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Price Premia for Sustainability Characteristics in Foods: Measurement Matters!

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ABSTRACT

There is a growing demand for foods with sustainability characteristics on Northern markets. Despite this trend, foods with sustainability characteristics, like organic farming, regional production and fairtrade certification, do still cover small market segments compared to the conventional market. The incentive for producers to switch from the mass to the niche market is the potential price premium associated with sustainability characteristics. In order to measure these premia, very different approaches are applied. We argue that supply-and-demand models incorporating the influence of sustainability characteristics on preferences and marginal costs are superior to willingness-to-pay studies focusing on hypothetical decisions by consumers alone. We apply hedonic price analysis to the German online market for honey. The differentiated market for honey allows to compare price premia across different sustainability characteristics. Price premia compared to the benchmark of a standard honey, are positive for regionality and negative for fairtrade.

Keywords: Fairtrade, hedonic price analysis, regional origin, organic production.

1 Introduction

A price premium is often seen as the major incentive for producers and processors to offer high-quality foods. One major category of foods to which a growing demand and large price premia are addressed are those with sustainability characteristics. Most studies on the demand for sustainable foods focus on the valuation of sustainability characteristics by consumers. It was shown that consumers have a positive marginal willingness to pay for characteristics such as ecological production of foods (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) as well as for combinations of sustainability criteria (Didier and Lucie, 2008).

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 not only value the sustainability characteristics of foods, but also the labeling of those credence attributes. Grunert et al. (2014) provide a survey of the literature; Janssen and Hamm (2012) and Loureiro and McCluskey (2000) deal with the labeling of organic production and protected geographical indications respectively and Van Loo et al. (2014) compare sustainability labels.

There is an interest of manufacturers and retailers, too, to increase the supply of products which deliver sustainability attributes. The incentive is a price premium that can eventually be realized with those product

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characteristics. An increasing literature refers to the question whether price premia can be captured by producers, manufacturers or retailers by supplying sustainable foods.

Despite the general interest in price premia on markets for high-quality foods, it has not been sufficiently discussed in the literature how price premia are measured and whether measurement matters. In a meta-study on geographical origin labeling (Deselnicu et al., 2013), price premia are compared across markets and countries and explained econometrically. Apparently, price premia vary strongly across studies and it seems that many different ways of measuring price premia do exist. In most cases, a discussion of advantages or disadvantages of the chosen method to compute price premia "correctly" is lacking as is the discussion of the appropriate reference price. In any case, there are severe limitations of willingness-to-pay studies with regard to the identification of price premia for sustainability characteristics. Firstly, a 'consumer attitude-behavioral intention' gap was identified for sustainable food consumption (Vermeir and Verbeke, 2006). This suggests that the marginal willingness to pay for sustainability characteristics may be overstated and hypothetical price premia range above the actual ones. Secondly, consumers' marginal willingness to pay is only one element determining consumer price premia. Additionally, the marginal costs of production are crucial to understanding actual price premia for sustainability characteristics. Therefore, models incorporating supply and demand are more appropriate for the analysis of price premia with sustainability characteristics than pure consumer studies.

In our contribution, we illustrate our arguments theoretically and present empirical evidence based on hedonic price analysis for the German online market for honey. Price premia for sustainability characteristics such as ecological production, fairtrade as well as the regionality of the product are computed. The analysis reveals that most but not all sustainability characteristics receive a consumer price premium. Moreover, the choice of the reference price is crucial for the size of the premium.

2 Theoretical Background

We use a highly stylized model in order to show how market segmentation for a food with a sustainability characteristic may arise in a formerly uniform conventional market. Figure 1 illustrates the model. A competitive market is posited, in which supply of the conventional food is represented by a market supply function *S* and demand by a market demand function *D*. The equilibrium price for the conventional food is then p_0.

