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Price Premium of Organic Food in Sweden

Abstract

Individuals are increasingly demanding pesticide-free and environmentally friendlier options in their grocery shopping. They are, however, well aware that when arriving at the cashier- they are going to have to pay for it. Literally. By applying a unique approach to the hedonic model this paper estimates the organic price premium for a basket of nine different goods using price scanner data collected from Swedish retailers. The estimated organic price premiums range from 16.2% to 53.5%. This paper finds little to no difference in organic price premiums between urban and rural regions.

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1. Introduction & Previous Studies

In the existing literature on organic price premiums there is little, if any, information on the 1. Nationwide premium variation between different types of goods, and 2. nationwide variation of the premium across region and type of store. The aim of this paper is to fill that gap, as well as linking our results to Swedish citizens' willingness to pay for organic food. Firstly by estimating the national average of the price premium using a log linear regression for a variety of goods, and secondly by accounting for the difference of the premiums between two of Sweden's most populated counties using a difference-regression analysis.

Information of consumer's willingness to pay (WTP) for organic food is presumably of great interest for several actors on the market, large-scale retailers and individual farmers alike. Transforming a conventional farm to meet the strict requirements of organic production is an investment the farmer would only reasonably make if she believed there was a market willing to pay her extra in return. As the public interest for healthier and safer food was beginning to grow, contingent valuation method was used by several authors to ask consumers themselves, how willing they would be to pay for organic food (Yiridoe, Bonti-Ankomah & Martin 2005). Contingent valuation method is a survey type method, which in this case lets the respondent state his or her WTP for organic produce in currency values. These studies may also ask respondents to prioritize different buying options rather than giving a specific price (Johnston & Roheim, 2006). As for 'putting the money where the mouth is' these studies fall short in giving any true values in what consumers actually pay.

In search of more trustworthy estimates of the price premium, hedonic pricing approaches have been used which relied on actual consumer behavior through price scanner data. The theory of the hedonic model allows for estimations of prices for the organic characteristic of a good, as well as any other specific characteristic (Rosen, 1974; Maguire, Owens and Simon 2004). Every good or service on the market consist of a number of characteristics which in combination makes a product that is sold on the market for a given price. To use one of the goods tested in this paper as an example: a bag of coffee beans has several objective characteristics such as package size, brand, roasting type, sales venue and the organic characteristic as well as subjective characteristics, for instance, taste and smell. The hedonic model operates under the assumption of competitive markets so that consumers and producers alike take prices as given. Individuals will under this condition consume differentiated

products that contain the desired characteristic up to the point where the marginal willingness-to-pay is equal to that characteristic's marginal price. Equivalently producers will maximize their profits by producing that specific characteristic up to the point where the marginal cost of production is equal to the marginal price. The price of that characteristic set by the market consequently represents optimal behavior by producers and consumers alike. Given this behavior one can analyze the price premium for organic foods by observing the prices at which goods are offered by stores.

Maguire, Owens and Simon (2004) used this method to estimate that the price premium for organic baby food in Raleigh, North Carolina and San Jose, California was approximately 16-27%, while Smith, Huang & Lin (2009) found a 60-109% premium for organic milk in the United States. A similar type of study shows premiums of free-range organic eggs in California estimated well above 100% (Lusk, 2010). Hence, the resulting size of the premium can vary immensely between studies, region and depending on which good is being investigated.

Due to the complexity of its nature, most of the hedonic papers only focus on one type of good. Although the combined use of these papers could give a view of how this premium varies across different goods, aspects such as the country, time, state, sample and details in method makes side-by-side comparison problematic. We found some papers to show the premium for a variety of certain agricultural products, but these seem to vary heavily between countries and are not attempting to account for the heterogeneity of products (Kenanoğlu & Karahan, 2002). Yiridoe, Bonti-Ankomah and Martin (2005) also report a table suggesting Sweden and other countries respective premium averages, but the paper which the table originates from is unfortunately no longer available. The table reports an organic price premium of 20-40% in Sweden and 10-30% in the US. Navigating through previous articles mentioned we have not seen satisfying attempts to account for the heterogeneity of the goods, as well as why the price premium itself varies so much between goods.

