Implicit Prices of Sustainability on the German Online Market for Honey

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Abstract

Sustainability characteristics play an increasing role in food markets. At least some consumers are willing to pay a price for organic or regional production, animal welfare or fairtrade. In order to analyse implicit prices of sustainability characteristics, it is important to go beyond consumer studies as such characteristics affect marginal costs as well. We employ a hedonic price analysis to compare the price premium of very different sustainability characteristics on the German online market for honey. Honey is particularly interesting, because it is perceived as a natural product, and regional and organic production competes with, for example, fairtrade products from developing countries. Consumer prices for honey contain positive as well as negative implicit prices for sustainability characteristics. Apparently, consumer valuation in terms of the marginal willingness to pay and marginal costs differ strongly across the sustainability characteristics.

Key Words

fairtrade; regional production; hedonic regression; honey prices; sustainability

1 Introduction

In many developed countries, consumers increasingly value eco-friendly and socially acceptable production when making purchasing decisions. Consumer studies have revealed positive assessments for various sustainability characteristics in foods. It has been shown that consumers have a positive marginal willingness to pay for characteristics such as ecological production (CRANFIELD, DEATON and SHELLEKERI, 2009), animal welfare (LAGERKVIST and HESS, 2011), fairtrade (DE PELSMACKER, DRIESEN and RAYP, 2005), local production (ADALJA, 2015), the region of origin or protected geographical indications (VAN DER LANS et al., 2001) and for combinations of sustainability criteria (DIDIER and LUCIE, 2008).

Although some authors have identified a 'consumer attitude-behavioural intention' gap for sustainable food consumption (VERMEIR and VERBEKE, 2006), the share of foods with sustainability characteristics has clearly risen. Taking Germany as an example, organic food sales increased by around 16% between 2015 and 2017 and rose in value to 10.04 billion euros in 2017 (BMEL, 2018). Sales of fairtrade products grew by about 15% between 2016 and 2017 and amounted to a total of 1,329 million euros in 2017 (FAIRTRADE DEUTSCHLAND, 2018).

Sustainability characteristics of foods are often credence attributes. Consequently, consumers suffer from quality uncertainty. Asymmetric information along the lines of AKERLOF's lemon problem (AKERLOF, 1970) prevails on the markets for sustainable foods. Hence, consumers are not only interested in the sustainability characteristics of foods, but also in the labelling of those credence attributes (see GRUNERT et al., 2014, for a survey; JANSSEN and HAMM, 2012, and LOUREIRO and MCCLUSKEY, 2000, for the labelling of organic production and protected geographical indications respectively and VAN LOO et al., 2014, for comparisons of sustainability labels).

For their part, manufacturers and retailers are interested in increasing the supply of products which deliver sustainability attributes. The incentive is a price premium that can eventually be realised with those product characteristics. An increasing literature refers to the question of whether a price premium can be captured by producers, manufacturers or retailers if they supply sustainable foods.

Consumer-oriented willingness-to-pay studies are not adequate to analyse the impacts of sustainability characteristics on consumer prices. Hedonic price analyses are preferable since, according to the basic approach of ROSEN (1974), the supply of and demand for characteristics have to be taken into account. Sustainability characteristics will affect not only consumers' demand but also the marginal costs of supplying these characteristics. Hedonic price models have been applied to include sustainability characteristics such as animal welfare (CHANG, LUSK and NORWOOD, 2010) or to general quality characteristics, including regional

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origin (COMBRIS, LECOQ and VISSER, 1997). However, the application of hedonic price analysis to a larger variety of sustainability characteristics has been rare. This is the focus of our analysis.

It is the objective of our study to investigate how various sustainability characteristics affect the market price and, thereby, the marginal willingness to pay in an empirical case study for the German honey market. Honey seems to be particularly interesting, as its product characteristics include multiple sustainability criteria and thus allows a comparison of their implicit prices: honey is a low-processed food, which can be produced organically and offered in environmentally friendly packaging. Furthermore, it is one of the few products that may originate in developing countries and qualify for fairtrade, or it can also be a domestic product of regional origin. Hence, it is possible to compare the implicit price for fairtrade with that of regional production. Such a comparison is not feasible for the most important fairtrade products (e.g. coffee, cocoa and bananas), as these commodities are cultivated solely in developing countries and not in industrialised countries.

The article is organized as follows. In Section 2, some background information on the German market for honey – including the online market – will be provided. In Section 3, we will elaborate in a theoretical analysis that the market price may or may not rise if a sustainability characteristic is added to a food product. The effect will depend on the implications of sustainability for preferences and marginal costs. In Section 4, the impacts of sustainability characteristics on German honey prices will be analysed with a data set of honey prices on the German online market. The data will be described, the empirical model outlined, and results will be presented and interpreted. We will discuss major results and derive some implications for future research in Section 5.

2 The German Market for Honey

The German market for honey is only briefly sketched here as it is described in detail elsewhere (see KRANDICK, 2015, and EFKEN and BERNHARDT, 2016). Germany is a large net importer of honey with a self-sufficiency ratio of about 27% in 2016. Honey production, consumption, and imports amounted to 21,600, 81,200 and 59,600 tonnes, respectively (BLE, 2017). Foreign honey is usually imported in bulk in steel drums with a volume of 200 litres (300 kilograms). Due to high freight costs and quality concerns, pre-packaged honey is hardly ever imported (CBI, 2009: 25).

The domestic honey industry consists of approximately 40 small and medium-sized companies. Honey packers have their private labels under which they sell to retailers (CBI, 2009: 14-15). Blended honey from different geographical origins or different floral sources accounts for the major share (ibid.: 27). However, German apiculture remains a largely non-professional activity. About 95% of German beekeepers pursue beekeeping as a hobby (BMELV, 2013: 4). In line with the overwhelming number of small-scale hobby beekeepers, as much as 80% of domestic honey is sold directly to consumers (EC DG AGRI, 2013: 86-87). Both domestic beekeepers and the domestic honey industry may also offer German honey, labelled with the brand “Echter Deutscher Honig” of the Deutscher Imkerbund (D.I.B.). The D.I.B. is the (national) umbrella organisation of hobby and part-time beekeepers, consisting of approximately 92,000 members, i.e. 92% of German beekeepers (EFKEN and BERNHARDT, 2016). Honey carrying the D.I.B. label needs to fulfil higher quality criteria than required by the German honey regulation (EC DG AGRI, 2013: 64).

German honey legislation regulates quality requirements as well as honey labelling. An indication of the honey’s country of origin is mandatory. If the honey is blended from different countries, it may also be declared as “a mixture of honey from EU and non-EU countries”. Furthermore, voluntarily stating the honey’s regional, territorial or topographical origin (e.g. honey from Luneburg Heath) is permitted. Organic honey production is regulated in the European Organic Regulation (EC) No. 834/2007 (Article 14) as well as in the Commission Regulation (EC) No. 889/2009 (Articles 13, 18, 19, 25). EU legislation constitutes minimum requirements for organic apiculture, while standards of the organic agricultural associations (e.g. Bioland, Demeter, Naturland) impose additional specifications on beekeeping and call for a higher product quality. For honey, organic quality is less a question of the bees’ food source and more a question of how the apiarist keeps the honeybees and processes the honey. For instance, synthetic chemical veterinary medicine, which is most effective in treating the parasitic varroa mite, is not allowed in organic production. Furthermore, organic honey cannot be fully harvested in summer. A reserve needs to be kept instead, in order to feed the bees with their own honey in colder periods. As a result, the German production volume of organic honey is limited (CBI, 2009: 11). However, the growth rates of fairtrade honey sales

have been high, fostered by an increased collaboration of retail companies with own brands (e.g. Aldi, Kaufland, REWE Group). In 2002, the globally uniform fairtrade label was introduced. In Germany, the label of the Fairtrade Labelling Organizations (FLO) is assigned by Trans-Fair e.V. Licensees are retailers, importers and producers. Monitoring and certification are executed by the independent FLO-Cert GmbH (FLO, 2017). Additionally, the GEPA label is important. GEPA, founded in 1975, imports, distributes and sometimes also processes products from Asia, Africa and Latin America. Its product range is monitored and certified by the established international monitoring and certification systems, such as FLO, the World Fair Trade Association (WFTO) and European Free Trade Association (EFTA) (GEPA, 2015: 1).

