REGIONAL-ORIGIN LABELING WITH QUALITY CONTROL: AN ECONOMIC ANALYSIS

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Regional Origin-Labeling with Quality Control: An Economic Analysis

1 Introduction

Within the last decade, an increasing number of food scares has affected the food markets in industrialized countries. Consequently, food quality uncertainty by consumers has become a major issue in food and agricultural policy and in food marketing. Given this background and the fact that consumers continue to be more health conscious, quality signals have become increasingly important on food markets.

One of these quality signals is the regional origin of foods. Numerous consumer surveys suggest that the regional origin has gained more weight in food-purchasing decisions (BALLING 2000, p. 19). The country or region of origin is now one of the most important determinants of food demand in the EU (BECKER 2002, p. 21). Surveys do additionally show that it is the own region which is preferred (GERTKEN/VON ALVENSLEBEN 1993, p. 248), but some consumers define their own region rather broadly. In Germany, e.g., about 40% of the respondents view the federal state in which they live as their own region (CMA/ZMP 2003). There is no doubt that consumers have at least some willingness to pay for the characteristic "regional origin".

The protection of the regional origin of foods is a major part of the EU's quality policy in agriculture. According to Council Regulation No. 2081/1992, "the promotion of products having certain characteristics could be of considerable benefit to the rural economy, in particular to less-favored or remote areas, by improving the incomes of farmers and by retaining the rural population in these areas" (COMMISSION OF THE EU 1992). There are two kinds of regional origin which can be registered and protected according to this Council Regulation:

(i) protected designation of origin (PDO);
(ii) protected geographical indication (PGI).

The first definition goes further than the second, as foodstuffs have to be produced, processed and prepared in that region. Additionally, a causal link has to exist between regional origin and quality: quality or characteristics have to be "essentially or exclusively due to a particular geographical environment with its inherent natural and human factors" (Art.2, Council Regulation No. 2081/1992). The PGI, on the other hand, covers a product where at least one of the stages – production, processing, or preparation – occurs in the designating area. In a somewhat weaker formulation than for PDOs, quality, reputation or other characteristics are "attributable to that geographical origin" (ibid., Art. 2) for a PGI.

Generic promotion of agricultural products by EU member countries as well as regional marketing initiatives by federal states have been widespread for years. There was a long dispute between the

European Commission and EU member states, e.g. Germany, on whether these regional promotion measures for agricultural products qualify for governmental support. The Commission's point of view was confirmed in 2001 when the Community's guidelines for State aid for advertising of products were established (COMMISSION OF THE EU 2001). According to these guidelines, only the promotion of those agricultural products can be supported which are protected designations of origin as outlined in Council Regulation No.2081/92. This decision implies that regional-origin labeling has to be associated with a quality-control system that leads to a superior quality, if the programmed is to be subsidized by the government.

Despite the high – and possibly increasing – value the EU addresses to the promotion of regional products, there is not much analytical work on the economic impacts of those initiatives. There is, however, a well-established literature on the economics of generic promotion, starting from classical and general contributions (NERLOVE/WAUGH 1961; FORKER/WARD 1993) to recent and very detailed impact analyses applied to selected questions, commodities and programs (see the contributions in KAISER 2003). Typically, the effects of generic advertising on demand for the advertised food are estimated or modeled and the redistributive and welfare impacts elaborated. Especially for the U.S., where generic advertising is financed by producer levies, cost-benefit ratios are calculated which relate additional revenues and costs for producers due to program participation. Studies in this literature investigated the importance of cross-price effects for advertising effectiveness (KINNUCAN 1996), the distribution of impacts of advertising within the marketing chain (KAISER/SCHMIT 2003), or the implications of market power for the allocative and redistributive effects of generic promotion (ZHANG/SEXTON 2002). Economic studies on European regional promotion programmers are rare, but some do exist for Germany (e.g., HOFF/CLAES1997 or HERRMANN/THOMPSON/KRISCHIK-BAUTZ 2002).

