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A Meta-Analysis of Geographical Indication Food Valuation Studies: What Drives the Premium for Origin-Based Labels?

Oana C. Deselnicu, Marco Costanigro, Diogo M. Souza-Monteiro, and Dawn Thilmany McFadden

We conduct a meta-analysis of studies estimating price premiums for agricultural products differentiated by Geographical Indication (GI). Models accounting for differences across product characteristics (food categories) and institutions (PDO, PGI, trademarks) explain a large portion of the variance in estimated premiums. Specifically, GIs capture the highest percentage premium in markets for products with short supply chains and relatively low added value (e.g., agricultural commodities). The premium is lower for wine and olive oil, where alternative means of product differentiation (e.g., branding) exist. Controlling for product characteristics, GIs adopting stricter regulations (PDO) yield larger premiums than less regulated ones (PGI).

Key words: food valuation, geographical indications (GI), meta-analysis, price premium, Protected Designations of Origin (PDO), Protected Geographical Indications (PGI), trademark

Introduction

Agricultural and food products have long been associated with unique characteristics and heritage aspects affiliated with their location of origin. Geographical names have been used since classical times to identify products of exceptional quality; for example, historical documents reveal that olive oils from Baetica were acclaimed in Rome (Blázquez, 1992). Through the ages, a number of products identified by their name of origin emerged and, more recently, have established a niche in food and beverage markets. Well-known examples of Geographical Indications (GIs) are the wines of Bordeaux and Porto, the cheeses of Parma and Rochefort, and the hams of Parma and Bayonne. Food products are often associated with geographic names with distinct agro-ecological conditions, representative animal breeds and plant varieties, or unique human capital and traditions that come under the general concept of regional terroir (see Josling, 2006).

In an increasingly industrialized and standardized food market, GI labels may assure consumers of a more genuine, unique, and higher quality food (Broude, 2005) while offering producers an opportunity to differentiate their products and perhaps obtain higher prices. Thus, one measure of a GI label's success might be based on the price differential between a GI product and its commodity-

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like competitors in the market.[1] A casual inspection of existing studies estimating the premium for GI labels suggests that their statistical and economic significance may vary substantially, as does the nature of the products and markets in which GIs have been used. Examples include wines from specific viticultural areas in America, Australia, and New Zealand; Jamaican rum and Blue Mountain coffee; and Basmati rice and Darjeeling tea from specific regions in India (Costanigro, Mittelhammer, and McCluskey, 2009; Schamel and Anderson, 2003; Das, 2006; Gautam and Bahl, 2010; Paus and Reviron, 2011).

These heuristic observations raise a simple but important question: what are the critical factors determining a GI premium? The most important one, product quality, has been studied extensively in the collective reputation literature as an endogenous firm choice (see Winfree and McCluskey, 2005, for a summary). We expand the more recent literature examining how different market characteristics or policy institutions, generally exogenous to the producers, influence the effectiveness of GI-based product differentiation (Menapace and Moschini, 2012; Costanigro, Bond, and McCluskey, 2012). This study analyzes the empirical literature on GIs in order to establish a link between the GI premium and specific product and market characteristics or institutions. Three major dimensions are considered: (1) broad food categories and the degree of food processing and product prices; (2) the existence or absence of an alternative differentiation mechanism (i.e., branding); and (3) the institutional and legal environment regulating the use of GIs.

To assess which factors influence price premiums in GI products, we compile a dataset of studies valuating GI across the world and conduct a meta-analysis regression. Meta-analyses are commonly used in the medical science field to establish common patterns in related studies and possibly reconcile conflicting evidence (Hunt, 1997). They are also increasingly used in economics to perform "a more formal and objective process of reviewing an empirical literature" (Stanley, 2001, pp. 147–148). The ultimate intent is to generate a set of guidelines, independent of any particular study, outlining the factors that are instrumental for a GI-based product differentiation scheme to capture a price premium and useful for producers and policy makers alike. To the best of our knowledge, no previous study has attempted to compare GI price premiums across product categories.

Background

An explanation of the economic mechanisms governing vertical product differentiation can be traced back to the work of Shapiro (1983) on the relationship between firm reputations and product quality. Since reputations develop slowly over time, a market price above cost of production is necessary to induce firms to produce at any quality level above the minimum standard imposed on all firms. The larger the difference between product quality and minimum quality standards (known by consumers before experience), the longer it will take to build a reputation for high quality, and thus the larger the incentive needs to be (see upper panel of figure 1).

Conclusions about the exact means by which GIs inform consumers about quality vary substantially in the literature; in all likelihood these mechanisms are complex and multifaceted. Menapace and Moschini (2012) postulate that GIs signal the specific minimum quality standards adopted by a region. Costanigro, McCluskey, and Goemans (2010) emphasize how GIs may essentially provide a means to broadly categorize food choices, thereby facilitating consumer learning and the articulation of quality expectations. Scarpa, Philippidis, and Spalatro (2005) argue that consumers' ethnocentric preferences or home bias may explain some of the preferences for origin-labeled foods. Another possibility, suggested by Broude (2005), is that GIs may counteract the perception that increased globalization has led to overly standardized food choices imposed by

[1] Note that a price premium is a necessary but not sufficient condition for the success of a GI, as premium prices may reflect higher costs of production or monitoring. Moreover, most studies evaluate price premiums at the consumer level; in the presence of market power at the retail level, benefits may be entirely captured at this stage of the supply chain. We thank an anonymous reviewer for bringing this point to our attention.

