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Modeling price-related consequences of the brand origin cue: An empirical examination of the automobile market

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Abstract

Price-related consequences of the country-of-origin (COO) cue have been widely neglected in the literature. This paper applies hedonic price analysis to examine a brand's COO effect on new car prices. The application of our models to an extensive dataset demonstrates that prices of new cars reflect not only implicit prices of performance and technological characteristics, but also price distortions that arise out of COO heterogeneity. Moreover, by allowing model parameters to vary across car-type segments, we are able to capture patterns of differential attribute and COO effects on prices, which are indicative of implicit price discrimination strategies. The paper provides new interesting insights into critical issues for pricing strategy and demonstrates the role of brand origin, segments, and observed product differences in the price structure of the automobile market. Our findings yield important implications for manufacturers and researchers.

Keywords: Country-of-origin, Pricing, Car market, Price premiums, Hedonic price analysis.

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1 Introduction

Various studies have applied hedonic price modeling to show that price variation among new cars can be explained by differences in key product characteristics such as horsepower, engine capacity, speed, and safety features (e.g., Andersson 2005; Reis and Santos Silva 2006). Such measurable attributes however may not be the only explanatory factors. One of the most widely examined topics in international marketing is whether the origin of a product or a brand makes them more or less preferable to consumers. It has been suggested that country-of-origin (COO) serves as an extrinsic informational cue for consumers' perceptions and evaluations of a product (Verlegh and Steenkamp 1999). A brand's or a product's COO acts as a signal of product quality, influences consumers' perceptions of risk and value, and directly affects the likelihood of purchase (see e.g., Jaffe and Nebenzahl 2006; Phau and Chao 2008).

In the car market, consumer choice is very wide. In Europe, there are about 50 brands which originate from 12 countries. Even a casual look at the car market reveals that prices differ in a systematic fashion among car models based on their brand's origin. This pattern may suggest implicit price premiums that are largely independent of technical characteristics and derive from unmeasured heterogeneity (Baltas and Saridakis 2010).

Therefore, the natural question is whether, and if so, how heterogeneity among brand origins determines different prices for otherwise equivalent cars. At the same time, the automobile market consists of several car-type segments (e.g., sedans, hatchbacks, multi-purpose vehicles, etc). This market structure allows car manufacturers to serve better their customers, as different body-types match different customer needs. As a result, an additional, but also interrelated question is how the structure of brand origin heterogeneity and its respective effect on prices varies across different car-type segments.

Although research on the COO effect on consumers' product attitudes and behaviours has explored many facets of the phenomenon from different perspectives, price-related consequences of COO have been widely neglected in the respective literature (Drozdenko and Jensen 2009; Koschate-Fischer et al. 2012). Until today, very few researchers have attempted to study the country-related effect on product price (Nebenzahl and Jaffe 1993).

The purpose of this paper is to address these fundamental questions, which are extremely important not only for the car industry but also for the public. More specifically, the aim of the paper is twofold: First, to examine how COO effects determine the price structure of the new car market, after controlling for the effects of key product characteristics; second, to identify any patterns of differential attribute and COO effects across car-type segments. To that end, we design and implement a standard hedonic price model considering observable car characteristics, which is subsequently extended to accommodate COO effects. First, an aggregate model for the whole car market is estimated. The aggregate model assumes that COO heterogeneity can lead to implicit price discrimination strategies, in which manufacturers may charge different price premiums depending on the respective image of their home country. Second, in an attempt to capture patterns of differential effects, a disaggregate specification is also estimated, which assumes that COO effects can vary across car-type segments.

2 Theoretical background

2.1 Hedonic price analysis

Research approaches that treat products as bundles of characteristics include multi-attribute choice models, conjoint models, and hedonic price models, with which the present paper is concerned. Car attributes such as engine power and airbags represent not only value to the buyer but also resource cost to the carmaker. Hedonic price models postulate that the price of a car reflects the bundle of embodied characteristics valued by some implicit or shadow prices (Baltas and Saridakis, 2010). In empirical studies, these implicit characteristic prices are coefficients that relate prices and attributes in a regression framework. We usually use the following semi-logarithmic specification

$$\log P_i = a_0 + \sum_j \beta_j x_{ij} + u_i \qquad (1)$$

where P_i is the price of the i product, a_0 is a standard regression intercept, β_j are regression coefficients, x_{ij} is the j characteristic of the i product, and u_i is the error term.

