Excise Tax Overshifting in the Hungarian Beer Market

Barna Bakó* Zombor Berezvai†

May 13, 2013

Abstract

We conduct this paper on excise tax shifting in the Hungarian beer market. Using a regression model we show that tax overshifting occurs in this market. We present a model with oligopolistic competition to explain how tax overshifting can occur because of the separated vertical structure. Our results suggests that Hungarian beer producers compete in Bertrand fashion and the hypothesis of collusion between beer producers can be rejected.

JEL codes: C25, L41, L66

Keywords: tax overshifting, collusion, vertical integration

1 Introduction

Tax shifting to consumers is a relevant problem in every country. Firms usually try to impose these taxes on the final consumer prices, although their success regarding the tax shifting depends highly on their market power. Hungarian government increased the excise tax imposed on alcoholic beverages several times in the last decade. This gives us the possibility to examine the market structure in industries where excise tax was increased by evaluating the ratio of tax shifting to the final prices.

We conduct this paper on excise tax shifting in the Hungarian beer market. Using a regression model on a 12-year long dataset we show that tax overshifting

*'Lendület' Strategic Interactions Research Group, Corvinus University of Budapest, e-mail: barna.bako@uni-corvinus.hu
†Eötvös Loránd University, e-mail: bzombor@fazekas.hu

occurs in this market. The relevant literature explains this result by assuming vertically integrated market structure. In this approach tax overshifting can occur easily (see Seade (1985)). However, beer manufacturers seldom if ever vent their products to the final consumers. Often, retailers are inserted between manufacturers and consumers. Thus, the beer industry is much more like a vertically separated industry rather than an integrated one. Based on this we give an alternative explanation to the tax overshifting.

Market structure and market power exertion can be examined by using cost and tax data. Raper et al. (2000) using price and quantity data determined market power exertion in the USA leaf tobacco market. Based on their method we assess market power exertion in the Hungarian beer market.

The structure of this paper continues with prior studies on beer demand elasticity and the connection between market structure and excise tax and cost shifting. In section 3 we describe the methodology and the dataset we used to estimate the model. Section 4 is made up of the results of the regression. Section 5 focuses on the tax overshifting and on its consequences regarding market structure. Concluding comments are presented in Section 6.

2 Literature Review

In this section, we focus our attention on some previous results on demand and price elasticity of beer industry, and especially on some studies that have analyzed the connection between excise tax increase and market structure.

Gallet (2007) conducted a meta-analysis for price and income elasticity of alcoholic beverages using the data from 132 studies published between 1945 and 2003. According to his results, beer is the most price inelastic alcoholic product. The same result is found by Bielinska-Kwapisz and Mielecka-Kubien (2011) who examined price and income elasticity of beer in Poland between 1950 and 2005. They found that price elasticity is very small, near to zero. Furthermore, the results are almost the same for China. Tian and Liu (2011) used a 5 years long Chinese panel data for estimating price elasticity of beer. They found that the elasticity is very small, in the province and city/country controlled model it was not significantly different from zero. Gil and Molina (2009) analyzed the drinking habits of the Spanish adolescent population. They found that beer is price inelastic even in this population, although the elasticity was significantly different from zero.

French et al. (2006) used a miscellaneous way to estimate price elasticity of beer. They made a survey and asked 329 people about their alcohol consumption change if prices would rise by 10%, 25% and 50%. The smallest change they observed was among beer drinkers; and the consumption reduction was less than the price increase.

According to Saffer (1989), tax increase does have an effect on beer consumption. However, consumption reduction depends on the tax shifting which is influenced by the market structure. Rojas (2008) examined the connection between price changes and market structure in the USA in 1991 when excise

tax on beer was doubled. He calculated hypothetical price changes using several market structures and compared those to the observed prices. The study claims that full collusion in the USA beer market can be rejected.

Slade (2004) pointed out another method to examine market structure from price and cost datas. She calculated Lerner indices for some theoretical models and set those against the actual Lerner index of UK's brewing industry. The best fitted model was multiproduct Bertrand competition. Collusion was rejected again.

3 Methodology and data

Reviewed literature suggests that excise tax increase effects on final prices can help to evaluate whether the firms compete as price takers, that is the market can be characterized as competition or the players behavior exhibit some sort of market power. In this paper our goal is to analyze the market structure of the Hungarian beer industry. In order to examine this, we developed a regression model that explains beer price shifts with cost and excise tax changes and with some demand control variables (temperature, import beer prices and crises proxy).