Despite the numerous extensions in the promotion literature, analyses were mainly carried out within models were one uniform price at one stage of the marketing chain is determined. When a regional marketing programmed includes regional-origin labeling as well as additional costs for quality control, as is the case under the EU Council Regulation 2081/1992, different qualities have to be distinguished. Market segmentation occurs between a higher-quality market for the labeled product and an average-quality residual market. There have been models of segmented agricultural markets, e.g. on country-of-origin labeling (LUSK/ANDERSON 2003) and on markets for foods with and without genetically modified organisms (SCHMITZ/MOSS/ SCHMITZ 2004). However, a segmented-market approach has not yet been applied to regional-origin labeling and its specific characteristics.

Given this background, it is the objective of this paper to provide a methodological framework for the analysis of regional marketing programmes which include regional-origin labeling as well and quality assurance and control. An equilibrium displacement model for a segmented market with differential qualities will be developed that can be applied to a variety of regional marketing programmers. An empirical application of the model is illustrated for one selected European example, i.e. "Gepruefte Qualitaet – Bayern".

2 The Model

The objective is to model economic implications of state-financed programs assuring both quality control at a superior level and the regional origin of an agricultural product.

To assess the direct and distributional effects of such programs, we develop a commodity market model that is segmented by both product quality and regional origin. Our segmented market model extends the existing work on commodity promotion evaluation which has been largely restricted to uniform markets. In our general model each region can produce for a uniform lower-quality market which we call the mass market. Each region can also incur additional program participation costs and produce for a high-quality market which is then regionally labeled. The demand for these high quality regional products may be augmented by regional promotional expenditures.

As stated earlier, a linkage between improved product quality and regional origin labeling is a justification for government-subsidized promotional efforts. So, we seek a model that will enable us to evaluate the ability of promotional programs designed to send product quality signals based on regional origin. However, as shown by KINNUCAN (1996), when markets are interrelated, ignoring the cross-price and cross-advertising effects will yield biased measures of advertising effectiveness. We extend this result to present a general model which allows for interactions between mass and regional markets with respect to price, regional advertising, supply response and differing cost structures.

We show the structure of the model first and then discuss its possible further applications.

2.1 Structure of the Model

A multi-equation market equilibrium model for two regions engaged in regional-origin labeling which are related in price, advertising and costs is specified as

Supply: $$S_j^i = S_j^i(P, C, Z) \tag{1}$$

Demand: $$D_j^i = D_j^i(P, A, X) \tag{2}$$

Market Equilibrium: $$S_j^i = D_j^i \tag{3}$$

where i = region A or B; j = mass-market product M, high-quality product A or B; **P** is a vector of producer prices, **A** is a vector of regional advertising expenditures, **C** = the additional producer cost of participation in the regional advertising program, and; **Z** and **X** are exogenous supply and demand shifters. We assume competitive markets at the farm level. Prices and quantities are determined endogenously according to the market equilibrium (3).

Following the general methods used by KINNUCAN (2003) and PIGGOTT (2003), the logarithmic differential approximation to equations (1) – (3) yields the following multi-equation equilibrium-displacement model (EDM):

Region A

Supply:

$$d\,ln\,S_M^A = \varepsilon_M^A\, d\,ln\,P_M + \varepsilon_{AM}^A\, d\,ln\,P_A$$
$$d\,ln\,S_A^A = \varepsilon_A^A\, d\,ln\,P_A + \beta 1\, d\,ln\,C_A \qquad (4)\text{-}(5)$$

Demand:

$$d\ln D_M^A = \eta_M^A\, d\ln P_M$$
$$d\ln D_A^A = \eta_A^A d\ln P_A + \eta_{AB}^A d\ln P_B + e_{AA}^A d\ln A_A + e_{AB}^A d\ln A_B^A \qquad (6)\text{-}(8)$$
$$d\ln D_B^A = \eta_B^A d\ln P_B + \eta_{BA}^A d\ln P_A + e_{BB}^A d\ln A_B^A + e_{BA}^A d\ln A_A$$

