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How do organic price premiums vary across different supply and demand side factors?

A hedonic analysis of the German market for fresh meat

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How do organic price premiums vary across different supply and demand side factors? A hedonic analysis of the German market for fresh meat

Abstract

Estimates of price premiums achieved by organic food over conventional products based on market data are highly relevant for food marketing as well as policymakers. We estimate a hedonic price model based on GfK household panel data for fresh meat purchases of 21,656 households in Germany from 2012 to 2014. In order to examine variation in organic price premiums, we interact the organic trait with supply and demand factors that are likely to affect implicit prices of organic claims. Our estimate for the basic effect of organic origin on meat price suggests a premium of 25 % over conventional meat. Results of the interactions between organic and other attributes show that organic premiums vary substantially across species and meat cuts. A general pattern is that channels and products generally perceived as cheaper relatively larger organic premiums over conventional prices. For example, organic origin achieves a higher premium in products such as roasts, steaks, and chicken breast for which a grown texture and sensory traits are important. We also find a trade-off between organic and other indicators of meat quality such as beef for species and butcher shops with regard to distribution. Here, it seems that the additional value of the organic claim is less strong, because other attributes partly provide the same utility regarding trust, safety, or taste. Overall, we find partly huge differences between prices of organic and conventional meat, which the clear potential to act as a major barrier for households to switch from conventional to organic meat.

Keywords

Germany, hedonic analysis, household scanner data, meat, organic, price analysis.

1 Introduction

There is a fierce competition on German market for fresh meat which has experienced several major structural changes over the last two decades. One major impact was the decision of ALDI in 2006 to offer fresh meat in its discount stores, putting substantial pressure on meat prices. Another trend was the decline in number and shares of traditional butcher shops as a

combined result of competitive pressure, changing consumer expectations, stricter regulations on production processes and facilities from the European Union, but also general image problems of the profession leading to declining numbers of laborers and successors of firms. On the other hand, there are growing efforts towards differentiation based on organic origin, increased animal welfare, and local origin, which are used by some farmers and processors to achieve price premiums over conventional products. These efforts are directed at consumers who increasingly value traits like health, sustainability, or ethical consumption. Major political initiatives such as the Federal Organic Farming Scheme and other forms of sustainable agriculture (BÖLN) aiming at “improving the general conditions for the organic agri-food sector“ in Germany (BMEL 2018) are evidence of this increased awareness finding its way into political programs.

One often-cited barrier towards higher market shares, especially of organic foods in general and organic meat in particular are substantial price premiums for organic over conventional products (Stumm 2004). Results from consumer studies using discrete choice experiments to elicit willingness to pay or qualitative studies on motivation and drivers of organic consumption provide some evidence but the overall picture remains unclear with major criticisms on the reliability of survey and experiment-based estimates (Niessen and Hamm 2008). One major limitation is that studies who provide an in-depth analysis of price premiums for crucial meat attributes based on detailed market data are lacking. However, reliable estimates of price premiums achieved by organic food over conventional products are highly relevant for food marketing as well as policymakers (Parcell and Schroeder 2007; Costanigro and McCluskey 2011).

The established approach to study price premiums for attributes based on actual market data are hedonic price analyses (Costanigro and McCluskey 2011). Respective studies provide evidence that organic products achieve significant price premiums of over 20 %, which vary across product categories as well as over time (Carlson and Jaenicke 2016). More detailed studies find that organic premiums also differ by shop type (Schroeck 2013), geographic location (Chang et al. 2010), and product attributes (Smith et al. 2009). The fresh meat sector is a very interesting case study regarding the value of organic claims, where organic products address consumer concerns like sustainability, health, and animal welfare probably even more than for other product categories. Additionally, different retail formats such as butchers, hypermarkets, and discounters competing against each other as well as the importance of

socio-economic characteristics given meat as a luxury good add to the importance of organic as an attribute driving product differentiation. Previous hedonic analyses for branded steaks (Schulz et al., 2012) and different cuts of pork and beef (Parcell and Schroeder, 2007) have provided evidence on significant impacts of various attributes of meat. Mostly for the US. However, there is not much empirical evidence on actual differences in organic premiums across different products, cuts, distribution channels, and consumer characteristics which is of vital interest for marketers as well as for policy design.

Our objective in this paper is to derive more detailed and explicit estimates of potentially heterogeneous organic price premiums for fresh meat on the German market. We propose a hedonic price model where we interact an indicator of organic with supply and demand factors that are likely to affect the implicit price of organic claims. A specific focus was on the price premium achieved by products of organic origin compared to their conventional counterparts and whether this premium differed across species and preparation type, distribution channel, and household characteristics. We employ GfK household panel data for fresh meat purchases of 21,656 households in Germany from 2012 to 2014.

The paper proceeds as follows. In Section 2, we present our econometric model and discuss hypotheses for various determinants of meat prices. In Section 3, we describe the data and provide summary statistics for the variables used in the analysis. Section 4 presents statistics on absolute prices and differences for organic and conventional meat across species and distribution channels, followed by a discussion of hedonic regression results. Section 5 discusses these results and concludes.

2 Specification of hedonic model for fresh meat

We base our analysis on Lancaster's (1966) characteristics approach assuming that consumers derive utility from goods they consume through the individual attributes of these goods. In turn, the price of goods and services can be expressed as the sum of implicit prices of single attributes that goods possess to a varying degree.

We model the impact of product attributes, distribution channels, and household characteristics on the natural logarithm of purchase prices of meat ($\ln Price$) according to equation (1)¹:

$$\begin{aligned} \ln Price = & \alpha + \beta \cdot Organic + \sum_i \gamma_i^* \cdot Species_i + \sum_j \delta_j^* \cdot Meat\ type_j + \varepsilon^* \cdot OTC + \\ & \sum_k \varphi_k^* \cdot Distribution_k + \sum_l \eta_l^* \cdot Population_l + \sum_m \theta_m^* \cdot Age_m + \\ & \sum_n \lambda_n^* \cdot Occupation_n + \sum_o \sigma_o^* \cdot HHSize_o + \sum_p \mu_p^* \cdot Income_p + \\ & \phi^* \cdot Female + \sum_q \psi_q^* \cdot Intensity_q + \sum_r \zeta_r \cdot State_r + \sum_s \rho_s \cdot Year_s + \\ & \sum_t \chi_t \cdot Month_t + \vartheta \end{aligned} \quad (1)$$

The parameters of product attributes and distribution characteristics can be interpreted as implicit prices, i.e. as the price premium a product achieves, if the respective attribute is present. As Rosen (1974) pointed out, interpreting these implicit prices as the willingness to pay of consumers for a certain (level of an) attribute is misleading. Rather, they are the result of supply and demand relations for attributes in characteristics space, where the marginal cost of providing an attribute equals consumers' marginal willingness to pay for an attribute.