Additional costs included in organic food production include, but are not limited to; longer production time, smaller yields, higher fertilizer costs, smaller quantities in shipping and providing organic feed for cattle. The increased production time and shorter yield come as the natural result of relieving the products from pesticides and genetic modification enhancers. As listed above, some costs which come not as naturally to mind is the smaller quantities in

shipping, which causes transportation costs per unit of these goods to increase. Prices observed in food stores also do not reflect the cost of production sufficiently, given that the government has subsidies for all food categories, with differing subsidies for organic and conventional food. The summary of all these costs will be used as an increased 'organic' marginal cost per unit produced, to which the price premium of the unit will be set at equal, given perfect competition in the market. Although market- and bargaining power might interfere with this assumption, we will let it stand for the purpose of this study as the structure of the different markets lies outside the scope of this paper.

We know from previous studies that Swedish citizens living in urban regions generally consume more organic goods than those who live in rural areas (Jordbruksverket, 2009). Regions are in this case assumed to vary in the typical 'organic purchaser' characteristics, causing the difference in demand (Govindasamy & Italia, 1999; Gil, Gracia & Sánchez, 2000; Salladarré et al. 2016). Since these characteristics have proven difficult to establish, with contradictory results across papers (Yiridoe, Bonti-Ankomah & Martin 2005; Loureiro &Hine 2002; Sanjuan et al. 2003), we will simply investigate whether the representative higher demand of urban areas has had any effect on the premium. The reasoning follows that if any area is found with a higher price premium than comparison groups, it could be due to escalated demand with short of supply, or reversely a lower demand for organic products with excess supply. In the year of 2014, when our data was collected, organic food sales in Sweden soared with an increase of 38% (Ekoweb, 2014). Swedish news agencies reported that stores had to increase import of organic goods from abroad to meet the demand, making the scenario of excessive demand-to-supply ratio very plausible (Svenska Dagbladet, 2014). We will test for this by comparing the price premium between regions, specifically more rural areas to urban, seeing that these tend to show large differences in demographics, and thus demand. Purposefully to see whether we find a difference, our results by this method will show us whether short run price setting behavior has occurred significantly in some regions more than others. This holds under the assumption that it is equally dear for rural and urban retailers to order organic products to their store, relative to conventional goods.

2. Methodology

This section has two parts, each corresponding to one of our two research questions. The first will describe our unique approach to the hedonic model in estimating the organic price premium, and the second will discuss the method for estimating the difference of the premium between urban and rural areas.

2.1 Nationwide organic price premium

Our method is slightly different from Hedonic pricing models used by Maguire, Owens and Simon (2004), but relies on the same principles. While we do not differentiate the characteristics of our goods, we assume them to be the same based on the homogeneity of our sample. The preeminent goods in our basket are duplets of the same brand, size and type of good. Nutritional value differences in this case are included in the Organic-labelling characteristic. In our log linear regression these duplets where given the same Good ID, with the variable of interest being a dummy distinguishing the difference between Organic and conventional versions of the good. The coefficient is then interpreted as the price premium of the Organic good. Naturally we have some flaws in these assumptions, which reduce the significance of our results compared to hedonic pricing models. For example, our estimates could be biased by differences in package design as well as showcase in the store, where organic goods in some Swedish stores have highly visible organic etiquettes or even an all organic section with a more enticing surrounding. Both of which might have an impact on the consumers' WTP for the good. What we gain from this type of analysis, however, is the overall premium differences between segments, as well as our sample size being representative of a larger variety of heterogeneous pricing between stores. We achieve this by adding controls for 23 regions, 16 differentiating store characteristics and a variable indicating the size of the store. These attributes have an effect on price setting relevant for our nationwide comparison and analysis.

2.2 Variation of the organic price premium between regions

To estimate the different premiums between regions we use a difference-regression with similar control variables and include an interaction term, which will be our new variable of interest. The interaction term will distinguish the joint effect of a good being organic and within a specified region, compared to its benchmark region. In favor of generalizability in

comparison, this model will also use logged values for its dependent variable. For three pairs of regions we then repeat this process to find if any statistically significant differences can be found.

Considering the desire to capture rural and urban areas we will still have to be careful in mentioning our results as primarily representative of those attributes. Aggregated regions will surely show elements of both, and our hope is rather to capture an overflow of the one over the other. Performing three types of this regression will also be a means to check for robustness, having a more extensive result table to compare our estimates with, before furthering any implications.