3 Theoretical Analysis: Sustainability Characteristics and Market Prices

The following theoretical model can be formulated for a quality-differentiated market such as honey:

$$q^S = \alpha_0 + \alpha_1 \cdot p + \alpha_2 \cdot Z_i + \alpha_3 \cdot SUST$$

(supply function) (1)

$$q^D = ß_0 + ß_1 \cdot p + ß_2 \cdot Z_j + ß_3 \cdot SUST$$

(demand function) (2)

$$q^D = q^S$$

(equilibrium condition) (3)

q^S (q^D) is the quantity supplied (demanded) of a product, p is its price, Z_i (Z_j) refers to a vector of supply-shifting (demand-shifting) characteristics i (j) other than sustainability, and *SUST* is a product characteristic indicating the sustainability of production.

The following signs of the price and quality coefficients of equations (1) and (2) can be expected:

$\alpha_1 > 0$, $\alpha_2 \gtreqless 0$, $ß_1 < 0$, $ß_2 \gtreqless 0$. If the sustainability characteristic, such as organic production or fairtrade, is valued by consumers, we can expect $ß_3 > 0$. If the sustainability characteristic induces higher production and/or processing standards, such as for organic production, this will ceteris paribus raise marginal costs: thus the quantity supplied at each price will be lower under ceteris-paribus conditions than for the conventional product, i.e. $\alpha_3 < 0$. Theoretically, it may happen that the sustainability characteristic is associated with declining marginal costs. If consumers value local or regional production compared with, for example, production outside the region, lower transport costs might lead to lower marginal costs and $\alpha_3 > 0$. In a situation in which production of a food like honey occurs domestically as well as in developing countries, favourable climatic conditions may lead to lower marginal costs in developing countries. Hence a fairtrade variant of the product may be associated with lower marginal costs than a conventional domestic product: Again, $\alpha_3 > 0$ will then hold. In general, the coefficient is a priori indeterminate: $\alpha_3 \gtreqless 0$. The sign of α_3 depends on the sustainability characteristic.

In order to elaborate how sustainability affects the market price, we can solve the equation system (1) to (3) for the situations with (*SUST* = 1) and without (*SUST* = 0) the sustainability characteristic and compare the market prices. For the product with an additional sustainability characteristic, the market price p can be derived by entering (1) and (2) in (3) and after some reformulations:

$$p = \frac{ß_0 - \alpha_0}{\alpha_1 - \beta_1} + \frac{ß_2}{\alpha_1 - \beta_1} \cdot Z_j - \frac{\alpha_2}{\alpha_1 - \beta_1} \cdot Z_i + \frac{ß_3 - \alpha_3}{\alpha_1 - \beta_1} \cdot SUST. \quad (4)$$

For the product with identical other features but without the sustainability characteristic the hypothetical market price p^* can also be derived from (1) to (3), now under the assumption *SUST* = 0:

$$p^* = \frac{\beta_0 - \alpha_0}{\alpha_1 - \beta_1} + \frac{\beta_2}{\alpha_1 - \beta_1} \cdot Z_j - \frac{\alpha_2}{\alpha_1 - \beta_1} \cdot Z_i \quad (5)$$

The effect of sustainability on the market price is then

$$\Delta p = (p - p^*) = \frac{\beta_3 - \alpha_3}{\alpha_1 - \beta_1} \cdot SUST. \quad (6)$$

Despite the highly stylised nature of the model, it is possible to draw some important conclusions from equation (6). If the sustainability characteristic is valued by consumers ($ß_3 > 0$), this will induce a price-raising effect under ceteris-paribus conditions. If the sustainability characteristic leads to increasing marginal costs compared with the conventional alternative ($\alpha_3 < 0$), as for organic production, this will reinforce the price-raising effect. If a sustainability characteristic leads to lower marginal costs than the conventional alternative, as may happen for regional production or fairtrade with better climatic conditions abroad, the demand-side effects of sustainability on the market

price may be mitigated. It could even happen that the product with the sustainability characteristic might be provided at lower prices: this is the case if ($ß_3$ - α_3) < 0. Most likely, however, sustainability will often be associated with higher market prices and ($ß_3$ - α_3) > 0. In that case, the positive implicit price of sustainability $\left[\left(ß_3-\alpha_3\right)/\left(\alpha_1-ß_1\right)\right]$ will be higher the more price-inelastic the supply (α_1) as well as demand ($|ß_1|$).

4 Empirical Analysis: How Sustainability Characteristics Affect Honey Prices on German Online Markets

4.1 Data

The empirical analysis combines price data from four German online food shops. The data set consists of 426 prices, which were collected from the webshops myTime.de (82 prices), gourmondo.de (51 prices), bio mondo.de (39 prices) and heimathonig.de (254 prices) in January 2015. These four online shops were chosen in order to represent the brick-and-mortar distribution channel for honey in Germany for that month. myTime.de was selected in order to represent German supermarkets. The webshop belongs to the German Buenting E-Commerce GmbH and offered about 31,000 products. Its product range, as well as its price level, resembles a stationary supermarket. gourmondo.de was chosen to reflect specialist retailers. The webshop of the Gourmondo Food GmbH offered around 17,000 international and German products and claimed to be the leading German online shop for international delicacies and specialities. biomondo.de was selected to represent organic food shops. This organic webshop also belongs to the Gourmondo Food GmbH but it offered a reduced range of 5,000 products that were all certified organic. 19 kinds of honey offered on gourmondo.de were sold at equal prices in the biomondo.de webshop. In order to prevent perfect collinearity, these kinds of honey were only taken into consideration in the gourmondo.de data set. The internet platform heimathonig.de was chosen to mirror direct sales to consumers. Approximately 200 German beekeepers offered their honey on this platform. Local beekeepers could be found on heimathonig.de by entering a German postcode or by selecting a certain area on a map of Germany.

The retail price of 500 grams of honey constitutes the dependent variable. Prices of honey with a different weight are converted to the common 500 gram package size. All available prices of packaged honey were taken into account, although delivery charges and special offer prices were not considered.[1] The Food Information Regulation (EU) No. 1169/2011 requires that all relevant product information be made available to consumers before purchase. In the case of online trade the required information needs to be available on the relevant website of the online shop. Hence the webshops provide information about generic product characteristics such as packaging, weight, brand, consistency, additives (e.g. herbs or nuts), the method of honey extraction and the botanical type of honey. The main variables of interest are the defined sustainability characteristics, namely organic production, fairtrade, environmentally friendly packaging and regional production. Product descriptions, as well as pictures, reveal whether a honey is produced organically and labelled with the Bioland or the EU organic label.[2] Furthermore, it is possible to see whether a honey is fairly traded and therefore carries the FLO or GEPA label. If a honey´s name contains a certain German region (e.g. “Chestnut honey from Palatinate”), it is recorded as regional German honey. The internet platform heimathonig.de shows the regional origin of each available honey, which is recorded accordingly. Six German regions are distinguished in the empirical analysis. In order to define these regions, German federal states were aggregated according to whether they have homogenous landscapes and beekeeping structures (i.e. the number of bee colonies per beekeeper, the productivity of bee colonies, historical price levels for honey). The German region “North” consists of the Federal States Lower Saxony (NI), Schleswig-Holstein (SH) and Bremen (HB). “Mid-West” comprises Hesse (HE), North Rhine-Westphalia (NW), Rhineland-Palatinate (RP) and Saarland (SL). Brandenburg (BB), Mecklenburg-West-Pomerania (MV), Saxony (SN), Saxony-Anhalt (ST) and Thuringia (TH) constitute the German region “East”. Bavaria (BY) represents the region “South East”

[1] If a honey was on sale, still the regular price was recorded.

[2] The hexagonal German organic label can be used voluntarily, in order to complement the EU organic label. In the empirical analysis it is not further distinguished whether a honey carries the German organic label or not. That is to say, there is no extra variable for the German organic label. Honey carrying the German organic label in addition to the EU label, is rather considered as produced according to EU legislation and certified with the EU organic label.

and Baden-Wuerttemberg the region "South West". Hamburg and Berlin are seen as "Metropolitan Areas". Table 1 provides descriptive statistics of the variables used in the empirical estimations.