The literature in the area of hedonic price analysis has grown at an impressive rate. An excellent review of hedonic price research can be found in Triplett (2004). The literature on car price hedonics falls into two broad streams (Hulten 2003). The first stream includes studies that are mainly concerned with estimating price indexes that account for quality change over time (e.g., Murray and Sarantis 1999; Reis and Santos Silva 2006). The second stream includes studies that focus on the coefficients on the right-hand side of the hedonic equation (e.g., Andersson 2005; Espey and Nair 2005; Riera et al. 2006).

2.2 COO effects and prices

The impact of a product's origin on consumer preferences is one of the oldest concerns in international marketing. Previous research on COO effects has mainly examined the impact that cognitive, affective, and normative associations with a particular country have on consumer attitudes. COO serves as an extrinsic informational cue for consumers' perceptions and evaluations of a product (Verlegh and Steenkamp 1999). A product's COO influences consumer judgment (e.g., Han 1989; Hong and Wyer 1991; Verlegh and Steenkamp 1999) and consumer choice (e.g., Chuang and Yen 2007), whilst it also affects consumers' perceptions of risk, value, and likelihood of purchase (Liefeld 1993; Peterson and Jolibert 1995; Verlegh and Steenkamp 1999). Excellent reviews on the issue can be found in Jaffe and Nebenzahl (2006) and Phau and Chao (2008).

Although a great deal of studies has emphasized the effect of COO on consumer attitudes and purchase intentions, price-related consequences of COO have been widely neglected in extant literature. More specifically, "few researchers have attempted to study the country image effect on product price" (Nebenzahl and Jaffe 1993, p. 161). However, focusing on price as a dependent variable when examining COO effects, rather than quality evaluations or purchase intentions, has many advantages. First, price offers a more precise measure of COO effect as it represents *"the amount of money we must sacrifice to acquire something we desire"* (Monroe 2003, p. 5). For example, a consumer may be more positive towards a product from country X than a product from country Y but, at the same time, may also be unwilling to pay a price premium for it. Therefore, product evaluations or purchase intentions are less valid outcome variables than price (Koschate-Fischer et al. 2012). Second, price allows for the "monetization" of the COO cue (Nebenzahl and Jaffe 1993). Price offers an elegant way to model COO effects as it reveals the extent to which consumers' perceptions of different COOs are reflected in the differences in the amount that those consumers are prepared to pay for products associated with each COO. It is expected that countries with a better image will be able to command higher price premiums. From a practitioner perspective, the ability to "monetize" the COO effect by translating it to real economic value is of great importance, since price is one of the most powerful marketing-mix elements and has direct and disproportional impact on profitability (Han et al. 2001; Völckner and Hofmann 2007).

To the best of our knowledge, only two studies, so far, have examined whether consumers are willing to pay different prices for a given product depending on the COO (i.e., Hu and Wang 2010; Koschate-Fischer et al. 2012). More specifically, Hu and Wang (2010) focused on an online auction setting (eBay) and found that U.S. retailers are able to command a premium, which appears to stem from country-of-origin equity instead of trading risk or product quality. The authors used actual transaction data and provided support for price-related consequences of the COO in an international trading context. The recent study of Koschate-Fischer et al. (2012) was similar to Hu and Wang's (2010) as it also focused on an auction mechanism. However, contrary to Hu and Wang (2010), who examined the origin of the retailer, Koschate-Fischer et al. (2012) examined the origin of the product itself.