Region B

Supply:

$$d\,ln\,S_M^B = \varepsilon_M^B\, d\,ln\,P_M + \varepsilon_{BM}^B\, d\,ln\,P_B$$
$$d\,ln\,S_B^B = \varepsilon_B^B\, d\,ln\,P_B + \beta 2\, d\,ln\,C_B \qquad (9)\text{-}(10)$$

Demand:

$$d\ln D_M^B = \eta_M^B\, d\ln P_M$$
$$d\ln D_B^B = \eta_B^B d\ln P_B + \eta_{BA}^B d\ln P_A + e_{BB}^B d\ln A_B + e_{BA}^B d\ln A_A^B \qquad (11)\text{-}(13)$$
$$d\ln D_A^B = \eta_A^B d\ln P_B + \eta_{AB}^B d\ln P_A + e_{AA}^B d\ln A_A^B + e_{AB}^B d\ln A_B$$

Equilibrium Conditions

$$\sum h_M^S\, d\,ln\,S_M = \sum h_M^D\, d\,ln\,D_M$$
$$d\,ln\,S_A^A = h_A^{DA}\, d\,ln\,D_A^A + h_A^{DB}\, d\,ln\,D_A^B \qquad (14)\text{-}(16)$$
$$d\,ln\,S_B^B = h_B^{DB}\, d\,ln\,D_B^B + h_B^{DA}\, d\,ln\,D_B^A$$

i = A, B (regions) and, j = M, A, B (products).

Superscripts denote the region (*A* or *B*), subscripts denote products (mass-quality product *M*, high-quality product *A* or, high-quality labeled product *B*), ε's are own- and cross-price elasticities of supply; η's are own- and cross-price elasticities of demand, *e*'s are the own- and cross-advertising elasticities and, *c*'s represent the marginal cost of participation for each region[1]. Equilibrium conditions (14) - (16) contain both supply and demand market shares h_j^{Si} and h_j^{Di}, respectively[2]. For instance h_A^{DA} is the market share of the total demand for high-quality product *A* within region *A*.

Given exogenous market shares, advertising quantities, and program participation cost, the linear equation system (14) - (16) can be solved for the three endogenous price change variables $d \ln P_j$ as,

$$\begin{bmatrix} d\ln P_M \\ d\ln P_A \\ d\ln P_B \end{bmatrix} = \begin{bmatrix} a_{11} & \cdots & a_{13} \\ \vdots & & \vdots \\ a_{31} & \cdots & a_{33} \end{bmatrix}^{-1} \begin{bmatrix} b_{11} & \cdots & b_{14} \\ \vdots & & \vdots \\ b_{31} & \cdots & b_{34} \end{bmatrix} \begin{bmatrix} d\ln A_A^A \\ d\ln A_B^A \\ d\ln A_A^B \\ d\ln A_B^B \end{bmatrix} + \begin{bmatrix} a_{11} & \cdots & a_{13} \\ \vdots & & \vdots \\ a_{31} & \cdots & a_{33} \end{bmatrix}^{-1} \begin{bmatrix} c_{11} & & c_{12} \\ \vdots & & \vdots \\ c_{31} & & c_{33} \end{bmatrix} \begin{bmatrix} d\ln C_A^A \\ d\ln C_B^B \end{bmatrix} \quad (17)$$

where the a matrix includes own- and cross-price elasticities of supply and demand as well as market shares, the *b* matrix includes own- and cross-advertising elasticities, and the *c* matrix includes parameters associated with the added cost of regional program participation.

Parameterization of the above model is needed to simulate how changes in own- and cross-region advertising expenditure and changes in program participation cost impact market prices and quantities. In our empirical illustration below, we use elasticity estimates from the literature. In addition, specific applications will likely necessitate restrictions to the general model to characterize the unique dimensions of any particular empirical application.