3. Data

Our study relies on data initially collected by the Swedish senior organization 'Pensionärernas Riksorganisation' (PRO). They have conducted this type of study annually since 1993, but have used it primarily to calculate mean averages in price for a basket of goods common for households in Sweden. 2000 volunteers recorded a total of 46 000 prices offered by different grocery stores and supermarkets in 23 Swedish regions on October 8th 2014. About 100 prices were discovered to be erroneously recorded and were consequently replaced by the region average. In total, 839 stores were sampled – which, according to PRO, constitutes nearly 20% of all grocery stores in Sweden. The stores sampled were not differentiated only by region but by size as well. Stores that offered fewer than 8000 goods were designated as small, and the ones that offered 8000 goods or more were designated as large. Their basket of goods consisted of 16 organic foods and 33 conventional foods as well as four over-the-counter drugs.

From this data we constructed a basket of our own comprised of nine conventional goods and their nine organic counterparts. Six pairs of goods were identical in the observable characteristics available to us (brand, size of package etc.) except for the organic label. These constitute the base of our sample and were selected simply because they fulfilled the homogeneity required for our method. Nutritional value, packaging design, and for fresh food- outward appearance, are the only factors included in the organic premium. Articles of

coffee and milk were also added to the basket because of their characteristics as "everyday goods", and articles of minced beef were added to the basket to increase the variety both in terms of price and food groups. These articles are, however, not included in the basket as equal members. The organic coffee also has a Fairtrade label, which in itself has a significant effect on pricing according to studies in the United States market, there estimated to be a premium of 15,4% (Wang, 2015). For milk and minced beef we lack information about the brands of the articles. Because of this lacking information, the organic price premium for milk and beef are likely to be biased by the brand difference. What we do know is that both articles of minced beef have the same country of origin (Sweden), and that both articles of milk have a 3% fat content.

The rather unique nature of this data provides us with a good picture of organic premium variety between all of these same goods for a vast amount of different stores, all collected manually on the very same day. This relieves us of controlling for time trends, and instead makes all of the prices homogenously affected by whatever seasonality prevailing on October 8th.

Table 1 displays descriptive statistics for all goods in our selected basket including average prices for each article in nominal terms. Due to the significant price differences between goods we will in this paper use a log-linear model to estimate the organic price premium for our basket of goods. Worth noting is also the number of prices recorded for the various articles. Presumably the goods in the original basket (PRO) were chosen because the conventional article of that good was offered in each of the stores sampled. As a result the number of observations are not equal between conventional articles and organic articles. However, the numbers of observations for each article are sufficient enough to assume similar random assignment variations between stores and regions among all goods.

Table 1
Key Descriptive Characteristics of Goods

Good	*N*	Organic Branding	Mean Price SEK	*Std. Dev.*	*Min.*	*Max.*
Coffee	839	No	*36.01*	*2.34*	*24.50*	*49,90*
Coffee (Organic) [a]	682	Yes	*47.22*	*4.47*	*29.9*	*59.95*
Bananas	839	No	*19.21*	*2.24*	*7.98*	*24.95*
Bananas (Organic)	804	Yes	*22.54*	*2.89*	*10.00*	*32.95*
Minced Beef [b]	839	No	*82.08*	*10.78*	*52.90*	*119.00*
Minced Beef (Organic) [b]	585	Yes	*112.66*	*10.35*	*69.90*	*149.00*
Egg 6-pack	839	No	*13.85*	*2.27*	*6.90*	*35.90*
Egg 6-pack (Organic)	746	Yes	*21.00*	*2.55*	*10.00*	*36.95*
Butter	839	No	*31.34*	*1.53*	*21.90*	*39.90*
Butter (Organic)	747	Yes	*40.58*	*1.91*	*29.95*	*49.90*
Milk [c]	839	No	*9.85*	*0.78*	*7.90*	*14.50*
Milk (Organic) [c]	721	Yes	*11.65*	*0.79*	*8.90*	*16.20*
Oats	839	No	*10.69*	*1.51*	*8.50*	*19.90*
Oats (Organic)	304	Yes	*17.81*	*3.01*	*10.95*	*28.50*
Tomato Ketchup	839	No	*17.83*	*1.87*	*10.90*	*27.50*
Tomato Ketchup (Organic)	687	Yes	*27.39*	*3.53*	*19.90*	*49.30*
Wheat Flour	839	No	*13.72*	*1.43*	*9.90*	*29.90*
Wheat Flour (Organic)	449	Yes	*23.21*	*2.15*	*18.90*	*34.90*
Total	13,276					

Note. Numerical values presented in Std. Dev., Min. and Max are all denominated in SEK.
[a] In addition to the Organic Food label, the Organic Coffee also had a Fairtrade label.
[b] Data does not specify if the Minced Beef prices are collected from the same producer & brand.
[c] Data does not specify if the Milk prices are collected from the same producer & brand.