Figure 1: Market Segmentation with Sustainability Characteristics and the Consumer and Producer Price Premium

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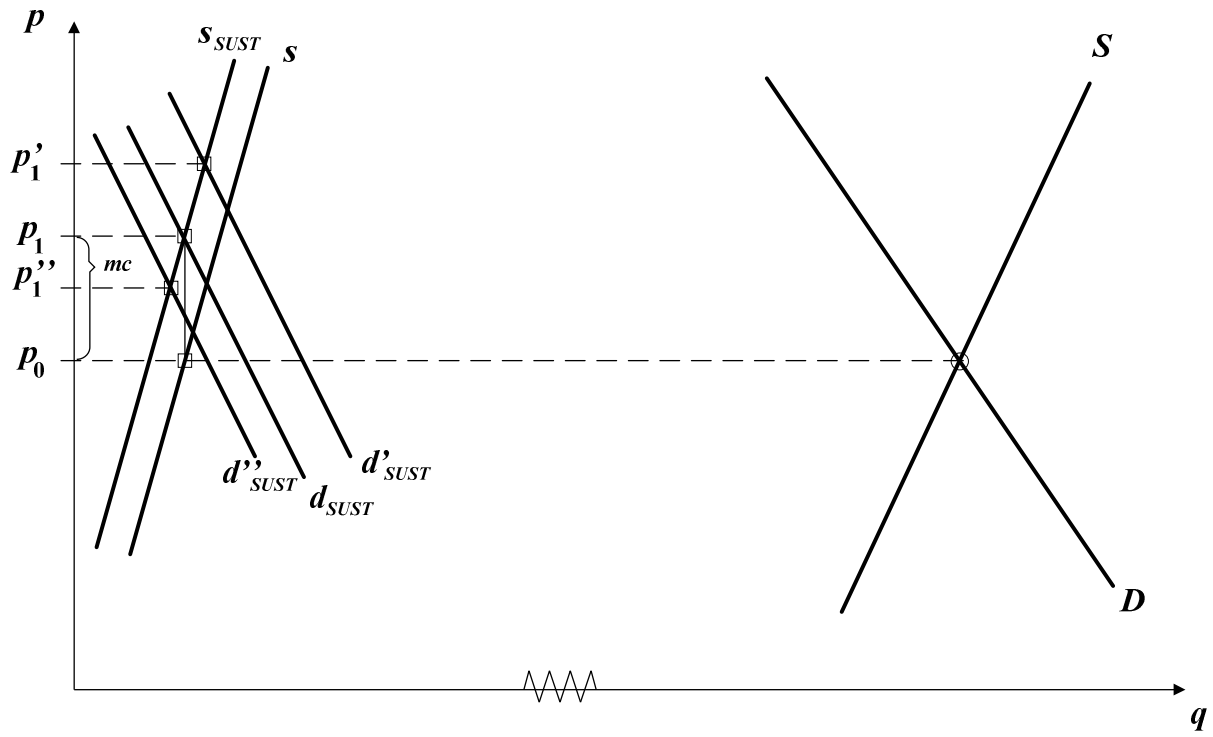

Source: Own presentation.

Suppose that a small fraction of producers will now switch to the production of a differential quality, i.e. the food with a sustainable characteristic such as ecological production, fairtrade, local or regional production with a protected geographical origin. The sustainable food will reach – at least originally – a tiny market niche so that the market price of the conventional food is unaffected. We indicate this by the interruption of the horizontal axis. Quantities on the mass market are by assumption very high compared to the niche market. The fraction of switching producers had initially a marginal cost function *s*. Switching to the sustainable product will raise marginal costs of production and marketing from *s* to s_{SUST}. This may be induced by stricter production standards which raise production costs, as for ecological production. It may also be due to costs of advertising or the protection of the sustainability labels to which producers have to contribute, as in the case of protected geographical indications or fairtrade.