The solution to equation (17) can be used to evaluate the total and distribution of economic welfare due to regional advertising. This can be accomplished by computing changes in producers and consumers surpluses, assuming parallel shifts in demand and supply.

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[1] We assume the components of X and Z are subsumed in the constant terms of equations (1) and (2).

[2] If for supply, $S = S_M^A + S_M^B$, then $d\ln S = d\ln S_M^A \cdot h_M^{SA} + d\ln S_M^B \cdot h_M^{SB}$, where h^{SA} and h^{SB} are supply shares on the mass market originating from region A and B, respectively. This same relationship holds for markets segmented on the demand side.

$$\sum_i \sum_j \Delta PS_j = \sum_i \sum_j \left[p_j S_j \cdot d \ln P_j \left(1 + 0{,}5 d \ln S_j \right) \right],$$
$$\sum_i \sum_j \Delta CS_j = \sum_i \sum_j \left[p_j S_j \cdot d \ln P_j \left(1 + 0{,}5 d \ln D_j \right) \right] \quad (18)\text{-}(19)$$

where, *PS* is producer surplus and *CS* is consumer surplus.

2.2 Possible Uses of the Model

The model presented above has been designed for a combined analysis of regional-origin labeling and quality control. This means that the implications of promotion expenditures for the labeled products can be elaborated as well as the consequences of increasing costs of producers due to the instruments of quality control. The model has been developed in this general from for a situation where competing high-quality products exist as well as a lower-quality mass product. This is typical for the current situation in the EU where different regional labels have been introduced for, e.g., beef and advertising occurs for competing labels. It is a crucial task in the empirical application of the model to define precisely (i) the competing high-quality products and (ii) the relevant market on which the products compete.

If strong competition between high-quality segments of the market do not exist, it is of course possible to reduce the model such that the regional label as the only high-quality product has to be distinguished from a lower-quality mass product.

There is the potential of the general model to serve other purposes as well. The EDM model could be applied to other relevant issues where market segmentation plays a major role. Cases in point are strategies of country-of-origin-labeling, differentiation of ecological as opposed to conventional farming and foods, or the labeling of foods that do not contain genetically modified organisms (GMOs). Some modeling approaches of these markets have already been provided. CHUNG/ZHANG/PEEL (2004) and LUSK/ANDERSON (2003) analyze country-of-origin labeling on the U.S. meat sector. The COOL provision of the 2002 Farm Sector and Rural Investment Act requires from September 30, 2004 that retailers label the country of origin on fresh and frozen foods. CHUNG/ZHANG/PEEL and LUSK/ANDERSON use models which distinguish between domestic and foreign products as market segments. Products from ecological as opposed to conventional farming are analyzed in a segmented equilibrium-displacement model by HAGNER (1997) and the impacts of governmental policies on the conventional and ecological markets are elaborated. MOSS/SCHMITZ/SCHMITZ (2004) use a partial-equilibrium segregation model in their study of how considerable resistance against the introduction of genetically modified (GM) crops leads to segregated markets for GM and non-GM crops. Based on this model, they illustrate the welfare implications of market segregation and the relevance of segregation costs.

Our model differs from these approaches in the literature in two major respects:

1. The modeling framework is applied to regional-origin labeling. None of the other modeling approaches has been used to study this issue.
2. Although individual papers go further in other respects than we do, none of the segmented-market models in the literature covers competition between high-quality products as does the presented model with the labeled goods of regions *A* and *B*.

An application of the model to a regional-labeling and quality control scheme will now be provided. The case study is related to the German program "Gepruefte Qualitaet – Bayern".

