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Does *terroir* size matter? Protected geographical areas and prices of European hams

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ABSTRACT

The boundaries of geographical indication (GI) areas represent the core of GI specifications. Theory suggests that smaller areas result in higher prices due to quantity restrictions and higher quality. However, empirical evidence on the importance of GI areas for using places as brands is scarce. Our regressions using newly coded data of GI areas in km^2 of 22 hams provide direct empirical evidence that larger areas are associated with lower prices. Subsample regressions suggest that areas affect prices through both quantity and (perceived) quality. Thus, our findings indicate that GI areas are a non-negligible factor in establishing collective regional brands.

KEYWORDS

geographical indications; regional brands; hedonic price analysis; European Union; Protected Designation of Origin (PDO); Protected Geographical Indication (PGI)

JEL O34, Q13, Q17, Q18

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1. INTRODUCTION

The protection of local foods is deeply rooted in Europe's historical DNA (Meloni & Swinnen, 2018). Merit and prestige of traditional foods are reflected in the EU's regulation No. 1151/2012 on geographical indications (GIs). EU GIs protect local producers from a denominated area against imitators and impose product specifications to assure consistent quality. There exist two major origin labels for foodstuffs: Protected Designations of Origin (PDOs) and Protected Geographical Indications (PGIs). For PDOs such as Italian Parma ham, all production processes must take place in a denominated region. For PGIs such as German Black Forest ham, only the most defining production steps must take place in the denominated region. For both labels the EU applies a *sui generis* scheme that grants only producers from a protected region collective intellectual property rights of a GI (Josling, 2006; Rangnekar, 2004).

Today, more than 1500 foods are protected under an EU GI and the number is rising.[1] The justification to protect a GI based on its geographical origin is its *terroir*. According to the EU, the concept of *terroir* unites the special natural and human factors that allegedly contribute to unique quality and authenticity of certified products produced in the GI area (Josling, 2006).

GI regulations and labels have been examined broadly (AND-International, 2019; Deselnicu et al., 2013; Huysmans & van Noord, 2021; Lence et al., 2007; Loureiro & McCluskey, 2000; Moschini et al., 2008; Rangnekar, 2004; Resano-Ezcaray et al., 2010; Teuber, 2011; Török et al., 2020; Yang & Renwick, 2019; Zago and Pick, 2004). However, the effects of the size of GI areas have received limited attention in prior applied economic research, which is surprising as the delimitation of the geographical area stands at the core of every GI application. Without a justified link to a specific area producers cannot register a GI (Gangjee, 2017). While these geographical boundaries seem to be inherently given, they can be in fact influenced by lobbying of interest groups and are subject to rent-seeking objectives of political and economic players (Landi & Stefani, 2015; Meloni & Swinnen, 2018).

Recently, Deconinck and Swinnen (2021) developed a political–economic model that highlights the politically set GI area as a key aspect affecting average prices and quality of a GI. Larger GI areas are expected to result in lower average (perceived) quality due to less specific *terroir* and fewer quantity restrictions due to more potential

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producers. Our paper's main goal is to examine empirically Deconinck and Swinnen's (2021) theory that larger GI areas have a negative relationship with prices of GI products.

Realizing added value through higher prices, that is, premiums, represents a major pillar of the economic sustainability of GIs (AND-International, 2019; Cei et al., 2018). GI certification has the potential to foster the value of regional brands and hence, regional development (Blancheton & Hlady-Rispal, 2021; Ilbery et al., 2005; Rangnekar, 2004; Tregear et al., 2007). Crescenzi et al. (2022) show that Italian municipalities with registered wine GIs improved their local development in the long run. Our paper contributes to this strand of literature by analysing whether the size of a GI area, that is, municipalities holding the same GI, affects average retail prices of hams.

With the help of a hedonic price analysis, we examine how GI areas relate to online retail prices of GIs sold in 11 EU member states. To do so, we created an original dataset of GI areas (km^2) comprising 22 raw hams from nine countries. Our results support the hypothesis established by prior theory that larger GI areas are associated with lower average prices. Thus, GI areas should be carefully determined by producers and policymakers upon registration. Our findings indicate that larger GI areas may impede efforts to leverage specific place-based intangibles, while smaller GI areas could promote regional brand differentiation by strengthening the ability to achieve premiums.

The present paper's main contributions are as follows. First, we explicitly include areas (km^2) of GI foods in an econometric model and examine the association of area size with prices. Second, we introduce important ham-specific control variables. Third, this study comprises a representative number of GIs that encompasses markets and products beyond the Southern EU context (Huysmans & Swinnen, 2019) that still dominates GI research. Finally, instead of relying on survey data as most GI price analyses (Leufkens, 2018), we gather actual retail price data from online stores.

2. GI AREAS AND EUROPEAN HAM

Our paper contributes to two major strands of extant research on GIs as tools to appropriate regional brand value. The first strand deals with the effects of the GI area on product prices. The second strand concerns the economics of GI ham products.

2.1. Effects of GI areas on prices

Overall, theory suggests that credible GI certification schemes can combat an asymmetric information problem by providing information to consumers about a product's true origin and quality standards (Desquilbet & Monier-Dilhan, 2015; Lence et al., 2007; Menapace & Moschini, 2014; Moschini et al., 2008; Zago and Pick, 2004). With an EU GI, producers have the chance to share marketing and certification costs. Even small producers may become competitive and provide high quality resulting in positive welfare effects (Moschini et al., 2008). Therefore, GIs can represent an informative signal for which consumers are willing to pay a premium.

The most defining characteristic of every European GI is its origin. The exact delimitation of the respective geographical area has historically been influenced by interest groups (Landi & Stefani, 2015; Meloni & Swinnen, 2018). However, only a minority of theoretical and empirical work has explicitly accounted for GI areas. Landi and Stefani (2015) modelled the policy process of GI establishment to predict outcomes of the size of GI areas. An important implication regarding prices is that policymakers with public interest who focus on an increase in social welfare tend to accept larger areas. One major reason for this implication is that consumer prices fall when producers outside an originally smaller GI area are included (Landi & Stefani, 2015). This effect of increasing GI areas resulting in lower prices is also emphasized by Deconinck et al. (2015) who analyse the interaction between producers and the regulator in a game-theoretical bargaining model.

Furthermore, Deconinck and Swinnen (2021) developed a model that puts the size of a GI area forward as a crucial factor that alters pricing, costs and quality. Landi and Stefani (2015) did not account for effects of GI areas on quality. However, according to the EU narrative, specific *terroir* that shapes product quality is the main motivation for a *sui generis* (*terroir*-based) GI scheme. Thus, larger areas with more producers and less specific *terroirs* are likely to lead to lower (perceived) quality and prices according to Deconinck and Swinnen (2021). Their model proposes an economic theory for the effects of GI areas. However, there remains a lack of substantive empirical evidence. Therefore, the main contribution of our paper is to examine whether the size of delimitated GI areas is indeed negatively associated with prices.

Studies included in comprehensive meta-analyses concerning GI price premiums of Deselnicu et al. (2013) and Leufkens (2018) did not explicitly control for the size of protected areas of EU GIs. Prior studies provide evidence that establishing a GI can have a positive effect on price (AND-International, 2019; Deselnicu et al., 2013; Leufkens, 2018), but little is known to what extent the size of a GI area mediates this price effect.

In the case of GI wine, Moran (1993) outlines that prices of smaller GIs should tend to be higher due to more distinct and authentic *terroir*-based quality and supply limitations as suggested by the aforementioned theory. In a longitudinal study, Haeck et al. (2019) find significant effects of the introduction of a GI delimitation on prices in the case of some Champagne wines, but not for, for example, Bordeaux wines. López-Bayón et al. (2020) investigate the quality of wines. While measuring quality is very hard for most products, it can be based on ratings in the case of wine. Their measure of GI area negatively affects the expected quality of Spanish wines, which provides evidence for the model of Deconinck and Swinnen (2021) that points out lower average quality for larger areas.