We used 12 years long monthly data sets (from 2000 to 2011) to estimate our model. According to Young and Bielińska-Kwapisz (2002) beer prices respond to tax changes within a quarter year period in the USA. Because of this effect, we used lags of cost and tax changes in our model.[1]

We chose three demand control variables. Temperature considerably biases the beer consumption. In the interval from 2000 to 2007 the correlation between yearly beer consumption in Hungary and average temperature was 0.734. From 2008 this tendency faulted due to the economic recession. That is the reason why we also included a crises proxy variable in our model. This dummy variable is 1 for every month in a quarter year when the Hungarian quarterly GDP growth rate is minus, 0 otherwise. In the Hungarian beer market, import beers have only a very small market share. However, after Hungary joined the European Union (1st May 2004) most of the import beers are duty free. The cheap import beers can cause a price reduction which can also be important in our model.

Formally, the model to be estimated for beer price at time t is:

$$\begin{aligned} \Delta p_t &= \alpha + \sum_{i=0}^{5} \beta_{1,t-i} \Delta c_{t-i} + \sum_{i=0}^{5} \beta_{2,t-i} \Delta \tau_{t-i} + \sum_{i=0}^{5} \beta_{3,t-i} \Delta p_{im,t-i} + \beta_4 \Delta T_t \\ &+ \beta_5 V_t + u_t \end{aligned} \tag{1}$$

where α is a constant, Δp_t is the domestic pre-VAT beer price change between the period t and $(t-1)$, Δc_t is the cost of production change between t and $(t-1)$, $\Delta \tau_t$ is the excise tax change between the periods, $\Delta p_{im,t}$ is the imported

[1] In practice, retail firms, e.g. pubs and supermarkets, sometimes have big stocks of beer and this can cause a long-drawn-out price change.

beer price change, ΔT_t is the monthly average temperature deviation from the 12 years average at month t, V_t is the crises proxy (dummy) variable at month t and u_t is a white noise error from a normal distribution with 0 average. The estimation method used is ordinary least squares (OLS).

Our data sets came from several sources. We used the average domestic and import beer prices and cost of production data published by the Hungarian Central Statistical Office. The VAT was filtered out from the domestic average beer price data series. Excise tax rate is defined by the Hungarian Parliament. As the nominal tax rate changes are determined by the corresponding law, we used the archive law database. All the four data sets are time series. To avoid modeling inflation, we deflated all the series using monthly consumer price indices or producer price indices (only for cost of production data set). The monthly average temperature data came from the Hungarian Meteorological Service. From the data set we calculated a 12 years average for every month, and used the deviation between the appropriate monthly data and the 12 years average. The crises dummy variable is based on the GDP growth rate published by the Hungarian Central Statistical Office.

4 Results

First, we estimated equation (1) that includes five time-lagged values of the production cost, excise tax and import beer price variables. Than, we omitted the variables that are insignificant at 5% level (using t-statistics).

Table 1 presents the final results with individual t-statistics and p-values. We used the same symbols as in equation (1). Not only the majority of the

Table 1: OLS regression results beer prices

Variable	Coefficient	Std. Error	t-ratio	p-value	
α	0.003098	0.0805007	0.0385	0.96936	
$\Delta\tau_t$	1.650360	0.223075	7.3982	< 0.00001	***
Δc_t	0.163590	0.0541698	3.0200	0.00302	***
Δc_{t-1}	0.154560	0.0530718	2.9123	0.00419	***
$\Delta p_{im,t}$	-0.008404	0.0036378	-2.3103	0.02236	**

lags proved to be insignificant, but so did the temperature and crises dummy variables.

There are some important criteria connected to the relevance of the model. The whole model is significant in every significance level (p-value of F-statistic is 2.08e–14). Another econometric issue is residual autocorrelation which is a sign of the misspecification of the model. Durbin-Watson test for first order residual autocorrelation is 2.1. It shows that there are no first order residual autocorrelation in our model ($\rho = -0.051$).

The coefficient on the beer tax changes implies that excise taxes are overshifted to retail prices. Linear restriction of the shifting parameter to one ($\Delta\tau_t = 1$) is statistically insignificant in every common significance level (p-value is 0.004).

The result shows that *ceteris paribus* 1 Hungarian Forint (HUF) real increase in excise tax will cause a 1.65 Hungarian Forint real increase in beer price by the time it reaches the retail level.

5 Discussion

Our results show that there is a significant price overshifting in the Hungarian beer market.

There are some other empirical studies, where tax overshifting was found. Besley and Rosen (1999) examined sales tax and commodity price differences between U.S. cities. They found tax overshifting for some special products, e.g. milk, shampoo, bred. Spoerer (2008) analyzed the incidence of the Prussian milling and slaughter tax. He compared several cities which had several tax rates and found obvious signs of tax overshifting. The study of Young and Bielińska-Kwapisz (2002) is closer to our results. According to them there was also excise tax overshifting in the USA beer market between 1982 and 1997. Their result shows that the overshifting parameter is 1.7–1.8 which is similar to our findings. Kenkel (2005) examined alcohol price changes in Alaska after excise tax more than doubled on 1st October 2002. He found a significant tax overshifting which occurred in every retail establishment type.