Earlier studies have used the hedonic model to find the organic price premium for a single good by recording prices of a number of differentiated articles of that good and controlling for all observable characteristics (Maguire, Owens and Simon 2004). We have chosen to construct a basket of goods in an attempt to find the general WTP for organic goods in Sweden. The most apparent weakness in our dataset is the fact that we have data on only one pair of articles for each good in the basket. Most goods on the market come in various package sizes and brands etc. In our basket of goods only one conventional article and one organic article of every good is sampled, thus not covering all articles on the different

markets. This limits our sample in terms of differentiation and leaves open the possibility that the WTP for organic goods varies between articles of different sizes, brands or other characteristics.

Given that not all stores offer prices for all 18 goods in the basket, and in order to control for various store characteristics, a set of 16 store dummies were created. These take in to account the different chains as well as the different segments within chain. In some cases the stores were able to be identified only as belonging to a certain chain, and in a few other cases no identification whatsoever was possible. These stores have been labeled "Coop Other", "ICA Other" and "Other" respectively. The previously introduced "size" variable will be used as an additional control.

Table 2 shows how many prices were observed in each of our coded store types. Of the 13 276 total observations, 679(or 5.12%) were recorded in stores for which we cannot fully control for store characteristics. Table 2 also reveals another potential problem with the data. Apart from the 95 stores coded as "Other", all other stores sampled in the PRO survey were grocery stores or supermarkets connected to large chains. Smaller convenience stores and "niche stores" have been excluded.

Table 2
Descriptive Characteristics of Store Types

Store type	*Freq.*	*Percentage*
(1) Coop Forum	547	4.12
(2) Coop Konsum	2,734	20.59
(3) Coop Extra	705	5.31
(4) Coop Nära	293	2.21
(5) Coop 'Other'	93	0.70
(6) ICA Kvantum	1,016	7.65
(7) ICA Nära	1,369	10.31
(8) ICA Supermarket	3,043	22.92
(9) ICA Maxi	744	5.60
(10) ICA 'Other'	491	3.70
(11) City Gross	149	1.12
(12) Netto	69	0.52
(13) Tempo	119	0.90
(14) Willys	645	4.86
(15) Hemköp	1,164	8.77
(16) Other	95	0.72
Total	13,276	100

Note. Frequency records the total number of prices scanned in each store type. Numerical values, in parentheses, representing each store type corresponds with the region dummy variables in our data.

The second part of our analysis will involve testing whether WTP for organic goods is higher in urban areas than in rural. For this reason a City dummy was created equaling 1 when the price offered was observed in Göteborg metropolitan area or Stockholm County and equaling 0 when if observed in any other region. While it might seem odd designating an entire county as a city, Stockholm County is in practice a single metropolitan area. Neither of these two areas have homogenous demographics, but for our purposes they represent the increased availability and size of the market inherent in metropolitan areas.

Furthermore we test if the WTP is significantly different between Skåne and Stockholm counties, mostly because we have the largest sample from these two. We do this by dropping all variables from the other counties and carrying out a difference-regression analysis showing whether the price premium is higher in one then the other. Carrying this regression out with other regions would be limited by their number of observations. Skåne is a rural county with only one third of the spread of inhabitants per square kilometer than Stockholm, and is also reported to have a lower average income, which also serves for our comparison purposes (SCB, 2014).

Table 3 shows how many prices were observed in each region. We found the definition for region quite inconsistent in the dataset. Most regions are counties, but some are districts within a county, with others such as Göteborg being simply a municipality. Why PRO have chosen this way of categorization is not fully known to us. Though annoying, this inconsistent classification of regions is fortunately irrelevant for the purposes of our analyses.