With respect to sustainability characteristics, Table 1 reveals that most honeys are produced and traded conventionally in the assortment of the webshops myTime.de, biomondo.de and gourmondo.de. About

Table 1. Descriptive statistics

	Quantity		Price (€/500g)			
Variable	**Number (*n*)**	**Share (%)**	$(\bar{x})$ [a)]	***S*** [a)]	**Min**	**Max**
Vendors (*V*)						
Online Shop						
myTime.de (Base Category)	82	19.2	7.54	3.34	2.49	18.30
gourmondo.de	51	12.0	12.25	8.99	4.39	46.95
biomondo.de	39	9.2	8.39	1.99	3.89	13.99
Heimathonig.de	254	59.6	8.53	3.61	4.79	22.71
Product characteristics (*PC*)						
Multipack	25	5.9	8.68	5.83	5.83	33.69
Brand						
Packer's brand (BC)	121	28.4	8.19	4.44	3.89	35.60
Private label	14	3.3	5.07	1.95	2.49	7.98
Deutscher Imker Bund (D.I.B.)	74	17.4	7.10	1.59	5.20	12.20
Individual beekeeper	195	45.8	9.13	3.89	4.79	22.71
Foreign brand	22	5.2	16.81	9.07	9.36	46.95
Consistency						
Liquid & other (BC)	186	43.7	9.23	5.16	2.49	46.95
Creamy	240	56.3	8.42	4.18	2.49	33.98
Additives (Herbs, spices etc.)	37	8.7	16.40	8.14	6.98	46.95
Non-standard extraction	4	0.9	14.23	1.91	11.5	15.9
Type (botanical origin)						
Polyfloral (BC)	266	62.4	8.27	4.13	2.49	33.69
Monofloral blossom	78	18.3	10.23	6.33	4.99	46.95
Heather	14	3.3	11.93	2.72	6.99	16.90
Rapeseed	33	7.7	7.05	2.24	4.79	16.67
Fir	8	1.9	9.85	1.21	7.79	11.99
Exotic	27	6.3	9.68	5.48	5.78	33.98
Sustainability Characteristics (*SC*)						
Organic						
Non-organic (BC)	284	66.7	8.65	4.80	2.49	46.95
EU organic label	110	25.8	9.14	4.83	3.89	33.98
Bioland label	32	7.5	8.55	1.54	6.50	11.99
Fairtrade						
Non-fairtrade (BC)	410	96.2	8.84	4.71	2.49	46.95
FLO label	3	0.7	6.82	2.01	4.49	7.98
GEPA label	13	3.1	7.09	1.58	4.39	9.27
Packaging						
Glass (BC)	401	94.1	8.86	4.72	2.49	46.95
PET dispenser	18	4.2	6.54	2.05	2.79	11.98
Other	7	1.6	9.77	3.29	5.50	14.27
Origin						
EU-non-EU mix (BC)	24	5.6	5.84	2.47	2.49	13.96
Germany						
Regional German honey	31	7.3	10.85	5.87	5.29	35.60
North (HB, NI, SH)	45	10.6	8.09	3.10	4.95	15.90
Mid-West (HE, NW, RP, SL)	27	6.3	7.18	1.29	5.50	10.58
East (BB, MV, SN, ST, TH)	40	9.4	7.35	2.97	4.79	17.00
South East (BY)	93	21.8	8.60	2.98	5.20	21.90
South West (BW)	43	10.1	8.13	2.29	5.50	18.95
Metropolis (HH, BE)	17	4.0	15.62	5.62	6.65	22.71
Foreign honey						
Foreign country	74	17.5	10.58	6.91	3.89	46.95
EU Mix	18	4.2	7.29	1.49	4.99	10.99
Non-EU Mix	14	3.3	5.77	1.41	3.99	7.98
Total	**426**	**100**	**8.77**	**4.64**	**2.49**	**46.95**

Notes: a) $\bar{x}$ is the arithmetic mean, s the standard deviation.
Source: own computations

one third is produced organically: while one quarter is certified with the EU organic label, around 8% is produced according to Bioland standards. The data set contains about 4% fairtrade honeys: 3% carry the GEPA label and the remaining one percent is marked with the FLO label. Glass is by far the most common means of packaging, with 94% of honeys being sold in a glass container. With respect to the origin, 7% of honeys in our sample are produced in Germany without any further regional specification, 62% can be assigned to one of the defined German regions and are therefore considered to be regional honey. Around 18% come from a single foreign country and 13% are blended from different international origins.

The average price for 500 grams of honey comes to 8.77 euros, with a standard deviation of 4.64 euros. Thus, the coefficient of variation of observed honey prices is 53%. The cheapest honey is a polyfloral honey, offered as a private label product on myTime.de at a price of 2.49 euros per 500 grams. It is sold in a glass container and is neither traded fairly nor produced organically or regionally. Instead, it contains a mixture of honey from EU and non-EU countries. gourmondo.de offers the most expensive honey at 9.39 euros per 100 grams (i.e. 46.95 euros per 500 grams). It is a liquid monofloral blossom honey, refined with additives, and is of a single-country origin. Accordingly, its glass container is labelled with a foreign brand name. The honey comes neither from organic production nor is it fairtrade.

When comparing arithmetic means, sustainability characteristics are associated with honey prices that are above and, in some cases, below average. Organic honey carrying the EU organic label is sold for 9.14 euros per 500 grams, an above-average price. Bioland-labelled honey reaches an average price level of 8.55 euros per 500 grams with a comparatively low coefficient of variation of 18%. With respect to the origin, it is remarkable that honey from German metropolitan areas reaches an average price level much above the overall average, which is most likely due to its scarcity. Honey mixtures from abroad are sold at prices below average. It is striking that fairtrade honey is sold at a price level below average, too. Honey carrying the FLO label costs 6.82 euros per 500 grams on average and GEPA-labelled honey has an average price of 7.09 euros per 500 grams. A closer look at generic product characteristics reveals very high average prices for honey carrying a foreign brand name (16.81 euros/500 grams), for honey with additives (16.40 euros/500 grams), for non-standard ways of extraction (14.23 euros/500 grams) and for the special honey type heather (11.93 euros/500 grams).

4.2 Empirical Model and Hypotheses

The empirical model is based on hedonic price analysis. Whereas pure consumer studies elaborate the hypothetical willingness to pay for product characteristics with survey or experimental techniques, hedonic price analysis is based on observed market data. Moreover, it was shown in the seminal contribution by ROSEN (1974) that implicit prices of product characteristics are driven by the demand for and supply of those characteristics.

Many specification issues should be considered in hedonic price analysis (for surveys, see TRIPLETT, 2006; COSTANIGRO and MCCLUSKEY, 2011). The approach chosen here follows earlier work in two important respects: (i) With regard to the functional form of the hedonic price equation, several alternatives have been estimated and compared. The most widely used function in hedonic analysis is the semi-logarithmic specification. It outperformed alternative specifications in our case, too, and provided plausible and robust results. It will be presented in the following. (ii) As our data include information on price but not quantity, it is not possible to estimate demand coefficients from the hedonic model as well as actual willingness to pay from a demand function. We concentrate rather on the reduced form of a supply-and-demand model in which actual prices represent market equilibria and are explained by supply and demand shifters. As we find in hedonic price analyses for other food markets (e.g., SCHOLLENBERG, 2012; SCHRÖCK, 2014), which address sustainability characteristics, too, price determinants include the retailer type, brands and detailed product characteristics.

The hedonic price function is estimated as a function of vectors considering online vendors (*V*), product characteristics (*PC*) and sustainability characteristics (*SC*):

$$\ln(p_i) = a_i + \sum_{j=1}^{3} b_j * V_{ji} + \sum_{k=1}^{14} c_k * PC_{ki} + \sum_{l=1}^{16} d_l * SC_{li} + u_i \quad (7)$$

The dependent variable p_i is the equilibrium price in euros per 500 grams of honey i. *a*, *b*, *c* and *d* are the parameters to be estimated and u_i is the stochastic error term. Vectors *V*, *PC*, and *SC* contain the explan-

atory variables, which are assumed to be exogenously given. Vector *V* represents the different online vendors. Vector *PC* consists of generic product characteristics (i.e. brand, consistency, additives, method of extraction, botanical type, weight in grams and type of packs). Vector *SC* contains sustainability characteristics, being the main variables of interest. *SC* includes variables for organic production, fairtrade, packaging material and origin:

$$\sum_{l=1}^{16} d_l \cdot SC_{li} = \sum_{l=1}^{2} d_l \cdot organic_{li} + \sum_{l=3}^{4} d_l \cdot fairtrade_{li} + \sum_{l=5}^{6} d_l \cdot packaging_{li} + \sum_{l=7}^{16} d_l \cdot origin_{li} \quad (8)$$

All variables, as well as their descriptive statistics, can be found in Table 1.

