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A segmentation of fresh meat shoppers based on revealed preferences

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Abstract

Meat-focused diets are highly debated considering their environmental and health consequences. A change in consumption patterns in industrialized countries seems inevitable. To inform marketers and policymakers on how to mitigate meat consumption as a means of obtaining sustainability goals, the present study identifies consumer segments based on their actual purchases of fresh meat cuts using German household scanner data for the year 2014. Our revealed-preference approach suggests that pork and beef traditionalists and convenience-oriented pork buyers may react to financial incentives. Poultry and premium red meat lovers may be influenced by targeted labeling and quality signals. Overall, low-meat consumption patterns seem to be less prevalent in Germany than commonly portrayed. [EconLit Citations: C38, D12, E21, Q18].

KEYWORDS
consumption patterns, Germany, marketing and policy design, meat consumption, segmentation

1 | INTRODUCTION

The globally high and rising meat demand has been linked to increased levels of global warming potential (GWP), blue water footprint, land use, nutrient loading (Springmann et al., 2018), and biodiversity loss compared to plant-based diets (Godfray et al., 2018). The increased demand is also associated with adverse health effects, especially with several non-communicable diseases (Geibel et al., 2021). However, effects vary depending on the type of meat. Ruminant meat is "blamed" for its high contribution to human-induced greenhouse gas emissions compared to other meat types (Clune, 2017), especially in the case of feed-food competition at the farm level (Van Zanten, 2022). From a health perspective, especially red meat is considered unhealthy (Geibel et al., 2021). Thus, especially poultry is associated with less adverse health effects and a lower environmental burden.

Various studies have called for a reduction of overall meat demand in industrialized countries (Bonnet et al., 2020; Godfray et al., 2018; Willett et al., 2019) as well as higher animal welfare standards to meet the ethical demands of the general public (Weible et al., 2016). As a consequence, policy and marketing strategies to shift consumption patterns toward more plant-based diets have been vigorously debated. Policy instruments that have been considered by EU member states comprise the taxation of meat, product labeling, social marketing campaigns, and behavioral interventions such as meat-free days or nudging (Bonnet et al., 2020). Private-sector activities include the introduction of plant-based meat alternatives (e.g., vegetarian or vegan burgers and nuggets) (Thavamani et al., 2020) or hybrid products replacing parts of the meat component by plant-based ingredients (e.g., "beef and carrot mince," "chicken sausages with feta") (Grasso & Jaworska, 2020). Also, organic meat is often advertised as a more sustainable alternative recognized for enhanced water conservation, soil fertility, biodiversity, and slightly improved animal welfare (Sanders & Heß, 2019).

A remaining question with regard to these strategies is whether they even reach consumers with unhealthy or unsustainable meat consumption patterns. For example, consumers with generally high meat consumption levels and strong preferences for red meat might be price-insensitive. Also, disinterested customers may not be persuaded by established or newly implemented animal welfare concepts, environmental or health labels. Studies investigating nutritional and environmental effects of fat (Jensen et al., 2016) or carbon meat taxes (Bonnet et al., 2018; Caillavet et al., 2016; Edjabou & Smed, 2013; Säll & Gren, 2015) have mostly considered meat consumption of an average consumer. However, Roosen et al. (2022) recently reported substantially lower price elasticities for those consumer groups with the highest per-capita consumption of fresh meat. Neglecting heterogeneous consumer behavior might lead to a shortfall of the desired effect. A market share of 1.4% (1.9% with regard to monetary units) of meat substitutes and a share of 2.6% (4.9% with regard to monetary units) of organic meat in total meat purchases of private German households in 2020 (AMI, 2020) suggest that marketing strategies most likely address consumers who are health-conscious or environmentally aware and therefore serve niche consumer groups only.

Accordingly, a comprehensive dietary transformation needs policy and marketing measures to be tailored to consumer segments (Apostolidis & McLeay, 2016). Such measures should, in view of the external effects mentioned above, particularly address consumers for whom a dietary change would be most desirable from an environmental footprint or health perspective.

Hence, insights into the buying behavior and scope of these specific consumer groups are needed.

A number of studies have derived consumer segments with a focus on consumer attitudes (Apostolidis & McLeay, 2016; Götze & Brunner, 2021; Malek et al., 2018) or lifestyle (Ortiz et al., 2021), and less frequently in combination with self-reported meat purchases or consumption (Cordts et al., 2014; Escriba-Perez et al., 2017). While these studies provide initial indications of which consumer segments need to change their meat consumption as a priority (Cordts et al., 2014; Kayser et al., 2013), they do not allow any conclusions to be drawn regarding purchasing patterns of individual buyer groups.

Kayser et al. (2013) described the share of meat types for the individual consumer segments they identified which is important in terms of health and the environment considering the above-mentioned differences of external effects. However, the authors missed providing indications of different meat cuts to allow for a detailed assessment

of actual purchasing patterns or to draw conclusions for marketing strategies. A product based perspective was also not covered by Apostolidis and McLeay (2016). They did, however, describe price relevance which would facilitate the evaluation of likely effects of taxes or labeling approaches. Against the backdrop of a citizen-consumer dichotomy in which the response behavior in surveys deviates from the actual purchasing behavior (Enneking et al., 2019), only limited conclusions can be drawn from literature regarding the corresponding meat buyer groups and their specific purchasing behavior.

The objective of the present study is to segment meat consumers based on their preferences revealed from actual purchase data to discuss different policy and marketing measures aiming at those households with particularly environmentally harmful or unhealthy meat consumption patterns. Shopping motives can vary considerably for different meat types (Casini et al., 2015; Font-I-Furnols & Guerrero, 2014). However, as buying patterns also differ for individual cuts of meat (Scozzafava et al., 2016), we apply a product level consideration of various prepared cuts to allow for an accurate analysis of the related purchasing behavior.

Our study addresses the following research questions:

1. Which consumer segments emerge when using product-based fresh-meat purchasing data as cluster variables?
2. How do these segments differ from those obtained by current studies that have clustered based on stated preferences?
3. For which consumer segments should changes in consumption be a priority and how can these be addressed by targeted policy and marketing instruments?

To the best of our knowledge, there is no empirical evidence on consumer segmentation with reference to purchase behavior at a disaggregated level. We investigate the case of fresh meat in Germany, a key European market with a persistently high per capita meat consumption of 57 kg in 2020 (BLE, 2021). We segment German fresh meat buyers by using representative household scanner data collected by the Gesellschaft für Konsumforschung (GfK) for the year 2014. We initially perform a principal component analysis to group different meat products in a meaningful way in terms of meat type, preparation method, and quality. The purchasing shares of the resulting nine different product groups serve as input for a two-step cluster analysis to identify household segments that are more homogeneous regarding purchasing patterns of different meat cuts. These clusters are then characterized in the scope of socio-demographics, total shopping quantity, shopping locations, and several stated attitudes using a multinomial logistic regression. Based on their profiles we provide conjectures on policy and marketing implications.