The present attempt builds on those two papers and can be considered as a follow-up study to Koschate-Fischer et al. (2012). However, our study has a different focus and a different methodology. More specifically, we focus on the automobile context and COO designates not the country where the product (car) was produced, but the home country of its brand. As a result, and according to Jaffe and Nebenzahl's (2006) classification, this paper focuses on the estimation of brand origin effects, rather than COO effects. The contribution of this study is twofold. From a theoretical front, contrary to the studies of Hu and Wang (2010) and Koschate-Fischer et al. (2012), who focused on retailer's and product's origin effects, respectively, we look at price-related consequences of brand origin effects. The image that consumers associate with the country in which a car was manufactured is not necessarily the same as the one they associate with the home country of its brand. According to the existing vehicle type choice literature, the latter is much more relevant and important from a consumer's preference perspective – see Baltas and Saridakis (2013) for a detailed review on vehicle type choice. From a managerial front, we provide insights into the extent to which manufacturers may charge (and consumers would be willing to pay) price premiums, depending on the brand origin. This is the first reported application that collectively estimates a large number of different COO effects. In total, we allow for price distortions that arise out of heterogeneity among 12 country names with long tradition and reputation in the car market. More importantly, we also allow the estimation of differential COO effects across various car-type segments, which are indicative of implicit price discrimination strategies. These insights are of substantial value to marketing managers responsible for the development of pricing strategies, particularly in markets where consumers are confronted with product offerings from multiple COOs differing in their image.

To address the aforementioned substantive objectives, we apply hedonic price analysis, a methodology which allows us to examine the structure of COO heterogeneity in the new car market and investigate the link between a car's brand origin and actual car sales prices.

3 Model development

COO conveys information about aspects of a product that are difficult to quantify, such as reputation, status, and quality. These are particularly so in the car market where a brand's origin plays a traditionally important role in purchase decisions. For example, car quality is often difficult to evaluate prior to purchase and buyers may have to rely on COO reputations. To investigate formally the above hypotheses, first, the standard hedonic regression model (1) is extended to include COO effects. Notice that model (1) has a standard regression intercept (α_0) and as many beta coefficients (β_j) as the number of product attributes. More specifically, let (α_c) represent the effect of COO c. Then, the hedonic model can be written as

$$\log P_i = \alpha_c + \sum_j \beta_j x_{ij} + u_i \tag{2}$$

where each COO has its own intercept.

Subsequently, we design and implement a disaggregate hedonic price model in which both attribute coefficients and COO effects are allowed to vary over car-type segments. More specifically, let α_{cs} represent the c COO effect within the s car-type segment, and β_{js} represent implicit or shadow price of the j characteristic within the s car-type segment. Then, the aggregate specification (2) can be expressed using the following disaggregate equation.

$$\log P_i = \alpha_{cs} + \sum_j \beta_{js} x_{ij} + u_i \tag{3}$$

Model (3) allows a different constant term (i.e., COO effect) and slope coefficient (i.e., implicit characteristic price) for each car-type segment. Both hedonic regression models (2) and (3) incorporate some type of COO-specific intercepts and are, in essence, panel data models that can be implemented by the fixed–effects technique (Greene 2002).

Our estimation dataset includes prices and characteristics of all new passenger car models that were available in the European car market in January 2010 and is taken from a licensed edition of the British BBC's Top Gear car magazine, which is a leading international automotive publication. The dataset includes 8 functional car characteristics ($j = 1,...8$), 12 COOs ($c = 1,...12$), and 4 car-type segments ($s = 1,...4$) in 921 model versions ($i = 1,...921$). Key variables included in the empirical analysis are listed in Table 1, along with a brief description, and anticipated signs with respect to new car prices. The explanatory variables were chosen on the basis of previous studies in this area and on characteristics presented in car magazines. Characteristics presented in car magazines can be regarded as good indicators of the characteristics of interest to potential buyers (Andersson 2005).

"Take in Table 1"

4 Results

The standard model (1) that ignores COO heterogeneity has an R-squared of 0.88 and the F-tests for 11 and 71 degrees of freedom (i.e., number of additional parameters in the proposed aggregate and disaggregate specifications 2 and 3, respectively) reject the constrained specification (1).