The explanatory variable *grams* is a metric variable and we deviate from a purely semilogarithmic model structure as the (natural) logarithm of this variable is utilised. This modification of the semilogarithmic functional form yielded a further increase of the corrected coefficient of determination. All other independent variables are qualitative variables and they are considered to be dummy variables in the regression model. For *m* categories of a qualitative variable, (*m*-1) dummy variables may be introduced. One category remains as reference or base category (*BC*). In the basic model, the base honey is offered in the webshop myTime.de and carries a German packer's brand name. It is a polyfloral honey without additives and it is of liquid (or other than creamy) consistency. It is extracted with common extraction methods, e.g. by means of using a spinning extractor and not pressed or scraped. With regard to sustainability characteristics, the honey is produced conventionally (i.e. not organic) and traded conventionally (i.e. it is not fairtrade). The honey is sold in a glass container and is described as a blended honey from countries within the European Union and non-European nations, without any further regional specification.

The existence of heteroscedasticity is likely to occur in cross-sectional data. Results of the White test confirm that the error term is not of constant variance. Therefore, heteroscedasticity-consistent standard errors according to WHITE (1980) are used in the estimations. The problem of multicollinearity has to be considered when defining explanatory variables. In order to test for multicollinearity, a Pearson correlation of the independent variables was examined. Various techniques have to be used to test for multicollinearity as our model contains mostly qualitative variables and one quantitative variable. No serious multicollinearity was detected.[3]

The impact of sustainability characteristics on price is determined by preferences for as well as marginal costs of providing these characteristics, i.e. by demand and supply factors. For some defined sustainability characteristics, such as organic production, it is expected that supply-side and demand-side effects work in the same direction, i.e. they increase prices. Additional costs of control and certification of organic production, together with additional costly requirements for organic beekeeping (e.g. parasite medicine, bee feed), seem to explain higher marginal costs and therefore justify a price premium from a supply-side perspective. Furthermore, preceding articles reveal that consumers appear to value certified organic quality with an increased willingness to pay for foods in general (JANSSEN and HAMM, 2012), particularly for fruits and vegetables (HUANG and LIN, 2007) and also for honey (COSMINA et al., 2016).

Previous empirical consumer research indicates that consumers favour regional foods (HENSELEIT et al., 2007) and also local (WU et al., 2015) or domestic versus foreign honey (COSMINA et al., 2016). Therefore, we posit that consumers prefer regional German honey to honey from Germany without regional traceability. On the supply side, a price premium for regional German honey can be expected, as regional honey is solely available in restricted quantities compared with honey which can be purchased and mixed from all over Germany. For all foreign honey and honey mixtures with foreign honey, a negative implicit price seems plausible. From a supply-side perspective, comparatively unfavourable climatic conditions exist in Germany, plus relatively low degrees of professionalisation (EC DG AGRI, 2013: 114 et seq.) and rather high wages (BLS, 2016) which apply for professional beekeepers. It is expected that lower international wages, economies of scale and better climatic conditions overcompensate for costs of international transport, as honey is usually imported as sea freight in large volumes. Hence, for honey that is packaged

[3] There is a positive correlation between the variables 'multipack' and 'grams'. When omitting the dummy variable for multipacks, statistical criteria deteriorate. This seems to be plausible, when considering that multipacks do not just contain large savings packages with a particularly high weight, but also small sample-size packages with a particularly low weight.

before transportation, the effect of high international transportation costs should be depicted in the dummy variable 'foreign brand'.

A further conjecture is that honey in glass containers is sold at higher prices than in PET dispensers because of higher costs of transportation, storage and breakage. Besides, consumers might prefer its ecological friendliness, safety for health, flavour-preserving characteristics and aesthetics.

Empirical evidence suggests that in the case of other products consumers are also willing to pay a price premium for fairly traded and produced goods (e.g. DE PELSMACKER et al., 2005). Fair prices have been defined in the fairtrade standards of the FLO. The 'fair price' consists of a Fairtrade Minimum Price and a Fairtrade Premium. The Fairtrade Minimum Price covers producers' average costs of production and is based on the honey´s quality and nature. Additionally, the mandatory Fairtrade Premium needs to be paid to the producer organisation. Its use is restricted to investment into social and economic development projects within the producing community (FLO, 2016: III). These arguments suggest that fairly traded honey might be priced above a conventional honey at the producer and consumer level. However, opposing impacts may also arise. On the demand side, honey is often seen as a natural product which can be supplied from the consumer's own region. Therefore, it is likely that the preference for the fairly traded foreign product honey is weaker than for coffee, cocoa or bananas where no domestic or regional substitutes coexist. Possibly, there is no or only a small additional willingness to pay for fairly traded honey by domestic consumers. On the supply side, better climatic conditions might induce a cost advantage of developing countries (EPOPA, 20015) that could lead to lower prices than for a standard domestic honey. This effect might be stronger than the additional costs induced by the fairtrade labelling and certification. Thus, it is a purely empirical question whether the fairtrade characteristic is either associated with a positive or a negative implicit price on the consumer market for honey.

4.3 Empirical Results

4.3.1 Implicit Prices of Sustainability Characteristics in the Hedonic Honey Price Model

The chosen semilogarithmic model explains 69.9% of the observed variation in (the natural logarithm of) prices across all four online shops. Altogether 23 characteristics affect honey prices significantly at the 95% to 99.9%-levels. Table 2 provides the estimated regression coefficients as well as relative price effects and implicit euro prices of the individual honey characteristics.

Starting with the sustainability characteristics of special interest, it is striking that some sustainability attributes do affect honey prices significantly: 10 of the 15 estimated coefficients appear to be significantly different from zero. While parameter estimates show that organic, regional and fairtrade production affect honey prices significantly, there is no significant difference in price levels for different materials of packaging. However, the magnitude and direction of price effects vary considerably between the significant sustainability attributes: Bioland-certified honey, as well as honey from Germany (all regions and in total), honey from a foreign country and a European blend of honey achieve substantially higher price levels compared with the base category. A negative price effect occurs for fairtrade honey carrying the GEPA label. Positive implicit prices might arise both from additional production costs and from a high consumer valuation. Conversely, price discounts might be caused as much by particularly low costs of production as by a reduced preference for fairtrade honey.

As expected, the price of Bioland-certified honey is significantly higher than the price of conventional honey. The regression coefficient of the Bioland dummy indicates that Bioland honey generates a price premium of 13.5%, which translates into an absolute price premium of 0.65 euros per 500 grams, while holding all other characteristics constant. Interestingly, EU organic certification does not yield a significant price bonus. As price effects are determined by supply as well as demand factors, there could be several reasons. EU organic certification seems neither to increase production costs substantially nor to lead to an increased product valuation by consumers. This finding seems to be plausible in the case of honey when considering that beekeeping requires relatively few input resources, such as bee feed or bee housing.

On the demand side, we have taken into account that consumers might already classify honey itself as an ecological and natural product, even if it is not produced organically and certified organic (ANSPACH et al., 2009: 391). Exceeding EU organic legislation, Bioland standards impose the additional (costly) requirements, membership fees and a higher product quality. On the demand side, it is likely that eco-conscious consumers value Bioland quality with a higher willingness to pay. For these reasons, the price premium of 13.5% is very plausible.

In general, using a blend of honey from Europe and foreign countries as the reference category, the importance of regional origin in the context of honey stands out. Compared with this base category, only non-EU mixtures do not achieve a price premium. All other coefficients for the regional origin are significant at the 95%- up to the 99.9% level. Table 2 depicts a high price premium for honey produced in Germany and lists price effects from 23.2% (Eastern Germany) to 53.1% (South West) for the German regions. Ceteris paribus, a honey which is marked as from German origin realises a price that is 39.1% above the price of an EU-non-EU-mix honey. The highest price premium holds for urban German honey with 66.6% or 3.20 euros per 500 grams. These findings indicate that consumer segments do exist which very clearly prefer German honey and honey from German regions to blended honey from unspecified sources.