With our paper, we add to this partial evidence by investigating the effect of areas on prices instead of quality. However, it is important to note that due to the common heterogeneity of GI products, it is difficult to generalize findings in GI research (Török et al., 2020). Overall, more research on *terroir* effects focusing on GIs other than wine is needed, which is why we focus on the popular GI food category of hams.

In a recent study, Chilla et al. (2020) investigate price effects of GI areas on German food GIs. In the case of Bavarian PGI asparagus and carp, such area limitation indeed has a positive price effect. However, the size of GI areas is again not explicitly measured. Merely the establishment of a GI leads to a 'regionally' limited area (Chilla et al., 2020). Thus, the need for thorough research that considers different sizes of areas among GIs becomes evident. We provide novel empirical evidence to better understand the economic effects of GI areas with the help of an econometric price analysis that explicitly considers different GI areas as a predictor.

2.2. Effects of GIs on ham prices

One of the most well-known GIs is the Italian Prosciutto di Parma ham, which even featured prominently in trade negotiations such as those for the Comprehensive Economic and Trade Agreement (CETA) (Huysmans, 2022; Josling, 2006). Not only is Italy renowned for its ham, but also other EU countries have similar century-old traditions: France has its Jambon de Bayonne, Belgium its Jambon d'Ardenne and Germany its Schwarzwälder Schinken. GI-protected ham production is common across Member States and intra-EU trade dominates the export of these products (Török & Jambor, 2016). These are prime reasons why we focus our analysis on GI hams.

Garavaglia and Mariani (2017) focus on Italian GI hams and surveyed Italian respondents living in Parma and Monza. They also find that consumers are willing to pay significantly more for PDO Parma ham. This higher willingness to pay is particularly present for respondents living farther away from the respective GI area who rely more on extrinsic cues such as the GI label (Garavaglia & Mariani, 2017). Van Ittersum et al. (2007) also reveal a higher willingness to pay by Italian respondents for PDO Prosciutto di Parma. The premium appears to be based on higher perceived quality thanks to a favourable attitude towards the region of origin and beliefs that GI labels ensure consistent quality (van Ittersum et al., 2007).

Moreover, Cilla et al. (2006) show that Spanish consumers are willing to pay more for the Spanish PDO ham of Jamón de Teruel. Resano-Ezcaray et al. (2010) confirm this tendency regarding Jamón de Teruel with the help of a conjoint ranking experiment of Spanish consumers' stated and revealed preferences, excluding Ibérico[2] hams. However, Mesías et al. (2010) focus on Spanish Ibérico ham and find that the PDO label is of rather low importance to Spanish consumers. This finding relates to Loureiro and McCluskey's (2000) earlier findings that PGI labels become insignificant to consumers in the case of high-quality cuts of fresh meat. Thus, special pig breeds such as Ibérico can act as a high-quality signal independent of a GI label. This value-added of Ibérico meat even caused disputes between Spain and the United States because American producers intend to produce 'Iberian' ham in Texas and Georgia (Burgen, 2020).

While most GI ham studies focus only on prominent PDOs from and sold in Italy and Spain, Kos Skubic et al. (2018) interview Slovenian respondents and find that they are willing to pay significantly more for domestic hams made in Slovenia. In general, the country of origin is the most important factor, while the PGI label plays a rather unimportant role. A limitation of this paper as well as other GI ham studies is the focus on one single market.

Schamel (2007) investigates with a hedonic model which factors influence prices of GI hams from three different countries that are sold in larger chunks at auctions on the German eBay website. In his model, the domestic product of German PGI Schwarzwälder Schinken is up to 30% cheaper than foreign products. Moreover, Italian PDO ham is found to be more expensive than Spanish TSG ham.[3] However, this study has limited implications regarding retail prices because price setting in online auctions strongly differs from ordinary supermarkets.

In that respect, Hassan and Monier-Dilhan (2006) focus, amongst others, on EU PGI hams and analyse corresponding retail prices with a hedonic model that is based on extensive French consumption data. PGI dry-cured hams can realize price premiums. However, Hassan and Monier-Dilhan (2006) emphasize the importance of distinguishing between national brands and private label products when analysing price premiums of public quality labels such as GIs.

All in all, our contribution to prior literature is based on five pillars. First, we explicitly incorporate GI areas (km^2) in our econometric models to investigate the association of area size with prices of GI hams. Second, by controlling for quantity in regressions on a subsample of Italian GIs we are able to substantiate GI theory that highlights a quality as well as quantity channel of areas on price. Third, we conduct a pan-European analysis that comprises a representative number of 22 GIs from nine countries going beyond the dominant Southern EU context (Huysmans & Swinnen, 2019). Fourth, we introduce original ham-specific controls and highlight their importance in the estimation of GI premiums. Finally, instead of relying on survey data like the majority of GI price analyses (Leufkens, 2018), we gather actual retail price data from online stores in 11 countries.

3. THEORY

To clarify our hypotheses and to guide our econometric model specification, we outline our theoretical foundation which is based on the literature above. Our theory focuses on how changes in the GI area affect equilibrium prices (Figure 1).

Increases of GI areas can negatively affect prices through two separate channels (shift from P_1 to P_2). First, on the supply side, the area presumably restricts

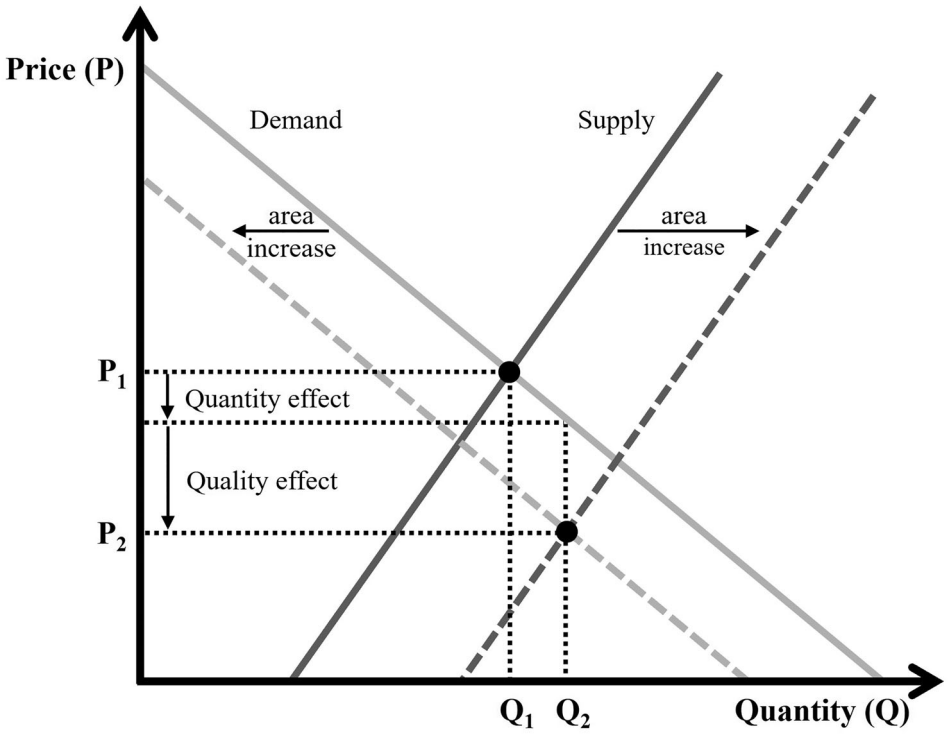

Figure 1. Graphical representation of the equilibrium model.

quantity, that is, larger areas lead to larger quantities. Therefore, a larger GI area shifts the supply schedule to the right, which results in a lower price. However, in line with the notion of *terroir*, the area can also affect quality through natural and human factors. Presumably, larger areas lead to lower (perceived) quality due to less unique biophysical characteristics, local know-how or specificity. Therefore, larger areas shift the demand schedule to the left, which results in lower prices as well.