2 | DATA AND METHODS

2.1 | Sample

The study employs nationally representative household scanner data from the *GfK ConsumerScan* panel which were collected using nonprobability quota sampling. Using hand-held scanners, households reported the quantity and expenditure for their fresh meat purchases on a daily basis. The resulting data set covers information on 53 different fresh meat products, with combinations of different cuts/preparations (e.g., chops) and species comprising (1) pork, (2) beef and veal, (3) poultry (chicken, turkey, goose, other poultry meat), (4) pork and beef mixed meat products and (5) lamb and red meat of other species (specialities). The data exclude processed meat and meat consumed out-of-home. The date of purchase, retail outlet and production method (e.g., organic) are indicated for each observation. Additionally, the data set contains socio-demographic information including age, sex, and occupation of the household's reference person who reports the data to the GfK and is mainly responsible for shopping and household management. It further covers household size, net household income, and place of

residence (GfK, 2019). These socio-demographic variables are used for setting the quota, for example, according to the micro census (Adlwarth, 2019). Furthermore, households had to respond to a wide array of statements regarding their food and meat purchasing behavior on a five-point Likert scale ("I do not agree at all"—"I agree completely") (GfK, 2014).

We analyzed purchases of 14,631 households that reported buying meat in 2014. We transformed the absolute purchase quantities reported in the data to per capita values using the modified OECD equivalent scale[1] (DESTATIS, 2021).

The variable on household size is categorical in the data with the highest category being "four or more." Therefore, we assumed a household size of four when computing the equivalence scales for these observations, accounting for 15.6% of all sample households. Due to missing attitude statement values, the final data set consisted of 11,487 households. Information on the demographic distribution of the sample is presented in Table 1 together with descriptive statistics.

We compare the demographic distribution of the raw data with official statistics in Table A1.

According to Table A1 the data set deviates from the distribution according to official statistics (DESTATIS, 2022a, 2022b, 2022c, 2022d). While single households are underrepresented in the GfK sample, households of two or more people are represented more strongly. With regard to net incomes, 43% of the GfK sample earns less than 2000 euros whereas only 22% of the total population are assigned to this salary grade according to official statistics (DESTATIS, 2022a, 2022b, 2022c, 2022d). Even though the classification of intermediate to high incomes differs, high incomes are rather underrepresented in the sample used in this study. The deviation of the gender distribution is most likely related to the fact that household reference persons reported food purchases to the GfK. We refrained from using survey weights in the course of subsequent analyses as they are not relevant for explorative classification and only lead to slight changes in the demographic distribution.

Table 2 provides descriptive statistics for the monthly per capita meat purchase quantities for individual species and fresh meat in total. High in demand is pork with a purchase quantity of 0.88 kg per capita and month followed by poultry (0.43 kg) and beef and veal (0.26 kg). Lamb and speciality meat show the lowest average purchase quantity and the highest unit value while having the highest variation in purchase quantities. The unit value for beef and veal (9.06 €/kg) on the other hand, i.e., the expenditure per kilogramme is the second highest compared with the other meat types, followed by poultry (6.24 €/kg), pork (6.02 €/kg), and beef and pork mixed meat products (5.29 €/kg).

The mean purchase quantity of pork, beef and poultry found in our data compares well to the distribution of individual species reported by the official meat supply balances for Germany in 2020 (BLE, 2021). These supply balances published by the Federal Agency for Agriculture and Food (BLE) measure the annual total and per capita meat consumption using production and foreign trade data adjusted for losses and waste. The coefficients used for adjustment account for inedible bones, nonfood uses, meat losses and meat waste, and have recently been revised and updated to current market conditions. Therefore, the German supply balance data can be considered as a reasonable standard comparable to, e.g., the ERS Food Availability Data System of the United States Department of Agriculture (USDA)) (Thies et al., 2022). We regard our data for 2014 as a suitable basis to draw implications for current purchasing behavior.

2.2 | Methods

This study attempts to identify buyer segments based on their purchases of individual meat products. The GfK data disclose 53 meat types that combine different species, cuts and preparation methods. As this is a relatively large

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[1]According to the modified OECD scale used in the context of the European Union Statistics on Income and Living Conditions (EU-SILC), the first adult person is given a weight of 1. Further adults and children are given a weight of 0.5 (DESTATIS, 2021).

TABLE 1   Definition and descriptive statistics for demographic variables in the total sample (*N* = 11,487).

Variable	Definition	N	Share (%)
Age	Age of household reference person		
≤39 years		2289	19.93
40–59 years		4830	42.05
≥60 years		4368	38.03
Household size	Number of household members		
1 person		2992	26.05
2 people		4931	42.93
3 people		1892	16.47
4 people or more		1672	14.56
Net income	Household net income		
Low (≤1999 €)		4968	43.25
Intermediate (2,000 to 3,999 €)		5619	48.92
High (≥4000 €)		900	7.83
Gender	Gender of the household reference person		
Male		2347	20.43
Female		9140	79.57
Occupation	Occupational group of the household		
White collar	reference person	4014	34.94
Blue collar		1626	14.16
Civil servant		533	4.64
Freelancer		143	1.24
Farmer, Self-employed		12	0.10
Stay-at-home persons		4777	41.59
Self-employed		382	3.33

Source: Author's own compilation of GfK data for 2014.

number to be used as input for the segmentation, we employ exploratory principle component analysis (PCA) to obtain a more manageable number of product groups. This approach identifies commonalities in purchase patterns across single items and aggregates individual products into groups of meat types that serve similar overarching goals. Different poultry cuts frequently bought by the same households within a month, for example, indicate the desire for leaner, healthier meat. Other households might buy different products for quick preparation such as steaks or chops. Hence, we expect to obtain more meaningful product groups in terms of meat type, preparation method, quality, and further consumer preferences and to aggregate the individual cuts accordingly. We used principal components with Varimax rotation to define the underlying structure in the data matrix and retained meat products with factor loadings larger than 0.40 (Hair et al., 2019).

A cluster analysis is performed in a second step to identify clusters as homogeneously as possible. The aggregated monthly purchase shares of the product groups which are derived from the PCA are used as inputs for

TABLE 2 Summary statistics for quantity (Q), expenditure (X) and unit value (UV) of monthly per capita meat purchases across species (N = 11,487).

Species		Mean	Median	SD	Min	Max	CV
Total meat	Q (kg)	1.80	1.47	1.32	0.06	20.95	0.73
	X (€)	11.05	9.00	8.22	0.52	135.3	0.74
	UV (€/kg)	6.44	5.94	2.16	1.85	31.14	0.34
Pork	Q (kg)	0.88	0.64	0.89	0.00	20.95	1.00
	X (€)	4.87	3.69	4.61	0.00	72.65	0.95
	UV (€/kg)	6.02	5.67	1.83	0.99	30.00	0.30
Beef and veal	Q (kg)	0.26	0.14	0.38	0.00	8.51	1.44
	X (€)	2.37	1.11	3.73	0.00	72.14	1.57
	UV (€/kg)	9.06	8.15	3.97	0.90	44.92	0.44
Poultry	Q (kg)	0.43	0.30	0.50	0.00	8.57	1.17
	X (€)	2.40	1.70	2.73	0.00	51.87	1.14
	UV (€/kg)	6.24	5.98	2.50	1.00	35.96	0.40
Pork and beef mixed meat	Q (kg)	0.19	0.10	0.27	0.00	4.19	1.37
	X (€)	0.93	0.51	1.27	0.00	24.69	1.36
	UV (€/kg)	5.29	4.58	1.75	1.49	18.50	0.33
Lamb, red meat, meat of other species (specialities)	Q (kg)	0.03	0.00	0.11	0.00	4.83	4.44
	X (€)	0.31	0.00	1.27	0.00	50.70	4.15
	UV (€/kg)	14.66	12.61	7.76	2.99	44.81	0.53

Abbreviations: CV, coefficient of variation; SD, standard deviation.