From the supply side, it seems plausible that regional honey leads to an increased price level, as

Table 2. Estimation of the semilogarithmic hedonic price function

Dependent variable ln(p)	**Independent variables and results**				
Variable	**Specification**	**Coefficient**	**Price effect** [a] **(%)**	**Price effect** [b] **(%)**	**Implicit price**[c] **(€)**
Constant Term		3.503***			
Vendors (*V*)					
Onlineshop (BC: myTime.de)	gourmondo.de	-0.046			
	biomondo.de	0.006			
	Heimathonig.de	-0.010			
Product Characteristics (*PC*)					
Ln (grams)		-0.311***	-26.73	-26.78	-1.29
Multipack (BC: Singlepack)	Type of pack	0.430***	53.73	53.28	2.56
Brand (BC: Packer's brand)	Private label	-0.233***	-20.78	-21.01	-1.01
	D.I.B.	0.018			
	Individual beekeeper	0.076			
	Foreign brand	0.518***	67.87	66.98	3.22
Consistency (BC: Liquid & other)	Creamy	-0.073**	-7.04	-7.07	-0.34
Additives (BC: No additives)	Additives	0.377***	45.79	45.59	2.19
Standard-Extraction	Other (e.g. pressing)	0.279*	32.18	31.51	1.52
Type (BC: Polyfloral)	Monofloral blossom	0.150***	16.18	16.12	0.78
	Heather	0.349***	41.76	41.40	1.99
	Rapeseed	-0.075(*)	-7.32	-7.27	-0.35
	Fir	0.248**	28.15	28.06	1.35
	Exotic	0.163**	17.70	17.36	0.83
Sustainability Characteristics (*SC*)					
Organic (BC: non-organic)	EU organic label	0.036			
	Bioland label	0.128*	13.65	13.55	0.65
Fairtrade (BC: non-fairtrade)	FLO label	0.108			
	GEPA label	-0.195**	-17.72	-18.02	-0.87
Packaging (BC: glass)	PET dispenser	-0.026			
	Other	0.111			
Origin (BC: EU-non-EU mix)	German Region: North	0.335***	39.79	39.06	1.88
	German Region: Mid West	0.284**	32.84	32.11	1.54
	German Region: East	0.215*	23.99	23.23	1.12
	German Region: South East	0.406***	50.08	49.18	2.37
	German Region: South West	0.432***	54.03	53.13	2.56
	German Region: Metropolis	0.518***	67.87	66.62	3.20
	Germany (total)	0.333***	39.51	39.10	1.88
	Foreign Country	0.358***	43.05	42.57	2.05
	EU Mix	0.292***	33.91	33.62	1.62
	Non-EU Mix	0.114			
Test statistics					
n = 426; Adjusted R^2 = 0.699; F-value = 30.9; White-Test p-value = 0.000.					

Notes: BC = Base Category; ***, [**, *, (*)] Significantly different from zero at the 99.9%-[99%-, 95%-, (90%)-] level.

[a] In semilogarithmic equations, the percentage impact of a dummy variable on the dependent variable is estimated according to HALVORSEN and PALMQUIST (1980) as: 100 * (e^{β}-1), e.g. for the Bioland variable: 100 · ($e^{0.128}$-1) = 13.65%.

[b] In semilogarithmic equations, the percentage impact of dummy variables on the dependent variable can also be estimated according to KENNEDY'S approach as $100\left(e^{(\beta-0{,}5V(\beta))}\right)-1$). This leads to consistent and (almost) unbiased estimations of the price effect (VAN GARDEREN and SHAH, 2002).

[c] Compared with the base category (BC): implicit euro prices are calculated using the mean price of 4.81 euros per 500 grams and the price effect according to Kennedy's approach. Implicit prices are shown only if regression coefficients are significantly different from zero at the 90% level at least.

Source: own computations

regional honey is only available in limited quantities. Beekeepers in metropolitan areas in particular tend to keep fewer than average colonies of bees, and total amounts of harvested honey are comparatively low. The South of Germany is characterised by its woodlands, which implies a more extensive method of apiculture. On the demand side, consumers in the South of Germany and in bigger cities like Hamburg and Berlin, are willing to pay extra for regionally produced honey. Those preferences for regionally produced commodities are in line with previous consumer research (e.g. BMEL, 2017: 11-24). Most of the popular fir honey (which induces a price premium of 28.1% compared to polyfloral honey) is mainly harvested in the Southern German forests. A sensitivity analysis showed additionally that the implicit prices of a regional origin are very dependent on the choice of the reference region.

Descriptive statistics in Table 1 showed that fairtrade honey reaches a sub-average price level in the examined data set. Estimation results of the hedonic analysis comply with the finding that certified fairtrade honey yields a markdown compared with conventionally traded honey. While GEPA-labelled honey experiences a price discount of 18.0% (0.87 euros), which is significant at the 99% level, the FLO label does not influence the honey price significantly. When interpreting estimation results, the coefficients of the fairtrade variables have to be compared with the benchmark category non-fairtrade honey. On the supply side, additional fairtrade costs arise from FLO certification and the social Fairtrade Premium of 20 US cents per kilogram (FLO, 2016: 27). Apparently, those are overcompensated or at least compensated for GEPA and FLO-labelled honey respectively by lower production and procurement costs compared with non-fairtrade honey. It seems consistent to reason that price discounts for GEPA honey, compared with non-fairtrade honey, are a result of particularly low production and procurement costs. On the demand side, it is striking that no price premium for the characteristic fairtrade is visible if we control separately for other important characteristics such as regional origin.

Estimation results do not yield a significant price impact of different packaging materials. PET packages will require less input, transportation and storage costs compared with glass. However, it might be that consumers appreciate PET dispensers that they find are particularly convenient to use. Thus, the overall price effect of PET dispensers is theoretically indeterminate.

We can draw a general conclusion on the role of regional origin and fairtrade from these findings: the marginal willingness to pay is clearly higher for German honey and honey from German regions than for blended honey from unspecified regions and also for fairtrade-labelled honey. Apart from the effects of sustainability characteristics, Table 2 reveals the importance of additional price determinants. Some generic product characteristics affect honey prices to a larger extent than the defined sustainability traits. Price premiums are particularly high for honey multipacks (53.3%), additives such as spices, herbs and nuts (45.6%) as well as specific types of honey such as fir (28.1%) or heather (41.4%), for which harvesting is particularly elaborate. Private label honey is sold 21.0% cheaper than branded honey. Furthermore, a larger packaging size leads to a price discount per kilogram. Because of the double-logarithmic relationship between honey price and the dummy variable for packaging size, the corresponding regression coefficient of -0.31 is an elasticity: if the weight increases by 1%, the average honey price drops by 0.31%.

A high price premium is paid for honey which is labelled with a foreign brand name. Ceteris paribus, a foreign brand name induces a surcharge of 67.0% compared with a trademark. It seems reasonable to assume that honey carrying a foreign label is bottled abroad and not imported in bulk but pre-packed. Consequently, transportation costs will increase. Consumers appear to value these international specialties with an increased marginal willingness to pay. It is striking that the vendor variables are not statistically significant, i.e. honey prices do not differ significantly across online shops if major honey characteristics are controlled for.

4.3.2 Sensitivity Analysis

The computation of price premiums for high-quality foods and their characteristics is very topical and the size of the implicit price seems to vary strongly with the methodological approach (see, e.g., DESELNICU et al., 2013). The choice of the benchmark category might be particularly important. In order to test the robustness of our results with regard to the implicit price of sustainability characteristics in honey, we performed some sensitivity tests. Theoretically, the mass product should be benchmark category of a higher-quality food. This implies that the effect of sustainability ought to be compared with the conventional product. Therefore, the empirical model's base honey was neither certified organic nor traded fairly. As we expected a preference for

domestic, regional or local honey, the base category led to the core result that regional origin is of higher importance than organic production and even more important than fairtrade in the case of the honey market.

Our sensitivity results show that major results of the base model are robust but that the great importance of regionality is not equally visible from different model specifications. Let us compare the base model of Table 2 with alternative models in the Appendices 1 to 3. In Appendix 1 a non-EU mix is used as the benchmark category of geographical origin. In Appendix 2 a German-origin honey is the reference category, and in Appendix 3 an EU mix. Compared with Table 2, a lower number of origin coefficients are statistically significant at the 95% level or higher, namely six in Appendix 1, four in Appendix 2 and only two in Appendix 3. Nine out of ten origin coefficients were statistically significant in Table 2. This illustrates that the impact of regional origin is much less visible if, as in Appendix 2, a more strongly preferred origin like Germany is chosen as the benchmark. Additionally, there are much lower implicit prices if such an alternative benchmark is used.

It can be seen, too, that all other coefficients of the model are very robust in terms of their signs, magnitude and statistical significance. The different coefficients regarding vendors and product characteristics remain largely unaffected. With regard to sustainability characteristics, organically produced honey receives a price premium according to all model specifications, but certified fairtrade and glass packaging do not capture a premium on the honey market. It is the impact of the regional origin that has to be interpreted with care and with regard to a precisely defined reference category.

