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# Geographical Indications as Factors of Market Value: Price Premiums and Their Drivers in the Hungarian Off-Trade Wine Market

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## Abstract

Using the name of the production zone to differentiate agricultural products has a longstanding tradition. Theory suggests that some of these names have a market value as they represent the common reputation of the producers and thus may contribute to dissolving the information asymmetry between producers and consumers. This study takes the example of the Hungarian off-trade wine market to show that price premia are attainable by using some GIs. It is revealed that group homogeneity is an essential factor of collective decisions on higher quality standards, which are important drives of price premia. Moreover, barriers to entry and the quality of the demarcated area are also related to the prices attainable by using GIs.

## Keywords

Geographical indications, hedonic price index, off-trade wine market, common pool resources, collective action, Hungarian wines.

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## Introduction

A large amount of scientific literature has been dealing with the determinants of wine prices recently. By mainly applying hedonic pricing models, the vast majority of these studies quantify the relationship between wine prices and, inter alia, origin, subjective and objective quality and labelling elements like variety, vintage or brands. Despite the large number of research on the topic, the role of geographical indicators is somehow understudied. This paper aims to estimate the effect of using geographical indications on the prices of wines and to reveal the factors influencing the performance of geographical indications on the market.

The paper is structured as follows: in Section 2, we analyse the concept and economic aspects of geographical indications and the relation of the production zone and quality. Here, we analyse previous research on the relation of GI use on wine prices as well. The hypotheses and the research methodology are detailed in Section 3, while results are presented in Section 4 and conclusions are drawn in Section 5.

Wines serve as a great example for the illustration of the economic benefits of using geographical indications. Wine products are experience goods (Strorchmann, 2012), because the consumers can only assess their quality after consuming them. Applying the findings of Akerlof’s (1970) model on market of lemons, it is vital for producers to differentiate and signal the quality of their products to obtain higher prices. There are several ways to do so, e.g. trademarks, communication via the media or geographical indications.

The area of production has always been an important factor of the wine market and labelling geographical names on wines has a long tradition. For a better understanding, the relation of wines and their place of origin shall be detailed. There are four groups of factors that influence wine quality (Gál, 2006): the place of origin (production zone – including physiographic, edafic, climatic and biotic dimensions), vintage year, grape varietal and technology. The weight of these factors is different for each wine, and their reproducibility varies as well. Certain grape varieties can be planted at any location where grape growing is possible, and technology is transferable, too. However, effects of human action on weather are non-controllable, and the production zone cannot be moved from one place to another. Therefore, place of origin has a major and inevitable role in differentiating wines. The actual biological manifestation of these impacts is described in detail by van Leeuwen et al (2004). Moreover, even the role of the elements of the place of origin is different in each wine region. Place of origin or production zone is often described as terroir; however, the latter has a different meaning as it encompasses the human factors: traditional know-how and technology (OIV, 2010).

As the key of the real, non-reproducible uniqueness of wines is the place of origin, it may be a profitable strategy for wineries to produce wines that carry characteristics related to their geographical origin (or rather, the terroir). At the same time, government measures regulating the practice of labelling the name of the production zone have been introduced since the beginning of the 20th century – yet, regional regulations on the delimitation of the area were applied much earlier in Porto, Chianti or Tokaj (Meloni and Swinnen, 2018). Despite the single European legislative framework, we distinguish between two substantially different approaches of GIs: the German and the Latin. For short, the German approach emphasises grape maturity (and thus, quality level), Latin the approach focuses on the typical products and of territory (see Barham, 2003 for a detailed description of the French concept serving as a base for the Latin approach). GIs have an important role in the EU's agriculture and are vital for the European wine sector. As signals for unique quality, using a GI can raise the price of the product, which is essential given the competition of the more efficient New Wine World (Tóth and Gál, 2014).

The legal protection of geographical indications is provided by measures on intellectual property and four distinctive EU quality regimes (wine products, agricultural products and foodstuff, aromatised wines and spirit drinks – see regulations No. (EU) 1308/2013, 1151/2012, 251/2014 and (EC) 110/2008 respectively). In the case of wine products, the European Union's wine law determines two types of geographical indications: protected designation of origin and protected geographical indication. By definition, the first represents a strong and exclusive relationship between the product and its place of origin, and the second implies a much weaker and limited relationship. As an essential provision of the EU regulation, producer organisations must regulate the use of GIs in so-called product specifications. These documents include all the rules on the whole production process, e.g., geographical delimitation of the production zone, quality standards for raw material, winemaking practices, provisions on chemical composition and organoleptic characteristics.