A certain degree of multicollinearity is expected in hedonic price analyses, and generally, in any model involving product attributes, since several product characteristics are usually interrelated. Dropping explanatory variables may reduce the degree of collinearity, but at the same time, this estimation strategy may lead to omitted variable bias (Asher 1992). For this reason, this study deals with a moderate number of key product characteristics that are unlikely to exhibit severe collinearity. This is also confirmed by our data. The model produces highly significant coefficients at the 0.01 level with low standard errors and expected signs, implying rather inconsequential collinearity. The same is suggested by auxiliary multicollinearity diagnostics (Hair et al., 2006).

Table 2 presents the estimates of the car characteristics based on the proposed aggregate and disaggregate specifications (2) and (3) respectively. A look at the estimates of the aggregate specification (column 2) suggests that all variables have the expected positive sign. Also, two points are worth noting. First, apart from performance-related attributes (e.g., horsepower and engine capacity), features related to comfort and luxury (e.g., leather interior and automatic air-conditioning) have also positive and significant effects. Second, the two safety features (i.e., airbags and electronic safety systems) have highly significant positive coefficients.

In Table 2 the estimates of the car characteristics based on the disaggregate specification (3) are also presented (columns 3-6). It can be seen that most of the coefficients have the expected positive sign and are highly significant. Furthermore, the estimated coefficients (i.e., implicit car attribute prices) vary significantly across car-type segments. For example, our findings suggest that safety features (e.g., airbags and ESP-TCS systems) command higher price premiums in mainstream, mass car-type segments (such as hatchbacks and sedans), whilst the respective coefficients are insignificant in high-end, sport car-type segments (such as coupe and convertible). Similarly, features related to comfort and luxury (e.g., alloy wheels and leather seats) command higher price premiums in high-end sport car-type segments (such as coupe and convertible) and SUVs, whilst the respective coefficients are insignificant in mainstream, mass car-type segments (such as hatchbacks). The results clearly suggest that car-type segments are sufficiently heterogeneous to allow price discrimination strategies. Evidently, the same car characteristic can be implicitly priced at a different price-level depending on the targeted car-type segment.

"Take in Table 2"

Also, we formally assessed whether the estimated coefficients (b values) presented in Table 2 vary significantly across the four car-type segments. Several methods have been proposed in the literature for this purpose. Cohen's (1983) significance test is the most widely used and can be applied to each predictor's b weights to directly test for a significant difference between pairs of regression models (i.e., G1 and G2). Cohen's test can be written as follows:

$$Z_{cohen} = \frac{b_{G1} - b_{G2}}{\sqrt{\frac{(df_{bG1} * SE_{bG1}^2) + (df_{bG2} * SE_{bG2}^2)}{df_{bG1} + df_{bG2}}}} \quad (4)$$

For larger sample sizes (N > 30 in each model) this Standard Error (SE) estimator is negatively biased (produces error estimates that are too small), and thus, the resulting Z-values are too large. Therefore, in our study, equation (4) can be transformed as follows (Brame et al. 1998; Clogg et al. 1995):

$$Z_{Brame/Clogg} = \frac{b_{G1} - b_{G2}}{\sqrt{(SE_{bG1}^2 + SE_{bG2}^2)}} \quad (5)$$

The corresponding test results for the difference between regression coefficients are shown in Table 3. Our findings support our intuition that all car characteristics have significantly different regression weights in at least one pair of models.

"Take in Table 3"

In Table 4 the estimated effects of the 12 COOs are presented based on the proposed aggregate and disaggregate specifications (2) and (3) respectively. A look at the estimates of the aggregate specification (column 2) suggests that all COO-specific parameters are highly significant at the 0.01 level and most of them intuitively sized. These parameters can be interpreted as shadow COO prices that reflect intrinsic COO values. It can be seen that COO premiums increase as we move from countries such as Russia, China, and Korea to countries with long tradition and expertise in car manufacturing, such as Germany, USA, and UK.