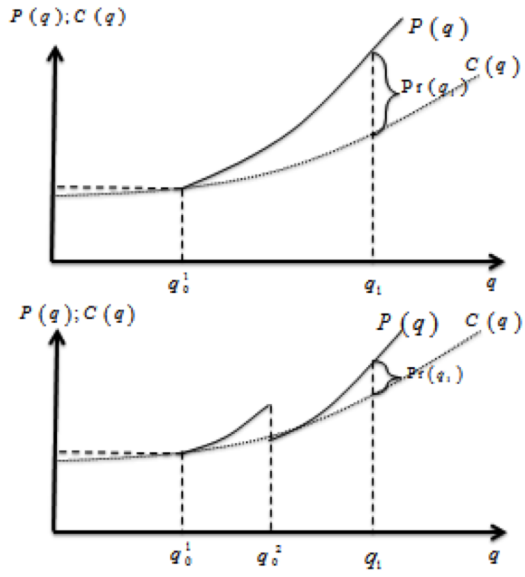

Figure 1. Equilibrium Reputation Premium (Pr) for Producing at Quality Level (q_1) with Single (q_0^1, Upper Panel) and Double (q_0^1 and q_0^2, Lower Panel) Minimum Quality Standards

Notes: $C(q)$ represents cost of production, P(q) is the market price. Adapted and simplified from Shapiro (1983) and Menapace and Moschini (2012).

international brands. Similarly, Herrmann and Teuber (2011) argue that GIs reveal and represent some sort of authenticity, cultural heritage, or the ability to trace food choices to their origins.

Farmers may use GI designations to differentiate their products and avoid competition in commodity markets, where brand-based product differentiation is otherwise impractical. That is, farmers and primary food processors using GI labels may have easier or more cost-effective access to niche markets, which could be associated with the ability to extract premium prices (Bramley, Biénabe, and Kirsten, 2009). Policy makers have long acknowledged consumer interest and the potential of GIs to impact product valuation, international trade flows, and farm policy (Herrmann and Teuber, 2011). Most importantly, GIs may represent a key option for raising farmers' incomes and promoting rural development (Josling, 2006).

After a long period of spontaneous and informal development, designations of origin have been the object of increasing policy and regulatory efforts, most notably in Europe. In the early 1990s, the European Union conferred legal protection to foods and foodstuffs with GIs through Regulation (EEC) 2081/92 (EEC Council, 1992). At the core of this regulation is the idea that products originating from certain regions are *sui generis*, in that there is a direct, demonstrable link between the product origin and its final quality (Herrmann and Teuber, 2011). This link occurs either via a set of standardized processing practices typical of a region or by the concept of terroir. The varying strength of this link is the rationale behind the use of two labels: in the case of a PGI (protected geographical indication), the production, processing, or preparation of a product must occur in the geographical area, while for a PDO (protected designation of origin), all stages must occur in the same region (O'Connor, 2004). In other words, PDOs have more stringent standards of production and signal a stronger link between origin and the product's attributes. Finally, this regulation confers protection from "abusive" or unwarranted use of PDO or PGI designations.

While the EU legislation on GIs is perhaps the most fully articulated and comprehensive (Josling, 2006), other countries have their own systems. In the United States, GIs are protected within the standard trademark system and most often simply verify the geographical origin of a product (Menapace et al., 2011). Names or signs, which otherwise would be considered primarily

geographically descriptive, can be registered as quality assurance programs (U.S. Patent and Trademark Office, 2011). The process of establishing and using such a verification process is straightforward. First, an agency (at the state or regional level) establishes the standards governing a GI-based trademark (e.g., Idaho Potatoes must be grown in Idaho and must be of a specific variety, such as Burbank; see O'Connor, 2004). It is up to the agency to choose how strict these standards are based on their perceptions of the existence of differentiation opportunities in the marketplace. Then, anyone who meets these standards is permitted to use the geographical name to market their product. In the case of GIs, the geographical origin is usually the main attribute that is regulated by the quality assurance program or trademark (U.S. Patent and Trademark Office, 2011). However, the allowance of multiple criteria suggests that trademark programs may display a weaker link between origin and product attributes than the PGI and PDO designations.

Methodology and Data Description

In this study we adopt a meta-analytical approach to identify the factors influencing the variation of price premiums across products. This methodology is increasingly popular in economics, and recent examples of its application include Lusk et al. (2005) on the valuation of genetically modified foods, Brander and Koetse (2011) on the value of urban open space, and Lagerkvist and Hess (2011) on consumer willingness to pay for animal welfare.

To gather the observations for our analysis, we searched several applied economic and food industry databases for studies estimating consumers' willingness to pay (WTP) or market premium for GIs in a variety of food products. In early 2011, we consulted the databases EconLit, Web of Science, EBSCO Business Source Premier, and Google Scholar. Studies published after this date or available only from other databases were not included. Since the first transnational regulation of GI products was introduced in the EU in 1992, we only included studies dated from the 1990s onwards. To identify relevant studies we used the following keywords and keyword combinations: "geographical indication," "protected designation origin," "protected geographical indication," "PDO," "PGI," "trademark," and "WTP label."

