Socially Optimal Taxation of Alcohol: The Case of Czech Beer

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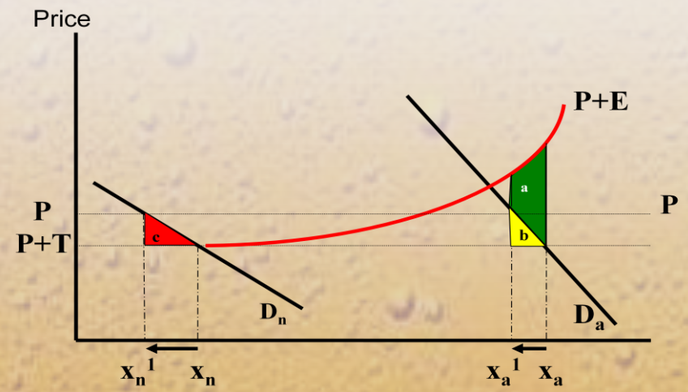
History of Czech Brewing

The origins of beer production in Czech region are connected with the Celtic tribes, in first century. In medieval ages, beer started to be manufactured by cloisters and the royal cities. Its producers were often endowed with various brewing-related privileges which became a source of future power conflicts. Beer consumption was so popular that times that Prague's bishop, St. Wenceslas, had reputedly asked the pope to ban beer production in his diocese. This was the first (and as well the last) „prohibition" in Czech lands.

The crucial period for further development in Czech beer industry was the last third of 19th century. Technological advancement and resulting turbulent growth of the industry created sustained excess of supply and fierce competition among the breweries. Between 1864 and 1910, the number of breweries has decreased by one half and their average production increased more than fivefold. As a result of this development, the Czech Republic has enjoyed extremely low beer prices even in 21st century.

THE MODEL

- Homogenous product
- Perfect competition, given price (***P***)
- Homog. society composed of N_a Abusers and N_n Non-abusers
- Different Demand curves (D_a, D_n)
- All external costs (***E***) caused by „Abusers"



$$W = \sum_{j=b,w,s} N_j^a \int_{x^{j1}}^{x^{j0}} E_j(X_j)\,dx - \sum_{j=b,w,s} \left\{ \frac{1}{2}\sum_{j=1}^{k} \left[T_j\left(-\Delta X_j^a\right)\right] + \frac{1}{2} T_j\left(-\Delta X_j^n\right) \right\}$$

$$\Delta X_b^a = \frac{T_b \varepsilon_b^a X_b^a}{P_b} + \frac{T_w \varepsilon_{bw}^a X_b^a}{P_w} + \frac{T_s \varepsilon_{bs}^a X_b^a}{P_s}$$

Where

E_i^* ....Marginl external abuse cost

ε_i ....Elasticity of i-th abuser group demand

X_i ...Product of No. of i-th group members and consumption

PROS & CONS OF BEER CONSUMPTION

- Medical expenditures due to diseases, Injuries, car accidents
- Loss of productivity
- Increased Criminality, Social exclusion, personal problems
- Possible correlation with smoking or other drugs' abuse

Estimated External Costs of Alcohol Consumption in 2006 (CZK billion)

Beverage	Tangible Costs	Intangible Costs	Total
Beer	11.4 -16.6	15.9 - 23.2	27.3 - 39.7
Total Alcohol	23.7	33.1	56.7

- Apart from simply measurable economic contribution, there are, probably large, positive externalities due to "social cohesion effect" of beer drinking.

Estimated Direct Contribution of Alcohol Production in The Czech Republic (CZK billion)

Contribution	Excise tax	VAT	Income Tax	Tourism Enhancement	Personal tax and employment (CZK billion/No. of jobs)	Total
Beer	3.6	4.0	2.2	3.6	7.9 / 76 000	21.2
Total Alcohol	10.7	4.8	2.6	1.6	10.9 / 105 200	32.7

BEER STATISTICS

Czech Republic is one of the leading world's beer producers and exporters. It is world leader in per head beer production and consumption with average consumption 155 and 160 litres per head. This means 48% share of ethanol drunk in the Czech Republic and 86% of alcoholic drinks' total volume.

Per-head Beer Consumption

	Country	2003 Per capita Consumption (liters)
1	The Czech Republic	156.9
2	Ireland	131.1
3	Germany	115.8
4	Australia	109.9
5	Austria	108.3
6	UK	99.0
7	Belgium	93.0
8	Denmark	89.9
9	Finland	85.0
10	Luxemburg	84.4

Source: http://www.kirinholdings.co.jp

The reason for immense popularity of beer could be found in long tradition of beer production in Czech lands

etc.

ALMOST IDEAL DEMAND SYSTEM

Introduced by Deaton and Muelbauer (1980), see also Edgerton et al. (1996) for its multi-stage application

$$w_i = \alpha_i + \sum_{j=1}^{n} \gamma_{ij} \log p_j + \beta_i \log\left(\frac{x}{P}\right)$$

$$\log P = \alpha_0 + \sum_{k=1}^{n} \alpha_k \log p_k + \frac{1}{2} \sum_{j=1}^{n} \sum_{k=1}^{n} \gamma_{kj} \log p_k \log p_j$$

Where w_i … weight of i-th commodity group expenditure in particular stage budget

p_j … j-th commodity price

x … total expenditure P… Price level thus $\frac{x}{P}$… real expenditure

Conditions required by the theory: $\sum_{i=1}^{n} \alpha_i = 1$ $\sum_{j=1}^{n} \beta_j = 0$ $\sum_{k=1}^{n} \gamma_{kj} = 0$ $\gamma_{kj} = \gamma_{jkj}$

Using real data, the symmetry condition does seldom hold

PRICE ELASTICITIES

Calculated own-price and cross-price elasticities (with t-stats) based on the data from **Czech Household Budget Survey** (2002-2007):

	Beer	Wine	Spirits
Beer	**-0.9715** (-4.452)	-0.0681 (-6.693)	0.0933 (-1.276)
Wine	-0.1143 (-3.969)	**-1.0880** (-6.693)	0.0491 (-1.729)
Spirits	0.2047 (8.821)	0.2302 (6.790)	**-1.2104** (-12.853)

RESULTS and IMPLICATIONS

Optimal Tax Calculation

	Tax per liter of ethanol (CZK)	Tax per liter of the beverage (CZK)	Relative tax	Reduction in abuse costs (CZK million)	Dead-weigh loss (CZK million)	Welfare Gain (CZK million)
beer	85 - 415	3,58 - 17,45	16% - 76%	540 - 14 535	278 - 7 627	818 - 22 161
wine	56 - 416	5,67 - 42,43	8% - 58%	141 - 4 554	58 - 2 418	199 - 6 971
spirit	43 - 284	17,14 - 113,67	7% - 49%	168 - 6 332	59 - 1 702	227 - 9 198
total				3 154 - 15 797	1 475 - 8 249	4 629 - 24 046

- Current tax levels in the Czech Republic seem to be sub-optimal.
- Tax harmonization not supported by the model results
- The optimal tax vector not determined by the absolute differences in elasticities but by their relative proportions.
- The higher ratio between non-abuser and abuser groups elasticity of demand, the lower optimal tax and the lower tax-induced welfare gain.

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