Source: Author's own compilation of GfK data for 2014.

the segmentation. Specifically, we conduct a two-step cluster analysis with a hierarchical procedure in the first step and a nonhierarchical in the second step. The hierarchical analysis uses the single-linkage procedure based on the nearest neighbor method to eliminate outliers (Hair et al., 2019). A total of 14 respondents is eliminated as their purchasing behavior differs clearly from the rest of the sample. The optimum number of clusters is determined using Ward's method. As these algorithms require substantial computing power it is infeasible to apply them to the entire set of more than 11,000 households. Therefore, we run the hierarchical procedure on a randomly drawn subset of 500 households to define the optimal number of clusters (K). The nonhierarchical K-means algorithm then assigns all households to one of the K predefined clusters.

To initially describe the individual segments, statistically significant differences with regard to the purchased quantity, expenditure, unit value, and shopping locations are evaluated using a Kruskal–Wallis H test. This is followed by a post hoc analysis (Dunn's test for pairwise comparison). While the significant Kruskal-Wallis H shows that at least one cluster is different from the others for all variables depicted in Table 4, pairwise comparisons controls for multiplicity and indicate which clusters actually differ (Dinno, 2015). To further characterize the clusters, a multinomial logistic regression is performed with the cluster type as a dependent variable. Independent variable compromise socio-demographics, total purchased quantity, shopping locations and attitudinal statements. This approach allows to isolate the effects of individual variables on cluster membership and to control for potential confounding. We use the first cluster as the base category in the MNL. To facilitate interpretation of the estimated

coefficients, we report the results as average marginal effects of each variable on the probability of cluster membership for all four clusters (Cameron & Trivedi, 2009). Goodness of fit was assessed by means of a deviance likelihood ratio-test and various pseudo-R^2-measures (Cox and Snell, Nagelkerke and McFadden) (Hair et al., 2019).

3 | RESULTS

3.1 | Results of the principal component analysis

A highly significant Bartlett's test of sphericity, Measure of Sampling Adequacy (MSA) values of 0.6–0.8 and a Kaiser–Meyer–Olkin (KMO) criterion of (0.73) indicated that the original data matrix of available meat cuts was suitable for PCA (Backhaus et al., 2018). Based on the correlation matrix for the individual meat cuts and the significance levels of the correlations, we removed seven cuts with low correlations with other meat products before the PCA and one category that could not be clearly assigned to any meat type. The initial PCA comprised 45 meat cuts. However, 24 meat cuts loaded ambiguously on several factors, which we also eliminated for the final analysis in the course of two reduction steps (all individual steps of the PCA can be found in the Table A2). We argue that the omitted products do not contribute to illuminating heterogeneity of purchasing behavior. The remaining data had a KMO of 0.59 which is acceptable (Hair et al., 2019). However, we ask the reader to be conscious, this is based on revealed preferences and not on attitudinal statements as commonly used in consumer research. We retained all factors with eigenvalues greater than 1, resulting in a final number of nine factors.

Table 3 shows the factor loadings for the 21 different meat types used to generate the factors. Values in bold type indicate loadings that have been allocated to a common factor. Factor 1 comprises traditional pork cuts such as gammon steak, chops, and minced pork. Gyros and goulash, both convenience pork products, are considered in Factor 7. Factor 2 summarizes various cuts of poultry, especially chicken and turkey breast and filet, and Factor 3 covers cuts of veal. Factor 4 comprises sautéed beef cuts such as steak and sirloin while traditional beef cuts such as rump, topside or silverside are covered by Factor 5. Lamb cuts other than filet are comprised in Factor 6. Beef filet is considered in Factor 8 together with lamb filet representing premium cuts of red meat. Factor 9 covers convenience mixed products consisting of pork and beef such as cevapcici and minced meat.

Based on the results of the PCA, we can therefore form groups of meat cuts that are homogeneous along the dimensions of meat type and preparation type. We argue that the identified product groups contribute to illuminating heterogeneity of meat purchasing behavior and to identifying individual clusters of fresh-meat-buying households. We decided to adopt the classification and used the standardized (deviations from the total samples' mean) shares of these nine product groups in total monthly purchase meat quantities in the clustering procedure. 4.7% of all households did not purchase any of the meat cuts that we used for PCA. Nevertheless, these households where still included in the subsequent segmentation since their total per capita fresh meat purchases were above zero.

3.2 | Description of segments

The cluster analysis yielded in four different clusters of fresh-meat-buying households: *poultry loving households* (25%), a cluster of *premium red meat lovers* (5%), a large group of *pork and beef traditionalists* (59%) and households belonging to *convenience-oriented pork buyers* (11%). Figure 1 shows the standardized mean share of the total monthly meat purchases per capita for the nine different product groups and each cluster. Each bar indicates the deviation from the sample mean.

To further describe these clusters, statistical key figures in Table 4 indicate the median and mean monthly purchasing quantity, expenditure, and unit value, as well as proportionate organic meat purchases and shopping

TABLE 3 Factor loadings for per capita monthly purchases of different meat types (N = 11,487).

Meat type	Factor loadings								
	Factor 1 Traditional pork cuts	Factor 2 Poultry cuts	Factor 3 Veal cuts	Factor 4 Sautéed beef cuts	Factor 5 Traditional beef cuts	Factor 6 Other lamb cuts than filet	Factor 7 Convenient pork cuts	Factor 8 Premium cuts of beef and lamb	Factor 9 Convenient mixed products
Gammon steak, pork	**0.697**	−0.002	0.021	0.065	0.097	0.074	0.057	−0.047	0.007
Chops, pork	**0.677**	0.026	−0.033	−0.036	0.058	−0.053	0.071	0.010	0.033
Minced pork	**0.567**	−0.123	−0.024	−0.058	−0.095	−0.029	0.052	0.099	−0.033
Breast, breast filet, chicken	−0.022	**0.777**	−0.034	−0.024	−0.025	−0.018	−0.008	0.032	0.006
Breast, breast filet, turkey	−0.027	**0.732**	0.002	0.037	0.027	−0.039	0.031	0.022	−0.007
Further cuts, poultry	0.342	**0.410**	0.142	0.063	0.050	0.232	0.018	−0.085	−0.020
Goulash, veal	−0.019	−0.034	**0.830**	−0.024	−0.010	−0.084	0.015	−0.008	0.006
Further cuts, veal	0.016	0.026	**0.792**	0.058	0.039	0.145	−0.029	0.076	−0.011
Sirloin, beef	0.023	−0.067	0.018	**0.788**	0.026	−0.020	−0.009	−0.007	−0.008
Steak, beef	−0.019	0.086	0.013	**0.770**	0.037	0.005	0.005	0.056	0.003
Rump, beef	−0.089	−0.035	0.013	−0.005	**0.820**	0.079	0.008	0.029	−0.006
Topside or silverside, beef	0.212	0.050	0.016	0.081	**0.752**	−0.048	0.022	0.010	−0.002
Further cuts, lamb	0.094	−0.007	0.035	0.034	0.003	**0.669**	−0.069	−0.003	−0.018
Chops, lamb	−0.091	−0.033	0.048	−0.016	0.164	**0.619**	0.053	0.073	−0.015
Back, lamb	0.002	−0.014	−0.005	0.078	−0.074	**0.593**	−0.004	0.064	0.040
Gyros, pork	−0.041	0.037	−0.008	0.021	−0.010	−0.008	**0.812**	−0.014	0.044
Goulash, pork	0.190	−0.027	−0.004	−0.038	0.002	−0.012	**0.734**	−0.001	−0.042

TABLE 3 (Continued)