Our main focus is to examine the existence and strength of price premiums of organic over conventional meat. The variable *Organic* is a binary indicator whether households reported their purchases as organic or not. Among product characteristics, we test for differences in meat prices across *Species*. Price premiums in this area may result from supply side factors such as costs of production and husbandry, slaughtering, marketing and availability of marketable cuts that vary across different species. Demand side factors potentially affecting implicit prices across species are taste preferences or health considerations (e.g. poultry vs. red meat). *Meat type* indicates different cuts or preparation types of purchased products. Price differences could emerge from costs of preparation on the supply side as well as considerations over ease of preparation and convenience on the demand side. We also hypothesize a positive effect of over-the-counter (*OTC*) purchases on prices paid versus self-service as a result of labor costs, higher efforts to guarantee freshness regarding supply, but also due to higher customer valuation of additional advice and service.

¹ For convenience, we suppress subscripts *ih* indicating purchase *i* made by household *h*.

We further expect pronounced price differences across *Distribution* channel, first and foremost as a result of different price strategies. Discounters, for instance, pursue an every-day-low-price strategy, which should also apply to meat products. On the other hand, supermarkets and especially hypermarkets use strong price discounts for meat to attract customers. In how far these promotions affect general price levels is an empirical question. On the other hand, we expect price differences across retail outlets to mirror general quality differences, in particular for other marketers and butcher shops. These are likely to supply meat of a higher quality level, which is not sufficiently captured by the available product attributes described above.

Product and distribution characteristics discussed so far are classical variables used in many previous hedonic regression models. Since we are dealing with data on single household purchases, we further control for characteristics of the households that are making these choices, in order to account for effects of search costs, frugality, and quality preferences on choice behavior over unobserved quality. This proceeding is similar to price regressions based on Cox and Wohlgemut (1986), whose procedure to adjust unit values for quality effects is commonly used in demand system studies when unit values are the only source of price information. The demographics we include into the model are *Population* size of households' place of residence, *Age*, *Occupation* type, *Household size*, *Income* level, and whether the shopper is *Female* or not. We also introduce a variable on households' *intensity of buying organic* meat products, as a proportion to total expenditure.

In order to assess, whether organic premiums vary over species, meat type, distribution channels and household characteristics, we introduce a full set of interactions of all variables with the organic indicator. Asterisks (*) in the superscripts indicate that we allow implicit prices of attributes and household effects to differ between conventional and organic purchases, e.g. $\gamma_i^* = (\gamma_i^c + \gamma_i^o \cdot \text{Organic})$. While potential organic price premiums across product attributes and distribution channels would have to be interpreted as a result of both demand and supply side effects, significant interaction terms among household characteristics should indicate differences in preferences and willingness to pay for organic meat.

Finally, we introduce a set of year, months, and state fixed effects to account for price variation along time and geographic dimensions. We assume the error term ϑ to be clustered at the household level.

3 Data and variables

We employ household panel data for fresh food products for Germany from 2012 to 2014 provided by the Gesellschaft für Konsumforschung (GfK) in their ConsumerScan “Frischepanel”. These home-scan consumer data provide detailed information on 1,486,585 meat purchases of 21,656 households regarding expenditure and quantity, cut/preparation type of meat, species, distribution channel, presence of an organic claim, and whether the product was purchased over the counter or packaged from the shelf. Additionally, the data include information on households’ socio-demographic characteristics, place of residence, and numerous attitudes towards food consumption. Both product attributes and household characteristics are divided into multiple categories (especially regarding cut/preparation type, species, and combinations thereof) which we aggregated to broader categories described in more detail below.

Dependent variables

The dependent variable is the unit price of each purchase in €/kg computed from the reported value of each observation divided by the reported quantity. Table 1 presents summary statistics for unit prices in absolute values and in logarithms. The average price of meat across all observations in our data is 6.67 €/kg. The median is a bit lower with 5.98 €/kg, indicating a skewed distribution. Prices vary considerably with a coefficient of variation of 0.55 and a range from 0.10 to 51.07 €/kg. Given the skewed distribution of absolute price values, we chose to use the logarithm of price as the main dependent variable for the hedonic regressions. However, we report results from linear specifications in the Appendix.

Table 1: Summary statistics of Price and ln Price, 2012-2014

Variable	Price	ln Price
<i>Definition</i>	Price in € per kg	Natural logarithm of Price
<i>Observations</i>	1,486,584	1,486,584
<i>Mean</i>	6.67	1.79
<i>Median</i>	5.98	1.79
<i>Standard deviation</i>	3.69	0.45
<i>Coefficient of variation</i>	0.55	0.25
<i>Minimum</i>	0.10	-2.26
<i>Maximum</i>	51.07	3.93

Source: Own computation based on GfK data 2012-2014.

Independent Variables

Product characteristics and distribution channel

Table 2 presents summary statistics for main categories and single indicators of product attributes and distributional characteristics. Since all variables are in binary form, we only report proportion and frequencies within each category. Our main variable of interest is whether meat products purchased are of organic origin or not. Panel households indicate whether a purchase was organic, but they do not further specify, which type of label the purchased products carried precisely. Hence, we are not able to distinguish between, for instance, the basic *EU organic label* and labels with stricter requirements for production practices such as *Demeter* or *Bioland*. According to Table 2, only 1.3 % of all reported purchases are of organic origin, which, however, is in line with commonly reported numbers for the organic meat market in Germany. Despite the low share of organic, the size of the dataset at hand still leaves us with almost 20,000 observations of organic meat products, providing an excellent basis for a detailed analysis of organic meat price determinants.

Table 2: Proportions and frequencies of product attributes and distribution characteristics

Variable	Perc.	Freq.	Variable	Perc.	Freq.
<i>Organic</i>			<i>OTC</i>		
Conventional (R)	98.7	1,466,748	Self-service (R)	66.7	992,083
Organic	1.3	19,836	Over-the-counter	33.3	494,501
<i>Species</i>			<i>Meat type</i>		
Chicken (R)	14.1	209,397	Minced (R)	25.9	336,010
Pork	49.6	736,580	Ribs	2.1	26,787
Turkey	7.9	117,751	Chops	4.7	60,450
Mixed	11.5	170,373	Roast	4.9	63,121
Beef	14.1	209,150	Goulash	4.4	57,077
Goose	0.2	2,365	Meatball	4.6	59,460
Veal	0.7	10,851	Tartare	0.6	7,991
Lamb	0.5	7,920	Schnitzel	5.7	73,989
Other animal	0.4	5,772	Barbecue	0.7	8,678
Other poultry	1.1	16,425	Steak	9.4	121,506
<i>Distribution channel</i>			Fillet	3.8	49,234
Discounter (R)	40.0	594,625	Poultry breast/fillet	15.0	194,389
Hypermarket	20.9	310,018	Other poultry	10.2	132,759
Supermarket	25.1	372,977	Other red meat	8.1	105,076
Other	3.4	50,777			
Butcher	10.6	158,187			

Note: Items labeled with “(R)” indicate reference categories in the subsequent hedonic regressions.