3 An Empirical Application of the Model

3.1 Background

The origin of Bavarian regional-origin labeling dates back to 1985 when the program "Quality from Bavaria" had been established by the Bavarian Ministry for Nutrition, Agriculture and Forestry (for details, see HERRMANN/THOMPSON/KRISCHIK-BAUTZ 2002). After having been used only for seed products and breeding cattle first, a program for cattle and beef was introduced in October 1994 under the influence of consumer concerns about BSE. To "re-establish and increase confidence of the strongly insecure consumer especially in Bavarian meat" was the declared objective for this program.(BSTMELF 1999, p. 10). Advertising for the program occurred in various media and a Bavarian meat-controlling institution, "Bayerische Fleischpruefung e.V.", was responsible for quality and test regulations. Activities under the program were suspended in late 2002 when BSE cases were discovered in Germany.

In accordance with the EU rules on protected designations of origin, a revised program was then started in February 2002: "Gepruefte Qualitaet – Bayern" (BSTMLF 2002). Participation in the program is open to producers, processors an retailers who agree to a detailed system of quality control. This is due to the fact that the regional label may only be supported under EU rules when a superior quality is guaranteed under the program.

3.2 Model Structure for Bavarian Beef

The empirical application of the general model refers to two regions (Bavaria and Rest of Germany) and the beef market. It is characterized by the following structure of the model.

Supply:

$$d\,ln\,S_M^A = \varepsilon_M^A\, d\,ln\,P_M + \varepsilon_{AM}^A\, d\,ln\,P_A$$
$$d\,ln\,S_A^A = \varepsilon_A^A\, d\,ln\,P_A + \beta 1\, d\,ln\,C_A \qquad (17)\text{-}(18)$$

Demand:

$$d\,ln\,D_M^A = \eta_M^A\, d\,ln\,P_M$$
$$d\,ln\,D_A^A = \eta_A^A\, d\,ln\,P_A + e_{AA}^A\, d\,ln\,A_A \qquad (19)\text{-}(20)$$

Rest of Germany (Region *B*)

Supply:

$$d\,\mathbf{ln}\,S_M^B = \varepsilon_M^B\, d\,\mathbf{ln}\,P_M \qquad (21)$$

Demand:

$$d\,ln\,D_M^B = \eta_M^B\, d\,ln\,P_M$$
$$d\,ln\,D_A^B = \eta_A^B\, d\,ln\,P_A + e_{AA}^B\, d\,ln\,A_A^B \qquad (22)\text{-}(23)$$

Equilibrium Conditions:

$$\sum h_M^S \cdot d\,\mathbf{ln}\,S_M = \sum h_M^D \cdot d\,\mathbf{ln}\,D_M$$
$$d\,\mathbf{ln}\,S_A^A = h_A^{DA} \cdot d\,\mathbf{ln}\,D_A^A + h_A^{DB} d\,\mathbf{ln}\,D_A^B \qquad (24)\text{-}(25)$$

i = *A, B* (regions) and; *j* = 0, *M, A*, (products).

Again, superscripts characterize the regions A and B, subscripts the high-quality product A and the mass product M. According to the market situation for Bavarian beef the following major adjustments to the general model were made. Bavaria is the largest exporter of beef among all German federal states. Bavarian exports occur both under the regional label and for unlabeled beef, i.e. for the high-quality and the mass market. Therefore, there is demand for Bavarian beef in the rest of Germany for both qualities (equations (26) and (28)). As exports form the region go to various regional markets in Germany, Bavarian beef competes with beef under various other labels as well as foreign beef. There is no single competitor of regionally-labeled Bavarian beef in the high-quality market sector. Thus, we posit that the labeled product has a superior quality than the average beef and we distinguish only the regional label as high-quality product from the lower-quality average beef.