Meat type	Factor loadings								
	Factor 1 Traditional pork cuts	Factor 2 Poultry cuts	Factor 3 Veal cuts	Factor 4 Sautéed beef cuts	Factor 5 Traditional beef cuts	Factor 6 Other lamb cuts than filet	Factor 7 Convenient pork cuts	Factor 8 Premium cuts of beef and lamb	Factor 9 Convenient mixed products
Filet, lamb	−0.010	0.005	0.050	−0.050	−0.012	0.038	0.015	**0.841**	0.014
Filet, beef	0.035	0.062	0.010	0.278	0.122	0.022	−0.074	**0.610**	−0.041
Minced pork/beef	0.024	−0.071	−0.001	−0.032	−0.024	−0.024	0.003	0.018	**0.731**
Cevapcici, pork/beef	−0.021	0.068	−0.005	0.024	−0.017	0.022	0.015	−0.021	**0.730**

Note: Bartlett's test of sphericity = 0.000; Kaiser–Meyer–Olkin (KMO) = 0.589; total variance explained through factors = 55.04%. We omitted 32 of 53 meat cuts from principle component analysis as they did not explain the heterogeneity across factors well. Factor loadings of meat types loading on the respective factors are marked in bold type.

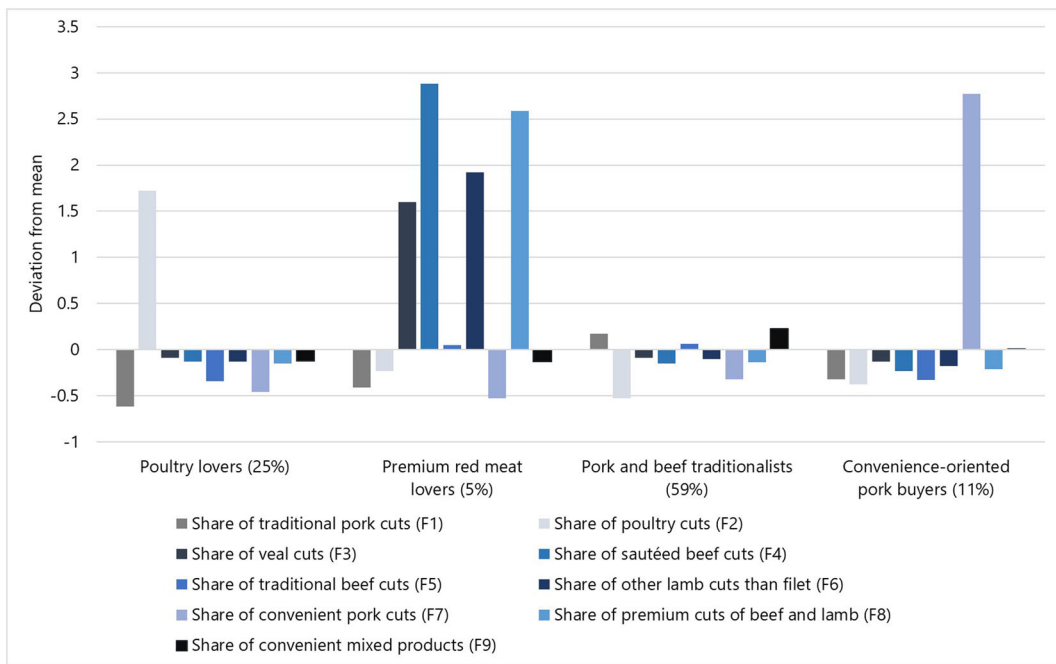*Source*: Author's own calculation based on GfK data for 2014.

FIGURE 1 The four identified segments and their mean deviation from the total samples mean.

locations. Additionally, statistically significant differences between the segments regarding these variables are presented.

The first cluster stands out due to an above-average share of poultry purchases. Indeed, _poultry lovers_ generate almost half of their meat purchases with a combination of three poultry cuts (Factor 2) (Table A3), purchased primarily at discount stores. The cluster of _poultry lovers_ includes 2817 households or 25% of the total sample. _Poultry lovers_ purchase 1.54 kg fresh meat per capita and month on average which is significantly lower than other segments. They show the lowest expenditure and relatively high unit values.

The second cluster exhibits high shares for four product groups of red meat cuts, in particular veal, sautéed beef cuts, premium cuts of beef and lamb, and other lamb cuts. _Premium red meat lovers_ account for 5% or 616 households of the sample. They purchase 1.71 kg of fresh meat per month on average which is slightly below the average for all households (1.80 kg). Households in this cluster have the highest monthly expenditure for fresh meat and pay the highest prices which differentiates them significantly from the other clusters. They also have the largest share of organic in relation to total meat purchases.

The third cluster of _pork and beef traditionalists_ is the largest cluster with a total of 6,745 households (59% of all households). A main feature of this cluster is that there are no strongly marked deviations from the overall means in the nine product groups. Thus, almost two-thirds of the households share quite similar consumption patterns with regard to meat types and specific cuts. Allocated households purchase traditional pork cuts, traditional beef cuts and convenient mixed products at a slightly higher rate than the total samples mean. These households exhibit the highest average monthly fresh meat purchase quantity with 1.95 kg per capita.

The remaining 11% of all households are allocated to the fourth segment, _convenience-oriented pork buyers_. A total of 1,295 households buy an above-average share of convenience pork cuts and convenience mixed products, whereas the values of all other product groups are below average. _Convenience-oriented pork buyers_ have the second lowest purchase quantity of fresh meat per capita (1.62 kg) and indicate the lowest average expenditure and unit value within the sample.

TABLE 4 Monthly fresh meat purchases and shopping locations for each cluster (N = 11,473).

	Clusters							
	1		**2**		**3**		**4**	
	Poultry lovers		Premium red meat lovers		Pork and beef traditionalists		Convenience-oriented pork buyers	
Variables	Median	Mean ± SD	Median	Mean ± SD	Median	Mean ± SD	Median	Mean ± SD
Purchases per capita (kg)***	1.2[a]	1.5 ± 1.2	1.4[b]	1.7 ± 1.2	1.6[c]	2.0 ± 1.4	1.4[b]	1.6 ± 1.1
Expenditure (€)***	7.5[a]	9.3 ± 6.7	13.3[b]	16.2 ± 12.1	9.8[c]	11.7 ± 8.1	7.9[a]	9.4 ± 6.4
Unit value (€/kg)***	6.1[a]	6.4 ± 2.0	9.4[b]	10.0 ± 3.3	5.8[c]	6.2 ± 1.9	5.5[d]	5.9 ± 1.5
Share of organic meat purchases (%)***	0.0[a]	1.9 ± 0.1	0.0[b]	2.8 ± 0.1	0.0[c]	1.6 ± 0.1	0.0[d]	0.9 ± 0.1
Share of retail shopping (%)***	7.8[a]	22.6 ± 29.8	23.7[b]	33.7 ± 32.7	14.3[c]	28.5 ± 32.3	9.2[a]	23.0 ± 29.7
Share of butcher shopping (%)***	0.0[a]	4.4 ± 13.7	0.0[b]	15.5 ± 26.8	0.0[c]	10.5 ± 22.1	0.0[d]	6.7 ± 18.5
Share of self-service warehouse (%)***	0.0[a]	15.8 ± 26.6	0.0[a]	14.6 ± 25.7	4.4[b]	22.5 ± 31.0	0.0[a]	17.3 ± 28.0
Share of discount shopping (%)***	56.1[a]	52.8 ± 36.1	16.3[b]	26.4 ± 29.9	24.3[c]	33.8 ± 32.6	52.0[a]	50.9 ± 35.6

Note: Kruskal–Wallis was applied to test H0: There are no differences on the regarded variable between the four consumer segments. Letters accompanying median values are the compact letter displays resulting from pairwise comparisons using Dunn's test. Values with the same compact letters are not significantly different.