Most of the studies referred to Seade (1985) to explain the empirical results. Seade (1985) showed that tax overshifting is a distinct possibility which depends on cost, demand and market structure. However, the theory of Seade (1985) assumed that the market is vertically integrated, the producers directly sell their products to consumers. Our opinion is that this assumption is not adequate for the Hungarian beer industry. Therefore we will give an alternative explanation for the phenomenon of tax overshifting.

This is based on the fact that brewers do not sell directly their product to consumers. Instead, in the supply chain, the producers sell beer to retail shops (or chains) and they vend the product to consumers. This can cause a phenomenon similar to double marginalization, when the final consumer price is higher than the price charged by an integrated industry.[2]

To see this consider the following. Suppose a vertically separated industry with an upstream and a downstream market. The upstream market is composed

[2]Other empirical studies also discovered signs indicating double marginalization. For instance, Park and Lee (2002) examined the Korean fixed-to-mobile services and found evidence that the reason of the very high prices is the double marginalization effect. West (2000) studied the liquor prices in Alberta after a privatization period. Government privatized retail liquor stores in 1993. However, the liquor product wholesaler did not change, it was still a government owned monopoly. In this vertically separated industry the liquor prices rose which West (2000) claims to be due to double marginalization appeared.

by three manufacturers and they are involved in price competition.[3] We assume that upstream firms produce homogenous products with a constant marginal cost (c) and based on the reviewed results we suppose that the demand function is characterized with constant elasticity. On the downstream market a number of n retailer compete in Bertrand fashion with differentiated products. This implies that retail shops are different in some aspects, e.g. service, convenience and assortment.

Demand functions for the final products are given by

$$D_i(p_1, \ldots, p_i, \ldots, p_n) = A_i p_1^{\delta_{i1}} \cdots p_i^{\delta_{ii}} \cdots p_n^{\delta_{in}}, \quad i = 1, 2, \ldots, n \tag{2}$$

where δ_{ii} is the own-price elasticity and δ_{ik} (where $k \neq i$) is the cross-price elasticity. We assume that $\delta_{ii} < -1$ for every i, which means that the demand faced by retailers is elastic in own-prices. However, we do not lay down conditions to $\sum_{l=1}^{n} \delta_{il}$, therefore the demand can be inelastic if we look at the entire market. This complies with the reviewed literature.

Using (2) we can derive the profit functions for each retailer. By maximizing those functions with respect to p_i we can calculate the downstream market equilibrium:

$$p_i^* = \frac{\delta_{ii}}{1 + \delta_{ii}} p_w \tag{3}$$

$$Q^* = \sum_{k=1}^{n} A_k \prod_{l=1}^{n} \left(\frac{\delta_{ll}}{1 + \delta_{ll}} p_w \right)^{\delta_{kl}} \tag{4}$$

where p_w stands for the wholesale price.

Manufacturers competing in Bertrand manner choose a wholesale price which equals with their marginal cost. Based on this result one can easily calculate the market clearing quantities and prices. Formally:

$$Q^* = \sum_{k=1}^{n} A_k \prod_{l=1}^{n} \left(\frac{\delta_{ll}}{1 + \delta_{ll}} c \right)^{\delta_{kl}} \tag{5}$$

$$p_w^* = c \tag{6}$$

$$p_i^* = \frac{\delta_{ii}}{1 + \delta_{ii}} c \tag{7}$$

As we can see from (7) the final prices are higher than the prices of an integrated industry, which in this situation would equal with the marginal costs. This is because retailers impose their markups on the prices charged by the

[3] We assume three manufacturers since the Hungarian beer industry is dominated by three major producers with a gross market share over 90%.

manufacturers. Since $\delta_{ii} < -1$, these markups are higher than one. As a result, if an excise tax is imposed on producers, the final prices increase with more than the tax amount and tax overshifting occurs.

Consequently, markups play a key role in our analyses. Barsky et al. (2001) examined markups in the USA food retail industry. One of their main conclusion was that markups on nationally branded and private label products are large in supermarkets. They defined five markup ratios and measured them using a real supermarket dataset. According to their results, retailers markups are between 1.03–1.46 for the majority of national branded products and between 1.07–4.87 for private label products. In Hungary, Györe et al. (2009) did a similar research regarding the Hungarian retail industry. Their findings are analogous, total retail markups are also large in Hungary, they are between 1.35 and 1.8. Although none of the studies specifically examined the beer retailers, we can assume that markups are quite high in this segment as well. Using these high markup ratios we can derive wholesale price changes caused by tax increase (excise tax is paid by producers in Hungary). If we divide the tax shifting parameter from regression (1) by retailers markups, we can get the wholesale price changes. This shows the tax shifting by beer producers.