3.3 Empirical results and Sensitivity Analysis

Not all parameters and elasticities of the empirical model are currently available. The same holds true for basic information on the market segments of labeled and non-labeled products. Reliable and precise data, e.g., on prices on the market segments are not available from publicly available statistics. Information on additional costs for producers and processors due to participation in a program that combines quality standards and control with regional-origin labeling is lacking, too. Data have a more tentative character and are sometimes based on expert knowledge which is a rough estimate or a precise information for one certain point of time. Given this background, simulations and sensitivity analyses are particularly important. An additional advantage of these simulations is that stronger changes of policy variables can be analyzed than those realized in the past. This is crucial when one is interested in, e.g., that Amount of additional advertising expenditures that is necessary to induce a defined price difference between the labelled and the non-labeled market or a sizeable increase in welfare of producers.

Table 1 summarizes parameters and elasticities of the empirical model. A key parameter of the model for evaluating the impacts of advertising for a regional-origin label is the advertising elasticity of demand. We take the econometric estimate of 0.04 by HERRMANN/THOMPSON/KRISCHIK-BAUTZ(2002) measured for the program "Quality from Bavaria". It is consistent with most studies from the generic-promotion literature that the advertising elasticity of demand is significantly positive but low – typically less than 0.1. Price elasticities of demand, with -0.8 in the high-quality segment and -0.4 on the mass market, are in the magnitude of econometric estimates for beef demand in Germany that have been estimated in the same study. Some recent econometric analyses based on demand systems indicate that the size of price elasticities might be at the lower end; they suggest that the absolute value of the price elasticity of demand for beef increased over time and might now be above unity in absolute terms (WILDNER 2000).

Table 1: Parameters and Elasticities of the Empirical Model

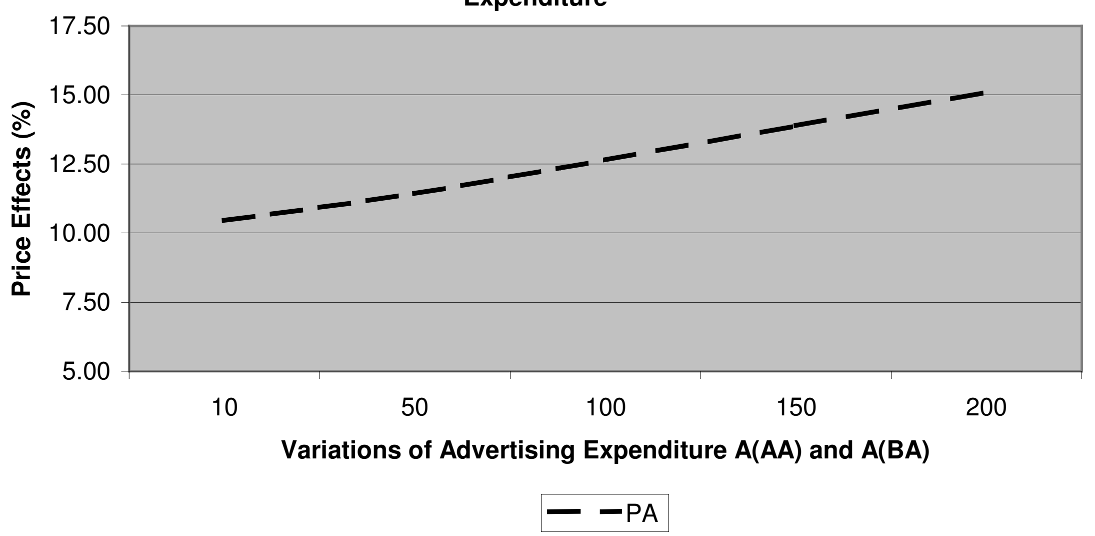
Price Elasticities of		Advertising and Cost Parameters	Market Shares
Supply	Demand		

ε_M^A	0.2	μ_M^A	-0.4	$d \ln A_A^A$	1.0	h_M^{SA}	0.3
ε_{AM}^A	-0.1	μ_A^A	-0.8	$d \ln A_A^B$	1.0	h_M^{SB}	0.7
ε_A^A	0.5	μ_A^B	-1.2	$d \ln C_A$	1.0	h_M^{DA}	0.2
ε_M^B	0.2	μ_M^B	-0.5	e_{AA}^A	0.04	h_M^{DB}	0.8
				e_{AA}^B	0.04	h_A^{DA}	0.6
				β_1	-0.1	h_A^{DB}	0.4

Source: Own compilation.