To sum up, larger GI areas are expected to result in higher quantities and lower quality. Consequently, we expect a lower equilibrium price for larger areas due to the quantity and quality channel. In short, our main hypothesis is as follows:

Hypothesis 1a. Larger areas are associated with lower prices.

As explained above, GI areas can capture also the quantity produced. Thus, even if we cannot observe quality directly, we can isolate the quality channel of GI areas further if we can control for area-unrelated quality attributes (e.g., maturation time) and quantity. In this case, we can refine our main hypothesis to:

Hypothesis 1b. Larger areas are still associated with lower prices when controlling for quantity due to the remaining quality channel.

Note that our hypotheses focus on the price and not the profitability of individual producers or the GI as a whole.

As we focus on the relationship of GI areas with final ham prices, we model our price analysis in the spirit of Rosen's (1974) widely used hedonic theory. A representative consumer obtains utility not from the product itself, but the individual quality attributes it incorporates. Therefore, the final price of a product can be regarded as a bundle of individual prices for each attribute. Consequently, the respective implicit prices of product characteristics can be estimated by a regression function, which takes product price as the outcome variable and consumer-relevant product characteristics as explanatory variables (Costanigro & McCluskey, 2011; Rosen, 1974). For hams, such a directly or indirectly observable characteristic is, for example, maturation time. Following previous work and our own theory, area size can be regarded as a proxy for *terroir*-related quality attributes and, hence, as a product characteristic in hedonic regression models.

Note that considered confounding factors such as quantity do not represent hedonic attributes per se because they are not recognizable by the consumer. Nonetheless, they are relevant regarding our estimations as not controlling for these factors can confound estimates and our models essentially remain hedonic as we regress unitary prices on product characteristics.

In practice, areas are endogenous, so the area coefficient observed in a cross-sectional sample may lack a causal interpretation. However, if producers strategically set the area, they would set smaller areas the stronger the quality effect, that is, the more negative the derivative of quality with respect to area (Deconinck et al., 2015). Producers would only set a large area for a given GI if the area had a relatively limited impact on quality, so that they can maintain a relatively high price in spite of a large area. This implies that any cross-sectional estimate of the quality effect of area on price would underestimate the true

causal effect, because producers would compensate for large effects of area on quality with smaller areas.

A typical strategy for causal identification is to use panel data. We checked for previous amendments to product specifications of all GI hams in our sample, but the sizes of areas have not been changed since their registration at the EU level. Therefore, a panel data analysis would not produce a more causal identification of GI area effects in our case. Unfortunately, to the best of our knowledge there have been no experiments with GI areas either in reality or with a survey. We also have no knowledge of natural experiments leading to plausibly exogenous changes in areas. In fact, discussions with producer groups and authorities have highlighted that changes in areas are rare and highly endogenous. Areas are typically increased when consumer demand and prices are very high, and decreased when part of the area was not being used for GI production anyway. This means that actual changes in areas are a very poor source of exogenous variation with which the causal effect of area on price could be isolated. We are also not aware of any established instruments for GI areas. In short, there is no evident way of identifying the causal effect of area on price.

Furthermore, the constancy of GI ham areas in our sample also ascertains that prices and areas are not simultaneously altered by varying lobbying strength of producers, which would cause endogeneity issues. The GI areas in our sample did not change once officially registered. Consequently, our cross-sectional, multi-GI and multi-country analysis on the association between GI area size and prices represents a solid starting point given the underdeveloped empirical research on the effects of GI areas on prices.

4. DATA

4.1. Focus product and markets

We manually gathered data from online store websites operating in 11 EU countries, namely Austria, Belgium, France, Germany, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Slovenia and Spain. These countries were chosen based on the following criteria. Our study encompasses all countries of origin of an eligible GI ham that have the euro as currency. Also, it includes the Netherlands as a major pig meat producer (Augère-Granier, 2020) and Ireland as a major ham importer (Török & Jambor, 2016).

We selected 36 online stores of established supermarkets that are present with physical stores in the respective city chosen for delivery, for example, Monoprix in Paris, REWE in Berlin or Coop in Rome. To avoid strong price differences due to strongly different store types we excluded specialty shops focusing on specific product categories. Online grocery shopping is a rather new phenomenon, but it has gained popularity since the COVID-19 pandemic and is expected to grow also after the crisis (Günday et al., 2021). However, the product offer on online stores might differ across a country and some supermarkets may offer online shopping only in certain cities. To ensure consistency we only gathered observations on supermarket websites providing home delivery in the respective capital's centre. We collected these cross-sectional data in April 2021.

With the help of thoroughly defined characteristics, we ensure comparability of hams included in our sample. GI and non-GI hams belong to the same product category of raw hams often sold in the 'charcuterie' (prepared meat) section. In this category, we only consider hams made from pig meat and exclude hams such as Bresaola, which is made from beef. Moreover, we focus on raw ham made from the hind leg. Thus, hams can only be air-dried and/or smoked, but not cooked and different cuts such as Italian Coppa or Spanish Paleta which are shoulder cuts are excluded. Moreover, the product must be pre-sliced and sold in a regular plastic package, which is the most common and standard packaging in supermarkets. Complete haunches of ham are seldomly offered and seem to represent a niche product mainly found in specialty shops. Finally, we exclude products with special features, for example, 'less salt', 'less fat' or 'truffle' hams.

Although our full sample comprises more than 768 GI and non-GI hams, our main sample considers only 190 GI hams. The reason is that we cannot use the areas (km^2) as a variable for our full sample because non-GI hams are not regulated regarding their production area. Nonetheless, we used our full sample to determine whether PDOs and PGIs have a positive effect on price compared with non-GIs and to scrutinize the influence of relevant control variables which are described in the following section. While PDO hams with typically stricter product specifications are associated with higher expected prices, PGI hams do not show such a statistically significant positive association when being compared with non-GI hams. For the results of our full-sample regressions, see Appendix A in the supplemental data online.

4.2. Predictors

To test our main hypothesis, we calculated the comparable price in €/100 g based on the displayed package price and size for every observation representing our dependent variable. The basis for our main independent variable is the GI area (km^2). All GI production areas are described in the official product specifications accessible on the eAmbrosia website.[4] Usually, the area is defined by administrative borders of, for example, municipalities or regions. The surfaces of each administrative unit were added to determine the overall GI area (Table 1). These surface data are publicly available on Eurostat or websites of national statistics offices (NUTS and LAU data).[5] In case the GI area is not defined by administrative borders, producer organizations or geographical institutes were contacted for approximation and their information was double-checked with geographical maps.

In addition, we control for the sourcing areas to account for differences in sourcing restrictions concerning the raw

Table 1. Size of production areas of protected geographical indication (GI) hams.

GI	Production area (km^2)	Label	Country of origin
Prosciutto di Carpegna	29	PDO	Italy
Prosciutto di San Daniele	35	PDO	Italy
Jamón de Trevélez	312	PGI	Spain
Kraški Pršut	429	PGI	Slovenia
Prosciutto di Norcia	641	PGI	Italy
Prosciutto di Parma	980	PDO	Italy
Prosciutto Amatriciano	1381	PGI	Italy
Prosciutto di Modena	1806	PDO	Italy
Jamón de Teruel	2524	PDO	Spain
Salaisons de Luxembourg[a]	2586	PGI	Luxembourg
Jabugo	3099	PDO	Spain
Jambon Noir de Bigorre	6056	PDO	France
Jambon d'Ardenne	7314	PGI	Belgium
Südtiroler Speck	7398	PGI	Italy
Jambon de Vendée	8757	PGI	France
Schwarzwälder Schinken	11,400	PGI	Germany
Dalmatinski Pršut	12,021	PGI	Croatia
Tiroler Speck	12,648	PGI	Austria
Jambon de Bayonne	14,710	PGI	France
Prosciutto Toscano	22,987	PDO	Italy
Cinta Senese[b]	22,987	PDO	Italy
Jambon d'Auvergne	23,497	PGI	France

Note: PDO, Protected Designation of Origin; PGI, Protected Geographical Indication.
[a]Full name: Salaisons Fumées, Marque Nationale Grand-Duché de Luxembourg.
[b]Mainly protects the pig breed's fresh produce, but the meat is traditionally used for ham production and the consortium sets rules for these hams and their labelling (see https://www.cintasenesedop.it/).
Source: Authors' own elaboration based on eAmbrosia and Eurostat data as well as information provided by GI producer organizations and regional geographical institutes.

material of pig meat. PDO hams and some PGI hams delimitate the area from where the pig meat for the production of ham can originate from. For example, Prosciutto di San Daniele can only be produced in the core GI region, which represents the municipality of San Daniele del Friuli. However, the meat can originate from pigs reared and slaughtered in the regions of Abruzzo, Emilia-Romagna, Friuli Venezia Giulia, Lazio, Lombardia, Marche, Piemonte, Toscana, Umbria and Veneto. Other PGI hams such as Schwarzwälder Schinken do not restrict sourcing to certain regions and, thus, the meat can also come from foreign countries such as Denmark, Poland or Spain. For such GI hams, the surface area of the EU is assumed to be the potential sourcing area.