To be included in the sample, the studies had to meet two general criteria: 1) GI valuation estimates were reported as a premium/discount with respect to a generic, non-GI, products;[2] and 2) products had strong geographical connotations identifying a specific region of production. The first criterion limited the results to include only articles for which it was possible to obtain valuation estimates (either directly or as a function of the reported parameter) calculated with respect to a generic (non-GI) reference product or a superordinal product categorization.[3] For example, we accepted instances where Bordeaux wine, a GI label, was valued with respect to a pool of other (non-GI) European wines, or other (non-GI) French wines. Regarding the second criterion, all estimates of premiums for products carrying a PDO, PGI, or trademarked geographical label were included, as were any products originating from a very specific region but that may not have an official GI label (e.g., wine from Hunter Valley, Australia).

Studies estimating consumer valuation of country of origin labels (COOL) were excluded from the sample because the link between geographic name and specific growing conditions (the concept of terroir) was considered too weak. That is, a WTP differential for similar food products made in United States compared to those made in China might have more to do with perceived differences in food safety standards than differences in agronomic conditions. Finally, we did not consider studies estimating the premium for locally grown products, as products marketed as local rarely identify specific characteristics of the region of production. For local products, the geographic connotation relates more to the distance between location of production and the location of consumption rather

[2] Examples of GI studies excluded under this criterion include Mtimet and Albisu (2006); Santos and Ribeiro (2005); Schamel and Anderson (2003); Ali and Nauges (2007); and Combris, Lecocq, and Visser (1997).

[3] The reference category in some studies is a pool of non-GI labeled products originating from the same area or country. We found this base category acceptable as it represents an average of non-GI products within that country or region.

than product origin and is therefore a relative concept. In short, what is perceived as local by a New York consumer is certainly not local for one in San Francisco, and vice versa. Such scrupulous selection negatively affected the size of the sample but was deemed necessary to ensure robust estimates and valid inference.

While meta-analyses in the medical field often include a large number of experimental, easily replicated studies, many economics studies use observational data, and replication of pre-existing research for validation purposes is uncommon and hardly publishable. Large meta-analytical studies are therefore rare in our field: Lusk et al. (2005) compiled twenty-five studies and seventy-six observations (WTP for GM foods), Richardson and Loomis (2009) compiled thirty-one studies and sixty-seven observations (WTP for endangered species), and Murphy et al. (2005) compiled twenty-eight studies and eighty-three observations (hypothetical bias in stated preferences). One exception is the large body of data on cigarette and alcohol demand elasticities analyzed by Gallet and List (2003) and Gallet (2007).

In our case, we identified twenty-five studies that complied with our inclusion rules. Included studies in many cases reported estimates for more than one GI, leading to a panel of 141 observations. The sample was adjusted to exclude extreme outliers,[4] yielding a final sample size of 134 observations collected from twenty-two papers. Table 1 lists each study, the food product involved, the broadly defined methodological approach of each study, and the number of GI estimates collected.

As in other meta-analysis studies involving valuation of labeled attributes (Ehmke, 2006; Lusk et al., 2005), estimates of the GI premiums were normalized across articles as the percentage price (or valuation) difference between labeled and unlabeled products. Thus, to construct our dependent variable, we used the simple formula

$$\%\text{Premium} = \left(\frac{\text{Price of GI Product} - \text{Price of Reference Product}}{\text{Price of Reference Product}} \right) \times 100. \tag{1}$$

WTP premiums were constructed analogously. This specification normalizes the estimates across different years, units of measure (e.g., kilograms, pounds, cc) and currencies reported, but the percentage premiums only represent additional revenues, gross of any additional investments, production costs, and marketing activities associated with GI labeling.

We faced several challenges while compiling the data. In a study using an experimental design where a reference price was not given (Groot and Albisu, 2009), the median of the price treatments is used as reference price (following Lusk et al., 2005). Furthermore, many studies (more than 30% of our sample) reported only point estimates and not the associated standard errors. Even for the cases in which some measure of the precision of the estimates was provided, we found them to be extremely heterogeneous.[5] Another limiting data issue had to do with the demographics of the sample, particularly income, which were either missing or reported inconsistently across studies (for example, "high" vs. "low" income instead of income categories or levels).[6]

While we acknowledge these limitations, the compiled dataset still contains a wealth of information, allowing for some insightful comparisons across the following classifications: location and period covered by the study, type of GI scheme (PDO, PGI, GI-based trademarks, or generic geographical references), sample size and type of data used in the original study (e.g., survey, experiment, scanner data), and methodology used to estimate the price premium (hedonic methods,

[4] To reduce the effect of extreme (and perhaps suspicious) observations on our estimates, we eliminated seven observations falling outside a +/- 2 standard deviations from the mean estimated percentage premium (see table 1 for excluded studies). One standard deviation in this sample is 38% and the mean is 21.3%, so estimates outside the -54% and +94% range were excluded.

[5] The metrics used included standard errors, t-statistics, and exact p-values or cutoff p-values (e.g., 0.01, 0.05, and 0.1). While all these measurements could be transformed into a uniform variable, no measurement of precision of the WTP estimate was reported for 44 out of a total of 141 observations (31.2% of our sample size).

[6] Income was considered an important variable a priori since studies that include a larger proportion of more affluent consumers may have inflated willingness-to-pay estimates.