Source: Own computation based on GfK data 2012-2014.

Regarding species, we find that household purchased pork in almost 50 % of cases. Beef and chicken account for 14.1 % each, followed by mixtures (of pork and beef) with 11.5 % and turkey (7.9 %). All other species only play a minor role in meat consumption of Germans. Across different cuts or preparation type, minced meat accounts for the largest proportion of all purchases (25.9 %), followed by poultry breast/fillets (15 %), other poultry parts (10.2 %), and steak cuts (9.4 %). Especially the first three categories give evidence of the trend towards meat types suited for dishes that can be quickly and easily prepared. Statistics for the distribution channel mirror the German retail landscape very well. Discounters account for 40 % of all reported purchases, while standard supermarkets and larger hypermarkets reach shares of 25.1 % and 20.9 %, respectively. Only 10.6 % of meat purchases have been made at traditional butcher shops and 3.4 % at other outlets (e.g. farmers' markets or direct marketers). Two-thirds of our observations are purchases from self-service shelves, while one-third represents purchases over-the-counter, which, too, mirrors a major trend in German meat marketing.

Household characteristics

Table 3 depicts proportions and frequencies of household characteristics available in the GfK data. The figures indicate, that the households in our sample tend to live more in villages, towns, and smaller cities up to 50,000 inhabitants (62 % of all observations). Households are relatively old, with only 16 % of purchases by households where the responsible person is younger than 40 years. This observation is certainly related to lower frequency of meat purchases by younger households in Germany. Almost 50 % of all purchases have been reported by 2-person households. Households are further located within middle income ranges, with many responsible persons being either housewives (private means) or white collar employees. Based on the share of expenditures for organic meats in relation to total meat expenditure, we generated a variable for organic buying intensity. Intensive buyers are defined as having a share of 50 % of organic purchases, medium buyers between 15 % and 50 %, occasional buyers between 5 % and 15 %, and "non"-buyers of less than 5 %. Statistics indicate that regular organic buyers, regardless whether they are characterized as occasional, medium, or intensive, are a clear minority.

Table 3: Proportions and frequencies of household characteristics

Variable	Perc.	Freq.	Variable	Perc.	Freq.
<i>Population</i>			<i>Household size</i>		
< 4k	16.2	241,222	Single	15.4	229,128
< 49k	46.0	683,250	2 person	47.9	712,300
< 499k	22.2	329,318	3 person	18.7	278,535
> 500k	15.7	232,794	4 or more	17.9	266,621
<i>Age categories</i>			<i>Income categories</i>		
29 years and younger	4.2	62,496	< 1,500 €	21.3	316,778
30-39 years	12.1	179,158	1,500-2,499 €	38.2	567,130
40-49 years	20.5	305,083	2,500-3,499 €	25.7	381,601
50-59 years	23.8	354,210	3,500-4,499 €	12.0	177,827
60-69 years	21.5	319,862	4,500 € and more	2.9	43,248
70 years and older	17.9	265,775			
<i>Sex</i>			<i>Employment</i>		
Male	17.1	253,608	BC employee	15.9	235,608
Female	82.9	1,232,976	WC employee	32.6	485,015
			Civil servant	5.1	75,877
			Freelancer	1.0	15,283
<i>Organic buying intensity</i>					
Non-buyer	93.3	1,386,692	Farmer	0.1	1,610
Occasional buyer	4.3	64,258	Private means	41.9	623,419
Medium buyer	2.0	30,088	Self-employed	3.4	49,772
Intensive buyer	0.4	5,546			

Source: Own computation based on GfK data 2012-2014.

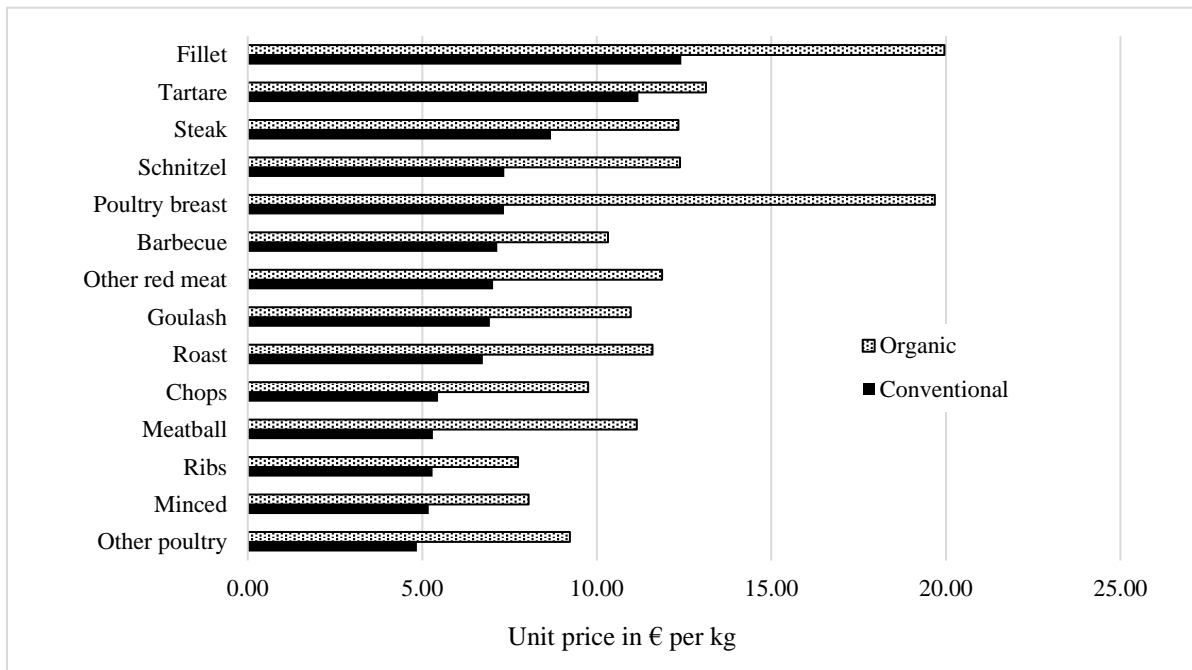
4 Empirical analysis of meat prices

Price variation across species, meat type, and distribution channel

Before turning to the results of the hedonic regressions, we would like to highlight some important features of prices across meat types, species, and distribution channel for both conventional and organic meat based on the following figures.