In table 4, the estimates of COO effects based on the disaggregate specification are also presented (columns 3-6). Again, all COO-specific parameters are highly significant at the 0.01 level and most of them intuitively sized. Furthermore, COO effects differ significantly across car-type segments. An analysis of the estimated parameters by column reveals the COO-specific price premiums within each car-type segment, whilst the analysis of the respective parameters by row reveals the patterns of differential COO-effects across car-type segments. It is important to remember that Table 4 does not reflect nominal product cost, but inferred price premiums that are estimated in a model that controls for functional differences in terms of observable car characteristics.

"Take in Table 4"

5 Discussion

Certain conclusions suggest themselves from the foregoing analysis. The first and most obvious is that car prices depend on observable characteristics related to performance, comfort, luxury, and safety. The second conclusion is that a brand's COO plays a role in the determination of price structure. The inclusion of COO-specific parameters provides a statistically significant improvement to the standard hedonic price model and therefore the respective hypothesis is supported. All 12 COO-specific parameters are highly significant and most of them intuitively sized. The COO effects detected here reveal the significance of a brand's home country in car choice decisions. It appears, in the light of the entire discussion, that a car is not simply a self-propelled vehicle used for land transport, but a complex bundle of tangible and intangible characteristics. Hedonic coefficients reflect supply-side resources and demand-side utilities of product characteristics. In this direction, we also examined differences in attribute coefficients and COO effects across car-type segments. More specifically, we allowed both intercept and slope coefficients (i.e., key attribute and COO parameters) to vary across car-type segments. This econometric treatment brings us to our third conclusion that car-type segments are sufficiently heterogeneous to allow discriminatory pricing strategies. The differential attribute and COO effects detected here, suggest that a car characteristic or a brand's home country image can be implicitly priced at a different price-level depending on the targeted car-type segment.

The results presented in this paper have relevance for various players in the auto industry. The hedonic parameters allow managers to assess the relative value of car attributes and appraise new concepts. A market-driven price for a new car can be determined and the existing price of a current vehicle can be assessed. We have also shown that COO invariably plays a significant role in price formation. We provided insights into the extent to which manufacturers may charge (and consumers would be probably willing to pay) COO-specific price premiums. These insights are of substantial value to marketing managers designing a pricing strategy, particularly when the consumer is confronted with product offerings from multiple COOs differing in their image. The COO premiums illustrate returns to investments, in an era where overall quality has risen and manufacturers rely more heavily on intangible aspects as a means of differentiation. Of equal interest are the differential effects detected across car-type segments, which are indicative of implicit price discrimination strategies.

As noted earlier, our dataset includes prices and characteristics of all new passenger car models available in the British car marker. It would be desirable to integrate similar datasets from car markets of other countries in order to examine, whether, and if so, how, COO effects differ across countries. More specifically, it would be interesting to estimate disaggregate models at the country-level that would allow the examination of differential COO effects across regional markets. It is expected that car makes will be able to command higher price premiums in their domestic markets compared to the ones they command in foreign car markets.

This study demonstrates that COO not only affects actual list car prices and what consumers are likely to buy, but also, how much they are willing to pay. Findings like these are particularly important for major car manufacturers that view multi-segment strategy as a means to diversify, increase profitability and chances of long-term survival.

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Table 1. Variables and anticipated signs with respect to new car prices

Variable	**Explanation**	**Mean (Std. dev.)**	**Anticipated sign**
Price	New car list price	43,018.610 (48,657.430)	N.A.
Engine capacity	Cubic centimeters divided by 1000	2.375 (1.202)	+
Horsepower	Engine horsepower	174.418 (101.621)	+
Speed	Maximum speed in Km per hour	203.197 (32.506)	+
Airbags	Number of airbags	4.887 (1.875)	+
		Frequency (in %)	
Alloy wheels	Dummy variable coded as one if car has alloy wheels	Yes: 58; No: 42	+
Air conditioning	Dummy variable coded as one if car has automatic air conditioning	Yes: 59; No: 41	+
ESP – TCS	Dummy variable coded as one if car has electronic safety system ESP-TCS	Yes: 48; No: 52	+
Leather	Dummy variable with value one if car has leather seats	Yes: 25; No: 75	+