A pre-condition for a higher consumer price of the sustainable compared to the conventional food is that demand for the sustainable food intersects the supply function (s_{SUST}) above p_0. This situation is given for all three alternative demand functions that are shown in Figure 1. The vertical distance between the supply curves s_{SUST} and *s* indicates the additional marginal costs of producers who switch to sustainable production. These additional marginal costs, i.e. *mc*, are exactly covered when the demand curve d_{SUST} holds for the product with the sustainability characteristic. Then, the price premium compared to the conventional product equals exactly the additional marginal costs of producing and marketing the sustainable alternative. Please note here that the supply-and-demand framework allows to distinguish between consumer and producer premia. At p_1, there is a consumer price premium (p_1-p_0). The net producer price, however, is identical to the original situation: p_0. Switching to the production of the sustainable variety would not pay off for producers. They would be indifferent towards the two options. Demand for the sustainable alternative should be higher than d_{SUST} in order to induce a producer price premium from the choice of the sustainable alternative. In the case of a higher demand for the sustainable food (d'_{SUST}), a higher price p'_1 would occur. The consumer price premium would be (p'_1 - p_0) and the corresponding price premium would now be positive, too: (p'_1 - p_0 - *mc*) > 0. Switching to the sustainable product would pay off for producers. With the alternative demand curve (d''_{SUST}) the price of the sustainable product would be p''_1. A positive consumer price premium would still exist: (p''_1 - p_0). It would be associated with a negative producer price premium, however: (p''_1 - p_0 - *mc*) < 0. Although the price of the sustainable product is higher than that of the conventional product, the price difference does not cover the additional marginal costs of producing the sustainable alternative. If d'_{SUST} remains the medium- or long-run demand curve, switching to the sustainable alternative is not attractive for producers. Even in the short-run, it is profitable to sell the sustainable product on the conventional market.

We can generalize from the theoretical model:

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(i) A consumer price premium for a sustainability characteristic may or may not lead to a producer price premium. The outcome depends crucially on the marginal costs of providing the sustainability characteristic.

(ii) A high price premium does not necessarily indicate high profits as the high-price market segment may be very small.

(iii) Price premia depend strongly on the reference price chosen.

(iv) Nevertheless, a positive producer price premium will become more likely with an increasing demand for the sustainability characteristics and, thus, with a rising consumer price premium.

For an empirical analysis, it is important to choose a supply-and-demand model which is based on actual market data and incorporates the consumers' marginal willingness to pay for the sustainability characteristic as well as marginal costs of its production and marketing. We will start from hedonic pricing analysis in the following empirical application and concentrate on the price premia for sustainability characteristics at the consumer market for honey in Germany.

3 Empirical Analysis of Price Premia for Sustainability Characteristics: The German Online Market for Honey

3.1 The German Honey Market

The German honey market is described in much more detail elsewhere (Efken and Bernhardt, 2016; Krandick, 2015). Major features are that about 95% of German beekeepers pursue beekeeping as a hobby and that 80% of domestic honey is sold directly to consumers. The domestic honey industry consists of approximately 40 small- and medium-sized companies which offer national brands as well as private labels. The self-sufficiency ratio is low with 27% in 2016 (BLE, 2017). The German honey market is very differentiated, too. Honey can be distinguished in terms of many different floral sources as well as regions of origin. The major share of the German honey market is covered by blended honey from different geographic origins and different floral sources.

The variety of honeys is offered in very different retail stores, in specialty grocery stores and via direct marketing, which is clearly more important for honey than for most other foods. The empirical analysis is based on online data, and it was the objective to picture the most important brick-and-mortar stores by the choice of the selected online stores.

3.2 Database

The empirical analysis combines price data from four German online food stores: (i) myTime.de; (ii) gourmondo.de; (iii) biomondo.de; (iv) Heimathonig.de. The dataset consists of 436 honey prices collected in January 2015.