Table 3
Descriptive Characteristics of Regions

Region	*Freq.*	*Percentage*
(1) Blekinge	204	1.54
(2) Bohuslän	337	2.54
(3) Dalarna	423	3.19
(4) Gävleborg	420	3.16
(5) Göteborg	339	2.55
(6) Jämtland	454	3.42
(7) Jönköping	442	3.33
(8) Kalmar	651	4.90
(9) Kronoberg	250	1.88
(10) Medelpad	135	1.02
(11) Norrbotten	355	2.67
(12) Skaraborg	250	1.88
(13) Skåne	1,647	12.41
(14) Stockholm	2,685	20.22
(15) Södermanland	487	3.67
(16) Södra Älvsborg	279	2.10
(17) Uppsala	803	6.05
(18) Värmland	715	5.39
(19) Västerbotten	470	3.54
(20) Västmanland	294	2.21
(21) Ångermanland	155	1.17
(22) Örebro	726	5.47
(23) Östergötland	755	5.69
Total	13,276	100

Note. Frequency records the total number of prices scanned in each region. Numerical values representing each region corresponds with the region dummy variables in our data.

4. Estimation Results and Discussion

The theory of the hedonic model offers little guidance on the matter of functional form use. Since our primary goal is to estimate the organic price premium for a basket of goods, and by extension the organic price premium in Sweden in general, we have chosen a log-linear model. Each good is by itself separable and additive in terms of their various characteristics, which is suggestive of a linear relationship for the purposes of estimation (Maguire et al 2004), but as part of the basket they are not. To buy an additional "unit" of the organic characteristic, consumers can choose to buy an additional unit of any of the organic articles in the basket of goods. Since there are significant prize differences between the various goods in our basket the estimates derived from a linear model would be inaccurate and misleading when applied to goods in general.

By using a log-linear model, however, the accuracy of our estimates would be incumbent upon prices not being set above the marginal cost. As argued by Feenstra (1995) such price-setting behavior by the producers would cause the log-linear model to overestimate the marginal value of the organic price premium, as well as other characteristics. While our knowledge about the Swedish food market is admittedly limited, we will for the purpose of the estimations assume that the markets for our selected goods are subject to heavy enough competition to prevent such price-setting behavior. Based on equation (1) a couple of different variables are used to measure good and store characteristics. As stated in the data section of this paper we control for various good characteristics in the very selection of the articles in the basket. With the previously noted exceptions, all pairs of goods are observed to be identical in every characteristic except for the organic label. Thereby the organic characteristic is measured directly. Store characteristics are controlled for by the type of store, the size of the store and the region where the observation is recorded.
A log-linear model using ordinary least squares is estimated as the following:

(1) $logPrice_{ink} = \alpha_i + \beta_i Organic + \delta_n(Region_n) + \gamma_k(StoreType_k) + \pi_k Size + \varepsilon_{ink}$

where $logPrice_{ink}$ is the logarithm of the price for the *i*th good in region n and the store type k, $Region_n$ denotes the *n*th region, $StoreType_k$ represents the type of store *k*, Size is a dummy variable which takes the value of 1 if store *k* offers prices for 8 000 goods or more and the value 0 if store *k* offers prices for less than 8 000 goods and ε_{ink} is the random error

component. The dependent variable is the logarithm of the price of the observation and the variable of interest is Organic.

Table 4
Regression Results

Good	***Number of observations***	***Coefficient for Organic Price Premium***		
		(A)	(B)	(C)
Full basket	N=13 276	0.346*** (0.011) [0.07]	0.348*** (0.011) [0.07]	0.349*** (0.011) [0.07]
Reduced basket	N=8771	0.424*** (0.007) [0.29]	0.428*** (0.007) [0.30]	0.429*** (0.007) [0.30]
Coffee	N=1521	0.267*** (0.004) [0.73]	0.268*** (0.004) [0.77]	0.268*** (0.004) [0.77]
Bananas	N=1643	0.161*** (0.007) [0.29]	0.161*** (0.006) [0.40]	0.162*** (0.006) [0.40]
Minced Beef	N=1424	0.321*** (0.007) [0.63]	0.321*** (0.006) [0.65]	0.321*** (0.006) [0.65]
Egg 6-pack	N=1585	0.420*** (0.007) [0.72]	0.420*** (0.006) [0.74]	0.420*** (0.006) [0.74]
Butter	N=1586	0.258*** (0.002) [0.88]	0.260*** (0.002) [0.90]	0.260*** (0.002) [0.90]
Milk	N=1560	0.171*** (0.003) [0.63]	0.171*** (0.003) [0.68]	0.171*** (0.003) [0.68]
Oats	N=1143	0.504*** (0.009) [0.73]	0.508*** (0.008) [0.81]	0.509*** (0.008) [0.81]
Tomato Ketchup	N=1526	0.430*** (0.006) [0.80]	0.438*** (0.005) [0.85]	0.438*** (0.005) [0.85]
Wheat Flour	N=1288	0.527*** (0.005) [0.89]	0.535*** (0.005) [0.91]	0.535*** (0.005) [0.91]
Controls for Region		Yes	Yes	Yes
Controls for Store type		No	Yes	Yes
Control for Size		No	No	Yes