***$p \leq 0.0001$.

Source: Author's own calculation based on GfK data for 2014.

4 | EXPLANATION OF CLUSTER MEMBERSHIP AND DISCUSSION OF RESULTS

Each of the identified segments is further characterized using a multinomial logistic regression (MNL). Results of the MNL regression are provided in Table 5. Explanatory variables include socio-demographics, place of residence, total purchase quantity of fresh meat, purchase frequency at discount and butcher shops as well as five statements on attitudes toward food and meat shopping for which we assume equidistance (further descriptive statistics of the explanatory variables can be found in the Table A3). The significant coefficients are the average marginal effects, that is, when multiplied by 100%, they indicate the percentage-point-change in the probability to belong to one cluster resulting from a one-unit change in the independent variable. The deviance likelihood ratio-test (χ^2 (df = 72) = 1788) was highly significant with a p value of ≤0.0001, McFadden pseudo-R^2 was 0.074.

The results in Table 5 show that a reference person in the intermediate age group significantly increases the chance of belonging to the smallest cluster of *premium red meat lovers*. The same holds true for intermediate and high incomes. Households in this cluster have a higher purchasing frequency at butcher shops and tend to value quality when shopping for fresh meat: they like to spoil themselves with good food and do not pay attention to the price. As these households also buy the largest share of organic meat among the clusters and pay comparatively high prices for all fresh meat product groups, only a small part of households actually has "willingness to pay" (WTP) above average unit values. This is in contrast to survey-based studies that typically report higher and more wide-spread WTP for sustainability attributes such as animal welfare (EC, 2016).

The chance of belonging to the largest cluster of *pork and beef traditionalists* increases with an age between 40 and 59. An age above 60 increases the probability of cluster membership significantly by 14 percentage points. Intermediate to high net incomes decrease the chance of being classified a traditional pork and beef shopper. These households rate the price of food as an important purchasing criterion. Also, higher total meat purchases per month increase the chance of cluster membership significantly. As *pork and beef traditionalist* represent 59% of all households (Figure 1), who exhibit an above average monthly fresh meat purchase quantity (Table 4) and indicate to shop rather budget-consciously (Table 5), we conclude that the share of classic meat eaters is still high within the German population. This contrasts with existing studies that conducted meat consumer segmentations based on attitudes toward single aspects of eating or self-reported total meat quantities and usually painted a more sustainable picture. Götze and Brunner (2021) labeled 45% of Swiss consumers as environmentally conscious, mostly regular meat eaters. At the same time, Cordts et al. (2014) described the minority of German consumers as meat fans and big eaters (12%) and identified 22% as "meat lovers with an affinity for sustainability." Kayser et al. (2013) identified 33% of German meat consumers as "heavy meat consumers" without considering actual consumed quantities or additional purchasing patterns.

As German consumers of advanced age more likely to be *pork and beef traditionalists*, changes on average dietary behavior may occur as this generation ages out of the population within the next decade. The 51–65 age group made up 23% of the total German population in 2020 due to the high birth rate within this generation ("babyboomers"). Their high consumption level is likely to decline with increasing age (Efken & Meemken, 2021). At the same time, a considerable part of the post-war generation, born between 1954 and 1945 and aged 60–69 in 2014, is already experiencing a higher mortality rate. However, considering the remaining time window for achieving climate targets (UN, 2015) such a "natural" dietary transformation would probably not proceed at the required pace.

Table 5 shows that households are five and ten percentage points less likely to belong to the cluster of *poultry lovers* if the household reference person's age is equal to or greater than 40 and 60, respectively. In contrast, a female household reference person significantly increases the likelihood of cluster membership. Also, single households are significantly more likely to belong to this cluster. An increase in total meat purchases per capita and month by 1 kg significantly lowers the probability of cluster membership. Regarding the attitudinal statements, results show that the probability of cluster membership increases for households stating that they look for quality

TABLE 5 Results of multinomial logit model presented as average marginal effects, dependent variable: Cluster membership (N = 11,473).

Cluster	1 Poultry lovers	2 Premium red meat lovers	3 Pork and beef traditionalists	4 Convenience-oriented pork buyers
Age (base: ≤ 39 years)				
(40–59 years)	−0.048***	0.012**	0.042***	−0.006
	(0.011)	(0.006)	(0.013)	(0.008)
(≥60 years)	−0.104***	0.009	0.140***	−0.045***
	(0.014)	(0.007)	(0.016)	(0.010)
Gender (base: male)				
Female	0.054***	−0.001	−0.029**	−0.024***
	(0.010)	(0.005)	(0.012)	(0.009)
Net income (base: low (≤1999 €))				
Intermediate (2000–3999 €)	0.014	0.034***	−0.029***	−0.019***
	(0.009)	(0.005)	(0.011)	(0.007)
High (≥4000 €)	0.024	0.108***	−0.094***	−0.038***
	(0.017)	(0.013)	(0.019)	(0.011)
Household size (base: 1 person)				
2 people	−0.038***	−0.036***	0.062***	0.012
	(0.011)	(0.008)	(0.013)	(0.008)
3 people	−0.047***	−0.041***	0.055***	0.034***
	(0.014)	(0.009)	(0.016)	(0.010)
4 or more people	−0.033**	−0.052***	0.038**	0.046***
	(0.015)	(0.009)	(0.018)	(0.012)
Occupation (base: white collar)				
Blue collar	−0.040***	−0.020***	0.046***	0.015
	(0.012)	(0.006)	(0.014)	(0.009)
Civil servant	0.010	−0.016**	−0.017	0.023
	(0.019)	(0.008)	(0.022)	(0.015)
Freelancer	0.048	0.007	−0.075*	0.020
	(0.037)	(0.017)	(0.041)	(0.029)
Farmer/self-employed	−0.017	−0.054***	0.116	−0.046
	(0.120)	(0.004)	(0.125)	(0.063)
Stay-at-home persons	−0.036***	0.007	0.031**	−0.002
	(0.012)	(0.007)	(0.013)	(0.009)
Self-employed	0.031	0.016	−0.037	−0.010
	(0.023)	(0.012)	(0.025)	(0.016)

(Continues)

TABLE 5   (Continued)

Cluster	1 Poultry lovers	2 Premium red meat lovers	3 Pork and beef traditionalists	4 Convenience-oriented pork buyers
Residence (base: village (<5000 inhabitants))				
Small town (5000–49,999 inhabitants)	0.010	0.010*	−0.022*	0.001
	(0.011)	(0.006)	(0.013)	(0.009)
Urban (≥50,000 inhabitants)	0.046***	0.019***	−0.056***	−0.009
	(0.012)	(0.006)	(0.014)	(0.009)
Fresh meat purchases	−0.062***	0.001	0.082***	−0.021***
(on average per month and capita)	(0.005)	(0.002)	(0.005)	(0.004)
Purchases at discount stores	0.104***	−0.020***	−0.121***	0.037***
(on average per month and capita)	(0.006)	(0.004)	(0.007)	(0.005)
Purchases at butcher shop	−0.112***	0.015***	0.071***	0.025***
(on average per month and capita)	(0.018)	(0.004)	(0.016)	(0.009)
Attitudinal statements[a]				
When buying food, I always look for quality, even if it is more expensive…	0.015***	0.010***	−0.009*	−0.016***
	(0.004)	(0.002)	(0.005)	(0.003)
When it comes to food, I pay more attention to the price than to the brand…	−0.008**	−0.006***	0.013***	0.001
	(0.004)	(0.002)	(0.005)	(0.003)
I like to spoil myself with good food…	−0.002	0.014***	−0.003	−0.009***
	(0.004)	(0.002)	(0.004)	(0.003)
In my spare time I am involved with animals…	−0.004	−0.004***	0.005	0.002
	(0.003)	(0.001)	(0.003)	(0.002)
When buying food, the issue of cholesterol plays a role…	−0.001	−0.002	0.001	0.002
	(0.003)	(0.002)	(0.004)	(0.003)