Table 1. Summary of GI Valuation Studies Included in the Final Analysis

No.	Authors	Year	Food Category	Methods	No. of Estimates
1	Akaichi and Gil[a]	2008	Produce	Other	1
2	Bombrun and Sumner	2003	Wine	Hedonic	12
3	Bonnet and Simioni	2001	Cheese	Other	1
4	Botonaki and Tsakiridou	2004	Wine	Other	1
5	Costanigro, Mittelhammer, and McCluskey	2009	Wine	Hedonic	7
6	Fotopoulos and Krystallis	2001	Olive Oil	Conjoint	1
7	Fotopoulos and Krystallis	2003	Produce	Conjoint	2
8	Galli et al.[b]	2011	Cheese	Other	31
9	Groot and Albisu[a]	2009	Produce	Conjoint	1
10	Hassan and Monier-Dilhan	2006	Cheese/ Meat	Hedonic	2
11	van Ittersum et al.	2007	Cheese/Produce/Meat	Other	6
12	Loureiro and McCluskey	2000	Meat	Hedonic	6
13	McCluskey et al.	2007	Produce	Conjoint	1
14	Menapace et al.	2011	Olive Oil	Conjoint	3
15	Mesías et al.	2010	Meat	Other	1
16	Mueller-Loose and Szolnok	2011	Wine	Hedonic	11
17	Oczkowski	1994	Wine	Hedonic	20
18	Quagrainie, McCluskey, and Loureiro	2003	Produce	Other	5
19	Sanjuán-López, Resano-Ezcaray, and Camarena-Gómez	2009	Produce	Hedonic	3
20	Santos and Ribeiro	2005	Olive Oil/Cheese/Wine	Hedonic	9
21	Schamel	2006	Wine	Hedonic	6
22	Skuras and Vakrou[a]	2002	Wine	Other	1
23	Stefani, Romano, and Cavicchi	2005	Grain	Conjoint	3
24	Stefani, Romano, and Cavicchi	2006	Grain/Meat/Produce	Other	3
25	Teuber	2010	Coffee	Hedonic	4

Notes: [a]Excluded from final sample due to outlier estimates.
[b]Four estimates excluded from final sample due to outlier estimates.

contingent valuation, other).[7] The valuation estimates were also categorized by broad food classes (e.g., cheese, meat, fruit) and three super-categories based on the level of processing that the base agricultural commodity underwent (highly processed for cheese and wine; low/intermediate for olive oil, grain, coffee, meat; and fresh for fruits and vegetables). A final categorization was based on the perceived propensity for firm branding within each product market, which we consider to be another important product differentiation mechanism. Wine and olive oil were characterized as markets in which brands are almost always present, while cheese and meat may be either branded or generic. In this time frame, private branding was less common for grains, fresh fruits, and vegetables. Table 2 provides descriptions of the variables and their descriptive statistics.

The percentage premium for all GIs varies widely from a minimum of -36.7% for Provolone Valpadana Cheese to +181.9% for Valle d'Aosta Fromadzo Cheese in Italy (Galli et al., 2011). The average percentage premium for GIs is 15.1%. While the mean WTP is positive, indicating that consumers are generally willing to pay more for GI products, there is a great deal of variability in the reported premiums (the standard deviation is 26.1%). It should also be noted that the majority of studies in this sample (55%) are based on valuations by European consumers, followed by studies of North and Central American products (31%), and then Australian and New Zealand studies (14%).

[7] Methodologies coded as "other" include simple reporting of a price differential between the labeled product and an unlabeled substitute (Galli et al., 2011), auctions/bids (Stefani, Romano, and Cavicchi, 2005; Akaichi and Gil, 2009), random utility models (Botonaki and Tsakiridou, 2004), and contingent-valuation methods (Skuras and Vakrou, 2002).

Table 2. Description of Variables

Variable	Description	Mean	Std. Dev.	Min	Max
WTP (%)	Value of the product in percentage price premium (+/ -) %	21.32	37.8	−36.73	181.92
WTP no outliers	Observations lying outside +/- 2 standard deviations from the mean are excluded	15.12	26.13	−36.73	90.60
WINE	Binary variable coded 1 if the product is in Wine Category, 0 otherwise	0.47	0.50	0	1
CHEESE	Binary variable coded 1 if the product is in Cheese Category, 0 otherwise	0.24	0.43	0	1
COFFEE	Binary variable coded 1 if the product is in Coffee Category, 0 otherwise	0.03	0.17	0	1
MEAT	Binary variable coded 1 if the product is in Meat Category, 0 otherwise	0.07	0.25	0	1
PRODUCE	Binary variable coded 1 if the product is in Produce Category, 0 otherwise	0.10	0.31	0	1
OLIVE OIL	Binary variable coded 1 if the product is in Olive Oil Category, 0 otherwise	0.05	0.22	0	1
GRAIN	Binary variable coded 1 if the product is in Grain Category, 0 otherwise	0.04	0.19	0	1
PDO	Binary variable coded 1 if product is PDO, 0 otherwise	0.45	0.50	0	1
PGI	Binary variable coded 1 if product is PGI, 0 otherwise	0.09	0.28	0	1
TRADEMARK	Binary variable coded 1 if product is defined as a Trademark or AVA (for wines) in original paper, 0 otherwise	0.21	0.41	0	1
REGIONAL	Binary variable coded 1 if product is regional (no specific geographic regulation), 0 otherwise	0.35	0.44	0	1
PRIMARY DATA	Binary variable coded 1 if primary data, 0 if secondary data sources are used	0.18	0.38	0	1
CONJOINT	Binary variable coded 1 if methodology is Conjoint, 0 otherwise	0.07	0.26	0	1
HEDONIC	Binary variable coded 1 if methodology is Hedonic, 0 otherwise	0.60	0.49	0	1
OTHER	Binary variable coded 1 if methodology is not Conjoint, Hedonic; 0 otherwise	0.33	0.47	0	1
LOW/INTERMEDIATE PROCESSED	Binary variable coded 1 if product involves low to intermediate processing, 0 otherwise (meat, grain, olive oil, coffee)	0.19	0.39	0	1
HIGHLY PROCESSED	Binary variable coded 1 if product involves a high level of processing, 0 otherwise (cheese, wine)	0.71	0.45	0	1
FRESH	Binary variable coded 1 if product is retailed fresh, 0 otherwise (produce)	0.10	0.31	0	1
FULL-BRAND	Binary variable coded 1 if product is most likely to have a brand (wine, olive oil), 0 otherwise	0.52	0.50	0	1
MIXED-BRAND	Binary variable coded 1 if product could have a brand (meat, cheese), 0 otherwise	0.31	0.46	0	1
NO BRAND	Binary variable coded 1 if product most likely does not have a brand (fruit/veggie, grain, coffee), 0 otherwise	0.17	0.38	0	1