Moreover, we identify a product as a PDO or PGI if the respective certification logo and/or name is shown on the product label or the protected name is used in the description. In our sample, the PDO production areas are on average smaller compared with PGIs (2137 versus 10,765 km^2). Also, as PDOs need to follow stricter rules and generally are associated with higher prices compared with PGIs we control for this difference with the dummy *PDO* (1 if PDO).

To continue, we control for the *Longevity* of a GI because collective GI reputation acquired over time can influence retail prices (Landon & Smith, 1998). Costanigro et al. (2010) mention that consumers may be willing to pay more for an established product with a long reputation of providing consistent quality. As GIs are bound to consistent quality standards, we expect older GIs to have a higher reputation resulting in higher prices. *Longevity* is measured in year-fractions according to European convention from the official EU registration date to the reference date of 1 April 2021 (start of data collection).

Unfortunately, there exist no additional systematic data on quality or the number and output of producers for all the diverse GI hams in our sample. Producers situated in a GI area can produce GI and non-GI hams at the same time, which illustrates the difficulty of clearly distinguishing between GI and non-GI products when using firm-level data. Also, a GI producer does not have to be member of an official producer organization. For example, the *Schutzverband der Schwarzwälder Schinkenhersteller* does not cover all producers of the German PGI ham.[6] In general, GI research suffers from very limited availability of detailed economic data on EU GIs (Török et al., 2020). Thus, we use the politically denominated GI area as a proxy for the quantity and quality channels described in our

theoretical model (see also Deconinck et al., 2015; Deconinck & Swinnen, 2021; Landi & Stefani, 2015).

Nonetheless, quantity remains an important factor to consider as outlined by our theoretical model. Because Italy does report GI production quantities (tons) of its GIs in the ISMEA Mercati online database,[7] we analyse a subsample of Italian GI hams in a first attempt to disentangle the quantity restriction from the quality effect of the area. Thus, for our Italian subsample regressions we can test Hypothesis 1b.

Moreover, all Italian producers are usually members of the respective *consorzio* (consortium) managing the GI. We also checked the number of producers per *consorzio* represented in our sample because a remaining endogeneity worry is that both area and price may be influenced by the number of producers. Fewer producers might be able to obtain a smaller area and monopolize production more. Not controlling for the number of producers could then misattribute some of the effect of having few producers to having a small area. Thus, for our subsample of Italian GI hams we control for quantity and the number of producers as well.

Based on the findings of prior literature described before and further considerations, we control for general influencing factors. Our first control, *National brand*, is a dummy coded as 1 if the product is not a private label brand of the supermarket. *Organic* is a dummy coded as 1 if the ham is certified by an official organic label. As hams are sold in packages ranging from 30 to 500 g we control for these differences with the continuous variable *Packsize* (g).

Finally, we introduce original ham-specific controls to GI price analyses. Mesías et al. (2010) mention that maturation time could have been an important factor in their analysis they were missing. Curing hams over months or even years is a costly process (Török & Jambor, 2016). Former ham papers tend to overlook maturation time, although Benedini et al. (2012) show that longer maturation time improves sensory quality of dry-cured hams. Spanish consumers regard long maturation times as an important quality cue (Cilla et al., 2006) and Italian respondents in the study of Garavaglia and Mariani (2017) also prefer longer ageing of Parma ham. Therefore, we control for costlier and quality-enhancing production based on longer maturation. Our continuous control *Maturation time* is measured in months as mentioned on product packages. If no explicit time (months) was displayed on packages, we checked the legally required minimum regarding specific types of ham stated in GI product specifications. For example, PDO Prosciutto di Parma and PGI Dalmatinski Pršut must be cured for at least 12 months.

Moreover, our full sample includes several hams made from special pig breeds similar to Ibérico such as other mainly so-called 'black pigs', for example, the Suino Nero in Italy, Porco Preto in Portugal and Porc Noir in France, or similar special breeds such as the Mangalica from Hungary and the Bísaro from Portugal. In addition to hams made from the Spanish Ibérico pig, our main GI sample includes hams made from the French Porc Noir de Bigorre and the Italian Cinta Senese. For Spanish consumers the use of Ibérico meat is highly influential regarding their preferences for dry-cured ham (Resano et al., 2007). Thus, we account for this potential quality cue with a dummy *Breed* coded as 1 if a special pig breed was used for the production of the ham.

5. ECONOMETRIC MODEL

Following extant hedonic price analyses that consider observed food prices from online stores (Jiang et al., 2019; Roselli et al., 2016; Solórzano Thompson et al., 2022), we estimate our hedonic price function with an ordinary least squares (OLS) approach to estimate expected retail prices of our main GI sample. We introduce country fixed effects to account for unobserved heterogeneity between groups because consumer price levels for meat products differ across countries. With only GIs in our main sample we can meaningfully cluster at the GI level. We cluster our standard errors accordingly at the level of our main variable of interest because every GI cluster is inherently connected to a specific area (km^2):

$$P_i = \alpha + \beta_1 \mathrm{Ln}Area_g + \gamma X' + \delta_c + \varepsilon_i \quad (1)$$

where β_1 concerns the coefficient of the GI area size. The subscript g stands for the respective GI. While the smallest GI area in our sample of Prosciutto di Carpegna is about 29 km^2, the largest area of Jambon d'Auvergne is greater than 23,000 km^2. Due to this skewness of the data, the natural logarithm of the area is used (Ln*Area*). X' represents the vector of our aforementioned control variables; δ_c is the fixed effect corresponding to the country of sale; and ε_i is the error term.

Finally, we zoom in on our GI subsample of Italian hams to disentangle further the channels of quantity and quality proposed by our theoretical model. We can control for quantity, which is measured as the total production (tons) of the respective GI ham in 2019, which represents the latest production data available at the time of data collection. We again use the natural logarithm (Ln*Production*) due to skewness of the data. While 89,000 tons of Prosciutto di Parma were produced, the total production of Prosciutto Amatriciano was 406 tons. As above, we estimate our hedonic price model with an OLS fixed-effects regression with clustered standard errors:

$$P_i = \alpha + \beta_1 \mathrm{Ln}Area_g + \beta_2 \mathrm{Ln}Production_g + \gamma X' + \delta_c + \varepsilon_i \quad (2)$$

where β_1 is the coefficient of the GI area size and β_2 is the coefficient of the quantity. The subscript g denotes again the respective GI. X' represents the vector of our control variables; δ_c are the fixed effects corresponding to the country of sale; and ε_i is the error term.

For descriptive statistics and correlation matrices of all variables included in our main sample and subsample

Table 2. Geographical indication (GI) main sample.