The ranking of unit prices for conventional meat across preparation types in Figure 1 holds no major surprises. Fillet (12.42 €/kg), tartare (11.19 €/kg), and steaks (8.69 €/kg) are the most expensive types, while ribs (5.30 €/kg), minced meat (5.18 €/kg), and parts of poultry other than breast (4.85 €/kg) rank at the bottom. Organic prices lie closer together, only fillet and poultry breast stand out with exceptionally high values of 19.96 €/kg and 19.68 €/kg, respectively. The highest average percentage price differences between conventional and organic meat types are observed for poultry breast (168 %), meatballs (110 %), other poultry (90 %), and chops (79 %).

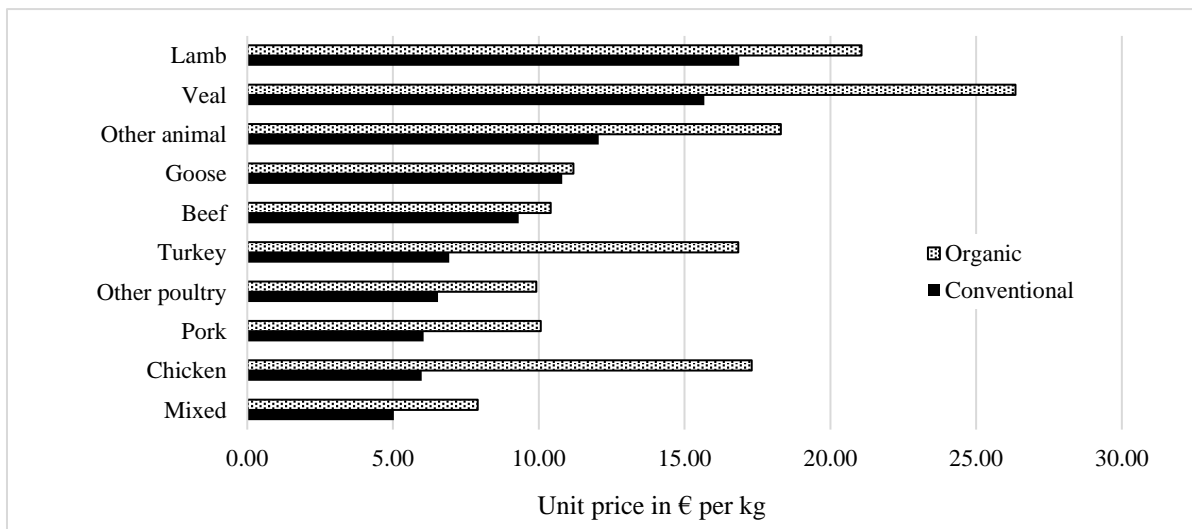
Figure 1: Unit prices of conventional and organic products across different meat types



Source: Own illustration based on GfK data 2012-2014.

For prices across species depicted in Figure 2, we find that lamb (16.88 €/kg) and veal (15.68 €/kg) demand the highest unit prices for conventional meat, while turkey (6.93 €/kg), other poultry (6.55 €/kg), pork (6.05 €/kg), and chicken (5.99 €/kg) all range at the lower end with similar prices. Mixtures of pork and beef (5.03 €/kg) have the lowest price. We observe the highest percentage differences between conventional and organic prices for chicken (189 %) and turkey (143 %), and a remarkably low premium for beef (12 %).

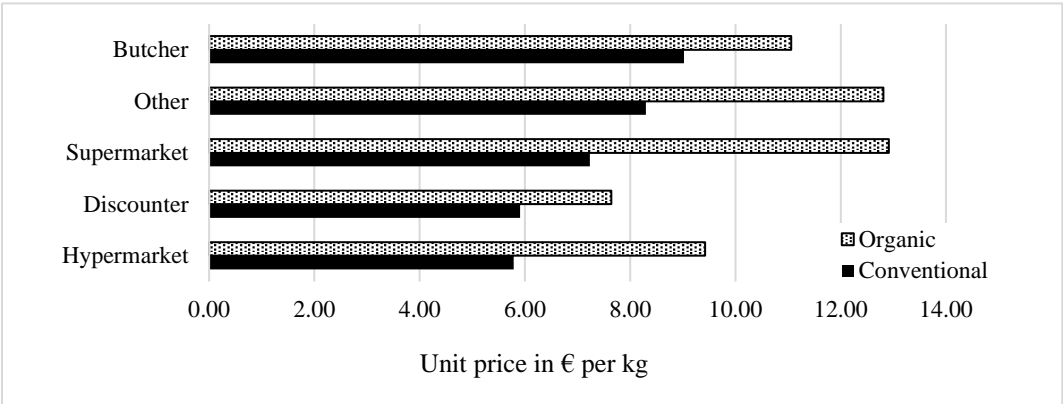
Figure 2: Unit prices of conventional and organic products across different species



Source: Own illustration based on GfK data 2012-2014.

Figure 3 shows prices across distribution channels. As expected, the highest average price for conventional meat is that in traditional butcher shops (9.02 €/kg), followed by others channels (8.30 €/kg), supermarkets (7.33 €/kg), and discounters (5.91 €/kg). The last rank is occupied by hypermarkets (5.79 €/kg), which use strong discounts on meat as a major strategic instrument to attract customers to their stores. The highest percentage premiums for organic meat on average are realized by supermarkets (79 %) and hypermarkets (63 %), while premiums in discounters (29 %) and butcher shops (23 %) are considerably lower, most probably for different reasons.

Figure 3: Unit prices of conventional and organic products across different distribution channels



Source: Own illustration based on GfK data 2012-2014.

Estimation results of hedonic price regressions

Since descriptive statistics indicated considerable differences in price setting for poultry compared to red meat, we treat these two groups as distinct market segments and conducted separate regressions for them. Table 4 presents results of hedonic price regressions based on eq. (1) for red meat. Estimation results in the left part of the table show the effects of product attributes, distribution channels, and household characteristics for conventional meat, while the right panel presents coefficients of the interaction terms of these variables with the organic indicator. We transformed the coefficients according to $(e^\beta - 1) \cdot 100\%$ to obtain percentage premiums depicted in the last column. The R^2 (0.49) indicates that the model is able to explain almost 50 % of the variation in the logarithm of unit prices. Most coefficients of explanatory variables for conventional meat are highly significant. Among product attributes and distributional characteristics, we find patterns very similar compared to those already indicated by descriptive statistics. Compared to pork, we find a substantial premium

of beef (46.9 %) as the main substitute in the red meat category. Veal and lamb, which are consumed mostly for special occasions demand very large premiums of 128.3 % and 116.8 %, respectively. Meat sold over the counter demands a price premium of 10.6 %. Compared to discounters as a reference, hypermarkets have a negative premium of 4.8 %, while prices paid in butcher shops are 36.3 % higher, all other things equal.