When the equilibrium-displacement model (20) to (28) is solved for prices on the high-quality and the mass market, it can be derived that a doubling of advertising expenditures – combined with a doubling of participation costs due to higher quality standards and stricter controls – would raise the price of the regionally labelled product by 12.7 %. Additionally, demand and supply on this market increase which means that the advertising effect is strong enough to overcompensate the cost effect and producers gain through regional-origin labelling on the high-quality market. We concentrate in the following on the price effects of regional-origin labeling on the two market segments. The price on the mass market is lowered by 2.8 %.

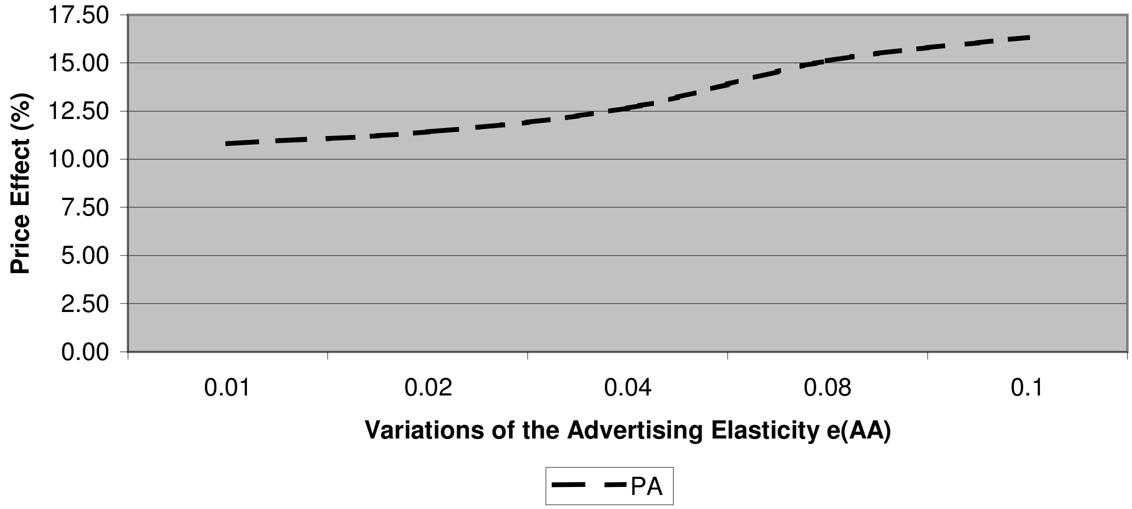
Figure 1: Percentage Price Effects Due to Variations of Advertising Expenditure[a)]



[a)] Only $d\ln A_A$ and $d\ln A_A^B$ are varied, all other coefficients are used from Table 1.

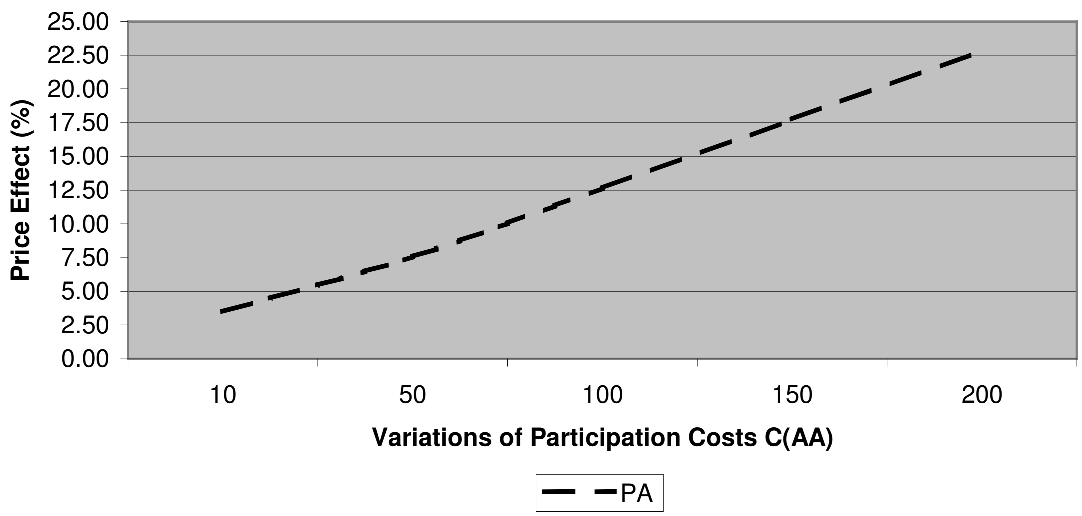
Source: Own computations.