Dependent variable: price (€/100 g)				
Regressor	**(1)**	**(2)**	**(3)**	**(4)**
Ln*Area*	−0.42**	−0.24**	−0.25***	−0.23***
	(0.16)	(0.10)	(0.07)	(0.07)
Ln*Sourcing*				0.09
				(0.13)
PDO		−0.00	−0.12	−0.01
		(0.63)	(0.55)	(0.56)
National brand		0.85***	0.92***	0.94***
		(0.25)	(0.25)	(0.26)
Organic		2.58***	2.51***	2.52***
		(0.24)	(0.21)	(0.20)
Packsize		−0.01***	−0.01***	−0.01***
		(0.00)	(0.00)	(0.00)
Maturation time		0.14***	0.16***	0.17***
		(0.05)	(0.05)	(0.05)
Breed		16.73***	14.07***	14.25***
		(3.15)	(2.79)	(2.80)
Longevity		0.06	0.02	0.03
		(0.05)	(0.04)	(0.04)
Constant	8.01***	3.87**	4.37***	2.63
	(1.14)	(1.46)	(1.13)	(2.75)
Country FE	Yes	Yes	No	No
Store FE	No	No	Yes	Yes
Summary statistics				
N	190	190	187	187
FE categories	11	11	28	28
No. of clusters	22	22	22	22
Adjusted R^2	0.12	0.81	0.83	0.83
AIC/AICc	983.81	697.95	568.80	569.84

Note: Clustered standard errors are shown in parentheses. Akaike information criterion (AIC) adjusted for small sample sizes (AICc). *$p < 0.1$, **$p < 0.05$ and ***$p < 0.01$.

regressions, see Appendices B and C in the supplemental data online, respectively.

6. RESULTS

6.1. GI main sample regressions

Table 2 reports estimates of our main specification, which includes all major general and ham controls with country fixed effects first (see model 2). Ultimately, we estimate more stringent models with store fixed effects and the additional control Ln*Sourcing* (the natural logarithm of sourcing area) (see models 3 and 4). Store fixed effects account for country and more granular store differences simultaneously. We dropped three observations to avoid singleton groups of stores with just one GI ham. Nonetheless, the significance levels of estimates do not change and their magnitudes remain at very similar levels, while the model fit is improved. All coefficients, except those for *PDO*, Ln*Sourcing* and *Longevity*, are significant at the 1% level.

First and foremost, our main hypothesis is confirmed. Ln*Area* has a statistically significant negative association with expected prices, controlling for all relevant variables that we detected in the full-sample regressions (see Appendix A in the supplemental data online). A 1 SD (standard deviation) increase in the natural logarithm of the GI area corresponds to an expected price decrease of about €0.50. The economic relationship of GI areas also becomes clearly visible in the plot of predictive margins at possible area sizes in Figure 2. Thus, larger GI areas are associated with lower expected prices, as assumed by extant theory (Deconinck et al., 2015; Deconinck & Swinnen, 2021; Landi & Stefani, 2015).

The coefficients of *National brand*, *Organic*, *Packsize*, *Maturation time* and *Breed* go in the same direction and have the same significance levels as in the full-sample regressions. However, the magnitude of the *Breed* variable coefficient is considerably higher and underlines once more the importance of controlling for special breeds of GI hams such as Jambon Noir de Bigorre from France

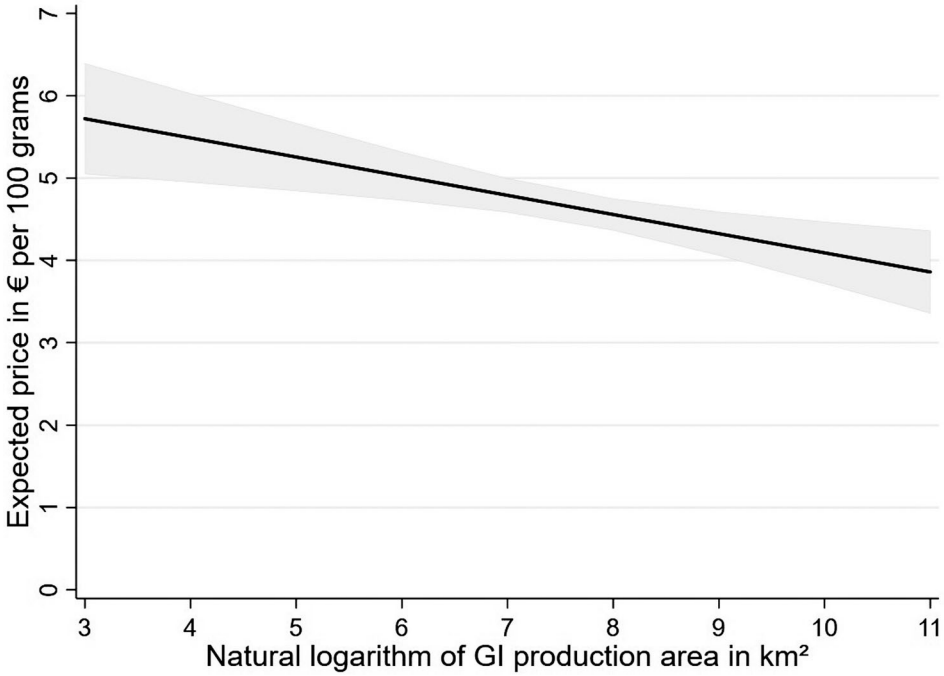

Figure 2. Predictive margins of Ln*Area* on expected price.
Source: Based on model 4 of Table 2.

(based on Porc Noir de Bigorre) or Jabugo from Spain (based on Ibérico). The coefficient of *Longevity* is positive as expected, but it is not statistically significant.

Also, we controlled whether the ham has a PDO certification with a dummy because PDOs are usually bound to more strict product specifications. However, the PDO certification has no significant effect. Once we control for GI areas and ham-specific attributes, there is no difference anymore between PGIs and PDOs. Thus, our In*Area* variable seems to capture better differences among GIs compared with a dummy based on the PDO versus PGI label. Our findings suggest that setting the size of a GI area can be more influential regarding average prices than the decision for a PGI or PDO label specifically.

Nonetheless, area size may be associated differently with PDOs and PGIs due to differences in production strategy and standards. Thus, we conduct a robustness check in which we split our GI sample in PDOs and PGIs (see Appendix E in the supplemental data online). The negative association of In*Area* with price remains significant in both subsample regressions, but the production area appears to matter more for PGIs. Moreover, while the sourcing area has a significant negative association in the case of PDOs, this is not the case for PGIs. Hence, the more effective constraint for PDOs seems to be the delimitation of sourcing, i.e., available pigs, while for PGIs it seems to be the delimitation of production, that is, processing capacity.

Finally, despite the differences regarding authorized sourcing areas and year of registration, Ln*Sourcing* and *Longevity* have no significant effect on expected prices and thus do not represent a relevant influencing factor in our sample. Most importantly, Ln*Area* remains significant with very similar magnitudes, which is also the case regarding the remaining predictors. Consequently, our findings confirm that larger GI areas are associated with lower prices.

6.2. Italian GI subsample regressions

While the aforementioned results provide evidence for the negative association between GI areas and prices, two main concerns remain. First, without directly controlling for the production quantity, higher prices may simply be driven by smaller supply without a remaining area effect based on the quality channel of Hypothesis 1b. Second, another endogeneity worry is that both area and price may be influenced by the number of producers. For our subsample of Italian GI hams, we control not only for the quantity but also for the number of producers in our regression model 7 (Table 3).

We exclude PDO Cinta Senese ham from our subsample analysis because the displayed total production concerns ham production as well as fresh meat, which is not covered by our analysis. Also, the *Breed* variable is omitted because Cinta Senese is the only Italian GI ham in our subsample that is based on a special pig breed. In addition, we opt for country fixed effects given the considerably smaller sample of Italian hams. Store fixed effects would result in more singleton groups that would force us to drop even more observations.[8]

Overall, the negative association of Ln*Area* with price is less pronounced in the Italian GI sample compared with our pan-European sample of GIs (see also Figure D1 in Appendix D in the supplemental data online). However, it remains significant at the 1% level once we control for Ln*Production* in model 6. As expected, Ln*Production* has a negative effect on prices, which is significant at the 10% level. All remaining predictors are statistically

Table 3. Geographical indication (GI) subsample.