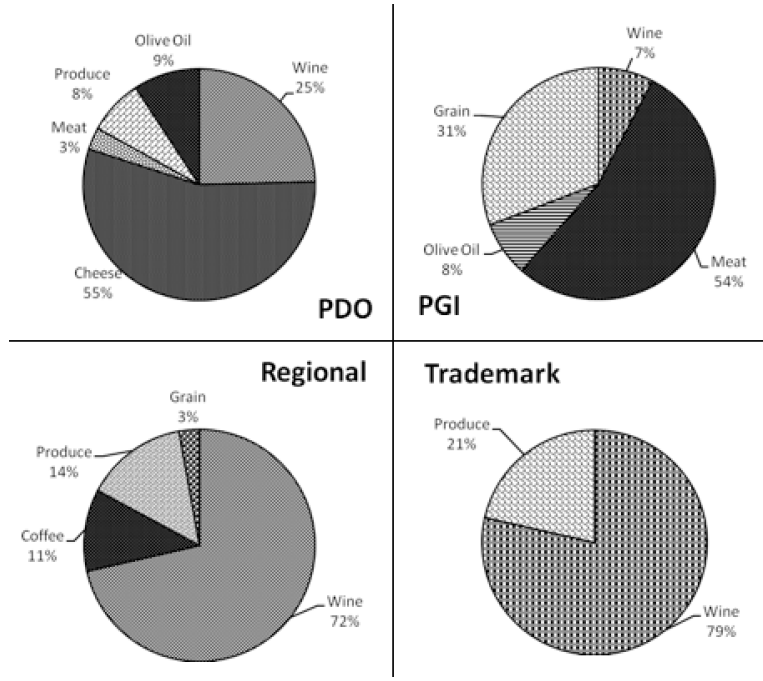

Figure 2. Product Categories by Quality Assurance Scheme

Figure 2 shows the broad product categories represented in our sample by the GI scheme (PDO, PGI, or trademark). From a statistical viewpoint, it would be ideal to have all product categories represented within each GI-based quality assurance scheme, with similar frequencies. Instead, PDO-protected products are mostly cheese, followed by wine, olive oil, fruits and vegetables, and meat. The majority of PGI-certified products in our sample are meats, followed by grains and olive oil, while GI trademarks are mostly used with wine products (73%),[8] as well as fruits and vegetables, such as Washington apples and Idaho potatoes. Comparing PDO and PGI product lists, it appears that, with the exception of fresh produce, the more processed products such as cheese, wine, and olive oil self-select into the more complex PDO quality assurance, while less processed meats and grain products are mostly certified by the less onerous process associated with a PGI.

Model and Estimation Methods

We estimate three model specifications, the most descriptive of which (model 1) takes the form:

$$
\begin{aligned}
\%\text{Premium}_{ij} \;=\; & \alpha_0 + \alpha_1(\text{Wine}_i) + \alpha_2(\text{Cheese}_i) + \alpha_3(\text{Meat}_i) + \\
& \alpha_4(\text{Grain}_i) + \alpha_5(\text{OliveOil}_i) + \alpha_6(\text{Produce}_i) + \\
& \beta_1(\text{PDO}_i) + \beta_2(\text{PGI}_i) + \beta_3(\text{Trademark}_i) + \\
& \gamma_1(\text{PrimaryData}_j) + \gamma_2(\text{Conjoint}_j) + \gamma_3(\text{Hedonic}_j) + \varepsilon_{ij},
\end{aligned} \tag{2}
$$

where $\%\text{Premium}_{ij}$ indicates the i^{th} estimated premium from the j^{th} study. Thus the general modeling framework assumes that the percentage WTP/price premium for GI-certified food products depends on product/market specific characteristics (as captured by the alpha coefficients), the quality assurance scheme (beta coefficients), and a series of study-specific controls (gamma coefficients)

[8] Wines are coded as trademarks when the original study specifies that they be produced in a specific American Viticultural Area (AVA).

accounting for the data and methods used in each original study.[9][10] The reference categories for each set of dummy variables are respectively coffee, unregulated regional designations of origin, and studies using methods other than conjoint and hedonic analyses.