Contrary to individual brands, GIs have a collective nature. The reputation of GIs can be assessed as a sum of individual reputations of group members (Tirole, 1996). Wineries that use GIs are interdependent on the one hand and competitors on the other and strive to differentiate themselves from the rest of the group by using their own individual brands (Patchell, 2008). Therefore, given the limited demand for products bearing a given geographical indication, the reputation of the group is exploited to the detriment of each other (Castriota and Delmastro, 2012).

From this point of view, the reputation of GIs is a common pool resource (Mike and Medgyesi, 2016) as we can observe the same type of contrast between short term individual and long-term group interest. Contrary to Hardin's (1968) suggestions on privatisation or government legislation, Ostrom (2003) proposes common governance as a solution. In the latter case, it is the group members who determine the conditions of access and use of the common pool resource. This is the same approach that the European Union's new regulatory framework on geographical indications applies.

The credibility of geographical indications is of crucial importance as consumers have to believe that the actual product using a GI differs from other products, and that is why it may be worth paying a price premium. Credibility or incredibility is a function of the availability of information on past individual performance. If this information is available, the actual products are traceable; credibility is easier to maintain (Tirole, 1996). Also, stricter rules in the product specifications yield result in reputation (Marchini et al., 2014).

Collective branding enables investment in quality under conditions when individual companies would not invest (Fishman et al., 2018). Evans and Guinnane (2007) show that a common reputation is worth to be created for high-cost groups or groups with members not too different from each other, and if marginal cost is declining. Moreover, increasing group size facilitates free riding as incentives of keeping the quality level weaken. This is echoed by Castriota and Delmastro (2014), stating that the relationship between group size and collective reputation is non-linear and an optimum for group size exists. However, Marchini et al. (2014) show that the increase of the group increases the reputation due to the accumulating investments in marketing.

As a darker side of GIs, collective brands often lack the focus on the consumer side, and even the INAO (the French government agency for GIs) acknowledged that consumers deemed it easier to recognise the varietal-based marketing approach of the New Wine World especially in the low-end and mid-priced markets (Tregear and Gorton, 2005). Therefore, the role of GIs is limited (Combris et al., 2006), and not all of them are associated with a positive price premium.

A series of studies show that different GIs have different impact on wine prices – Arancibia et al. (2015), Benfratello et al. (2009), Cardebat and Figuet (2004), Cardebat and Figuet (2009), Carew and Florkowski (2010), Landon and Smith (1998), Shane et al. (2018), Thrane (2009), Troncoso and Aguirre (2006) – even when controlling for the varietal composition of the wines – Ling and Lockshin (2003), Noev (2005) and Roma et al. (2013). Moreover, studies of Bordeaux (Ali and Nauges, 2007 and Blair et al., 2017), Burgundy (Combris et al., 2000) or Italian (Levaggi and Brentari, 2014) wines found that the place of the GI in the local or national GI hierarchy is also related to the price and smaller geographic units – such as parcels – may have a price premium as well (San Martin et al., 2008). Angulo et al. (2000) and Di Vita et al. (2015) even argue that GI are the most important price determinants in the Spanish and the Sicilian markets, respectively. Schamel and Anderson (2003) advocates that the role of origin in determining wine prices is increasing. Studies of Bordeaux wines show an indirect impact of GIs on prices as they may affect the impact of expert ratings (Ashton, 2016, and Hay, 2010). Ugochukwu et al. (2017) shows that using GIs results higher prices, but not vice versa: higher prices are independent of the producers' choice on the use of GIs.

Producer groups have to find a right balance between being too tight or too loose when setting the rules in product specifications, e.g. imposing higher production cost vs lacking meaningful differentiation (Tregear and Gorton, 2005). Minimum quality standards and effective enforcement are fundamental drivers of group reputation (Castriota and Delmastro, 2014). Probability of free riding grows along with group size as the growth of the number of producers using the collective reputation weakens the incentives for keeping the quality level (Winfree and McCluskey, 2005; Tregear et al., 2007) – which may be avoided by testing the actual hedonic value of the products.