Regarding household characteristics, we find that prices increase slightly but steadily with increasing population size. Prices tend to decrease with age, probably because of a rising frugality among older people. Occupation types do not show many significant differences, except for white collar employees and self-employed persons, who appear to pay somewhat higher prices. Estimated effects of household size indicate economies of scale, with prices decreasing with increasing number of household members. We find a clearly positive impact of household income on the price paid for meat indicating a higher demand for quality with rising incomes. Households in the highest income category pay 12.4 % more *ceteris paribus* than those in the lowest category. There is no significant effect of the shopper's sex on prices paid. Finally, our estimates indicate that households with a high buying intensity of organic meat also pay large price premiums for conventional meat in general.

The basic price premium of organic meat is estimated at 28.7 %. This value is correctly interpreted as the premium of organic vs. conventional for all reference categories, for example, as the organic premium in discounters. All other interaction effects for the different variables have to be added on top of that. Among species, we find an additional organic premium for mixtures of 14.8 % compared to pork, while beef (-14.7 %) and lamb (-18.4%) actually have lower premiums for meat of organic origin. We also find additional premiums for chops (10.2 %), roasts (10.7 %), and meatballs (26.0 %), and a lower premium for barbecue products (-18.5 %) compared to minced meat. Also fillets have a high coefficient, which is insignificant, however, probably because of the low number of observations. There is no secular effect of organic for over-the-counter sales compared to self-service. Among distribution channels, supermarkets realize the highest additional organic premium with 25.1 %, followed by other channels (18.4 %), and hypermarkets (13.1 %). Butcher shops apparently have less leverage (or need) for considerable organic premiums.

Table 4: Results of hedonic regression for red meat, 2012-2014, dependent variable ln Price

	Direct effects			Variable x Organic			
	Coef.	S.E.	%	Coef.	S.E.	%	
Organic	0.252	(0.032)	***	28.7			
Species (Ref: Pork)							
Mixed	0.073	(0.003)	***	7.5	0.138	(0.016)	*** 14.8
Beef	0.384	(0.004)	***	46.9	-0.159	(0.016)	*** -14.7
Veal	0.826	(0.009)	***	128.3	0.010	(0.054)	1.0
Lamb	0.774	(0.010)	***	116.8	-0.204	(0.087)	** -18.4
Meat Type (Ref: Minced)							
Ribs	0.058	(0.007)	***	6.0	-0.067	(0.049)	-6.4
Chops	0.095	(0.004)	***	10.0	0.097	(0.020)	*** 10.2
Roast	0.151	(0.004)	***	16.3	0.102	(0.018)	*** 10.7
Goulash	0.263	(0.003)	***	30.1	-0.003	(0.017)	-0.3
Meatball	0.082	(0.006)	***	8.6	0.231	(0.053)	*** 26.0
Tartare	0.357	(0.012)	***	42.9	-0.027	(0.061)	-2.7
Schnitzel	0.360	(0.004)	***	43.3	-0.012	(0.022)	-1.2
Barbecue	0.454	(0.006)	***	57.5	-0.204	(0.114)	* -18.5
Steak	0.451	(0.004)	***	57.0	0.028	(0.020)	2.9
Fillet	0.745	(0.005)	***	110.7	0.143	(0.020)	15.3
Other	0.078	(0.006)	***	8.2	0.044	(0.048)	4.5
Over-the-counter	0.100	(0.004)	***	10.6	-0.178	(0.017)	-16.3
Distribution channel (Ref: Discounter)							
Hypermarket	-0.050	(0.003)	***	-4.8	0.123	(0.013)	*** 13.1
Supermarket	0.084	(0.004)	***	8.8	0.224	(0.017)	*** 25.1
Other	0.129	(0.012)	***	13.8	0.169	(0.022)	*** 18.4
Butcher	0.310	(0.007)	***	36.3	0.053	(0.020)	** 5.4
Population (Ref: < 4,999)							
< 49k	0.017	(0.004)	***	1.8	0.016	(0.015)	1.6
< 499k	0.026	(0.005)	***	2.7	0.038	(0.017)	** 3.9
> 500k	0.032	(0.007)	***	3.3	0.037	(0.017)	** 3.7
Age (Ref: 29 years and younger)							
30-39 years	-0.009	(0.005)	**	-0.9	0.026	(0.022)	2.6
40-49 years	-0.021	(0.005)	***	-2.0	0.015	(0.021)	1.5
50-59 years	-0.024	(0.005)	***	-2.4	-0.004	(0.022)	-0.4
60-69 years	-0.027	(0.006)	***	-2.6	0.003	(0.022)	0.4
70 years and older	-0.015	(0.007)	**	-1.5	0.028	(0.024)	2.8
Employment type (Ref: BC Employee)							
WC employee	0.014	(0.004)	***	1.5	0.011	(0.011)	1.1
Civil servant	0.013	(0.008)		1.3	0.011	(0.017)	1.1
Freelancer	-0.001	(0.015)		-0.1	0.009	(0.025)	0.9
Farmer	-0.029	(0.041)		-2.9	0.112	(0.045)	** 11.8
Private means	0.005	(0.005)		0.5	0.006	(0.014)	0.6
Self-employed	0.017	(0.008)	**	1.7	-0.005	(0.024)	-0.5
Household size (Ref: Single)							
2 person	-0.032	(0.005)	***	-3.2	0.018	(0.014)	1.8

3 person	-0.051	(0.006)	***	-5.0	0.029	(0.017)	*	2.9
4 or more	-0.068	(0.007)	***	-6.6	0.038	(0.017)	**	3.9
Household income (Ref: below 1,500 €)								
1,500-2,499 €	0.035	(0.004)	***	3.5	0.004	(0.013)		0.4
2,500-3,499 €	0.061	(0.005)	***	6.3	-0.017	(0.015)		-1.7
3,500-4,499 €	0.091	(0.006)	***	9.5	-0.029	(0.015)	*	-2.9
4,500 € and more	0.117	(0.010)	***	12.4	-0.024	(0.022)		-2.4
Female	0.005	(0.004)		0.5	-0.006	(0.011)		-0.6
Organic buying intensity (Ref: Non-buyer)								
Occasional buyer	0.051	(0.008)	***	5.2	-0.013	(0.009)		-1.3
Medium buyer	0.079	(0.010)	***	8.2	-0.017	(0.011)		-1.7
Intensive buyer	0.122	(0.018)	***	13.0	-0.038	(0.021)	*	-3.7
Constant	1.274	(0.012)	***					
<i>N</i>	957,311							
<i>R</i> ²	0.4869							

Note: *** $p < 1\%$; ** $p < 5\%$; * $p < 10\%$. Robust standard errors in parentheses. Regression additionally controls for year, month, and state effects. Price premiums in % computed by $(e^\beta - 1) \cdot 100\%$.