Models 2 and 3 aim to abstract from specific product categories and investigate general product and market characteristics that may explain variations in GI premiums. In model 2 we replace the product category dummies with variables quantifying the level of processing to obtain the specification:

$$\text{Premium}_{ij} = \alpha_0 + \alpha_1(\text{HighlyProcessed}_i) + \alpha_2(\text{Fresh}_i) + \beta_1(\text{PDO}_i) + \ldots + \varepsilon_{ij}. \tag{3}$$

In model 3 we focus on the degree of firm branding observed for each product:

$$\text{Premium}_{ij} = \alpha_0 + \alpha_1(\text{FullBrand}_i) + \alpha_2(\text{MixedBrand}_i) + \beta_1(\text{PDO}_i) + \ldots + \varepsilon_{ij}. \tag{4}$$

Admittedly, these two "umbrella" categories are somewhat collinear, as longer supply chains seem to be typical of markets in which brand names have developed.

As it was not possible to directly include reliable measures of the variance of the estimates in our meta-analysis, our approach was to designate statistically insignificant estimates as zero. For the remaining estimates, we follow the approach set by Lusk et al. (2005) and use the sample size of the original study as a measure of precision. We expect the variance to decrease as the sample size increases, as long as a study employed a consistent estimator. Thus, all three models are first estimated via ordinary least squares (OLS) and then by weighted least squares (WLS), where the weights are proportional to the sample size of each study. This implies that estimates of GI premiums generated from a larger sample size will have a greater effect on our estimated coefficients than estimates coming from a smaller sample.

Regarding the error term of our model, it seems reasonable to assume that the residuals are uncorrelated across studies, but some degree of correlation should be expected when premium estimates are obtained from the same study. As a cautionary measure, we use a robust (clustered on the individual study) estimator of the variance-covariance matrix. Random and fixed effect (panel) models were also estimated. For the fixed effects model, the null hypothesis that all fixed effects are jointly equal to zero cannot be rejected with a joint F-statistic ($\text{prob} > F = 0.943$). For the random effects model, the null hypothesis that within-study variances are zero, tested with the Breusch-Pagan LM Test, cannot be rejected ($\text{prob} > \chi^2 = 0.218$). This suggests that the weighted OLS regression estimation method may be appropriate.

Results

Estimation results are reported in table 3. Both unweighted and weighted results are provided for model 1, while models 2 and 3 are presented only in the weighted version. As a robustness check, model 1 was also estimated (via WLS) using only the data from Europe-based studies. For model 1, the weighted model is superior to the unweighted model in that it provides more precise estimates (lower standard errors) and overall model fit (R-squared increases from 0.241 to 0.666). Thus, we focus the remaining discussion on the results estimated via WLS.

The first notable result is that GI labeling for grain, meat, and fresh produce commands the highest price premiums: 121.5%, 72% and 64%, respectively. Cheese follows with a premium increase of 43.5%. In contrast, the lowest percentage price increases for GI labeling are associated with olive oil and wine, with 31% and 21.5% premiums, respectively. All these estimates are

[9] Because of strong collinearity, it was not possible to estimate the effect of certification schemes while controlling for possible country-specific effects. To investigate the robustness of our result to such effects, model 1 was re-estimated using only studies conducted in Europe.

[10] A reviewer suggested the inclusion of interaction terms in our estimation. We did consider this possibility and tested a number of options. However, due to our sample size and multicollinearity between the interaction terms and other variables, a main effect model was deemed preferable.

Table 3. Estimation Results

Variable	Model Estimator Data	Model 1 OLS all	Model 1 WLS all	Model 1 WLS Europe	Model 2 WLS all	Model 3 WLS all
Wine		22.96*	21.57***			
		(12.17)	(0.69)			
Cheese		26.6	43.48***	19.59***		
		(16.47)	(5.03)	(2.48)		
Meat		32.26	72.03**	66.01**		
		(19.68)	(25.97)	(21.95)		
Produce		24.88*	63.88***	18.06		
		(14.83)	(16.44)	(19.21)		
Olive Oil		26.30	31.19***	0.66		
		(16.74)	(6.47)	(2.54)		
Grain		51.76**	121.54***	107.33***		
		(21.80)	(22.12)	(17.72)		
Full Brand						−34.49*
						(17.09)
Mixed Brand						−14.02
						(17.01)
Highly Processed					−3.09	
					(10.32)	
Fresh					27.76	
					(18.15)	
PDO		12.03*	20.69***	8.58***	30.69***	21.91***
		(6.63)	(4.13)	(1.78)	(7.96)	(3.53)
PGI		5.77	−37.23	−69.07***	10.29	−7.65
		(14.89)	(25.41)	(20.48)	(12.78)	(4.62)
Trademark		35.05***	39.01***		39.08***	39.56***
		(6.11)	(0.92)		(0.93)	(1.03)
Primary Data		−10.05	−1.28	−0.99	−0.95	1.82
		(9.83)	(9.65)	(10.55)	(9.36)	(11.07)
Conjoint		17.57	53.75***	60.41***	44.67***	58.29***
		(13.64)	(15.87)	(18.02)	(15.37)	(15.94)
Hedonic		1.43	63.78***	65.36***	51.68***	62.65***
		(10.18)	(3.5)	(2.46)	(7.98)	(4.20)
Constant		−23.45	−85.81***	−50.28***	−49.05***	−29.07*
		(15.28)	(3.5)	(2.64)	(15.42)	(17.02)
Adjusted-R^2		0.241	0.666	0.814	0.636	0.656
F-stat		4.51	–	319.4	344.58	330.3
		(0.000)	–	(0.000)	(0.000)	(0.000)
Obs.		134	134	71	134	134

Notes: Numbers in parentheses are standard errors. Single, double, and triple asterisks (*, **, ***) indicate significance at the 10%, 5%, and 1% level.

statistically significant at the 1% level. It should be noted that, as average prices are quite different across product categories, this ranking of premiums might change if they are to be considered in absolute monetary terms. When only European studies are used in the estimation, the magnitude of the premiums changes (and statistical significance is lost because of the smaller sample size), but the ordinal ranking of classifications is generally preserved (see figure 3).