The actual role of GIs may also be influenced by a set of factors describing the socio-economic characteristics of the producer's community. Well-founded and organised communities can act more efficiently to the benefit of their members (Carter, 2015). Even partial information of the consumer and setting standards (regarding both character and quality level) can result in welfare gains. The costs of information and the creation of quality schemes shall be set according to these gains.

## Materials and methods

Hedonic price index is an obvious method to assess the impact of GIs on wine prices. Rosen's (1974) model regards goods as an aggregate of their characteristics. Therefore, differences in prices reflect differences in the set of features. These models are often applied in the literature of wine economics, however, as Unwin (1999) denotes, the execution of the methodology is usually not flawless as competition is not perfect on wine markets, model specification is rather data-driven, and multicollinearity distorts significance levels. On the other hand, Thrane (2004) advocates that hedonic price indices are meaningful if econometric methods are well applied and results are interpreted in a good manner. Hedonic price indices are not intended to estimate consumer behaviour, but are basically supply-oriented, that is, how some supply side characteristics impact prices.

This study is based on hedonic price indices calculated on a sample of 2,672 wines. Contrary to the previously mentioned studies, data was not collected from the wine press, as the prices and the use of geographical indications were observed in the Hungarian off-trade sector (main wine shops and supermarkets). If a wine was observed on multiple sites, the lowest price was included in the dataset. The scope of the study extended only to wines, other grapevine products (such as sparkling wine) were excluded. All wine prices were recalculated for an amount of a 0.75 litre bottle. 33 of the 37 Hungarian wine GIs were observed. However, 5 GIs had to be omitted due to the low number of wines in the sample. Certain geographical indications are segmented into two or three quality levels using additional terms to the name itself (e.g. Eger Superior or Villány

Prémium). To deal with this phenomenon, these geographical indications were treated as two or three separate names (depending on the actual number of quality levels); therefore, in the end, 33 GIs were included.

In the first step of the study, the price premiums of GIs were estimated by hedonic price index models. As heteroskedasticity occurred, (1) robust standard error models were used instead of ordinary least squares models (White, 1980). Furthermore, (2) quantile regressions were also run (for medians). There are two advantages of using quantile regression models in this case: tackling heteroskedasticity (as suggested by Di Vita et al, 2015) and the distortion of averages by outliers (such as expensive wines sold in small quantity). Given the findings of previous studies, the following hypothesises were developed.

*H1.1 Geographical indications have a positive price premium in the market.*

As literature showed, GIs are expected to have a (positive) price premium under certain conditions regarding the producer group (Carter, 2015), the interconnection of individual and group reputation (Patchell, 2008 or Castriota and Delmastro, 2012), the motivation for investing in quality (Fishman et al., 2010), consumer legibility (Tregear and Gorton, 2005). Each observed GI would get its own dummy variable, as the reference group would be the wines without geographical indication. Furthermore, the impact of labelling crus (parcels) should be assessed by adding a common dummy to the model for single vineyard wines.

*H1.2 Individual brands have a price premium as well.*

Although individual brands are not the most important element for the Hungarian consumers, it is assumed that individual brands serve as an important factor in achieving price premium for wines. Given the large number of possible brands, they are grouped according to their performance on the two most important prizes that wine makers can get in Hungary. The first tier (dummy) consists of producers who have received either of the two awards, and the second tier (dummy) contains those that were nominated and the information on the nomination is available for consumers. The rest of producers form the reference group.

*H1.3 The concentration of compounds is positively linked to prices.*

According to an alternative formulation of this hypothesis, in general, the more concentrated (or, the less diluted) a wine is, the higher its price may be. An evident cost reason supports this hypothesis: the production of more concentrated wines costs more. The question, however, is whether this is also reflected in the price. When examining this hypothesis, we take into account the sugar-free extract content (g / l) and the residual sugar content (g /l). Alcohol is still an important compound, but we omit it in the models to avoid multicollinearity. The role of sugar is examined by colour, as we assume that the relationship between sugar content and price is different for white and other (rosé, red) wines (as all great natural sweet wines are white). Data were provided by the wine authority.