5 Discussion

The present empirical analysis assesses price effects of sustainability characteristics, namely organic certification, fairtrade, the packaging material and regional production for the German honey market. The findings are based on 426 honey prices, aggregated from the four German online shops mytime.de, gourmondo.de, biomondo.de and heimathonig.de in January 2015. By means of the hedonic approach, implicit prices are estimated for sustainability characteristics as well as for further honey attributes.

To summarize from the empirical results: sustainability characteristics matter in the online market for honey. The findings suggest that organic production and certification, fairtrade and regional manufacturing influence buyers' willingness to pay and suppliers' costs of production respectively. No significant effects concerning the packaging material can be verified. The results highlight further that valuation is not uniform across different sustainability characteristics. While Bioland certification and regional processing in Germany's South East, South West and metropolises induce price premiums of 13.6%, 49.2%, 53.1% and 66.2% respectively, fairly traded GEPA honey causes a price discount of 18.0%. When interpreting estimation results, both supply-side and demand-side effects on price need to be considered. High implicit prices for Bioland honey and regional German honey might arise from an increased consumer valuation as well as from higher marginal costs of production. Negative implicit prices for fair GEPA honey might indicate low costs of production as well as weak of preferences for a fairtrade label in this market with strong competition from the regional products.

Our results point to the importance of regionally produced honey for the German market, although implicit prices are clearly affected by the choice of the benchmark category. This suggests that trust in the production process matters. One can imagine that consumers in the northern parts of the world are more sceptical about the trustworthiness of producers in the south than about the trustworthiness of local beekeepers, especially bearing in mind different food standards and different bee habitats.

What lessons could honey producers on the German market learn from the hedonic analysis? Our primary goal was to elaborate how honey prices can be explained by honey characteristics in a demand-and-supply framework. Therefore, we focused more on the link from producers' marginal costs to market prices than on the implications arising from implicit prices of characteristics for honey supply. Despite this, the empirical findings seem very relevant for all market participants and, in particular, for honey producers. The computation of implicit prices for honey characteristics yields more market transparency. It captures price effects of honey characteristics under ceteris-paribus conditions which are not available from any statistical source of the German honey market. Individual honey producers, who are able to switch to another type of honey, may use implicit prices of honey characteristics as an orientation for their own price setting. As there is no strong consumer

preference for fairtrade labels, it can be concluded from the analysis that fairtrade organisations may combine the fairtrade product with other honey characteristics, such as additives or a liquid consistency, to participate in existing price premia for characteristics. It has to be borne in mind, however, that these implicit prices may vary over time and that they have been computed here for one specific period.

The question arises how the presented empirical findings are related to other studies on honey. To our knowledge, there is no other quantitative study on the German honey market – neither a consumer study nor a hedonic pricing analysis. But there are consumer studies on consumers' attitudes towards honey in other European countries. One recent example is the study by COSMINA et al. (2016), who investigate in Italy the determinants of individual consumers' willingness to pay for honey characteristics, including sustainability criteria. The authors conducted a face-to-face survey including a choice experiment and estimated determinants of the consumers' willingness to pay within a latent class model. There are some interesting parallels in our study and that of COSMINA et al. With regard to the importance of honey attributes, the consumer study also showed that the origin of honey was the major determinant of consumers' willingness to pay and ranked much higher than the organic attribute (COSMINA et al., 2016: Table 3). Additional to our research, COSMINA et al. were able to show that clusters of honey consumers exist who value origin and organic production as well as other honey characteristics very differently.

On the other hand, COSMINA et al. do not compare regional origin and organic production with fairtrade and, by choosing a pure consumption model, cannot interpret supply-side characteristics of sustainability variables. This underlines the advantage of the hedonic approach and the results elaborated in this article. It seems fruitful in future research to test for other markets and other time periods whether the marginal willingness to pay for fairtrade foods will fall when competition from regional products is available.

When comparing the results of consumer studies and hedonic price analysis with regard to the willingness to pay for sustainability characteristics, it should be borne in mind that the two approaches measure different things. Willingness-to-pay estimates in consumer studies picture the individual consumer's hypothetical willingness to pay for one unit of a product or a product characteristic. Hedonic price analysis measures the observed marginal willingness to pay in a market equilibrium for individual products or characteristics and it is a major advantage that the actual rather than a hypothetical marginal willingness to pay can be observed.

Some arguments have to be borne in mind, however, when interpreting empirical results of the hedonic analysis. Implicit prices of a sustainability characteristic of honey may be valid for a market niche only in which some consumers are willing to pay a price premium compared to a conventional product but many others are not. It may well be that a honey from a particular region or from ecological production may realize such a premium but captures a much lower absolute willingness to pay since the demand curve for the sustainable product lies far left from demand for the conventional alternative. A computation of absolute levels of the willingness to pay would be an interesting task for future research, both for the honey market and in hedonic analyses in general. Price and quantity data would have to be combined in order to compare the different equilibria for product varieties with and without sustainability characteristics and to determine the areas under the respective demand functions.

Our theoretical model is based on the presumption that supply and demand for individual sustainability characteristics are in an equilibrium. The theoretical basis seems to be sound as the coefficients of the hedonic model were plausible and could be explained with supply-side and/or demand-side characteristics. However, it remains an interesting question for future research to test the market-power as opposed to the competitive market-equilibrium hypothesis. Some honeys may actually induce prices above marginal costs for certain sustainability characteristics, such as protected geographical indications, and the implicit price of the characteristic may include some market power. [4] It is possible that, for some honeys with strong brands and/or characteristics, firms set prices above marginal costs.

References

ADALJA, A. (2015): An examination of consumer willingness to pay for local products. In: Agricultural and Resource Economics Review 44 (3): 253-274.

AKERLOF, G. (1970): The market for 'lemons': quality uncertainty and the market mechanism. In: Quarterly Journal of Economics 84 (3): 488-500.

[4] We are grateful to one anonymous reviewer for bringing up this argument.

ANSPACH, V., J. HERRMANN and D. MOELLER (2009): Status Quo der Oekologischen Bienenhaltung in Deutschland. In: Mayer, J., T. Alfoeidi, F. Leiber, D. Dubois, P. Fried, F. Heckendorn, E. Hillmann, P. Klocke, A. Luescher, S. Riedel, M. Stolze, F. Strasser, M. van der Heijden and H. Willer (eds.): Werte – Wege – Wirkungen: Biolandbau im Spannungsfeld zwischen Ernaehrungssicherung, Markt und Klimawandel: Beitraege zur 10. Wissenschaftstagung Oekologischer Landbau, ETH Zurich, 11.-13. Februar 2009: (Band 2: Tierhaltung, Agrarpolitik und Betriebswirtschaft, Maerkte und Lebensmittel). Dr. Koester Verlag, Berlin: 388-391. In: http://orgprints.org/15160/4/band-02-gesamt-exemplar-oe.pdf, accessed July 3, 2017.

BLE (Bundesanstalt für Landwirtschaft und Ernährung) (2017): Versorgungsbilanz mit Bienenhonig. In: https://www.ble.de/SharedDocs/Downloads/DE/BZL/DatenBerichte/VersorgungsbilanzHonig, accessed January 2, 2018.

BLS (Bureau of Labor Statistics, United States Department of Labor) (2016): Arbeitskosten im Verarbeitenden Gewerbe. Stand: 10.10.2016. In: https://www.destatis.de/DE/ZahlenFakten/LaenderRegionen/Internationales/Thema/Tabellen/Basistabelle_Arbeitskosten.html;jsessionid=406EF10CEB7775DE3F7B6974BE30B8C1.cae1, accessed July 3, 2017.

BMEL (Bundesministerium fuer Ernaehrung und Landwirtschaft) (2017): Oekobarometer 2017. Repraesentative Bevoelkerungsbefragung im Auftrag des Bundesministeriums fuer Ernaehrung und Landwirtschaft. In: http://www.bmel.de/SharedDocs/Downloads/Ernaehrung/Oekobarometer2017.pdf?__blob=publicationFile, accessed July 3, 2017.

BMEL (Bundesministerium fuer Ernaehrung und Landwirtschaft) (2018): Bio bzw. ökologischer Landbau. In: https://www.bmel.de/DE/Landwirtschaft/Nachhaltige-Landnutzung/Oekolandbau/oekolandbau_node.html, accessed August 30, 2018.

BMELV (Bundesministerium fuer Ernaehrung, Landwirtschaft und Verbraucherschutz) (2013): Bestandsaufnahme und Perspektiven der Bienenhaltung und Imkerei in Deutschland. In: http://www.bmel.de/SharedDocs/Downloads/Tier/TierzuchtTierhaltung/Bestandsaufnahme-Imkerei.pdf?__blob=publicationFile, accessed January 12, 2016.