Source: Own computation based on GfK data 2012-2014.

While our results indicate substantial differences of product and distribution characteristics on the prices of conventional versus organic meat, they provide less evidence of household characteristics as drivers of higher prices of organic meat. We find slightly higher prices in larger cities, which could be due to distribution costs not accounted for so far or different attitudes towards organic products in larger cities. We also find small organic premiums for 3- or 4-person households, which may be due to the presence of children. Earlier research found that households with smaller children have a higher probability of buying organic milk and dairy products (Buder et al. 2010). These types of households may additionally have a higher willingness to pay for organic products. Unfortunately, we have no information available in the data to test for the presence of children directly. We do not find major effects for age, employment type, income, sex, or buying intensity.

Results of hedonic regressions for poultry presented in Table 5 suggest a much higher price premium for organic origin of 48 % in the reference categories. Generally, we find high premiums of chicken breast (75.3 %) and turkey breast (78.1 %) in the conventional segment. Other than for red meat, these more expensive cuts can realize additional organic premiums of 36.1 % in the case of chicken breasts and 7.2 % for turkey breast. Regarding over-the-counter sales, poultry incurs a negative premium in general.

Table 5: Results of hedonic regression for poultry, 2012-2014, dependent variable ln Price

	Direct effects			Variable x Organic			
	Coef.	S.E.	%	Coef.	S.E.	%	
Organic	0.395	(0.106)	***	48.4			
Meat type (Ref: Chicken, other)							
Turkey, other	0.300	(0.006)	***	35.0	-0.007	(0.057)	-0.7
Other poultry	0.296	(0.012)	***	34.4	-0.150	(0.055)	*** -13.9
Chicken breast/fillet	0.562	(0.004)	***	75.3	0.308	(0.030)	*** 36.1
Turkey breast/fillet	0.577	(0.004)	***	78.1	0.070	(0.031)	** 7.2
Goose	0.676	(0.021)	***	96.5	-0.370	(0.067)	*** -30.9
Over-the-counter	-0.089	(0.009)	***	-8.5	0.004	(0.025)	0.4
Distribution channel (Ref: Discounter)							
Hypermarket	0.035	(0.005)	***	3.6	0.118	(0.059)	** 12.5
Supermarket	0.198	(0.007)	***	21.9	0.048	(0.044)	4.9
Other	0.342	(0.017)	***	40.8	-0.160	(0.047)	*** -14.8
Butcher	0.612	(0.014)	***	84.4	-0.385	(0.046)	*** -31.9
Population (Ref: < 4,999)							
< 49k	0.017	(0.006)	***	1.7	-0.040	(0.035)	-3.9
< 499k	0.014	(0.007)	*	1.4	-0.066	(0.040)	* -6.4
> 500k	0.026	(0.009)	***	2.6	-0.054	(0.039)	-5.3
Age (Ref: 29 years and younger)							
30-39 years	-0.015	(0.007)	**	-1.5	0.032	(0.058)	3.2
40-49 years	-0.026	(0.007)	***	-2.6	0.072	(0.060)	7.4
50-59 years	-0.053	(0.007)	***	-5.2	0.006	(0.059)	0.6
60-69 years	-0.061	(0.008)	***	-6.0	0.041	(0.064)	4.2
70 years and older	-0.054	(0.010)	***	-5.3	0.069	(0.066)	7.2
Employment type (Ref: BC employee)							
WC employee	0.019	(0.006)	***	2.0	0.086	(0.043)	** 9.0
Civil servant	0.018	(0.010)	*	1.9	0.065	(0.057)	6.7
Freelancer	0.004	(0.021)		0.4	0.122	(0.062)	** 13.0
Farmer	-0.033	(0.032)		-3.2	0.547	(0.082)	*** 72.8
Private means	0.000	(0.008)		0.0	0.138	(0.050)	*** 14.8
Self-employed	0.013	(0.013)		1.3	0.099	(0.070)	10.4
Household size (Ref: Single)							
2 person	-0.058	(0.008)	***	-5.6	0.031	(0.038)	3.2
3 person	-0.071	(0.008)	***	-6.9	0.021	(0.047)	2.1
4 or more	-0.095	(0.009)	***	-9.0	0.005	(0.049)	0.5
Household income (Ref: below 1,500 €)							
1,500-2,499 €	0.032	(0.006)	***	3.2	-0.038	(0.041)	-3.8
2,500-3,499 €	0.061	(0.007)	***	6.3	-0.022	(0.042)	-2.2
3,500-4,499 €	0.082	(0.008)	***	8.6	-0.012	(0.044)	-1.2
4,500 € and more	0.115	(0.014)	***	12.2	-0.077	(0.057)	-7.4
Female	0.018	(0.006)	***	1.8	-0.031	(0.028)	-3.1

Organic buying intensity (Ref: Non-buyer)							
Occasional buyer	0.044	(0.009)	***	4.5	0.062	(0.039)	6.4
Medium buyer	0.085	(0.015)	***	8.9	0.096	(0.039)	** 10.0
Intensive buyer	0.201	(0.038)	***	22.3	0.097	(0.057)	* 10.2
Constant	1.300	(0.017)	***				
<i>N</i>	342,076						
<i>R</i> ²	0.4211						

Note: *** $p < 1\%$; ** $p < 5\%$; * $p < 10\%$. Robust standard errors in parentheses. Regression additionally controls for year, month, and state effects. Price premiums in % computed by $(e^\beta - 1) \cdot 100\%$.

Source: Own computation based on GfK data 2012-2014.

Prices across distribution channels differ substantially and suggest a high degree of cost and/or quality variation. Discounters demand the lowest price for poultry *ceteris paribus* with hypermarkets close behind (+3.6 %). Supermarkets achieve a premium of 21.9 % and traditional butcher shops of 84.4 %. Across distribution channels, only hypermarkets realize an additional premium (12.5 %) over discounters, while other outlets and butchers have lower organic premiums. This result indicates, that other outlets and butcher shops sell high-quality poultry already in the conventional segment.

Regarding household characteristics, we find similar effects for population size and age categories as in the case of red meats. However, results indicate that different occupation types pay significant premiums for organic over conventional poultry. White-collar employees pay 9 % more for organic, freelancers 13 % more, housewives 14.0 % more, and farmers pay up to 72.8 % more for organic poultry than blue-collar employees. For household size and household income, we find the same effects as for red meat. Remarkably, the percentage differences in unit prices over income categories are nearly identical to those of red meat. Female shoppers are willing to pay more for poultry than male shoppers, all other things equal. We also find considerably increasing price premiums with increasing organic buying intensity, for both conventional as well as for organic poultry.