*H1.4 The age of wine is positively related to the price.*

We assume that the price of more mature wines is higher than that of younger wines. The higher cost of production justifies this, but the consumers' belief that wines will only get better and better over time may have a more serious impact, too. The age of the wine is the difference between the date (year) of data collection and the date (year) of the harvest of the grapes used as the raw material. For items where this information is not available (or which are from multiple vintages), we consider the year of the last harvest period before marketing to be the vintage year.

*H1.5 The quantity (lot size) impacts the price in a negative way.*

Obviously, the less the available quantity is, the more the price will be (because of various reasons such as lower selling pressure, higher average cost). From another point of view, the assumption is that wine makers are better off producing and selling higher priced wines in a smaller quantity (for reasons of quality control capacities etc.). Data were provided by the wine authority.

The design of models E1.1-E1.2 is shown below:

$$\ln P = \beta_0 + \beta_i * GI_i + \beta_j * IB_j + \beta_1 * SV + \beta_2 * SFE$$
$$+\beta_3 * SUGAR * WHITE + \beta_4 * SUGAR * NONWHITE$$
$$+\beta_5 * AGE + \beta_6 * \ln Q + \varepsilon$$

where:

$P$: price
$GI_i$: GI dummies
$IB_j$: individual brand dummies
$SV$: dummy for single-vineyard wines

*SFE*: concentration of sugar-free extract

*SUGAR*: sugar content

*WHITE:* white wine dummy

*NONWHITE:* dummy for rosé or red wines

*AGE:* age of the wine

*Q:* lot size

The second step aimed to reveal the factors influencing the performance of geographical indications on the market by applying several models. Market value can be measured in several ways, hereby I consider (1) the ln of mean prices of GIs and (2)-(3) the price premia for each GI estimate during the first step. As literature suggested, the following factors were considered.

*H2.1 The more homogenous the group of producers is, the easier the collective action is; hence, higher prices and revenues can be reached.*

As geographical indications are of a collective nature, their management requires high quality collective action. Group homogeneity is an important issue of collective action (Carter, 2015; Evans and Guinnane, 2007). This factor is measured as group heterogeneity by the standard deviation of the total amount of wines marketed by a single producer with the geographical indications concerned. Data were provided by the vine and wine interbranch organisation (HNT).

*H2.2 The stricter the rules of using a GI, the higher the prices are.*

GIs, by theory, signal distinctive product quality. Thus, the wine quality (e.g. quality standards or rules on organoleptic characteristics) set in the product specification shall be easily and meaningfully differentiated. Here, we consider the maximal yield as a good measurement for the rigour of rules. Usually, the higher the yields, the lower the quality level is. Quality regulations were observed in the product specifications of the GIs (see AM, 2019).

*H2.3 The stricter the rules of using a GI, the higher are the entry barriers.*

Barriers to entry hinder new competitors to enter the market and contribute to higher prices by lowering the amount of supply and the level of competition. In case of geographical indications, the most effective barrier is the delimitation of the production area. Determining such an area is based on viti-vinicultural factors such as (micro-) climate or soil. However, from an economic point of view, it serves as an effective entry barrier as a newcomer may not use the geographical name for products originating or produced outside the delimited area. This factor is measured as the percentage of the area covered by vineyards compared to the whole size of the delimited area. The higher this percentage is, the harder is to enter the market, therefore the higher should be the prices. Data on area size were provided by Department of Geodesy Remote Sensing and Land Offices of the Government Office of Budapest.

*H2.4 The better the geographic area is, the higher the prices are.*

As place of origin is an important factor of wine quality, it is obvious that the better the delimited area is, the higher quality will be. Quality of the area (from a viticultural point of view) is measured by a 400-point system (cadastrial points). Data were provided by the Department of Geodesy Remote Sensing and Land Offices of the Government Office of Budapest.

As the number of GIs observed is limited, multiple regression analysis including all variables would face substantial methodological obstacles. Therefore, we analyse the hypothesises in two groups, the first for the GI rules (H2.1 and H2.2) and the second for other factors (H2.3 and H2.4). In addition to hypothesis H2.1 and H2.2 we test whether they are interconnected by using two-stage least squares model, where the rigour of GI rules (maximal yield) is instrumented by group heterogeneity. For control reasons, restricted models are calculated for each variable.