Table 2. Coefficients of car characteristics

Variable	**Aggregate (2)**	**Disaggregate (3)**			
	Total sample	Hatchback	Sedan	MPV-SUV-SW	Coupe-Convertible
Engine capacity	0.140*	0.424*	0.008	0.152*	0.047
	(0.021)	(0.047)	(0.040)	(0.032)	(0.039)
Horsepower	0.003*	-0.001	0.004*	0.003*	0.003*
	(0.000)	(0.001)	(0.000)	(0.000)	(0.001)
Speed	0.000	0.004*	0.002	-0.001	0.002
	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)
Airbags	0.028*	0.054*	0.055*	0.012	-0.005
	(0.005)	(0.006)	(0.011)	(0.008)	(0.016)
Alloy wheels	0.130*	-0.017	0.067	0.147*	0.155**
	(0.020)	(0.023)	(0.039)	(0.029)	(0.066)
Air conditioning	0.141*	0.054**	0.068	0.139*	0.102
	(0.021)	(0.024)	(0.045)	(0.028)	(0.081)
ESP – TCS	0.154*	0.111*	0.167*	0.193*	0.047
	(0.020)	(0.024)	(0.040)	(0.027)	(0.070)
Leather	0.113*	0.060	0.138*	0.070**	0.148*
	(0.023)	(0.046)	(0.039)	(0.030)	(0.055)

*Significant at the 0.01 level (standard error in parenthesis)

**Significant at the 0.05 level

Table 3. Brame/Clogg Z-test results for the difference between regression coefficients

Engine capacity	Horsepower	Speed	Airbags	Alloy wheels	Air conditioning	ESP–TCS	Leather
Hatchback vs Sedan							
6.740*	-3.536*	1.414	-0.080	-1.855	-0.275	-1.200	-1.293
Hatchback vs MPV-SUV-SW							
4.784*	-2.828*	3.536*	4.200*	-4.431*	-2.305*	-2.270*	-0.182
Hatchback vs Coupe-Convertible							
6.173*	-2.828*	1.414	3.453*	-2.461*	-0.568	0.865	-1.227
Sedan vs MPV-SUV-SW							
-2.811*	0.707	2.121*	3.161*	-1.646	-1.340	-0.539	1.982*
Sedan vs Coupe-Convertible							
-0.698	0.707	0.000	3.090*	-1.148	-0.367	1.488	-0.148
MPV-SUV-SW vs Coupe-Convertible							
2.081*	0.000	-2.121*	0.950	-0.111	0.432	1.966*	-1.245

*Significantly different regression coefficients between groups

Table 4. Country-of-origin and associated effects

COO	**Aggregate (2)**	**Disaggregate (3)**			
	Total sample	Hatchback	Sedan	MPV-SUV-SW	Coupe-Convertible
China	8.874*	N/A	N/A	9.160*	N/A
Czech	8.924*	8.018*	8.752*	9.288*	N/A
France	8.847*	7.952*	8.552*	9.338*	9.046*
Germany	9.066*	8.109*	8.826*	9.517*	9.302*
Italy	8.948*	8.067*	8.812*	9.449*	9.140*
Japan	8.978*	8.054*	8.692*	9.464*	9.089*
Korea	8.893*	7.975*	8.687*	9.391*	8.818*
Russia	8.585*	N/A	8.277*	8.967*	N/A
Spain	8.892*	8.042*	8.681*	9.396*	N/A
Sweden	9.137*	8.021*	8.846*	9.649*	9.298*
UK	9.380*	N/A	9.117*	9.738*	9.668*
USA	9.126*	8.214*	8.951*	9.539*	9.149*

*Significant at the 0.01 level

N/A signifies a parameter which was not estimated because the respective combination is unavailable in the market