Dependent variable: price (€/100 g)			
Regressor	**(5)**	**(6)**	**(7)**
Ln*Area*	−0.14**	−0.11***	−0.10*
	(0.05)	(0.03)	(0.05)
Ln*Production*		−0.14*	−0.11
		(0.07)	(0.11)
No. of producers			−0.00
			(0.00)
PDO	0.80**	0.92***	0.96**
	(0.33)	(0.20)	(0.28)
National brand	1.00**	1.02**	1.02**
	(0.38)	(0.36)	(0.36)
Organic	2.56***	2.60***	2.61***
	(0.18)	(0.23)	(0.24)
Packsize	−0.01**	−0.01**	−0.01**
	(0.00)	(0.00)	(0.00)
Maturation time	0.09***	0.09***	0.09***
	(0.02)	(0.02)	(0.02)
Longevity	−0.09**	−0.06**	−0.07
	(0.03)	(0.02)	(0.04)
Constant	6.63***	7.08***	6.86***
	(0.80)	(0.91)	(0.88)
Country FE	Yes	Yes	Yes
Summary statistics			
N	102	102	102
FE categories	10	10	10
No. of clusters	8	8	8
Adjusted R^2	0.58	0.58	0.57
AICc	306.74	307.73	310.16

Note: Clustered standard errors are shown in parentheses. Akaike information criterion (AIC) adjusted for small sample sizes (AICc). *$p < 0.1$, **$p < 0.05$ and ***$p < 0.01$.

significant at the 5% or 1% levels and go in the expected directions except for *Longevity*, which has a negative association with price.

Adding the *No. of producers* may overspecify model 7 given the limited number of observations, but Ln*Area* is still significant at the 10% level. Ln*Production* and *No. of producers* are actually not statistically significant, but both show the expected negative coefficients.

To sum up, our regressions on the Italian GI subsample confirm Hypothesis 1b that larger areas are still negatively associated with price once controlling for quantity and other relevant influencing factors. These results indicate that small GI areas are not only associated with higher prices due to quantity restrictions but also due to a (perceived) quality element.

Finally, we would like to address one major limitation of our regressions which is that our econometric exercise cannot prove causality. Our first-stage hedonic models are also peculiar as they partly include control variables such as the quantity and number of producers, which are characteristics not recognizable to the consumer. More advanced attempts, for example, considering firms' market power, using second-stage hedonic functions and non-parametric approaches (e.g., Bajari & Benkard, 2005; Chernozhukov et al., 2021; Heckman et al., 2010) could not be applied given the limited data. Nonetheless, our main and subsample regression results confirm the expected tendency of larger GI areas to have lower prices and, hence, should be regarded as an outset to future studies on *terroir* size effects.

7. DISCUSSION AND CONCLUSIONS

We provide the first direct empirical evidence of a negative association between GI area size and online retail prices of GI foodstuffs. This association even holds when we control for quantity in subsample regressions on Italian GI hams, suggesting a (perceived) quality channel of GI areas. Both quantity and quality channels of GI areas have been outlined by previous as well as our own theory on GIs. By explaining differences in average prices, our findings regarding the size of GI areas also contribute to previous literature that highlights GIs as a tool to achieve higher price premiums.

In the case of European ham, the sizes of GI areas strongly vary. Our study is the first to measure the politically set geographical delimitation of GI ham production areas. While the smallest areas comprise single municipalities of less than 35 km^2, the largest areas span regions larger than 20,000 km^2. Cross-sectional price data and additional information of hams were gathered in 36 online supermarkets operating in the capitals of 11 EU member states, including major EU economies such as France, Italy, Spain and Germany. Based on hedonic theory, we estimate prices per 100 g with OLS fixed-effects regressions accounting for general and ham-specific variables. Such product-specific attributes tended to be neglected by prior GI research.

Regressions on our main sample of GI hams account for the explicit areas (km^2) and show that as the GI area increases in size, prices are expected to fall considerably. Moving from the smallest observed area to the largest in our sample, the expected price per 100 g drops from about €6 to €4. Therefore, smaller GI hams tend to realize higher prices, which is likely partially due to their exclusivity and more specific regional origins, that is, *terroir*.

Moreover, focusing on Italian GIs only, where GI production quantities are publicly reported, we find that the negative association between area and price remains when controlling for quantity. This finding suggests that higher prices for smaller GIs are not only driven by quantity restrictions, but also by higher (perceived) quality of smaller GIs.

In general, area size can only be regarded as a potential contributing factor. Higher prices for smaller areas may partially be driven by environmental conditions such as, for example, distinctive sea air influencing taste during maturation or human factors such as, for example, locally

cultivated *savoir-faire* passed on over generations. Also, a larger area size may result in higher supply but lower perceived quality as a more specific origin can signal exclusivity to the consumer. However, we want to point out again that a small area cannot guarantee price premiums or superior quality over competitors.

Furthermore, quality remains a malleable concept. Much more than area size is at play for GIs. For example, product specifications can be stricter or looser defined, which could mitigate possible *terroir* size effects. Also, a surrounding region may be a powerhouse in producing ham, which could strengthen production abilities of a GI. Moreover, strong collective brands such as the famous 'Parma crown' may influence perceived quality irrespective of area size. Future research must disentangle these various interplays further.

Nevertheless, GI delimitations should be carefully determined to optimally appropriate value from a protected regional origin. GI producers could, for example, safeguard smaller areas to secure higher prices, which may support brand differentiation and reputation. On the contrary, GIs with extremely large areas such as Feta cheese (mainland Greece and the former prefecture of Lesbos)[9] are likely to struggle in building a distinct regional brand as specificity remains an important pillar of GI success (Barjolle & Sylvander, 1999). With very large areas, it is presumably more challenging to forcefully differentiate with more specificity and authenticity against products of competitors. Feta producers face foreign imitators evoking Greek origin even in other EU countries (European Commission, 2019).

To sum up, GIs from smaller areas may have a higher potential to differentiate place-based brands through distinctive regional specificity and, hence, to capture high-value markets by securing higher average prices.

However, if smaller GIs tend to achieve higher prices, why do we also observe large GIs? More research on causes is clearly needed, but we can hypothesize some reasons.

First, adjacent producers to the historic 'core' area and regional or national authorities may be able to broker larger GI areas in the first place (Gangjee, 2017). Such larger areas benefit producers in peripheral areas, but could be at the expense of more specific and authentic *terroir*.

Second, large GIs may tend to have lower prices but could still help producers by increasing sales. While the GI literature has emphasized price premiums, the effect of a GI label on turnover may of course run through volume as well as prices. Higher prices and related premiums do not guarantee higher profits and producer incomes (Török et al., 2020). Halloumi producers dubbed the PDO registration as a catastrophe because the strict rules apparently threaten their production capabilities (Iacovides, 2021). Our study does not aim to analyse the supply side in detail and the corresponding explicit benefits of producers, but examines the association of GI areas with observed retail prices. Thus, future research should investigate how *terroir* size affects the economic sustainability of GI producers in the long-run.

Third, large GIs with lower prices may still be more profitable due to economies of scale. Extant theory showed that there can be economies of scale due to certain GI fixed costs (e.g., Deconinck & Swinnen, 2021). However, economies of scale may be rather limited as GIs tend to have strictly specified and relatively artisanal production methods. For example, Benitez et al. (2005) show that in the French Brie sector costlier PDO standards impede economies of scale in production. Still, larger areas may allow for more GI producers that can spread fixed costs and use collective power (Moschini et al., 2008) to build effective marketing campaigns contributing to the economic success of GIs. Hence, lower prices for a larger area need not imply lower profit.

Finally, we want to note that our analysis can only provide indicative results and not causality. Thus, our findings should be interpreted with caution. Nonetheless, we hope to have contributed to a better understanding of how *terroir* size may affect prices and to provide thought-provoking impulses for future research with more data and in other contexts.