The design of the 2SLS models (models E2.1-E2.3) for testing hypothesises H2.1-2.2 is showed below:

$$MV = \beta_0 + \beta_1 * YIELD + \varepsilon$$

$$YIELD = \beta_0 + \beta_1 * GROUP + \varepsilon$$

where:

*MV:* market value of the GI, measured by the ln of mean price or the estimated

*GROUP:* producers' group heterogeneity

*YIELD:* maximal yield for using the GI

The design of the models (models E2.4-2.6) for testing hypothesises H2.3-2.4 is showed below:

$$MV = \beta_0 + \beta_1 * BE + \beta_2 * CADPOINT + \varepsilon$$

where:

*MV:* market value of the GI, measured by the ln of mean price or the estimated

*BE:* barriers to entry

*CADPOINT:* average cadastrial points of the delimited area

The descriptive statistics are presented in Tables A1-A2 of Annex.

## Results and discussion

The regression analyses of the first step were first carried out in a restricted manner (only containing GI dummies), then extended models containing all variables were calculated (reflecting the suggestion of Thrane, 2004). Thus, it was possible to estimate the difference in the gross and net shadow prices of GIs.

Results of the first step (summarised in Table 1) confirmed the two hypothesises as the models showed a positive price premium for 24-25 geographical indications out of the 33 observed depending on the model (which is in line with H1.1). This means that GI wines can be sold at a higher price for the consumers as expected. However, the value of the price premium was negative for one GI, suggesting that the name of "Duna-Tisza közi" region reflects cheaper prices (are usually sold cheaper). The differences in the estimated coefficients of restricted and extended models show that at first glance, GIs may incorporate important other factors like chemical composition, lot size, age or individual brands.

The first step of the study also proved that segmentation based on quality level within geographical indications makes sense, as the price premium was substantially higher for the wines in concern. In addition, the study revealed that prices had a strong and robust relation to individual brands (confirming H1.2; +46-48% for the 1st tier and 34% for the 2nd tier). The results underline that producers tend to position their single vineyard wines high as the indication of a vineyard's name raised the price by 46-49%. This has very important implications for wine marketing and reputation.

The models show that chemical composition (sugar-free extract) is positively related to the price; an additional gram to the average (median) of 25.58 (24.40) g/l would cost 0.93% (0.71%) more (H.1.3). Older wines cost more, the impact of an additional year of ageing is 11-12% (H1.4). The relation of the lot size and the price is negative, with 1% of the increase in quantity the prices decrease by 0.22% (H1.5).

The results of the first step underline that in general, geographical indications may influence wine prices, however, this is not true for all of them and the impact may be negative as well. On the other hand, negative coefficients show that some geographical indications are positioned low, which may be a conscious common action of the producers. GIs with positive effects mainly include the most known ones with larger production area and well organised producers' group or small ones with special wine character.

All factors included showed the expected relationship with the three proxies of market value; thus, results proved that the socio-economic factors involved impact the market value of GIs significantly (see Table A3 of Annex). Tables 2 and 3 summarise the results of the extended models.

The rigour of production rules has a positive impact on market value in all models. The mean price of a GI where an additional hl of wine is allowed to be produced on one hectare is 2.81% lower, while the impact on implicit prices is -1.38 – -1.47. Group heterogeneity is strongly connected to the market value of GIs as the mean price of wines with a GI with an additional hl of the standard deviation is 0.92% lower than the average. Therefore, GIs reflect quality and GI wines can be sold at a higher price. The application of two stage least square models proves that these two variables are interconnected. Moreover, these models estimate the impact of regulation on maximal yield as an additional one hectolitre increase is paired with a 4.25% drop of the mean price and a 2.16-2.33-point drop in the previously estimated implicit prices. The comparison of the $R^2$ values (which are higher in the model using mean price) suggest that the rigour of the production rules impacts other price-affecting dimensions, too, which is in line with oenological theory (i.e., lower yields result in higher concentration of compounds). Group heterogeneity is significantly related to the rigour of the rules as a hectolitre increase in the standard deviation of the supply increases the maximal yield by 0.22 hectolitres per hectare.