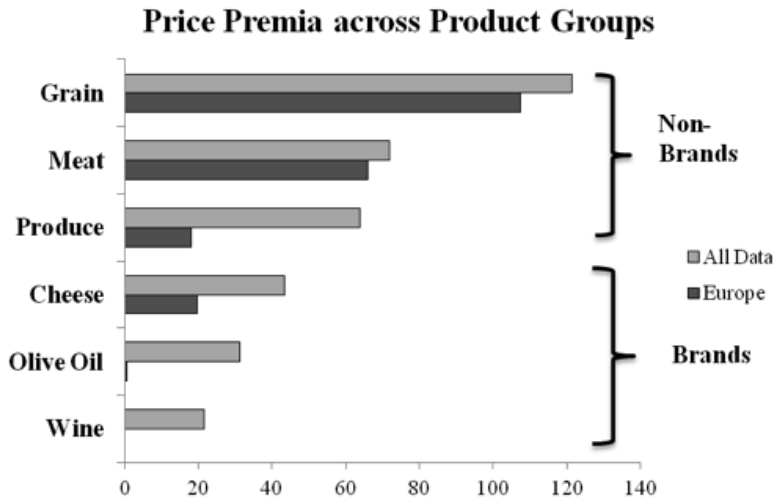

Figure 3. Price Premiums across Product Groups (Comparison between All Data and European Data)

Controlling for product-specific differences, a European product with a PDO certification commands a price premium 21% higher than one using a nonregulated regional name. In short, the PDO percentage premium is higher than the average PGI value, which aligns with our expectations considering that the PDO certification process is more complex and requires a stronger connection between raw materials, stages of production, final product characteristics, and the geographical area of production. While this ordinal ranking in premium for PDO and PGI certifications appears clear, little more can be said regarding the magnitude of the PGI premium: table 3 shows that the point estimate for PGI certification is imprecise, with very large standard errors, weak significance, and changing signs across alternative specifications. In the United States, the presence of a GI trademark is associated with an even higher price premium than the PDO, 39%. In terms of methodology, valuation methods such as conjoint analyses and hedonic models tend to generate higher premiums estimates than the reference group of "other" methods, by an average of 54% and 64%, respectively.

Results from model 2 suggest that the categorization of food products by level of processing does not provide much insight for the rationale behind the cross-product differences in premium observed in model 1. GIs for fresh produce provide the largest premium (27.8%), but the processing intercept shifters have weak significance and most of the product-specific premiums seem to transfer to the PDO and PGI estimates, which increase to 30.7% and 10%, respectively. Model 3 is slightly superior in fit (see adjusted R^2) to model 2, and produces results that are more consistent with those obtained with the more product-driven model 1. According to model 3, the GI premium for fully branded products (wine and olive oil) is 34.5% lower than for GI products not generally carrying a private label. Products that sometimes display brand names (meats, cheeses) also register a decrease in their price premium, albeit a smaller and insignificant one.[11]

Discussion

The systematic analysis of the existing body of research on GI premiums unequivocally confirmed our original observation: while GIs constitute an effective differentiation instrument in food markets, the magnitude of the price premium associated with GIs varies rather significantly across products

[11] We acknowledge that partitioning food categories as fully branded (wine, olive oil), mixed branded (meats, cheeses), or unbranded (grain, fruits/vegetables, coffee) is somewhat arbitrary. However, we argue that this fits the specific products included in the dataset. Moreover, having estimated alternative model specifications, we found that the way we partition the degree of branding across food categories does not significantly change the interpretation of our result.

Table 4. Product Characteristics Influencing GI Price Premium

Characteristic	High Percent Premium	Low Percent Premium
Product	Grain, fruits, vegetables, agricultural produce	Wine, olive oil, cheese
Length of Supply Chain	Short	Long
Numbers of Producers	More (farmers)	Less (Food Industry)
Brand Names	Generally No	Generally Yes
Processing Level	Generally Low	Generally High
Product/Quality Differentiation	Lower, depends on product variety cultivar	Higher, depends on food processor

and markets. Comparing high (percentage) premium (grain, meats, fruits, vegetables) and low premium products (wine, olive oil, cheese), a set of key differentiating product characteristics emerge (see table 4). The prevalence of high percentage GI premiums corresponds to minimally processed foods with short supply chains, and a large number of atomistic, undifferentiated producers. In contrast, premiums are smaller when the products are processed, the supply chain is long, and firm brands are known to consumers.