5 Discussion and conclusion

This paper's objective was to investigate determinants of price variation in the German market for fresh meat. A specific focus was on the price premium achieved by products of organic origin compared to their conventional counterparts and whether this premium differed across species and preparation type, distribution channel, and household characteristics. Based

on a large set of GfK household panel data, we estimated hedonic regressions separately for meat and poultry.

The estimated models explain up to 50 % of the variation in logarithmic meat prices with most explanatory variables showing significant and plausible effects. Our estimate for the basic effect of organic origin on meat price suggests a premium of 25 % over conventional meat. Results of the interactions between organic and other attributes show that organic premiums vary substantially across species and meat cuts. A general pattern is that channels and products generally perceived as cheaper turn out to have the highest organic premiums relative to conventional prices. For example, the organic price premium at butcher shops (+ 5.4 % relative to discounter) was significantly lower than that found for supermarkets (+ 25.1 %) and the organic premium of pork was significantly higher than that of beef and lamb. Interaction terms of organic and household characteristics such as sex, age, income, or household size are not significant.

Our findings for organic price premiums and their heterogeneity across distribution and product attributes point to important features of organic products on the fresh meat market. First, the organic attribute is rewarded more highly in products for which a grown texture and sensory traits are more important such as for roasts, steaks, and chicken breast. Second, we find a trade-off between organic and other indicators of meat quality such as beef for species and butcher shops with regard to distribution. Here, it seems that the additional value of the organic claim is less strong, because other attributes partly provide the same utility regarding trust, safety, or taste.

The additional willingness to pay for organic seems to be less of a secular amount that is put on top of each single product. Rather, even consumers who have a preference for organic meat apparently have an upper bound for the money they are willing to spend on organic meat and then choose the species (i.e. poultry), type (i.e. minced), or combinations of both that still lie within their budget. This notion implies that, notwithstanding varying differences in production costs for organic and conventional meat across species, providers of organic meat that is relatively cheaper in production realize higher margins. Partly huge differences between organic and conventional meat can be regarded as a major barrier for households to switch from conventional to organic meat.

References

- BMEL (2018): Federal Ministry of Food and Agriculture. Organic Farming in Germany. Available at: https://www.bmel.de/EN/Agriculture/SustainableLandUse/_Texte/OrganicFarmingInOrganic.html#doc381512bodyText11. Accessed 23.05.2018
- Buder, F., U. Hamm, M. Bickel, B. Bien and P. Michels (2010): Dynamik des Kaufverhaltens im Bio-Sortiment. Final report of research project 2809OE014 of the German 'Bundesprogramm Ökologischer Landbau'. [Dynamics of purchase behavior for organic products.] Research project funded by the German Federal Ministry of Nutrition, Agriculture and Consumer Protection (BMELV), Bonn and Berlin.
- Carlson, A. and E. Jaenicke (2016): *Changes in Retail Organic Price Premiums from 2004 to 2010*, ERR-209, U.S. Department of Agriculture, Economic Research Service, May 2016.
- Chang, J. B., Lusk, J., & Norwood, B. (2010): The Price of Happy Hens: A Hedonic Analysis of Retail Egg Prices. *Journal of Agricultural and Resource Economics* **35**, 406-423.
- Costanigro, M. and J. McCluskey (2011): Hedonic price analysis in food markets. In: Lusk, J.L., Roosen, J., Shogren, J.F. (eds.): *The Oxford Handbook of the Economics of Food Consumption and Policy*. Oxford University Press, New York, NY, 152-180.
- Cox, T.L., Wohlgenant, M.K. (1986): Prices and Quality Effects in Cross-Sectional Demand Analysis. *American Journal of Agricultural Economics* **68**, 908-919.
- Jaenicke, E. and A. Carlson (2015): Estimating and investigating organic premiums for retail-level food products. *Agribusiness* **31(4)**, 453-471.
- Krystallis, A., I. Arvanitoyannis and G. Chrysohoidis (2006): Is there a real difference between conventional and organic meat? Investigating consumers' attitudes towards both meat types as an indicator of organic meat's market potential. *Agricultural Economics* **12(2)**, 47-78.
- Lancaster, K.J. (1966): A new approach to consumer theory. *Journal of Political Economy* **74**, 132-157.
- Niessen, J. and U. Hamm (2008): Identifying the gap between stated and actual buying behaviour on organic products based on consumer panel data. Presented at the 16th IFOAM Organic World Congress, Modena, Italy, June 16-20, 2008.
- Parcell, J. and T. Schroeder (2007): Hedonic Retail Beef and Pork Product Prices. *Journal of Agricultural and Applied Economics* **39**, 29-46.
- Rosen, S. (1974): Hedonic prices and implicit markets: Product differentiation in pure competition. *Journal of Political Economy* **82**, 34-55.
- Schroeck, R. (2013): Valuing country of origin and organic claim: A hedonic analysis of cheese purchases. *British Food Journal* **116**, 1070-1091.
- Schulz, L., T. Schroeder and K. White (2012): Value of beef steak branding: Hedonic analysis of retail scanner data. *Agricultural and Resource Economics Review* **41**, 260-273.
- Smith, T., C. Huang and B.-H. Lin (2009): Estimating organic premiums in the US fluid milk market. *Renewable Agriculture and Food Systems* **24**, 197-204.
- Stumm, C. (2004): Wie „teuer“ sind Bio-Lebensmittel? [How 'expensive' are organic food products?] *Ökologie & Landbau* **132**, 45-46.

Appendix

Table 6: Results of linear hedonic regression for red meat, 2012-2014, dependent variable Price