Figure 2: Percentage Price Effects Due to Variations of the Advertising Elasticity[a)]

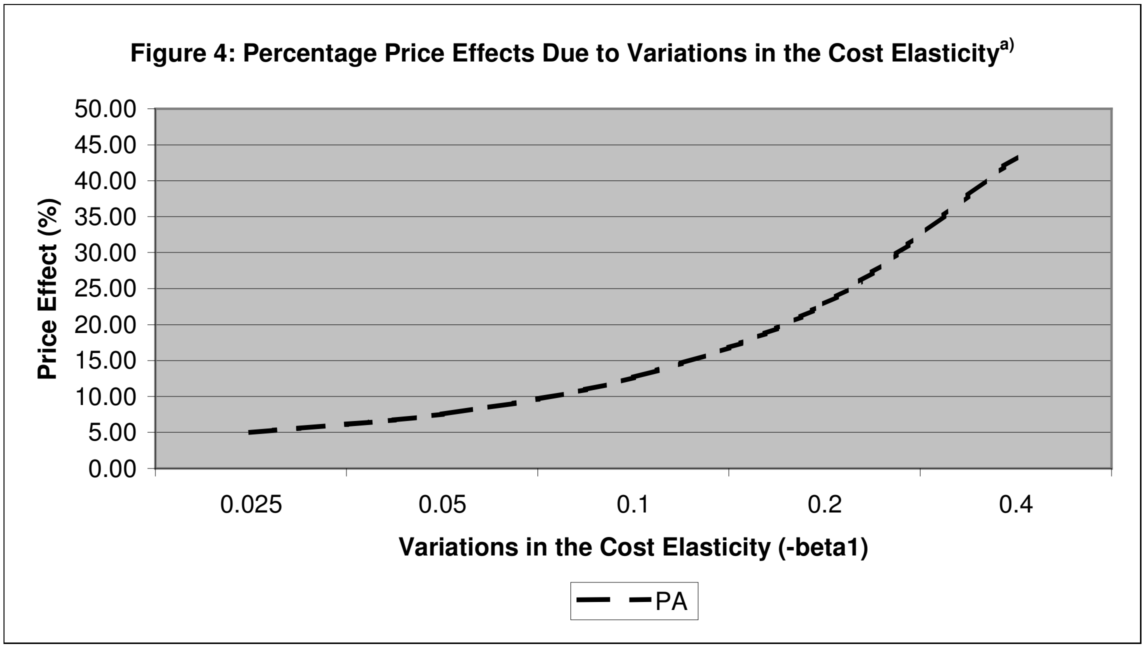


a) Only ε_{AA}^{A} and ε_{AA}^{B} are varied; all other coefficients are used from Table 1.
Source: Own computations.

Figure 3: Percentage Price Effects Due to Variations of Participation Costs[a)]



a) Only $d\ln C_A$ is varied; all other coefficients are used from Table 1.
Source: Own computations.



a) Only β_1 is varied; all other coefficients are used from Table 1.
Source: Own computations.

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