Note: Coefficients indicate average marginal effects based on multinomial logit regression with *poultry lovers* as base-category. Standard errors are reported in parentheses Test statistic: LR (Likelihood ratio) test: χ^2 (df = 72) = 1788; Nagelkerke = 0.164; Cox and Snell = 0.144; McFadden's R^2 = 0.074.

[a]Out of 20 statements available five statements were selected that seemed most appropriate to explain the understanding of health awareness, meat quality and price sensitivity of meat shoppers.

***$p ≤ 0.01$; **$p ≤ 0.05$; *$p ≤ 0.1$.

Source: Author's own calculation based on GfK data for 2014.

when buying food, even if it is more expensive. Along the same line, the probability decreases for households stating they pay more attention to the price than to the brand.

The likelihood of belonging to the cluster of *convenience-oriented pork buyers* is high for younger households with male household reference persons, lower incomes, and three or more members. Also, pork and convenience

favouring households place price above quality and do not indicate the desire to spoil themselves with good food. An increase in the monthly purchase quantity of fresh meat by one kilogram decreases the chance to be allocated to this cluster by 2 percentage points. Higher shopping frequencies at both butcher shops and discount stores increase the probability of cluster membership.

The cluster of *convenience-oriented pork buyers* together with *poultry lovers* exhibit a tendency toward reduced meat consumption. The female and rather young *poultry lovers* generate almost half of their meat purchases with a combination of three poultry cuts (Factor 2). As they purchase the lowest share of traditional pork cuts and have the lowest monthly per capita meat purchases, they consume a rather healthy assortment of meat types. Households with a male household reference person that belong to the cluster of *convenience-oriented pork buyers* especially favor meat cuts that can be prepared quickly and purchase the second-lowest meat quantity among the clusters.

On the one hand, a reduced meat demand among younger generations is in line with findings of the National Consumption Survey II which calculated meat consumption based on individual dietary interviews. Results indicated that 15–18-year-old consumers exhibit a 7% reduction of meat consumption compared to the overall average (Krems et al., 2013). According to Spiller et al. (2021), twice as many 15–29-year-old consumers considered themselves to be vegetarian or vegan in 2021 compared to the total German population. An evaluation of GfK data on meat substitutes respectively revealed that within single households, the group consumers aged below 34 years showed the highest level of purchased meat substitutes while indicating the lowest meat purchases in 2020 (GfK, 2021).

On the other hand, our results for the two segments with rather young male and female reference persons draw a more differentiated picture compared to surveys characterizing the young generation as predominantly quality- and health-focused (Brümmer & Zander, 2020; Savelli et al., 2019). First, *convenience-oriented pork buyers* do not demand quality at any price. Moreover, they favor meat cuts which are not necessarily associated with a balanced diet. Second, *poultry lovers* who most likely have an affinity for health considering their low fresh meat purchase level and their preferences for poultry meat mainly and foremost shopped in discount markets. This should be examined in the course of further research and was not to be expected as Pirsich et al. (2020) described "discounter buyers" as not very quality-oriented and studies so far portrayed the image of young females as environmentally conscious consumers (Sanchez-Sabate & Sabaté, 2019), but completely missed considering their financial standing.

5 | POLICY AND MARKETING IMPLICATIONS

5.1 | Identified priority groups

A *major* objective of this study was to identify consumer segments for which changes in meat consumption should be a priority. We identified *pork and beef traditionalists*, who purchase 24 kg of fresh meat annually with a preference for pork chops, gammon steak and minced pork, as a group to target specifically when aiming for a more rapid dietary change with a view toward health and the environment. From an environmental footprint perspective, *premium red meat lovers* should be targeted first since the production of beef and lamb causes notably higher negative environmental effects than pork and poultry (Clune et al., 2017).

We found that younger segments, that is, *poultry lovers* and *convenience-oriented pork buyers* are already moving away from a particularly meat-heavy diet. However, at least *convenience-oriented pork buyers* would need to be persuaded to change their diet in the long term as they mainly demand pork cuts that are high in fat.

Since the average per capita fresh meat purchases were on average, and for all segments, above 16 kg per capita and year, they exceeded the EAT-Lancet Commission recommended consumption level that is consistent with a "planetary health diet" (Willett et al., 2019). Thus, a dietary transformation would be desirable with a view on the environment and for all households. The maximum annual meat consumption level suggested by the German

Nutrition Society (DGE) (31 kg) (DGE, 2020) was not reached; however, processed meat products were not included in the data set. Out-of-home eating accounts for an additional one-third of total meat consumption in Germany (Thies et al., 2022) and could also not be considered but would result in the DGE recommendations being exceeded.

5.2 | Financial incentives

Regarding the negative external effects of high meat consumption levels and the inertia of dietary patterns, meat taxation and information measures have been mentioned as relevant instruments for meat demand management (Bonnet et al., 2020). Apostolidis and McLeay (2016) emphasized the importance of targeting meat reduction efforts tailored to individual consumer groups. The cluster profiles provide insights into consumer diversity and allow to derive implications for market actors and policy makers.

The feasibility of an excise as well as an ad valorem tax resulting from abolishing the reduced value-added tax (VAT) rate on animal products, that is, increasing it from 7% to 19% to finance improved animal husbandry conditions, are currently at the center of the political debate in Germany (Deblitz et al., 2021; Karpenstein et al., 2021; KNW, 2020). A consistent finding of studies estimating price elasticities of demand is that lower-income households are more price sensitive than higher-income households (Ni Mhurchu et al., 2013; Park et al., 1996; Peltner & Thiele, 2021; Staudigel & Schröck, 2015; Thiele, 2008). *Pork and beef traditionalists* report to be price sensitive when purchasing food and pay rather low average prices for meat. Intermediate to high net incomes decrease the chance of belonging to this cluster. Thus, price-related measures such as taxes have considerable potential to effectively reduce the fresh meat consumption of this segment. However, we assume that a significant price increase would be needed to cause a real change in consumer behavior, particularly for consumers with a deeply anchored habit of regular meat consumption (Brombach et al., 2015).

Future studies estimating demand systems would have to particularly consider *pork and beef traditionalists* to ascertain whether profound dietary changes can actually be controlled by legislative intervention. In studies with a different national focus, consumer heterogeneity has already been accounted for regarding the estimation of demand reactions (e.g., Staudigel & Schröck, 2015). Roosen et al. (2022) illustrated distinct reactions to price and expenditure variation across meat-types as well as household groups. Explicit recommendations on magnitude and type of taxes require detailed knowledge of demand reactions for the products to be taxed. At the same time, it is necessary to investigate substitution effects to other meat types and cuts purchased, production practices and the place of purchase triggered by tax-induced price changes. This could be particularly interesting for the cluster of *pork and beef traditionalists*, due to their diversified assortment of demanded meat types. Moreover, the analysis in further studies of substitution effects might need to go even beyond the consideration of direct meat substitutes. Shewmake et al. (2015), for instance, emphasized cross price elasticities between meat, cereal and bakery as well as alcoholic beverages in the course of an assessment of the demand response to carbon labeling.