All restricted models and extended models E2.4-E2.6 confirm the hypothesis regarding barriers to enter as the mean price of a GI with an additional percentage point of land use is 3.20% higher, while using an extended model would lead to an estimated impact of 2.77%. The impact of a 1-point rise of land use ration on estimated implicit prices of GIs varies between 1.53-1.54 points (decreasing to 1.48-1.34 points in the extended model).

| Variable | R1.1 (robust standard errors) | E1.1 (robust standard errors) | R1.2 (quantile regression for the median) | E1.2 (quantile regression for the median) |
|---|---|---|---|---|
| Sugar free extract (quadratic) | | 0.0001*** | | 0.0002*** |
| White*Sugar | | 0.0024*** | | 0.0025*** |
| Non-white*Sugar | | -0.0060*** | | -0.0054*** |
| Age | | 0.1213*** | | 0.1119*** |
| Lot size (log) | | -0.2236*** | | -0.2165*** |
| Badacsony | 0.8541*** | 0.3139*** | 0.8484*** | 0.2726*** |
| Balaton | 0.3527*** | 0.3462*** | 0.3681*** | 0.3064*** |
| Balatonboglár | 0.5729*** | 0.2869*** | 0.5113*** | 0.2546*** |
| Balaton-felvidék | 0.5539*** | 0.2616*** | 0.6371*** | 0.2034* |
| Balatonfüred-Csopak | 0.7078*** | 0.3067*** | 0.6937*** | 0.3441*** |
| Bükk | 0.6744*** | 0.2188 | 0.6943*** | 0.2042 |
| Duna | 0.4599** | 0.1201 | 0.4066*** | 0.3423* |
| Dunántúli | 0.0776 | 0.1733** | 0 | 0.1063 |
| Duna-Tiszaközi | -0.7893*** | -0.4621*** | -0.8905*** | -0.5973*** |
| Eger Classicus | 0.4401*** | 0.2901*** | 0.5113*** | 0.2525*** |
| Eger Superior | 1.4709*** | 0.6720*** | 1.5416*** | 0.6250*** |
| Eger Grand Superior | 1.8768*** | 0.6731*** | 1.7119*** | 0.7934*** |
| Eger before 2010 | 1.4692*** | 0.2397* | 1.4674*** | 0.2138* |
| Etyek-Buda | 0.5055*** | 0.3555*** | 0.4422*** | 0.3394*** |
| Felső-Magyarország | 0.4134*** | 0.2052*** | 0.4641*** | 0.2163*** |
| Hajós-Baja | 0.2745** | 0.1314 | 0.3208*** | 0.0801 |
| Káli | 1.2758*** | 0.8412*** | 1.1984*** | 0.7222*** |
| Kunság | 0.2976*** | -0.0294 | 0.3296*** | -0.0425 |
| Mátra | 0.2230** | 0.0151 | 0.2804*** | 0.0329 |
| Mór | 0.4745*** | 0.2551*** | 0.5113*** | 0.2586* |
| Nagy-Somló | 0.8569*** | 0.3838*** | 0.8949*** | 0.3699*** |
| Neszmély | 0.5128*** | 0.1835** | 0.4422*** | 0.1185 |
| Pannon | 0.3224*** | 0.3195*** | 0.4066*** | 0.2765** |
| Pannonhalma | 0.7370*** | 0.5400*** | 0.7991*** | 0.5188*** |
| Pécs | 0.5769*** | 0.2508*** | 0.5119*** | 0.1645* |
| Sopron/Ödenburg | 0.9230*** | 0.3623*** | 0.7640*** | 0.3302*** |
| Szekszárd | 0.7760*** | 0.3488*** | 0.7430*** | 0.3032*** |
| Tokaj wine specialty | 2.2646*** | 0.6634*** | 2.1815*** | 0.5620*** |
| Tokaj non-wine specialty | 0.9692*** | 0.3439*** | 0.9394*** | 0.2831*** |
| Tolna | 0.3603** | 0.0644 | 0.4780*** | -0.0106 |
| Villány Classicus | 0.5705*** | 0.3252*** | 0.5759*** | 0.3039*** |
| Villány Prémium | 1.6922*** | 0.8359*** | 1.7119*** | 0.7523*** |
| Zala | 0.5610*** | -0.0128 | 0.5759*** | 0.0247 |
| Single vineyard wine | | 0.3776*** | | 0.3972*** |
| Tier1 individual brand | | 0.3898*** | | 0.3756*** |
| Tier1 individual brand | | 0.2935*** | | 0.2961*** |
| Constant | 6.8311*** | 8.6380*** | 6.8013*** | 8.5877*** |
| Adjusted-$R^2$/Pseudo-$R^2$ | | | 0.2262 | . |