	Direct effects			Variable x Organic		
	Coef.	S.E.		Coef.	S.E.	
Organic	0.683	(0.348)	**			
Species (Ref: Pork)						
Mixed	0.938	(0.022)	***	1.552	(0.179)	***
Beef	3.755	(0.044)	***	-1.026	(0.195)	***
Veal	9.051	(0.155)	***	6.023	(1.351)	***
Lamb	9.019	(0.168)	***	-0.220	(1.432)	
Meat Type (Ref: Minced)						
Ribs	0.765	(0.040)	***	-0.712	(0.330)	*
Chops	1.015	(0.027)	***	0.928	(0.202)	***
Roast	0.960	(0.029)	***	1.553	(0.220)	***
Goulash	1.562	(0.021)	***	0.855	(0.208)	***
Meatball	1.112	(0.038)	***	2.076	(0.508)	***
Tartare	2.042	(0.116)	***	0.731	(0.751)	
Schnitzel	2.746	(0.031)	***	1.028	(0.260)	***
Barbecue	3.304	(0.042)	***	-0.663	(1.085)	
Steak	3.846	(0.040)	***	1.566	(0.295)	***
Fillet	7.012	(0.079)	***	5.084	(0.425)	***
Other	0.894	(0.036)	***	0.271	(0.411)	
Over-the-counter	0.932	(0.031)	***	-1.805	(0.185)	***
Distribution channel (Ref: Discounter)						
Hypermarket	-0.053	(0.021)	**	0.802	(0.139)	***
Supermarket	0.777	(0.030)	***	2.565	(0.190)	***
Other	1.269	(0.099)	***	2.283	(0.234)	***
Butcher	2.412	(0.054)	***	1.446	(0.233)	***
Population (Ref: < 4,999)						
< 49k	0.163	(0.033)	***	0.108	(0.135)	
< 499k	0.206	(0.040)	***	0.343	(0.149)	**
> 500k	0.300	(0.053)	***	0.337	(0.159)	**
Age (Ref: 29 years and younger)						
30-39 years	-0.077	(0.036)	**	0.199	(0.259)	
40-49 years	-0.156	(0.036)	***	0.020	(0.248)	
50-59 years	-0.168	(0.036)	***	-0.134	(0.248)	
60-69 years	-0.173	(0.043)	***	-0.039	(0.256)	
70 years and older	-0.096	(0.051)	*	0.221	(0.275)	
Employment type (Ref: BC Employee)						
WC employee	0.087	(0.030)	***	0.093	(0.105)	
Civil servant	0.082	(0.065)		0.179	(0.176)	
Freelancer	0.023	(0.124)		-0.005	(0.257)	
Farmer	-0.268	(0.194)		1.072	(0.261)	***
Private means	0.048	(0.037)		0.006	(0.144)	
Self-employed	0.106	(0.065)		-0.010	(0.238)	
Household size (Ref: Single)						

2 person	-0.239	(0.040)	***	0.029	(0.149)	
3 person	-0.372	(0.050)	***	0.093	(0.180)	
4 or more	-0.509	(0.050)	***	0.172	(0.182)	
Household income (Ref: below 1,500 €)						
1,500-2,499 €	0.227	(0.030)	***	0.072	(0.125)	
2,500-3,499 €	0.397	(0.036)	***	-0.019	(0.134)	
3,500-4,499 €	0.660	(0.045)	***	-0.059	(0.146)	
4,500 € and more	0.992	(0.109)	***	-0.011	(0.228)	
Female	-0.031	(0.034)		0.029	(0.110)	
Organic buying intensity (Ref: Non-buyer)						
Occasional buyer	0.467	(0.073)	***	-0.246	(0.091)	***
Medium buyer	0.671	(0.110)	***	-0.164	(0.118)	
Intensive buyer	1.289	(0.256)	***	-0.661	(0.274)	**
Constant	2.567	(0.085)				
<i>N</i>	957,311					
<i>R</i> ²	0.51					

Note: *** p < 1 %; ** p < 5 %; * p < 10 %. Robust standard errors in parentheses. Regression additionally controls for year, month, and state effects. Price premiums in % computed by $(e^\beta - 1) \cdot 100$ %.

Source: Own computation based on GfK data 2012-2014.

Table 7: Results of linear hedonic regression for poultry, 2012-2014, dependent variable Price

	Direct effects			Variable x Organic		
	Coef.	S.E.		Coef.	S.E.	
Organic	-1.630	(1.726)				
Meat type (Ref: Chicken, other)						
Turkey, other	1.439	(0.030)	***	1.432	(0.584)	**
Other poultry	1.885	(0.088)	***	-0.089	(0.609)	
Chicken breast/fillet	2.890	(0.026)	***	9.404	(0.435)	***
Turkey breast/fillet	2.972	(0.027)	***	4.891	(0.397)	***
Goose	5.581	(0.293)	***	-2.383	(0.837)	***
Over-the-counter	-0.393	(0.061)	***	-1.123	(0.368)	***
Distribution channel (Ref: Discounter)						
Hypermarket	0.296	(0.032)	***	3.381	(0.930)	***
Supermarket	1.574	(0.046)	***	3.132	(0.747)	***
Other	2.349	(0.122)	***	1.653	(0.725)	**
Butcher	4.765	(0.132)	***	-0.840	(0.782)	
Population (Ref: < 4,999)						
< 49k	0.120	(0.039)	***	-0.099	(0.541)	
< 499k	0.115	(0.048)	**	-0.783	(0.639)	
> 500k	0.170	(0.060)	***	-0.222	(0.613)	
Age (Ref: 29 years and younger)						
30-39 years	-0.042	(0.042)		0.235	(0.965)	
40-49 years	-0.102	(0.044)	**	0.862	(0.997)	
50-59 years	-0.257	(0.044)	***	-0.662	(0.952)	
60-69 years	-0.303	(0.049)	***	0.079	(1.042)	
70 years and older	-0.253	(0.062)	***	0.637	(1.067)	
Employment type (Ref: BC employee)						
WC employee	0.111	(0.038)	***	1.640	(0.673)	**
Civil servant	0.099	(0.069)		1.017	(0.964)	
Freelancer	0.026	(0.144)		1.621	(0.939)	*
Farmer	-0.131	(0.245)		7.983	(1.203)	***
Private means	0.023	(0.048)		2.113	(0.773)	***
Self-employed	0.098	(0.082)		1.345	(1.043)	
Household size (Ref: Single)						
2 person	-0.357	(0.049)	***	0.172	(0.536)	
3 person	-0.469	(0.055)	***	0.298	(0.733)	
4 or more	-0.624	(0.058)	***	-0.519	(0.762)	
Household income (Ref: below 1,500 €)						
1,500-2,499 €	0.207	(0.038)	***	-0.712	(0.561)	
2,500-3,499 €	0.386	(0.044)	***	-0.312	(0.585)	
3,500-4,499 €	0.523	(0.051)	***	0.121	(0.636)	
4,500 € and more	0.841	(0.115)	***	-0.529	(0.814)	
Female	0.105	(0.041)	**	-0.276	(0.389)	
Organic buying intensity (Ref: Non-buyer)						

Occasional buyer	0.284	(0.064)	***	0.517	(0.536)	
Medium buyer	0.551	(0.107)	***	1.567	(0.550)	***
Intensive buyer	1.314	(0.298)	***	2.958	(0.764)	***
Constant	3.745	(0.119)	***			
<i>N</i>	342,076					
<i>R</i> ²	0.4226					

Note: *** $p < 1\%$; ** $p < 5\%$; * $p < 10\%$. Robust standard errors in parentheses. Regression additionally controls for year, month, and state effects. Price premiums in % computed by $(e^\beta - 1) \cdot 100\%$.

Source: Own computation based on GfK data 2012-2014.