The rather young households belonging to *convenience-oriented pork buyers* (11%) express less quality-motivation but price-consciousness with comparably low unit-values for meat they buy. A low income significantly increases the chance of belonging to *convenience-oriented pork buyers*. Research has shown that target groups in precarious living conditions are more difficult to reach via information approaches and that low incomes pose limits on purchase options (Spiller et al., 2017). Due to an additional lack of interest in quality aspects, the extent to which measures of an informative nature could reach *convenience-oriented pork buyers* remains open. This group seems to be susceptible to financial incentives. Raising the price could possibly generate a more substantial drop in their meat demand since habits are not yet deeply rooted. However, studies have demonstrated that the introduction of a meat tax has a regressive effect and particularly burdens the lower income classes (e.g., Säll, 2018; Wier et al., 2005).

At the same time, by introducing a tax based on CO_2 emissions, substitute products and plant-based alternatives could become more favorable compared to meat. As positive financial incentives are associated with

less negative emotional response (Just & Hanks, 2015), balanced diets could additionally be encouraged by price promotions on plant-based alternatives. Personalized price promotion (PPP) has recently been discussed as a promising measure to achieve timely sales of perishable foods contributing to the reduction of food waste as well as to incentivize purchases of foods with a healthier nutrient profile (Nguyen et al., 2019). In a similar vein, PPP might target price sensitive *convenience-oriented pork buyers* to make purchases—and long-term adoption—of plant-based meat alternatives more attractive.

5.3 | Informative measures

Previous literature found young, female and quality-conscious consumers to be the most willing to change meat consumption (Sanchez-Sabate & Sabaté, 2019) and to be particularly accessible via labels (Kumar & Kapoor, 2017), making *poultry lovers* a target group for market participants. We assume that these households could be reached easily since they also favor poultry cuts, which are more healthful compared to the other meats studied and show comparably high unit values for the meat products they buy. Animal welfare labels could possibly promote the consumption of meat with improved animal welfare requirements more strongly in this target group as generally envisaged by the Scientific Advisory Board on Agricultural Policy, Food and Consumer Health Protection (WBAE) (WBAE, 2020).

The environmental consequences of meat consumption seem to be a particular driving factor influencing changes in dietary behavior of young consumers (Zühlsdorf et al., 2021). Further research is required on the purchase motivation of young *poultry lovers* to evaluate the potential effect of labels focussing on health, animal welfare and climate. Examining the underlying quality perception of these buyers would be particularly interesting considering the announcement by certain German discounters to exclusively offer fresh meat produced under improved husbandry conditions (outdoor climate and organic husbandry) from 2030 onwards (Schulze Steinmann & Arden, 2021). According to Naderi and van Steenburg (2018) "rational and self-oriented motives" have encouraged Millennials to behave in an environmentally friendly way. During the time our data was collected, only around two thirds of the group of Millennials (aged 16–33 years in 2014) may have been making independent shopping choices. As this group grows older, their consumption patterns and underlying motives will get more important and relevant for targeted marketing measures reinforcing their motivation to choose "animal-welfare meat" or healthier meat subsidies.

Premium red meat lovers are additionally relevant to successfully derive marketing strategies, since they expressed attitudes consistent with valuing quality food and spoiling themselves with good food (Table 5), and purchase the most organic meats among the segments (Table 4). Due to their financial provision and their correspondingly low price sensitivity in their food shopping, they may accept further price increases to maintain their long-established dietary habits instead of lowering their meat consumption or substituting beef and lamb with poultry. They might be willing to pay additional prices for further quality meat attributes such as "improved animal welfare conditions" and "produced more sustainable." Therefore, targeted marketing can bring about a change toward more sustainability for *premium and red meat lovers*. A detailed examination of these households' quality understanding (in terms of meat texture or animal husbandry system) could provide further insights for market participants.

Increasing the availability of "hybrid meat substitutes" with a reduced meat component, which are close to conventional meat products regarding most product characteristics, could gradually reduce meat consumption even for "taste-driven" meat enthusiasts with little interest in health information (Apostolidis & McLeay, 2016). This might also affect traditional pork and beef buyers by partly changing their nutritional environment. Curbing consumption of all meat products does not seem feasible for this segment; a development toward more flexitarian diets through financial interventions accompanied by attractive substitutes might be achievable.

6 | LIMITATIONS AND CONCLUDING REMARKS

A number of limitations need to be considered when interpreting our results. It should be noted that the product groups used for clustering did not cover all available meat cuts of the data set, but at the same time allowed for the greatest possible delineation of different buyer groups. Thus, the selected product groups allowed us to identify individual purchasing patterns, which have then been described considering total fresh meat consumption. Although the present analysis provides important insights into heterogeneous consumer segments with regard to fresh meat while covering about 50% of household meat purchases (AMI, 2020), future research may also include processed meat. Along the same line, a significant share of meat is consumed out-of-home (Thies et al., 2021) and excluded from this analysis.

Our analysis did not characterize nonmeat buyers, as the central focus of our study was to identify meat consumers. Moreover, it was household-based and thus conducted at an aggregated level. Nevertheless, the purchases of all household members are reflected in the shopping behavior of the respective reference person which led to a well-founded distinction of consumer segments. Attitudes and socio-demographics were related to the households' reference person responsible for food shopping. Still, there is need for future nutritional monitoring enhanced with a regular collection of individual dietary data (Thar et al., 2020). Also needed are implications regarding price instruments built on self-reported sensitivity. Future research may cluster explicitly based on estimated parameters of price elasticities or WTP, for example, via latent class models.

Overall, we found that the majority of German households has not yet moved away from traditional meat consumption habits and would have to be encouraged to change their dietary behavior, especially through financial incentives accompanied by targeted communication campaigns to bring about a change in their "food environment."

These household profiles certainly portray a transitory picture of meat buying patterns in Germany. Looking ahead, the relative size of these clusters is likely to change. We might see a future increase in demand for poultry in the context of climate and health debates. Several of today's younger, quality focused households could gradually join a segment of premium meat consumers. At the same time, a growing range of appealing meat alternatives might also further influence their meat demand. The share of households that we described as convenience-oriented and thus interested in a time-saving preparation of inexpensive meals could increase with a view on an upcoming Generation Z. This study can be regarded as a baseline for follow up research to monitor the dynamics of meat-eating habits. It therefore makes an important contribution to a comprehensive information base for political decision-making.

DATA AVAILABILITY STATEMENT
The data that support the findings of this study are proprietary data from Gesellschaft für Konsumforschung (GfK), Nuremberg, Germany. Authors are not allowed to publicly share these data due to contractual agreements. Interested researchers may access the data on-site at Technical University of Munich or the Thuenen Institute of Market Analysis with permission from GfK.

ETHICS STATEMENT
The data used in this study was acquired from Gesellschaft für Konsumforschung (GfK). In the course of the procurement process, ethical requirements were considered as part of the legal requirements for the federal procurement procedure. GfK's data collection requires voluntary reporting by the participants.