The first column shows what subsample of goods was used in the regressions. In the reduced basket coffee, minced beef and milk have been dropped. Columns (A), (B) and (C) employs three different sets of control variables which are specified in the bottom three rows of the table.
Standard errors are reported in parentheses and adjusted R-squares are presented in the brackets.
**Indicates significance at the 10% level*
***Indicates significance at the 5% level*
****Indicates significance at the 1% level*

Table 4 reports the results of our estimations with various subsamples and controls. The full basket includes prices for all 18 goods in our sample, which is nine conventional goods and their organic counterparts. In the 'reduced basket' we have excluded coffee because the organic article of coffee in our sample also possess a Fairtrade label, a characteristic that also increases the price of the article and one our model does not allow us to control for. We have also dropped minced meat and milk because we can't tell from the data whether or not the pairs of articles share all good characteristics except for the organic label.

With an exception in the case of bananas our model performs well with overall adjusted R-squared ranging from 0.65 to 0.91 for all goods in our basket when full controls are employed. If we also exclude coffee, minced beef and milk the range of the adjusted R-squares drop to the range of 0.74 to 0.91. Why our model does so poorly in accounting for the price variation of bananas we could not say. One possible explanation is that bananas are perishable, with a very short expiration date, and that different individual stores might have been selling bananas of different "ages" at the time of the survey (October 8th 2014). This would then affect the price variation if "older" bananas had their prices reduced in an attempt from the stores to offload them before their imminent expiration dates.

Turning to the estimated coefficients for Organic labels they are as expected consistently positive and significant. Our two baskets report an organic price premium of 34.9% and 42.9% percent respectively. The nine goods sampled have organic price premiums ranging from 16.2% to 53.5%.

When looking at the coefficients for our two baskets as well as the various goods individually we note that the magnitude of the estimates differ quite significantly, in a statistical sense as well as in an economic one, between the different goods sampled. This might indicate that willingness to pay for organic goods is not consistent across food groups. Remembering that the organic label signifies an absence of pesticides, as well as environmentally sustainable production, consumers that view organic foods as a healthier option might care less about the use of pesticides in some food groups than others. The perception of environmental utility should be same for all products. An explanation that we consider more likely, however, is one that is in keeping with our underlying assumption: due to competitive markets prices are set at the marginal cost. The differences between the organic price premiums for the various goods would thusly be explained varying differences in production costs for organic and

conventional goods between the various food groups. Whatever the cause of the differing price premiums for organic food articles these results make it apparent that a general consumer WTP for the organic characteristic of a good cannot be established, at least not by this dataset. Comparatively our results also show a wider range of the premium than the 20-40% previously mentioned, but at the same time specific goods such as milk differ, where previously a premium of 60-109% was found.

In the second part of our analysis we will explore the possibility that the price premium for organic goods is higher in urban areas than in rural as might be indicated by that fact that the percentage of goods bought that are organic is higher in cities than in other parts of Sweden. (Jordbruksverket, 2014) We will test this hypothesis on three different subsamples.
In the first subsample we will compare the metropolitan county Stockholm County with the more rural county Skåne County. This subsample was chosen, in spite of the fact that Skåne County is home to the smaller (compared to Stockholm and Göteborg) city Malmö and a couple of towns that could be viewed as small cities as well, because they were the two regions with the most observations and therefore constituted the best statistical material available to us. Once again a log-linear model using OLS was used and estimated as follows:

(2) $logPrice_{ik} = \alpha_i + \beta_i Organic + \sigma Stockholm + \varphi(Organic * Stockholm) + \gamma_k(StoreType_k) + \pi_k Size + \varepsilon_{ik}$

where the dependent variable $logPrice_{ik}$ is the logarithm of the price for good *i* in store *k*. The variable Stockholm is a dummy variable that takes the value of 1 when the observation is recorded in Stockholm County and the value 0 when the observation is recorded in Skåne County. The variable (Organic*Stockholm) is an interaction variable which shows the difference in the organic price premium in Stockholm County relative to Skåne County. The variables Organic, $(StoreType_k)$ and Size are the same as in (1). ε_{ik} is the random error component.
In the second subsampled we compared the prices observed in the regions Göteborg and Stockholm County to the prices observed in all other regions using the following log-linear OLS model:

(3) $logPrice_{ik} = \alpha_i + \beta_i Organic + \mu City + \rho(Organic * City) + \gamma_k(StoreType_k) + \pi_k Size + \varepsilon_{ik}$

This model is the same as (2) in every aspect other than that the Stockholm dummy has been replaced by a city dummy taking the value 1 when the observation is recorded in Stockholm County or Göteborg and the value 0 when recorded elsewhere in the country.
In the third subsample we have dropped all observations in Skåne County to check whether the exclusion of observations in Malmö (and other large towns such as Lund, Landskrona and Helsingborg affect our estimates. All models use the full set of controls used in column "(C)" of Table 4.

Table 5
Difference-Regression Results

Good	***(Stockholm)***	**(City)**	**(City II)**
Full basket	0.019	0.022	0.023
	(0.041)	(0.027)	(0.018)
	[0.07]	[0.07]	[0.07]
	N=4332	N=13 276	N=11629
Reduced basket	-0.010	-0.015	-0.016
	(0.026)	(0.017)	(0.017)
	[0.28]	[0.30]	[0.30]
	N=2874	N=8771	N=7654
Coffe	0.038**	0.000	-0.000
	(0.015)	(0.010)	(0.006)
	[0.73]	[0.76]	[0.77]
	N=480	N=1521	N=1341
Bananas	-0.038	-0.022	-0.019
	(0.027)	(0.014)	(0.014)
	[0.30]	[0.40]	[0.40]
	N=526	N=1643	N=1442
Minced Beef	0.036*	-0.008	-0.016
	(0.021)	(0.015)	(0.015)
	[0.67]	[0.64]	[0.65]
	N=486	N=1424	N=1248
Egg 6-pack	-0.009	-0.001	-0.003
	(0.026)	(0.016)	(0.016)
	[0.71]	[0.73]	[0.73]
	N=517	N=1585	N=1384
Butter	-0.018**	-0.010**	-0.009*
	(0.007)	(0.005)	(0.005)
	[0.92]	[0.90]	[0.90]
	N=525	N=1586	N=1385
Milk	0.055***	0.007	-0.004
	(0.013)	(0.008)	(0.007)
	[0.58]	[0.62]	[0.71]
	N=492	N=1560	N=1386
Oats	0.064**	0.029	0.017
	(0.030)	(0.018)	(0.018)
	[0.77]	[0.81]	[0.82]
	N=395	N=1143	N=989
Tomato Ketchup	-0.029	-0.017	-0.015
	(0.019)	(0.012)	(0.012)
	[0.83]	[0.84]	[0.85]
	N=486	N=1526	N=1336
Wheat Flour	-0.016	-0.029***	-0.033***
	(0.016)	(0.011)	(0.012)
	[0.92]	[0.91]	[0.91]
	N=425	N=1288	N=1118
Controls for Region	-	-	-
Controls for Storetype	Yes	Yes	Yes
Control for Size	Yes	Yes	Yes

The first column shows what subsample of goods was used in the regressions. In the reduced basket coffee, minced beef and milk have been dropped. The column titled "Stockholm" compares Stockholm County to Skåne County, the column titled "City" compares Stockholm County and Göteborg to rest of the country. In the "City II" column observations from Skåne County have been dropped from the sample used.
Standard errors are reported in parentheses and adjusted R-squares are presented in the brackets.
**Indicates significance at the 10% level*
***Indicates significance at the 5% level*
****Indicates significance at the 1% level*

In Table 5 the coefficients for the variables of interest, which are the interaction variables (Stockholm*Organic) and (City*Organic) respectively, are reported with standard errors in parentheses and adjusted R-squared in brackets. When you run this many regressions the balance of probabilities states that a couple would be statistically significant on the 10% or the 5% level due to false positives. Even so our model presents a few estimates that might be worth noting. Quite unexpectedly the organic price premium for wheat flour is shown to be lower in Stockholm County compared to the rest of the country. We can come up with no explanation for why this would be the case. But returning to the average organic price premium for wheat flour presented in Table 4 and the average prices of the two articles of wheat flour in Table 1 we can conclude that, while statistically significant, the 3.3 percentage point's lower organic price premium is economically insignificant.