According to our calculation, at the producers level, there is almost no or only a marginal tax overshifting. If excise tax is increased by 1 real HUF, beer manufacturers will raise their wholesale prices by circa 1 real HUF. That gives us information about market power exertion between producers and retail shops. In section 2 we reviewed some studies in connection with power exertion. As Rojas (2008) and Slade (2004) rejected collusion between beer manufacturers, we can also exclude the possibility of cartel in the Hungarian beer market. The fact that producers shift over exactly the amount of the excise tax shows us that the upstream collusion hypotheses can be rejected and Bertrand competition seems to be an adequate description of the Hungarian beer upstream market.

6 Summary

This paper provides an exploratory study on excise tax shifting and market structure in the Hungarian beer market. Our results show a statistically significant tax overshifting, 165% of the tax increase was passed through to consumer prices.

The key to explain our result is to focus on the vertically separated structure of the beer industry. Beer producers sell their products to retail shops and chains. Retail shops put their markups to the wholesale price of the beer and sell the product to the final consumers. Therefore, consumer prices exhibit two markups instead of one. However, markups data suggest that retail shops are dominant in the supply chain and hold almost all the market power. Our findings suggest that beer manufacturers compete in Bertrand fashion. Based on these results we can reject the assumption of collusion on the upstream market.

References

Barsky, R., Bergen, M., Dutta, S. and Levy, D. (2001), 'What Can the Price Gap between Branded and Private Label Products Tell Us about Markups?', National Bureau of Economic Research, Cambridge Working Paper

Besley, T. and Rosen, H. S. (1999), 'Sales Taxes and Prices: An Empirical Analysis', *National Tax Journal*, 157-178.

Bielinska-Kwapisz, A. and Mielecka-Kubien, Z. (2011), 'Alcohol Consumption and Its Adverse Effects in Poland in Years 1950-2005' *Economic Research International*, 1-13.

French, M. T., BrownTaylor, D. and Bluthenthal, R. N. (2006), 'Price elasticity of demand for malt liqour beer: Findings from a US pilot study', *Social Science & Medicine*, 2101-2111.

Gallet, C. A. (2007), 'The demand for alcohol: a meta-analysis of elasticities', *The Australian Journal of Agricultural and Resource Economics*, 121-135.

Gil, A. I. and Molina, J. A. (2009), 'Alcohol demand among young people in Spain: an addictive QUAIDS', *Empirical Economics*, 515-530.

Györe D., Popp J., Stauder M. and Tunyoginé Nechay V. (2009), 'Az élelmiszer-kiskereskedelem beszerzési és árképzési politikája (Supply Management and Pricing Policy of the Food Retail Trade)', Research Institute of Agricultural Economics, Budapest Working Paper

Kenkel, D. S. (2005), 'Are Alcohol Tax Hikes Fully Passed Through to Prices? Evidence from Alaska', *American Economic Review* 273-277.

Österberg, E. L. (2011), 'Alcohol tax changes and the use of alcohol in Europe', *Drug and Alcohol Review*, 124-129.

Park, M.-C. and Lee, S.-W. (2002), "Double marginalization' problems: evidence from the Korean fixed-to-mobile service market', *Telecommunications Policy*, 607-621.

Raper, K. C., Love, H. A. and Shumway, C. R. (2000), 'Determining Market Power Exertion Between Buyers and Sellers', *Journal of Applied Econometrics*, 225-252.

Rojas, C. (2008), 'Price Competition in U.S. Brewing', *The Journal of Industrial Economics*, 1-31.

Saffer, H. (1989), 'Alcohol consumption and tax differentials between beer, wine and spirits', National Bureau of Economic Research, Cambridge Working Paper

Seade, J. (1985), 'Profitable Cost Increases and the Shifting of Taxation: Equilibrium Responses of Markets in Oligopoly', The University of Warwick Working Paper

Slade, M. E. (2004), 'Market Power and Joint Dominance in U.K. Brewing', *The Journal of Industrial Economics*, 133-163.

Spoerer, M. (2008), 'The Laspeyres-Paradox: tax overshifting in nineteenth century Prussia', *Cliometrica*, 173-193.

Tian, G. and Liu, F. (2011), 'Is the Demand for Alcoholic Beverages in Developing Countries Sensitive to Price? Evidence from China', *International Journal of Environmental Research and Public Health*, 2124-2131.

West, D. S. (2000), 'Double Marginalization and Privatization in Liqour Retailing', *Review of Industrial Organisation*, 399-415.

Young, D. J. and Bielińska-Kwapisz, A. (2002), 'Alcohol taxes and beverage prices', *National Tax Journal*, 57-73.