Note: *: 10%; **: 5%; ***: 1% level of significance
Source: own calculation

Table 1: Results of the first step regression analyses.

| Variable | E2.1 | E2.2 | E2.3 |
|---|---|---|---|
| Dependent variable | Mean price (log) | Estimated implicit price (model E1.1) | Estimated implicit price (model E1.2) |
| Maximal level of yield | -0.0425*** | -2.1633*** | -2.3267*** |
| Constant | 11.8060*** | 346.4681*** | 358.5228*** |
| Dependent variable (first stage regression) | Maximal level of yield | Maximal level of yield | Maximal level of yield |
| Group heterogeneity | 0.2164** | 0.2164** | 0.2164** |
| Constant | 92.7287*** | 92.7287*** | 92.7287*** |
| N | 33 | 33 | 33 |
| $R^2$ | 0.4419 | 0.2751 | 0.3433 |

Note: *: 10%; **: 5%; ***: 1% level of significance
Source: own calculation

Table 2: Results of the extended models containing local regulations.

| Variable | E2.4 | E2.5 | E2.6 |
|---|---|---|---|
| Dependent variable | Mean price (log) | Estimated implicit price (model E1.1) | Estimated implicit price (model E1.2) |
| Barrier to entry | 2.7733*** | 1.4752*** | 1.3433*** |
| Cadastral point | 0.0073*** | 0.4485*** | 0.3389** |
| Constant | 4.8410*** | -31.7796 | 0.5963 |
| N | 33 | 33 | 33 |
| adjusted $R^2$ | 0.45 | 0.3973 | 0.3028 |
| AIC | 46.9161 | 319.4429 | 320.7158 |
| BIC | 51.4057 | 323.9324 | 325.2054 |

Note: *: 10%; **: 5%; ***: 1% level of significance
Source: own calculation

Table 3: Results of the extended models containing external factors.

GIs with an additional point higher average quality of the demarcated area have a mean price 0.94% higher (shrinking to 0.73% in the extended model). The impact on the estimated implicit prices is between 0.44-0.56 higher than the average (0.34-0.45 in the extended model).

Both Aikike and Bayesian information criteria show that models using mean price as a measurement for market value fit better. Moreover, adjusted $R^2$ values show as well that these models have higher explanatory value. However, models E2.5-E2.6 (and R2.1-R3.4) use a better estimation of the actual market value of GIs as the dependent variable is cleared from other possible impacts on the price (age, individual brand, chemical composition, quantity).

The extended models show that the socio-economic parameters of GIs explain 30-40% of the variations in wine prices. As expected, the coefficients of the given variables decreased in all cases comparing the restricted and the extended models.

## Conclusion

This study focused on the role of GIs in the market by analysing the situation of the Hungarian off-trade wine market. The analysis confirmed that the use of geographical indications may allow producers to achieve a price premium, hence can be a vehicle of maintaining the presence of traditional quality products in the market despite the potential higher costs. Thus, GIs are incentives for investment to quality.

However, not all GIs represent a price premium; moreover, in one of the cases, the price premium is negative. The valuable information on GI products is not that they are special in some way – it is why they are special, and a well-functioning GI shall bear this information. Moreover, this raises the issue of the factors laying behind the market performance of GIs. As GIs are of a collective nature, collective action is a crucial issue. As literature suggested, the structure of producer groups is an essential factor.

The results of the first step confirm that the higher the concentration of compounds, the higher the price of wines. Therefore, setting higher minimal values for these compounds in the product specification should result in higher prices. However, a measure in this manner shall be taken with caution as the character of a wine can be biased. This kind of action shall likely target the minimal price.

Producers tend to position their single vineyard wines high, which is reflected in the relatively high shadow price of vineyard names on the label. Therefore, it seems to be worth to introduce special regulation on the use of these names.

Geographical indications are a quite regulated field of the vine and wine sector. On the one hand, a large amount these regulations are created by the local communities (mainly specific rules), on the other hand, some vital framework legislation exists, provided by the EU or national governments. This study highlights the vital role of producers' communities in the market success of geographical indications. Thus, policies aimed at empowering and strengthening these communities may result in more valuable GIs as well.