The overall results shown displayed in Table 5 predictably fail to reject the hypothesis that the organic price premium is the same all over the country. Why this was fully expected goes back to one of our underlying assumptions: prices are set at marginal cost. There is no reason to suspect that marginal costs would be higher for organic goods compared to conventional goods in cities. So while it could still be possible that WTP for the organic characteristic is higher in Swedish cities compared to the Swedish countryside, due to competitive markets this difference would not reflect itself in the prices offered by stores around the country. Assuming is in fact the case it would mean that the welfare consumer surplus on the markets of our sampled organic goods is higher in cities, but that goes beyond the scope of this paper. Another reason why we have failed to show a higher WTP for organic characteristics in cities may lie in our somewhat rough coding of our data. The report from Jordbruksverket that showed greater consumption of organic goods in Swedish cities failed to specify what areas where designated as part of a city, and so we were unable to use the same coding. Any difference between our designation and theirs would be a potential source of bias.

5. Conclusions

Combining an extensive and differentiated dataset with the hedonic framework this study attempts to estimate how much Swedish consumers value organic articles of food compared to their conventional counterparts, be it for wanting to decrease or avoid pesticide exposure or employing an environmentally sustainable pattern of consumption. By examining the markets

for nine different goods the hope was to be able to draw broad and general conclusions about the magnitude of the price premium for organic food Swedish consumers are willing to pay. However, the results indicate that no such conclusions can be drawn. The price premium for the organic articles in our basket range from 16.2% to 53.5%, and with the size of our sample basket, making an average serves little well. The premium difference is assumed to be driven by the different marginal cost of transforming each conventional good to meet the organic requirements. Further studies examining the specific components of this marginal cost would expand the literatures ability to explain the organic price premium in general. With that high a variation it becomes evident that the markets for different foods are too dissimilar for a generalization of the premium itself to be possible.

What this study does reveal is the close to perfect market equilibrium of the organic price premium on the retail level as we find no economically significant differences on the premium across regions, despite a reported higher urban demand in a year of significant market growth. We found no significant results indicating that the increased demand had any effects on pricing, assuming that the regions accounts for different shares of organic consumer characteristics. While all of our data is collected on one day, arguably the demand shock was not permeated through all of Sweden, and should then show higher prices in those regions most affected. Implications are then that regions with higher organic food consumption might continue to grow, without expecting an increase of price premium.

Additionally, under the assumption that all markets are competitive enough so that prices are set at the marginal cost of production the premiums estimated from retail prices will only represent the lower bound willingness-to-pay for articles labelled as organic. If willingness-to-pay increases within a country like Sweden there should be a demand increase for those goods with a lower premium, as well as the entry of food groups whose premium has previously been too high for the market to consider.

Following that logic one might speculate that the Swedish citizens' WTP for organic food articles in general is equal to or greater than 53.5% since that is the highest premium found in our sample, and that the rest of the premiums are simply held down due to lower marginal costs. And while some consumers are evidently willing to pay more than a 50% premium for an organically produced good the fact that the two goods with an organic premium that exceed 50%, oats and wheat flour, are the two goods for which the organic option is the least

frequent among sampled stores might indicate that a significant number of consumers find that premium too high to pay. Assuming that all of our stores have the option of including organically labelled version of their goods, this would be a reasonable explanation. It is strengthened by our data showing that each of our 839 different stores had included the conventional version of the same brand, and should then easily be able to include the organically labelled version as well. However, it is also likely that consumers' WTP for organic food are at different levels depending on the good in question, not just the costs.

By design this study does not account for the valuation of organic foods made by non-purchasers or purchasers who buy their organic food in niche stores. Just because consumers don't buy the organic articles sampled in this does not mean they do not put a premium on pesticide free food or environmentally sustainable food production. It might be that their premiums are lower than the ones offered by stores or that due to budgetary restraints only some of the food products they buy are organic and that these are not picked up by our sample. Likewise, purchasers who buy their organic goods in specialized niche store, or other smaller stores not sampled here, are not accounted for in this study.

While the source, or sources, of the organic price premiums can't be identified, this paper does provide some of the first reliable estimates of organic price premiums on the Swedish market. Though these estimates can't be relied upon to be generalizable for all different articles on the nine different markets studied, they do offer a starting point for future studies as well as a comparison to the self-reported WTP estimated by contingent valuation studies.

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