df=72) = 2130; Nagelkerke=0.183; Cox and Snell=0.169; McFadden's R2 = 0.072. *** p<0.01, ** p<0.05, * p<0.1

Source: Original calculation.

4 Discussion and concluding remarks

Against the background of developing effective and targeted measures to reduce overall meat consumption levels in Germany, it should be taken into account that consumption patterns and the determinants hereof vary from individual to individual. Thus, target group-oriented instruments also considering the different meat types due to their varying environmental effects are needed.

Based on household panel data for 2014, descriptive statistics already indicated a heterogeneous demand behaviour in terms of monthly per capita fresh meat purchases. Two-step cluster analysis revealed four household segments based on their purchased shares for different fresh-meat types. Subsequently, the clusters were characterized using a multinomial logistic regression.

Rather young female-headed households, looking for quality instead of a cheap price, living in urban areas and showing a monthly fresh-meat purchase below the total samples average were assigned to the first household segment of poultry lovers (24 %). Beef, lamb & speciality purchasers (17 %), the second segment, on the other hand, had an average monthly meat purchase above the total samples mean. Older age groups and households with a rather high income were allocated to this segment, at the same time also with female reference persons. These households appeared to be quality-conscious and not price-sensitive. Younger households belonged to the third and smallest segment, mixed meat eaters (15 %), who tend to be less quality-conscious, but at the same time, surprisingly, had the lowest average purchase volume. Since households in this segment favour mixed products of pork and beef, it can be assumed that they are more convenience-oriented.

Pork-purchasing households, the fourth segment identified in the cluster analysis consisted of the majority of all households (45 %). In line with expectations, the highest purchasing volumes were found for this household segment. Allocated households tend to live in rural areas and had a rather low income. The price of food appeared to be an important purchase criterion for these shoppers, whereas less importance was attached to the quality of the goods.

This is why future policy instruments such as meat taxes should address this buyer segment in particular, to counteract health risks associated with high meat consumption and aiming for a more sustainable dietary pattern. However, "beef, lamb & speciality purchasers" also showed an above-average monthly fresh-meat purchase per capita. As the production of beef and lamb notably causes negative environmental effects they should also be targeted through appropriate measures. Nevertheless, this buyer segment had a rather high income and reported to be less price sensitive. This is why it may be a challenge to influence their purchasing behaviour through a tax. Both buyer segments include households with rather old reference persons. Since dietary habits are rigid, it is most likely a challenge to exert political influence regardless of the specific measure.

At the same time, however, it may be a question of generational change and thus of time that a transformation of the average dietary behaviour is achieved. Younger shoppers (poultry lovers and mixed meat eaters), already seem to demand a lower volume of fresh-meat while partly being willing to put more emphasises on quality than on the price. From a health and environmental point of view all segments found in this study would have to be addressed through political instruments due to their meat consumption level.

In the course of assessing the results, it should be noted that, based on the available data, only the purchases of fresh meat could be covered. In order to analyses total purchases, processed goods would also have to be included. In addition, a significant proportion of meat is consumed outside the home in restaurants, hotels, communal catering etc. The poor data situation however, currently complicates a segmentation in this context. Also, the analysis does not include and characterise non-meat buyers. Furthermore, it should be noted that a reduction in domestic meat consumption does not go hand in hand with an equivalent reduction in domestic production, as a considerable part of the meat produced in Germany is sold on the European domestic market or internationally (EUROSTAT, 2020).

Especially against the background of negative health effects, a segmentation based on the absolute purchase quantities would have been interesting. However, considering this variable within the cluster analysis did not lead to the formation of alternative buyer segments. The absolute meat purchase intensity is already included in the cluster variables used, as there is a likely correlation between these variables.

A household segmentation based on purchases of different meat types is still a clearly aggrandized approach. Future research should therefore focus on the identification of product-based buyer segments, enabling a more detailed analysis especially regarding consumers demanding convenience products and thus provide further important information for policy-makers. Based on the results of this study, no statements could be made regarding the purchasing behaviour of the found segments in the event of a price change and the implementation of a tax.

As younger age groups already show a below-average purchasing volume, they respond to the required behaviour change. Whether for health or sustainability reasons is not yet clear and would also need to be investigated further.

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