CBI (Centre for the Promotion of Imports from Developing Countries, Ministry of Foreign Affairs of the Netherlands) (2009): CBI Market Survey: The Honey and Other Bee Products Market in the EU. Rotterdam, NL.

CHANG, J.B., J.L. LUSK and F.B. NORWOOD (2010): The price of happy hens. A hedonic analysis of retail prices. In: Journal of Agricultural and Resource Economics 35 (3): 406-423.

COMBRIS, P., S. LECOQ and M. VISSER (1997): Estimation of a hedonic price equation for Bordeaux wines. Does quality matter? In: The Economic Journal 107 (441): 390-402.

COSMINA, M., G. GALLENTI, F. MARANGON and S. TROIANO (2016): Attitudes towards honey among Italian consumers: A choice experiment approach. In: Appetite 99 (April): 52-58.

COSTANIGRO, M. and J. MCCLUSKEY (2011): Hedonic Price Analysis in Food Markets. In: Lusk, J.L., J. Roosen and J.F. Shogren (eds.): The Oxford Handbook of the Economics of Food Consumption and Policy. Oxford University Press, Oxford: 152-180.

CRANFIELD, J., B.J. DEATON and S. SHELLIKERI (2009): Evaluating consumer preferences for organic food production standards. In: Canadian Journal of Agricultural Economics 57 (1): 99-117.

DE PELSMACKER, P., L. DRIESEN and G. RAYP (2005): Do consumers care about ethics? Willingness to pay for fairtrade coffee. In: Journal of Consumer Affairs 39 (2): 363-385.

DESELNICU, O.C., D.M. COSTANIGRO, D.M.S. MONTEIRO and D.T. MCFADDEN (2013): A meta-analysis of geographical indication food valuation studies: what drives the premium for origin-based labels? In: Journal of Agricultural and Resource Economics 38 (2): 204-219.

DIDIER, T. and S. LUCIE (2008): Measuring the willingness to pay for organic and fair trade products. In: International Journal of Consumer Studies 32 (5): 479-490.

EC DG AGRI (European Commission Directorate General Agriculture and Rural Development) (2013): Evaluation of Measures for the Apiculture Sector: Final Report. July 2013. In: http://ec.europa.eu/agriculture/evaluation/market-and-income-reports/2013/apiculture/fulltext_en.pdf, accessed July 3, 2017.

EFKEN, J. and A. BERNHARDT (2016): Studie über die Erzeugungs- und Vermarktungsstruktur des Bienenzuchtsektors in Deutschland. Johann Heinrich von Thünen-Institut, Bundesanstalt für Ländliche Räume, Wald und Fischerei, Braunschweig.

EPOPA (Export Promotion of Organic Products from Africa) (2005): Export Opportunities for African Organic Honey and Beeswax. A Survey of the Markets in Germany, the United Kingdom and the Netherlands. Bennekom, Netherlands.

FAIRTRADE DEUTSCHLAND (2018): Transfair e.V., Jahres- und Wirkungsbericht 2017. In: https://www.fairtrade-deutschland.de/service/mediathek.html, accessed August 30, 2018.

FLO (Fairtrade Labelling Organization International) (2017): Certifying Fairtrade. In: https://www.fairtrade.net/about-fairtrade/certifying-fairtrade.html, accessed July 3, 2017.

– (2016): Fairtrade Minimum Price and Fairtrade Premium Table: Current Version: 15.12.2016. Superseded previous version: 04.04.2016. In: https://www.fairtrade.net/fileadmin/user_upload/content/2009/standards/documents/2016-04-04_EN_Fairtrade_Minimum_Price_and_Premium_Table_PUBLIC.pdf, accessed July 3, 2017.

GEPA (Gesellschaft zur Foerderung der Partnerschaft mit der Dritten Welt GmbH) (2015): Zahlen-Daten-Fakten: Geschaeftsjahr 2014/2015. In: https://www.gepa.de/fileadmin/user_upload/Info/GEPA/ZahlenDatenFakten_D.pdf , accessed July 3, 2017.

GRUNERT, K., S. HIEKE and J. WILLS (2014): Sustainability labels on food products: consumer motivation, understanding and use. In: Food Policy 44 (February): 177-189.

HALVORSEN, R. and R. PALMQUIST (1980): The interpretation of dummy variables in semilogarithmic equations. In: The American Economic Review 70 (3): 474-475.

HENSELEIT, M., S. KUBITZKI, D. SCHUETZ and R. TEUBER (2007): Verbraucherpräferenzen für regionale Lebensmittel – Eine repräsentative Untersuchung der Einflussfaktoren. In: Berichte über Landwirtschaft 85 (2): 214-237.

HUANG, C.L. and B.H. LIN (2007): A hedonic analysis of fresh tomato prices among regional markets. In: Review of Agricultural Economics 29 (4): 783-800.

JANSSEN, M. and U. HAMM (2012): Product labelling in the market for organic food: consumer preferences and willingness-to-pay for different organic certification logos. In: Food Quality and Preference 25 (1): 9-22.

KRANDICK, L. (2015): Spiegeln sich Nachhaltigkeitskriterien von Lebensmitteln im Produktpreis? Ergebnisse einer hedonischen Analyse für Honig mit Daten aus Online-Shops. Arbeitsbericht Nr. 63. Institut für Agrarpolitik und Marktforschung. Justus-Liebig-Universität, Gießen.

LAGERKVIST, C.J. and S. HESS (2011): A meta-analysis of consumer willingness to pay for farm animal welfare. In: European Review of Agricultural Economics 38 (1): 55-78.

LOUREIRO, M.L. and J. MCCLUSKEY (2000): Assessing consumer response to protected geographical indication labeling. In: Agribusiness 16 (3): 309-320.

ROSEN, S. (1974): Hedonic prices and implicit markets: product differentiation in pure competition. In: Journal of Political Economy 82 (1): 34-55.

SCHOLLENBERG, L. (2012): Estimating the hedonic price for fair trade coffee in Sweden. In: British Food Journal 114 (3): 428-446.

SCHRÖCK, R. (2014): Valuing country of origin and organic claim: a hedonic analysis of cheese purchases of German households. In: British Food Journal 116 (7): 1070-1091.

TRIPLETT, J. (2006): Handbook on hedonic indexes and quality adjustments in price indexes: special application to information technology products. OECD Publishing, Paris.

VAN GARDEREN, K.J. and C. SHAH (2002): Exact interpretation of dummy variables in semilogarithmic equations. In: The Econometrics Journal 5 (1): 149-159.

VAN DER LANS, I.A., K. VAN ITTERSEN, A. DE CICCO and M. LOSEBY (2001): The role of the region of origin and EU certificates of origin in consumer evaluation of food products. In: European Review of Agricultural Economics 28 (4): 451-477.

VAN LOO, E.J., V. CAPUTO, R.M. NAYGA, Jr. and W. Verbeke (2014): Consumers' valuation of sustainability labels on meat. In: Food Policy 49 (1): 137-150.

VERMEIR, I. and W. VERBEKE (2006): Sustainable food consumption: exploring the "consumer attitude-behavioral intention" gap. In: Journal of Agricultural and Environmental Ethics 19 (2): 169-194.

WHITE, H. (1980): A heteroskedasticity-consistent covariance matrix and a direct test for heteroskedasticity. In: Econometrica 48 (4): 817-838.

WU, S., J.R. FOOKS, K.D. MESSER and D. DELANEY (2015): Consumer demand for local honey. In: Applied Economics 47 (41): 4377-4394.