While these results appear evident, their interpretation should be approached more cautiously: an overly literal interpretation of the estimates' magnitudes is not advisable given the aggregate and heterogeneous nature of our data. The most fruitful discussion comes, we believe, from a qualitative reading of the results in light of other relevant theoretical or empirical findings in the literature. These premiums are simply an indicator of market value, and increased producer revenue may face additional costs of production and marketing. We make no conclusions about the impact of these premiums on producer welfare or profits.

According to our estimates, there is a relatively strong, inversely proportional relationship between the use of firm branding and the GI premium (see figure 3), which is robust to the type of consumer population (rest of the world vs. European only). Previous work by Costanigro, McCluskey, and Goemans (2010) examining firm and regional reputations in the wine market offers an interpretative framework. In their article, a shift from cheap to expensive wines causes reputation premiums to migrate from collective names (viticultural areas) to brand names (specific wineries). They interpret this to mean that the consumer may not see the value (in terms of search costs) in critically differentiating across many individual producers when buying less expensive products (such as grains, fruits and vegetables). Under such circumstances, GIs are the main product differentiation tool because they provide a simple categorization of the available choices. When purchasing more expensive products (such as wine and olive oil), the incentive to learn about differences in quality across brand names is more pronounced, allowing brand names to capture a larger share of the reputation premium.

This reasoning does not necessarily imply that GIs have little use in markets for expensive food products. As a matter of fact, the ubiquitous presence of denominations of origin in wine and cheese (see figure 2) is proof to the contrary. For expensive food products, consumers may use GIs to narrow down the large choice set of competing firms to a specific group or groups of producers for which learning about individual firm differences is more efficient and worth the search time. Then, consumers can investigate the subset of selected brands (identified by the GI) more thoroughly or invest in directly experiencing a specific product (through samples or trial).

The relationship between institutional framework regulating GIs and price premiums is especially relevant for its implications on food marketing policies. In Europe, more stringent regulations for the PDO designation appear to secure a higher price premium than its less stringent quality-assurance counterpart (PGI). Stricter regulations may signal increased benefits to consumers in the form of food safety, quality assurance, and stronger cultural or heritage connection, prompting a higher willingness to pay for products that are more closely regulated. It is therefore surprising that the GI trademarks in the United States command premiums higher than either the PDO or PGI designations, despite a less rigorous accreditation process. One possibility is that country-specific

(United States versus Europe) factors, which could not be accounted for in the model, play a relevant role.

However, this empirical result can also be explained on economic grounds, based on the theoretical findings of Menapace and Moschini (2012) regarding the relationship between minimum quality standards, reputation price premiums, and use of GI labels. When a single quality standard is enforced (e.g., a standard q_0^1 imposed by a single GI trademark, shown in the upper panel of figure 1), the provision of high quality products (q_1) necessitates a large reputation premium (measured by $Pr(q_1)$),[12] because the reputation for high quality significantly lags the preemptive investment in quality. The coexistence of two minimum-quality standards (e.g., PGI $= q_0^1$ and PDO $= q_0^2$, in the lower panel of figure 1) shortens the lag between producing at high quality and developing a corresponding reputation, lowering the reputation premium. Therefore, a tiered GI certification scheme such as the one adopted in Europe may principally benefit consumers (see also Moschini, Menapace, and Pick, 2008) by lowering the reputation costs of providing high-quality food products.

Conclusions and Future Research

Agricultural and food products have long been associated with unique quality attributes strongly associated with the agro-ecological characteristics and culinary traditions of their origin. GIs formalize this connection in the marketplace, typically leading to positive price premiums. We investigate this market dynamic by analyzing how price premiums for GIs vary by product, regional designation, and intrinsic product characteristics. The analysis provided observational evidence in support of several hypotheses, which should be further corroborated with experimental work.

In terms of percentage price premiums, agricultural produce, and minimally processed foods benefit the most from GI differentiation. We interpret this finding in light of the fact that, in addition to GIs, products with value-added characteristics and longer supply chains may use private brands to capture reputation premiums. In other words, brands and GIs may play a similar role in product differentiation and thus be substitutes for each other. The institutional framework for the GI was found to matter: within the same country, quality assurance schemes with higher quality standards (such as PDO) receive higher premiums than less stringent ones (such as PGI). Moreover, when multiple labeling schemes with different minimum quality standard coexist (as for PDOs and PGIs in Europe), the price premium associated with the labels is lower than when a single label is used (as for the GI trademark in the United States). Our interpretation is that reputations for high quality are easier to achieve (and thereby less costly for the consumer) when multiple quality assurance schemes segment the quality spectrum.

In addition to the results just discussed, reviewing the existing body of empirical research on GI provided an interesting perspective on where the academic frontier has moved in the last two decades. While our analysis would surely have benefited from a larger number of estimates, future empirical research on GIs will have to go beyond the mere quantification of a premium. Rather than increasing the sophistication of experimental and estimation methods, we believe that the most valuable approach will be to construct better behavioral models of consumer psychology and decision making within realistic shopping experiences. For example, little has been done in our discipline to understand how consumers learn and generalize from their own experiences or how label information is filtered and processed to form quality (or other) expectations about food products. On the supply side, empirical assessments of how (consumer-level) GI premiums are transmitted through the supply chain are virtually nonexistent, and information about the additional cost of production, marketing, and monitoring GI certification schemes is scarce.

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[12] While we think it is important to compare expectations based on theory with our empirical findings, this definition of premium (price minus cost) is not equivalent to what is measured in empirical work (a difference in prices between two products of presumably different quality). We thank an anonymous reviewer for pointing this out.

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