The analysis underlined the role of collective action as the more homogenous a producer group is, the more likely they behave and think about the geographical indication(s) they use. This draws attention to a new dimension of the positioning of new GIs or repositioning existing ones. To have a meaningful differentiation, a GI shall reflect on special product quality. This can be attained more easily if the quantity of products labelled with the same GI does not vary by group members on a large scale.

The role of delimited production area is an essential issue in case of GIs regarding the link between origin and the quality of the final product. The actual size and quality of the production area is an important policy tool as it serves as a barrier to entry into the market. Thus, all initiatives on the enlargement of the production area shall be treated with particular caution.

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# Appendix

| Variable | Observations | Mean | Std. deviation | Min | Max |
|---|---|---|---|---|---|
| Price (0.75 litre bottle) | 2672 | 2693.231 | 5856.222 | 194.85 | 194330 |
| Lot size | 2672 | 20084.92 | 39199.5 | 120 | 607568 |
| Sugar | 2672 | 13.22216 | 37.67067 | 0 | 578 |
| Sugar free extract | 2672 | 25.57687 | 6.893633 | 15.6 | 124.6 |
| Age | 2672 | 2.538922 | 1.919959 | 1 | 17 |

Source: own calculation

Table A1: Descriptive statistics – first step.

| Variable | Observations | Mean | Std. deviation | Min | Max |
|---|---|---|---|---|---|
| Mean price | 33 | 2822.652 | 2939.132 | 502.4947 | 16876.8 |
| Estimated implicit price (model A) | 33 | 137.3513 | 37.75101 | 62.99593 | 231.9148 |
| Estimated implicit price (model B) | 33 | 133.6054 | 35.78275 | 55.02954 | 221.0901 |
| Maximal level of yield | 33 | 96.66667 | 17.48511 | 35 | 120 |
| Group heterogeneity | 33 | 18.20166 | 33.36183 | 0.2948969 | 188.8688 |
| Barrier to entry | 33 | 22.87153 | 11.7276 | 5.214826 | 49.14261 |
| Cadastral point | 33 | 301.8485 | 32.70524 | 219 | 333 |

Source: own calculation

Table A2: Descriptive statistics – second step.

| Model | (R1.1) ARM | (R1.2) ARS | (R1.3) ARP | (R1.4) ARK | (R2.1) RRM | (R2.2) RRS | (R2.3) RRP | (R2.4) RRK | (R3.1) QRM | (R3.2) QRS | (R3.3) QRP | (R3.4) QRK |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Dependent variable | Mean price (log) | Mean price (log) | Mean price (log) | Mean price (log) | Estimated implicit price (model A) | Estimated implicit price (model A) | Estimated implicit price (model A) | Estimated implicit price (model A) | Estimated implicit price (model B) | Estimated implicit price (model B) | Estimated implicit price (model B) | Estimated implicit price (model B) |
| Maximal yield | -0.0281*** | | | | -1.3781*** | | | | -1.4723*** | | | |
| Group heterogeneity | | -0.0092*** | | | | -0.4680** | | | | -0.5034*** | | |
| Cadastral point | | | 0.0094*** | | | | 0.5583*** | | | | 0.4388** | |
| Barrier to entry | | | | 0.0320*** | | | | 1.7349*** | | | | 1.5394*** |
| Constant | 10.4138*** | 7.8606*** | 4.8523*** | 6.9615*** | 270.5661*** | 145.8702*** | -31.183 | 97.6720*** | 275.9307*** | 142.7681*** | 1.1396 | 98.3961*** |
| N | 33 | 33 | 33 | 33 | 33 | 33 | 33 | 33 | 33 | 33 | 33 | 33 |
| $R^2$ | 0.5986 | 0.2331 | 0.2342 | 0.3478 | 0.4074 | 0.1711 | 0.234 | 0.2905 | 0.5176 | 0.2203 | 0.1609 | 0.2546 |
| AIC | 36.6507 | 58.0143 | 57.9693 | 52.6691 | 319.014 | 330.0895 | 327.4853 | 324.9574 | 308.6904 | 324.5362 | 326.9588 | 323.0524 |
| BIC | 39.6438 | 61.0074 | 60.9623 | 55.6621 | 322.007 | 333.0825 | 330.4783 | 327.9504 | 311.6834 | 327.5292 | 329.9518 | 326.0454 |

Source: own calculation

Table A3: Results of the restricted models of the second step of the regression analysis.