The German online market for honey is described in Krandick (2015) in more detail. The webshop myTime.de belongs to the German Buenting E-Commerce GmbH and offered about 31,000 products in 2015. Its product range, as well as its price level, resembles a stationary supermarket. Gourmondo.de was chosen in order to reflect specialist retailers. The webshop of Gourmondo Food GmbH offers around 17,000 international and German products and claims to be the leading German online shop for international delicacies and specialties. Biomondo.de is supposed to represent organic food shops. The organic online shop also belongs to the Gourmondo Food GmbH. At the time of data collection, biomondo.de offered a reduced range of 5,000 products that are all organically certified. 19 kinds of honey, which are offered on gourmondo.de, were sold at equal prices in the biomondo.de online shop. In order to prevent perfect collinearity, these kinds of honey are only taken into consideration in the gourmondo.de dataset. The internet platform Heimathonig.de was chosen in order to mirror direct sales to consumers. Approximately 200 German beekeepers offer their honey on this platform. Local beekeepers can be found on Heimathonig.de by entering a German postcode or by selecting a certain area on a map of Germany.

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3.3 The Empirical Model

The empirical model is based on hedonic price analysis. Whereas pure consumer studies elaborate the hypothetical willingness to pay for product characteristics with surveys 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.

We follow earlier work in two important points: Firstly, several alternative functional forms were estimated and compared. The log-linear specification, which is the most widely used function in hedonic analysis, fitted the data best and provided plausible and robust results. It will be presented in the following. Secondly, it is not possible to estimate demand coefficients from the hedonic model as well as actual willingness to pay from a demand function. Our data include price but not quantity information. Therefore, we concentrate 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. Like 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 empirical model is then

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

where the logarithm of the price of honey in Euros per 500 grams (p_1) is a function of vectors for online vendors (*V*), product characteristics (*PC*) and four sustainability characteristics (*SC*), i.e. organic production, environmentally friendly, packaging, fairtrade and regional origin. The vector of sustainability characteristics is:

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

It is the major advantage of our case study that very different sustainability characteristics that are observable on the honey market, and price premia can be computed for those characteristics and compared.

In the theoretical part, it was important to define the reference price for the price premium. The conventional market was chosen as the logical benchmark for a product with a sustainability characteristic. The choice of the reference price is more difficult in the empirical case study as we observe many varieties with different sustainability characteristics. Our reference product is one that can characterize the mass market for honey: The base honey is offered in the online shop 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. not fair). 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.

3.4 Results

Results of the econometric model are shown in Table 1. The estimated regression coefficients, percentage price effects and implicit Euro prices of specific honey characteristics are provided. The chosen semilogarithmic model explains 69.9% of the observed variation in (the logarithm of) prices across all four online shops. Altogether 23 characteristics affect honey prices significantly at the 95%- to 99.9%-levels.

The computation of price effects of sustainability characteristics from statistically significant regression coefficients yields interesting findings on their relative importance:

1. Regional origin is by far the most important sustainability characteristic for honey on the German online market. Consumer price premia range from 24.0% (East German region) to 67.9% (German metropolis) compared to the benchmark of an EU-Non-EU mix. These percentage price increases are way above those for other sustainability characteristics.
2. Organic production is not generally associated with a price premium compared to non-organic production. There is no statistically significant premium for the EU organic label, but the Bioland label captures a price premium of 13.5%.

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3. When packaging in glass containers, pet dispensers and others are distinguished, there are no statistically significant impacts of any form of packaging. Glass, which is often regarded as particularly environmentally-friendly, does not capture a price premium.
4. An interesting case is fairtrade honey. It reveals that fairtrade-certified honey does not necessarily realize a price premium compared to non-fairtrade honey. Two fairtrade labels were introduced, i.e. the globally uniform label of the Fairtrade Labelling Organizations (FLO) and products of GEPA, which is the largest European fairtrade company. Whereas fairtrade honey certified by FLO does, ceteris paribus, not significantly differ in terms of pricing from non-fairtrade honey, honeys of GEPA realize significantly lower consumer prices than non-fairtrade honeys.