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DATA AVAILABILITY

Replication data and code are available for download at https://doi.org/10.34894/RX0QIN.

DISCLOSURE STATEMENT

No potential conflict of interest was reported by the authors.

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NOTES

1. For the eAmbrosia database, see https://ec.europa.eu/info/food-farming-fisheries/food-safety-and-quality/certification/quality-labels/geographical-indications-register/ (status October 2021).
2. A special Spanish 'black pig' breed providing high-quality meat, which is also based on an exclusive diet and free range. Ibérico meat itself is not protected by a GI (Burgen, 2020).
3. Traditional specialties guaranteed (TSGs) must be produced according to traditional techniques, but can be produced anywhere. Thus, TSGs are not included in our main sample of GIs.
4. See https://ec.europa.eu/info/food-farming-fisheries/food-safety-and-quality/certification/quality-labels/geographical-indications-register/ (status March 2021).
5. See https://ec.europa.eu/eurostat/web/nuts/national-structures.
6. See https://schwarzwaelder-schinken-verband.de/ (status March 2021).
7. See https://www.ismeamercati.it/retefood-dop-igp#MenuV.
8. Although store fixed effects are technically the more stringent specification, country fixed effects already account for most heterogeneity among groups. This can also be seen in Table 2 where coefficients and significance levels remain very similar across model specifications.
9. For the GIview database, see https://www.tmdn.org/giview/gi/EUGI00000013179 (status October 2021).

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REFERENCES

AND-International. (2019). *Economic value of EU quality schemes, geographical indications and traditional specialities guaranteed*. Publications Office of the European Union. https://doi.org/10.2762/396490

Augère-Granier, M.-L. (2020). *The EU pig meat sector*. https://www.europarl.europa.eu/thinktank/en/document/EPRS_BRI(2020)652044

Bajari, P., & Benkard, C. L. (2005). Demand estimation with heterogeneous consumers and unobserved product characteristics: A hedonic approach. *Journal of Political Economy*, *113*(6), 1239–1276. https://doi.org/10.1086/498586

Barjolle, D., & Sylvander, B. (1999). Some factors of success for origin labelled products in agri-food supply chains in Europe: Market, internal resources and institutions. In Proceedings of the 67th EAAE seminar, European association of agricultural economists, Le Mans, October 28–30, 1999.

Benedini, R., Parolari, G., Toscani, T., & Virgili, R. (2012). Sensory and texture properties of Italian typical dry-cured hams as related to maturation time and salt content. *Meat Science*, *90*(2), 431–437. https://doi.org/10.1016/j.meatsci.2011.09.001

Benitez, D., Bouamra-Mechemache, Z., & Chaaban, J. (2005). Public labelling revisited: The role of technological constraints under protected designation of origin regulation. Paper presented at the EAAE XIth congress, European Association of Agricultural Economists, Copenhagen, August 23–27, 2005.

Blancheton, B., & Hlady-Rispal, M. (2021). Ensuring product quality: Luxury clusters in cognac and leather. *Regional Studies*, *55*(2), 282–294. https://doi.org/10.1080/00343404.2020.1800626

Burgen, S. (2020). Fury in Spain at US plans to produce 'Iberian' ham in Texas and Georgia. *The Guardian*, 15 August. https://www.theguardian.com/world/2020/aug/15/fury-in-spain-at-us-plans-to-produce-iberian-ham-in-texas-and-georgia

Cei, L., Defrancesco, E., & Stefani, G. (2018). From geographical indications to rural development: A review of the economic effects of European Union policy. *Sustainability*, *10*(10), 3745. https://doi.org/10.3390/su10103745

Chernozhukov, V., Galichon, A., Henry, M., & Pass, B. (2021). Identification of hedonic equilibrium and nonseparable simultaneous equations. *Journal of Political Economy*, *129*(3), 842–870. https://doi.org/10.1086/712447

Chilla, T., Fink, B., Balling, R., Reitmeier, S., & Schober, K. (2020). The EU food label 'protected geographical indication': Economic implications and their spatial dimension. *Sustainability*, *12*(14), 5503. https://doi.org/10.3390/su12145503

Cilla, I., Martínez, L., Guerrero, L., Guàrdia, M. D., Arnau, J., Altarriba, J., & Roncalés, P. (2006). Consumer beliefs and attitudes towards dry-cured ham and protected designation of origin Teruel ham in two Spanish regions differing in product knowledge. *Food Science and Technology International*, *12*(3), 229–240. https://doi.org/10.1177/1082013206065722

Costanigro, M., & McCluskey, J. J. (2011). Hedonic price analysis in food markets. In J. L. Lusk, J. Roosen, & J. F. Shogren (Eds.), *The Oxford handbook of the economics of food consumption and policy*. Oxford University Press. https://doi.org/10.1093/oxfordhb/9780199569441.013.0007

Costanigro, M., McCluskey, J. J., & Goemans, C. (2010). The economics of nested names: Name specificity, reputations, and price premia. *American Journal of Agricultural Economics*, *92*(5), 1339–1350. https://doi.org/10.1093/ajae/aaq065

Crescenzi, R., De Filippis, F., Giua, M., & Vaquero-Piñeiro, C. (2022). Geographical indications and local development: The strength of territorial embeddedness. *Regional Studies*, *56*(3), 381–393. https://doi.org/10.1080/00343404.2021.1946499

Deconinck, K., Huysmans, M., & Swinnen, J. (2015). *The political economy of geographical indications* (LICOS Discussion Paper Series No. 372). https://feb.kuleuven.be/drc/licos/publications/dp/dp372

Deconinck, K., & Swinnen, J. (2021). The size of *terroir*: A theoretical note on economics and politics of geographical indications. *Journal of Agricultural Economics*, *72*(1), 321–328. https://doi.org/10.1111/1477-9552.12407

Deselnicu, O. C., Costanigro, M., Souza-Monteiro, D. M., & McFadden, D. T (2013). A meta-analysis of geographical indication food valuation studies: What drives the premium for origin-based labels? *Journal of Agricultural and Resource Economics*, *38*(2), 204–219. https://doi.org/10.22004/ag.econ.158285

Desquilbet, M., & Monier-Dilhan, S. (2015). Are geographical indications a worthy quality label? A framework with endogenous quality choice. *European Review of Agricultural Economics*, *42*(1), 129–150. https://doi.org/10.1093/erae/jbu008

European Commission. (2019). *Commission refers Denmark to the Court for failing to fulfil its obligations in relation to the name 'Feta'*. https://ec.europa.eu/commission/presscorner/detail/en/IP_19_6312.

Gangjee, D. S. (2017). Proving provenance? Geographical indications certification and its ambiguities. *World Development*, *98*, 12–24. https://doi.org/10.1016/j.worlddev.2015.04.009

Garavaglia, C., & Mariani, P. (2017). How much do consumers value Protected Designation of Origin certifications? Estimates of willingness to pay for PDO dry-cured ham in Italy. *Agribusiness*, *33*(3), 403–423. https://doi.org/10.1002/agr.21494

Günday, G., Kooij, S., Moulton, S., Karabon, M., & Omeñaca, J. (2021). How European shoppers will buy groceries in the next normal. *McKinsey Insights*. https://www.mckinsey.com/industries/retail/our-insights/how-european-sho ppers-will-buy-groceries-in-the-next-normal#

Haeck, C., Meloni, G., & Swinnen, J. (2019). The value of *terroir*: A historical analysis of the Bordeaux and Champagne geographical indications. *Applied Economic Perspectives and Policy*, *41*(4), 598–619. https://doi.org/10.1093/aepp/ppz026

Hassan, D., & Monier-Dilhan, S. (2006). National brands and store brands: Competition through public quality labels. *Agribusiness*, *22*(1), 21–30. https://doi.org/10.1002/agr.20070

Heckman, J. J., Matzkin, R. L., & Nesheim, L. (2010). Nonparametric identification and estimation of nonadditive hedonic models. *Econometrica*, *78*(5), 1569–1591. https://doi.org/10.3982/ECTA6388