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APPENDIX A

TABLE A1 Comparison of descriptive statistics for demographic variables in the total sample (N = 14,631) and official statistics.

Variable	Share (%)	Variable	Official statistics (%)
Age		*Age*	
≤39 years	26.29	≤45 years	34.99
40–59 years	41.78	45–65 years	36.83
≥60 years	31.93	≥65 years	28.18
Household size		*Household size*	
1 person	25.19	1 person	40.80
2 people	41.08	2 people	34.40
3 people	18.08	3 people	12.35
4 people or more	15.64	4 people or more	12.44
Net income		*Net income*	
Low (≤1999 €)	43.20	Low (≤1,999 €)	22.15
Intermediate (2000 to 3999 €)	48.54	Intermediate (2000–3499 €)	38.59
High (≥4000 €)	8.26	High (≥3500 €)	39.27
Gender		*Gender*	
Male	21.28	Male	49.06
Female	78.72	Female	50.94

Note: Information on age refers to the household reference person. *Gender* refers to the total population in official statistics.

Source: Author's own calculation based on GfK data for 2014; DESTATIS (2022a, 2022b, 2022c, 2022d) based on data for 2014.

TABLE A2 Individual steps of the principle component analysis.

Steps	Number of meat cuts	Data handling
Step 1	53	Based on the correlation matrix for the individual meat cuts and the significance levels of the correlations, we removed seven cuts with low correlations with other meat products (less than 0.03) We removed the following 7 meat cuts: Pork knuckle, meatball (pork), cevapcici (pork), gyros (beef), meatballs (beef), rump (veal), meat of other species (poultry).
Step 2	46	We removed one category that could not be clearly assigned to any meat type: Meat cuts, other species.
Step 3	45	We run a PCA with Varimax rotation for the remaining 45 meat cuts. The following 19 meat cuts loaded ambiguously on several factors, which we also eliminated: Roast

(Continues)

TABLE A2 (Continued)

Steps	Number of meat cuts	Data handling
		(pork), filet (pork), ground meat (pork), steak (pork), schnitzel (pork), rips (pork), belly (pork), barbecue plate (pork), further meat cuts (pork), other meat cuts (pork & beef), ground meat (beef), roulades (beef), soupmeat (beef), tatar (beef), other meat cuts (beef), schnitzel (veal), haxe (veal), lachse (lamb), other meat cuts (lamb).
Step 4	26	We run a PCA with Varimax rotation for the remaining 26 meat cuts. The following 5 meat cuts loaded ambiguously on several factors, which we eliminated: Goulash (pork & beef), ground meat (pork & beef), goulash (beef), barbecue braid (pork), further cuts (turkey).
Step 5	21	We run a PCA with Varimax rotation for the remaining 26 meat cuts. The remaining meat cuts loaded on 9 factors.

Source: Author's own calculation based on GfK data for 2014.

TABLE A3 Monthly fresh meat purchases per capita, cluster and product group expressed as share of in relation to total monthly meat purchase per capita ($N = 11,473$).

Buyer segment	Mean	Median	SD	Min	Max	CV
1 Poultry lovers, purchase per capita (kg)	1.54	1.22	1.22	0.06	14.72	0.79
Share of traditional pork cuts (F1) (%)	3.43	0.00	5.71	39.23	0.39	1.66
Share of poultry cuts (F2) (%)	47.76	42.53	18.88	23.64	100.00	0.39
Share of veal cuts (F3) (%)	0.16	0.00	0.85	0.00	11.88	5.17
Share of short roasted beef cuts (F4) (%)	0.93	0.00	2.27	0.00	20.07	2.44
Share of traditional beef cuts (F5) (%)	0.63	0.00	2.28	0.00	42.69	3.60
Share of other lamb cuts than filet (F6) (%)	0.19	0.00	1.09	0.00	13.89	5.63
Share of convenient pork cuts (F7) (%)	1.68	0.00	2.93	0.00	15.08	1.74
Share of premium cuts of beef and lamb (F8) (%)	0.21	0.00	0.93	0.00	9.92	4.32
Share of convenient mixed products (F9) (%)	0.32	0.00	1.38	0.00	24.55	4.30
2 Premium and red meat lovers, purchase per capita (kg)	1.71	1.37	1.22	0.12	8.74	0.71
Share of traditional pork cuts (F1) (%)	5.88	2.18	8.95	0.00	73.53	1.52
Share of poultry cuts (F2) (%)	16.10	13.51	14.61	0.00	70.14	0.91
Share of veal cuts (F3) (%)	2.55	0.00	5.27	0.00	31.08	2.07
Share of short roasted beef cuts (F4) (%)	11.43	6.00	16.10	0.00	100.00	1.41
Share of traditional beef cuts (F5) (%)	2.29	0.00	4.94	0.00	32.75	2.16
Share of other lamb cuts than filet (F6) (%)	4.79	0.00	9.59	0.00	70.78	2.00
Share of convenient pork cuts (F7) (%)	1.68	0.00	2.93	0.00	19.72	2.30
Share of premium cuts of beef and lamb (F8) (%)	5.47	2.02	7.97	0.00	47.20	1.45
Share of convenient mixed products (F9) (%)	0.30	0.00	1.47	0.00	18.37	4.95

TABLE A3 (Continued)

Buyer segment	Mean	Median	SD	Min	Max	CV
3 Pork and beef traditionalists, purchase per capita (kg)	1.95	1.62	1.38	0.06	20.95	0.71
Share of traditional pork cuts (F1) (%)	12.67	8.31	14.89	0.00	100.00	1.18
Share of poultry cuts (F2) (%)	11.35	10.52	9.40	0.00	45.36	0.83
Share of veal cuts (F3) (%)	0.16	0.00	0.75	0.00	10.73	4.52
Share of short roasted beef cuts (F4) (%)	0.88	0.00	2.16	0.00	16.50	2.44
Share of traditional beef cuts (F5) (%)	2.31	0.00	5.77	0.00	87.17	2.50
Share of other lamb cuts than filet (F6) (%)	0.28	0.00	1.27	0.00	14.29	4.58
Share of convenient pork cuts (F7) (%)	2.51	0.00	3.33	0.00	15.04	1.33
Share of premium cuts of beef and lamb (F8) (%)	0.23	0.00	0.88	0.00	9.76	3.80
Share of convenient mixed products (F9) (%)	1.37	0.00	6.85	0.00	100.00	5.01
4 Convenience-oriented pork buyers, purchase per capita (kg)	1.62	1.35	1.06	0.25	7.94	0.65
Share of traditional pork cuts (F1) (%)	6.92	3.76	9.20	0.00	65.85	1.32
Share of poultry cuts (F2) (%)	13.73	11.26	12.29	0.00	61.54	0.89
Share of veal cuts (F3) (%)	0.11	0.00	0.65	0.00	10.04	6.04
Share of short roasted beef cuts (F4) (%)	0.59	0.00	1.91	0.00	16.66	3.26
Share of traditional beef cuts (F5) (%)	0.68	0.00	2.40	0.00	32.11	3.53
Share of other lamb cuts than filet (F6) (%)	0.09	0.00	0.72	0.00	10.99	7.99
Share of convenient pork cuts (F7) (%)	20.98	17.21	12.47	10.33	100.00	0.59
Share of premium cuts of beef and lamb (F8) (%)	0.10	0.00	0.66	0.00	12.39	6.67
Share of convenient mixed products (F9) (%)	0.71	0.00	2.90	0.00	57.31	4.08

Source: Author's own calculation based on GfK data for 2014.

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