4 Summary and Conclusions

We can summarize and draw some conclusions from the preceding analysis:

1. Price premia for sustainability characteristics in foods depend on the consumers' preferences as well as marginal costs of providing those characteristics. Therefore, it is important to use a supply- and-demand model to measure the characteristics.
2. In the hedonic price analysis, it was shown that price premia for sustainability criteria do exist at the consumer level. They are in most cases positive, but not always. Moreover, the price premia seem to deviate from those for other foods:
   (i) In the case of honey, price premia for regionality are clearly higher than for organic production. One possible reason may be that honey is perceived as a natural product already even if it is not produced and certified organically.
   (ii) In contrast to major fairtrade products like coffee and chocolate, fairtrade labels do not induce a price premium for honey. This may be due to the fact that, in case of a competition between regionality and fairtrade, consumers prefer the regional product. It is also likely that, given clearly lower production costs in developing countries, fairtrade honey is associated with lower marginal costs. A producer price premium is then possible even when no premium occurs on the consumer market.
3. Sensitivity analyses reveal that the choice of the reference price, and of the traditional product on a differentiated market like honey, affects the magnitude of the price premium strongly.

It remains a task for future research to elaborate in more detail linkages between price premia at the consumer and the producer level.

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Table 1: Estimation of a Semilogarithmic Hedonic Price Function[a)]

Dependent variable log(p)	Independent variables and results			
Variable	**Specification**	**Coefficient**	**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*)				
Log (gram)		-0.311***	-26.73	-2.34
Assortment (BC: No assortment)	Honey assortment	0.43***	53.66	4.71
Brand (BC: Packer´s brand)	Private label	-0.233***	-20.78	-1.82
	D.I.B.	0.018		
	Individual beekeeper	0.076		
	Foreign brand	0.518***	67.87	5.95
Consistency (BC: Liquid & other)	Creamy	-0.073**	-51.81	-4.54
Additives (BC: No additives)	Additives	0.377***	45.79	4.02
Standard Extraction	Other (e.g. pressing)	0.279*	32.18	2.82
Type (BC: Polyfloral)	Monofloral blossom	0.15***	16.16	1.42
	Heather	0.349***	41.75	3.66
	Rape	-0.075(*)	-7.23	-0.63
	Fir	0.248**	28.15	2.47
	Exotic	0.163**	17.70	1.55
Sustainability Characteristics (SC)				
Organic (BC: Non-organic)	EU organic label	0.036		
	Bioland label	0.128*	13.54	1.19
Fairtrade (BC: Non-Fairtrade)	FLO label	0.108		
	GEPA label	-0.195**	-17.72	-1.55
Packaging (BC: Glass)	PET dispenser	-0.026		
	Other	0.111		
Origin (BC: EU-Non-EU-Mix)	German Region: North	0.335***	39.79	3.49
	German Region: Mid-West	0.284**	32.48	2.88
	German Region: East	0.215*	23.99	2.10
	German Region: South-East	0.406***	50.08	4.39
	German Region: South-West	0.432***	54.03	4.74
	German Region: Metropolis	0.518***	67.87	5.95
	Germany (total)	0.333***	39.51	3.47
	Foreign Country	0.358***	43.05	3.78
	EU-Mix	0.292***	32.58	2.86
	Non-EU-Mix	0.114		
Test statistics				
n = 426; Adjusted R^2 = 0.699; F-value = 30.9; White-Test p-value = 0.000; HCCM-Estimation.				

[a)] BC = base category; HCCM = Heteroskedasticity-consistent covariance matrix; ***, [**, *, (*)] significantly different from zero at the 99.9%- [99%-, 95%-, (90%-)] level.

[b)] In semilogarithmic equations, the percentage impact of a dummy variable on the dependent variable is estimated according to Halvorsen and Palmquist (1980) as 100 * ($e^{ß}$ -1), e.g. for the Bioland variable: 100 *($e^{0.128}$-1) = 13.54%.

[c)] Implicit Euro prices are calculated using the mean price of 8.77 Euros per 500 grams. Implicit prices are shown only if regression coefficients are significantly different from zero at the 90% level at least.

Source: Modified from KRANDICK (2015).

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