Huysmans, M. (2022). Exporting protection: EU trade agreements, geographical indications, and gastronationalism. *Review of International Political Economy*, *29*(3), 979–1005. https://doi.org/10.1080/09692290.2020.1844272

Huysmans, M., & Swinnen, J. (2019). No *terroir* in the cold? A note on the geography of geographical indications. *Journal of Agricultural Economics*, *70*(2), 550–559. https://doi.org/10.1111/1477-9552.12328

Huysmans, M., & van Noord, D. (2021). *The market for lemons from Sorrento and Gouda from Holland: Do geographical indications certify origin and quality?* (USE Working Paper Series No. 21-08). https://www.uu.nl/sites/default/files/REBO-USE-WP21-08.pdf

Iacovides, K. (2021). Halloumi producers grill government over PDO 'success'. *Cyprus Mail*, 25 April. https://cyprus-mail.com/2021/04/25/halloumi-producers-grill-government-over-pdo-success/

Ilbery, B., Morris, C., Buller, H., Maye, D., & Kneafsey, M. (2005). Product, process and place. *European Urban and Regional Studies*, *12*(2), 116–132. https://doi.org/10.1177/0969776405048499

Jiang, Y., Wang, H., Jin, S., & Delgado, M. (2019). The promising effect of a green food label in the new online market. *Sustainability*, *11*(3), 796–714. https://doi.org/10.3390/su11030796

Josling, T. (2006). The war on *terroir*: Geographical indications as a transatlantic trade conflict. *Journal of Agricultural Economics*, *57*(3), 337–363. https://doi.org/10.1111/j.1477-9552.2006.00075.x

Kos Skubic, M., Erjavec, K., & Klopčič, M. (2018). Consumer preferences regarding national and EU quality labels for cheese, ham and honey. *British Food Journal*, *120*(3), 650–664. https://doi.org/10.1108/BFJ-04-2017-0236

Landi, C., & Stefani, G. (2015). Rent seeking and political economy of geographical indication foods. *Agribusiness*, *31*(4), 543–563. https://doi.org/10.1002/agr.21412

Landon, S., & Smith, C. E. (1998). Quality expectations, reputation, and price. *Southern Economic Journal*, *64*(3), 628–647. https://doi.org/10.1002/j.2325-8012.1998.tb00084.x

Lence, S. H., Marette, S., Hayes, D. J., & Foster, W. (2007). Collective marketing arrangements for geographically differentiated agricultural products: Welfare impacts and policy implications. *American Journal of Agricultural Economics*, *89*(4), 947–963. https://doi.org/10.1111/j.1467-8276.2007.01036.x

Leufkens, D. (2018). The problem of heterogeneity between protected geographical indications: A meta-analysis. *British Food Journal*, *120*(12), 2843–2856. https://doi.org/10.1108/BFJ-12-2017-0710

López-Bayón, S., Fernández-Barcala, M., & González-Díaz, M. (2020). In search of agri-food quality for wine: Is it enough to join a geographical indication? *Agribusiness*, *36*(4), 568–590. https://doi.org/10.1002/agr.21665

Loureiro, M. L., & McCluskey, J. J. (2000). Assessing consumer response to protected geographical identification labeling. *Agribusiness*, *16*(3), 309–320. https://doi.org/10.1002/1520-6297(200022)16:3<309::AID-AGR4>3.0.CO;2-G

Meloni, G., & Swinnen, J. (2018). Trade and *terroir*. The political economy of the world's first geographical indications. *Food Policy*, *81*, 1–20. https://doi.org/10.1016/j.foodpol.2018.10.003

Menapace, L., & Moschini, G. C. (2014). Strength of protection for geographical indications: Promotion incentives and welfare effects. *American Journal of Agricultural Economics*, *96*(4), 1030–1048. https://doi.org/10.1093/ajae/aau016

Mesías, F. J., Gaspar, P., Escribano, M., & Pulido, F. (2010). The role of protected designation of origin in consumer preference for Iberian dry-cured ham in Spain. *Italian Journal of Food Science*, *22*(4), 367–376.

Moran, W. (1993). Rural space as intellectual property. *Political Geography*, *12*(3), 263–277. https://doi.org/10.1016/0962-6298(93)90057-E

Moschini, G. C., Menapace, L., & Pick, D. (2008). Geographical indications and the competitive provision of quality in agricultural markets. *American Journal of Agricultural Economics*, *90*(3), 794–812. https://doi.org/10.1111/j.1467-8276.2008.01142.x

Rangnekar, B. D. (2004). The socio-economics of geographical indications. *UNCTAD-ICTSD Project on Intellectual Property Rights and Sustainable Development*, *8*, 1–52. https://unctad.org/system/files/official-document/ictsd2004ipd8_en.pdf

Resano, H., Sanjuán, A. I., & Albisu, L. M. (2007). Consumers' acceptability of cured ham in Spain and the influence of information. *Food Quality and Preference*, *18*(8), 1064–1076. https://doi.org/10.1016/j.foodqual.2007.05.002

Resano-Ezcaray, H., Sanjuán-López, A. I., & Albisu-Aguado, L. M. (2010). Combining stated and revealed preferences on typical food products: The case of dry-cured ham in Spain. *Journal of Agricultural Economics*, *61*(3), 480–498. https://doi.org/10.1111/j.1477-9552.2010.00250.x

Roselli, L., Carlucci, D., & De Gennaro, B. C. (2016). What is the value of extrinsic olive oil cues in emerging markets? Empirical evidence from the U.S. e-commerce retail market. *Agribusiness*, *32*(3), 329–342. https://doi.org/10.1002/agr.21454

Rosen, S. (1974). Hedonic prices and implicit markets: Product differentiation in pure competition. *Journal of Political Economy*, *82*(1), 34–55. https://doi.org/10.1086/260169

Schamel, G. (2007). Auction markets for specialty food products with geographical indications. *Agricultural Economics*, *37*(2–3), 257–264. https://doi.org/10.1111/j.1574-0862.2007.00272.x

Teuber, R. (2011). Consumers' and producers' expectations towards geographical indications. *British Food Journal*, *113*(7), 900–918. https://doi.org/10.1108/00070701111148423

Thompson, J. S., Molina, J. P., Brenes, R. C., Valerio, W. M., Jiménez, S. N., Ramírez, C. S., Murillo, L. V., & Navarro, D. B. (2022). Hedonic price of wine at retail market in Costa Rica. *International Journal of Food and Agricultural Economics*, *10*(2), 119–130. 10.22004/ag.econ.321780

Török, Á, Jantyik, L., Maró, Z. M., & Moir, H. V. (2020). Understanding the real-world impact of geographical indications: A critical review of the empirical economic literature.

Sustainability, *12*(22), 9434. https://doi.org/10.3390/su12229434

Török, Á, & Jambor, A. (2016). Determinants of the revealed comparative advantages: The case of the European ham trade. *Agricultural Economics – Czech*, *62*(10), 471–481.

Tregear, A., Arfini, F., Belletti, G., & Marescotti, A. (2007). Regional foods and rural development: The role of product qualification. *Journal of Rural Studies*, *23*(1), 12–22. https://doi.org/10.1016/j.jrurstud.2006.09.010

van Ittersum, K., Meulenberg, M. T. G., van Trijp, H. C. M., & Candel, M. J. J. M. (2007). Consumers' appreciation of regional certification labels: A pan-European study. *Journal of Agricultural Economics*, *58*(1), 1–23. https://doi.org/10.1111/j.1477-9552.2007.00080.x

Yang, W., & Renwick, A. (2019). Consumer willingness to pay price premiums for credence attributes of livestock products – A meta-analysis. *Journal of Agricultural Economics*, *70*(3), 618–639. https://doi.org/10.1111/1477-9552.12323

Zago, A. M., & Pick, D. (2004). Labeling policies in food markets: Private incentives, public intervention, and welfare effects. *Journal of Agricultural and Resource Economics*, *29*(1), 150–165. doi:10.22004/ag.econ.31143