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Appendix

Appendix 1. Alternative estimation of the semilogarithmic hedonic price function (non-EU mix as benchmark category)

Dependent variable ln(p)	Independent variables and results			
Variable	**Specification**	**Coefficient**	**Price effect [a] (%)**	**Implicit price[b] (€)**
Constant Term		3.650***		
Vendors (*V*)				
Onlineshop (BC: myTime.de)	gourmondo.de	-0.048		
	biomondo.de	0.004		
	Heimathonig.de	-0.019		
Product Characteristics (*PC*)				
Ln (grams)		-0.312***	-26.85	-1.29
Multipack (BC: Singlepack)	Type of pack	0.432***	53.59	2.58
Brand (BC: Packer's brand)	Private label	-0.231**	-20.85	-1.00
	D.I.B.	0.009		
	Individual beekeeper	0.065		
	Foreign brand	0.514***	66.31	3.19
Consistency (BC: Liquid & other)	Creamy	-0.074**	-7.16	-0.34
Additives (BC: No additives)	Additives	0.375***	45.30	2.18
Standard-Extraction	Other (e.g. pressing)	0.271*	30.46	1.47
Type (BC: Polyfloral)	Monofloral blossom	0.150***	16.12	0.78
	Heather	0.359***	45.50	2.06
	Rapeseed	-0.075(*)	-7.27	-0.35
	Fir	0.245**	27.67	1.33
	Exotic	0.162**	17.23	0.83
Sustainability Characteristics (*SC*)				
Organic (BC: Non-organic)	EU organic label	0.038		
	Bioland label	0.127*	13.44	0.65
Fairtrade (BC: Non-Fairtrade)	FLO label	0.080		
	GEPA label	-0.197**	-18.18	-0.87
Packaging (BC: Glass)	PET dispenser	-0.030		
	Other	0.110	10.24	0.49
Origin (BC: Non-EU Mix)	German Region: North	0.213*	23.20	1.12
	German Region: Mid West	0.162		
	German Region: East	0.093		
	German Region: South East	0.285**	32.30	1.55
	German Region: South West	0.310**	35.68	1.72
	German Region: Metropolis	0.399**	48.11	2.31
	Foreign Country	0.221**	24.38	1.17
	EU Mix	0.150(*)	15.95	0.77
	EU-Non-EU Mix	-0.158(*)	-14.87	-0.72
	Germany (total)	0.196*	21.29	1.02
Test statistics				
n = 426; Adjusted R^2 = 0.700; F-value = 31.11; White-Test p-value = 0.0012.				

Notes: BC = Base Category; ***, [**, *, (*)]: Significantly different from zero at the 99.9%-[99%-, 95%-, (90%)-] level.

[a] In semilogarithmic equations the percentage impact of dummy variables on the dependent variable can also be estimated according to KENNEDY'S approach as $100\left(e^{(\beta-0{,}5V(\beta))}\right)-1$). This leads to consistent and (almost) unbiased estimations of the price effect (VAN GARDEREN and SHAH, 2002).

[b] Compared with the base category (BC): implicit euro prices are calculated using the mean price of 4.81 euros per 500 grams and the price effect according to Kennedy's approach. Implicit prices are shown only if regression coefficients are significantly different from zero at the 90% level at least.

Source: own computations

Appendix 2. Alternative estimation of the semilogarithmic hedonic price function (Germany as benchmark category)

Dependent variable ln(p)	**Independent variables and results**			
Variable	**Specification**	**Coefficient**	**Price effect** [a] **(%)**	**Implicit price**[b] **(€)**
Constant Term		3.862***		
Vendors (*V*)				
Onlineshop (BC: myTime.de)	gourmondo.de	-0.051		
	biomondo.de	0.001		
	Heimathonig.de	-0.035		
Product Characteristics (*PC*)				
Ln (grams)		-0.313***	-26.92	-1.29
Multipack (BC: Singlepack)	Type of pack	0.431***	53.44	2.57
Brand (BC: Packer's brand)	Private label	-0.229**	-20.69	-1.00
	D.I.B.	-0.007		
	Individual beekeeper	0.047		
	Foreign brand	0.518***	66.93	3.22
Consistency (BC: Liquid & other)	Creamy	-0.074**	-7.16	-0.34
Additives (BC: No additives)	Additives	0.370***	44.58	2.14
Standard-Extraction	Other (e.g. pressing)	0.259*	28.88	1.39
Type (BC: Polyfloral)	Monofloral blossom	0.150***	16.12	0.78
	Heather	0.375***	45.50	2.17
	Rapeseed	-0.076*	-7.36	-0.35
	Fir	0.242***	27.29	1.31
	Exotic	0.164*	17.47	0.84
Sustainability Characteristics (*SC*)				
Organic (BC: Non-organic)	EU organic label	0.034		
	Bioland label	0.127**	13.44	0.65
Fairtrade (BC: Non-Fairtrade)	FLO label	0.108		
	GEPA label	-0.194*	-17.94	-0.86
Packaging (BC: Glass)	PET dispenser	-0.022		
	Other	0.100		
Origin (BC: Germany)	German Region: North	0.038		
	German Region: Mid West	-0.013		
	German Region: East	-0.081		
	German Region: South East	0.113(*)	11.72	0.56
	German Region: South West	0.136*	14.36	0.69
	German Region: Metropolis	0.226**	24.98	1.20
	Foreign Country	0.012		
	EU Mix	-0.063		
	Non-EU Mix	-0.236**	-21.26	-1.02
	EU-Non-EU Mix	-0.366***	-30.85	-1.48
Test statistics				
n = 426; Adjusted R^2 = 0.702; F-value = 31.31; White-Test p-value = 0.0041.				

Notes: BC = Base Category; ***, [**, *, (*)]: Significantly different from zero at the 99.9%-[99%-, 95%-, (90%)-] level.

[a] In semilogarithmic equations the percentage impact of dummy variables on the dependent variable can also be estimated according to KENNEDY'S approach as $100\left(e^{(\beta-0{,}5V(\beta))}\right)-1)$. This leads to consistent and (almost) unbiased estimations of the price effect (VAN GARDEREN and SHAH, 2002).

[b] Compared with the base category (BC): implicit euro prices are calculated using the mean price of 4.81 euros per 500 grams and the price effect according to Kennedy's approach. Implicit prices are shown only if regression coefficients are significantly different from zero at the 90% level at least.

Source: own computations

Appendix 3. Estimation of the semilogarithmic hedonic price function (EU mix as benchmark category)

Dependent variable ln(p)	Independent variables and results			
Variable	**Specification**	**Coefficient**	**Price effect** [a] **(%)**	**Implicit price**[b] **(€)**
Constant Term		3.809		
Vendors (*V*)				
Onlineshop (BC: myTime.de)	gourmondo.de	-0.049		
	biomondo.de	0.006		
	Heimathonig.de	-0.030		
Product Characteristics (*PC*)				
Ln (grams)		-0.313***	-26.92	-1.29
Multipack (BC: Singlepack)	Type of pack	0.432***	53.60	2.58
Brand (BC: Packer's brand)	Private label	-0.229***	-20.69	-1.00
	D.I.B.	-0.001		
	Individual beekeeper	0.053		
	Foreign brand	0.518***	66.98	3.22
Consistency (BC: Liquid & other)	Creamy	-0.074**	-7.16	-0.34
Additives (BC: No additives)	Additives	0.374***	45.16	2.17
Standard-Extraction	Other (e.g. pressing)	0.263*	29.41	1.41
Type (BC: Polyfloral)	Monofloral blossom	0.15***	16.12	0.78
	Heather	0.370***	44.48	2.14
	Rapeseed	-0.076(*)	-7.36	-0.35
	Fir	0.242**	27.29	1.31
	Exotic	0.164**	17.47	0.84
Sustainability Characteristics (*SC*)				
Organic (BC: Non-organic)	EU organic label	0.035		
	Bioland label	0.129(*)	13.67	0.66
Fairtrade (BC: Non-Fairtrade)	FLO label	0.107		
	GEPA label	-0.194**	-17.94	-0.86
Packaging (BC: Glass)	PET dispenser	-0.027		
	Other	0.103		
Origin (BC: EU Mix)	German Region: North	0.079		
	German Region: Mid West	0.028		
	German Region: East	-0.04		
	German Region: South East	0.153		
	German Region: South West	0.177(*)	19.00	0.91
	German Region: Metropolis	0.265(*)	29.73	1.43
	Germany (total)	0.044		
	Foreign Country	-0.063	- 6.32	-0.30
	Non-EU Mix	-0.183*	-16.88	-0.81
	EU-Non-EU Mix	-0.313***	-27.03	-1.30
Test statistics				
n = 426; Adjusted R^2 = 0.702; F-value = 31.28; White-Test p-value = 0.00				

Notes: BC = Base Category; ***, [**, *, (*)]: Significantly different from zero at the 99.9%-[99%-, 95%-, (90%)-] level.

[a] In semilogarithmic equations, the percentage impact of dummy variables on the dependent variable can also be estimated according to KENNEDY'S approach as $100\left(e^{(\beta-0{,}5V(\beta))}\right)-1)$. This leads to consistent and (almost) unbiased estimations of the price effect (VAN GARDEREN and SHAH, 2002).

[b] Compared with the base category (BC): implicit euro prices are calculated using the mean price of 4.81 euros per 500 grams and the price effect according to Kennedy's approach. Implicit prices are shown only if regression coefficients are significantly different from zero at the 90% level at least.

Source: own computations