

APPROACHING ELASTICITY OF DEMAND IN TOBACCO INDUSTRY

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Abstract

Elasticity, as a core issue of economic activities, deserves attention frequently be it a micro or macro level of observation. Price elasticity of demand affects producers' decisions about prices and marketing as well as impacts of taxes on tobacco products and smoking regulation. This paper focused more on the micro-level. Nonetheless, the product – cigarettes in the tobacco industry - in the question of the case study is global and having a global impact. For this reason, the paper describes differences among countries. Therefore, the macro aspects of the elasticity will not be avoided. This text shall provide one more example of the managerial approach towards microeconomic issue examined. Data on price and quantity contribute to the discussion on the elasticity coefficient. Data have to lead to results in the elasticity coefficient and its comments that were a primary goal of the paper. These comments were to influence individual decision making for the use of tobacco product concerning health risks. Not only a personal decision making but also a societies decision making is discussed. The interaction between the two points of view creates new situations in the market. Clashes of microeconomics and macroeconomics standpoints determine outcomes in the market. The demand for tobacco and cigarettes is usually considered inelastic in microeconomics. Results can contribute to an evaluation of the tobacco regulation.

Keywords: elasticity, consumption, income, tobacco, taxes

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Introduction

In the scope of the Conference "International Days of Statistics and Economics"¹; this paper puts forward the elasticity and its application in praxis. Companies all over the world (let us name an example of cooperation between China, Zimbabwe) watch for the elasticity of their products. Companies may focus on elasticity issue in terms of product specifications or of

¹ In a section within Economics: Current economic problems from the perspective of microeconomics and macroeconomics

consumers characteristics. Product specifications vary for the plants are grown in different soil and different climate conditions, and so on. Consumer characteristics are manifold: starting from basic ones such as age, gender ending with preferences ranging from more prone to less prone for the use of tobacco product. As these specifications change over time, it is proper to review the issue of elasticity again. As numerous authors already reviewed the topic, this paper examines the case of the sharing economy to a certain extent that may be different from the ones discussed by (Cohen, Hahn, Hall, Levitt, & Metcalfe, 2016; Farber, 2008; Hall, Horton, & Knoepfle, 2019; Mas-Collel & Whinston, 1995).

Structure of paper is: First, mentioning a few notes on theoretical background for that topic. Second, introducing the case in comparison with the environment, surrounding companies driving the change in people's healthier living. Third part reflects theoretical notes into the case study. Reflection shall provide the reader with the advantage of either strong or a weak, subtle agreement with theory. This reflection contributes to a novelty of the paper for the conference.

1 Elasticity demand as a core issue of activities in economics

Unpredictable markets are prone to copy a human nature, sometimes unpredictable. Nonetheless, elasticity helps to predict consumers behaviour and adjust companies response (Mas-Collel & Whinston, 1995).

In general, the dependent variable is the quantity consumed, and the independent variable is the price² of a given commodity. For the demand function, there are two approaches: either based on consumer's total income (Marshallian demand function) or consumers utility (Hicksian demand). It is more convenient to use uncompensated Marshallian demand function and thus understand price-substitution effect in combination with income effect (Nghiem, Wilson, Genç, & Blakely, 2013).

The demand for a commodity depends, of course not only on its price, the consumer's income, prices of other products and other factors. In the case of the demand for tobacco the consumer's income, the main other factors, are smoking restriction and information campaign.

Following the same reference source: the determination of demand function for this product would be useful to decide about elasticity. There exist several demand model specifications: (1) conventional, (2) myopic addiction, (3) rational addiction. Models are using data in the form of annual or quarterly data, linear or transformed for double-log or log-lin.

² Tax can be used for approximation of retail price per pack of cigarettes.

According to Wilkins, Yurekli (2004) and others, the conventional demand function is extended by other factors.

$$Q = a + bP + c_1I + c_2C + c_3T + c_4S + c_5D + \varepsilon \quad (1)$$

Where: Q = per capita consumption of cigarettes P = weighted average real retail price per cigarette, I = real personal disposable income per adult, C = consumer price index, T = time trend variable in y S = index of smoking restrictions, D = an intercept dummy for the introduction of an intensive "smoking or health" information campaign, ε = error term, all in year t.

It is possible to use a conventional demand function because it is a simple way to illustrate main factors what are influencing demand.

The formula of price elasticity is well-known from microeconomics

$$\eta = \frac{dQ}{dP} * \frac{P}{Q} \quad \text{or} \quad \eta = \frac{Q_2 - Q_1}{(Q_2 + Q_1):2} : \frac{P_2 - P_1}{(P_2 + P_1):2} \quad (2)$$

Estimation of the price elasticity of demand is essential not only for consumer and producers but elasticity also affects the impact of taxes on price and quantity and effects on the budget.

2 Economic application of demand elasticity for cigarettes

Market structure influences elasticity. In a market in question, the market concentration ratio in the tobacco industry was measured for 99% in Microeconomics textbooks. Thus, it could have been considered for oligopolistic market structure, taking into consideration the fact that mergers of tobacco producers were done earlier. The progress and evolution brought about new products, not only a brand name. Since there are different types of cigarettes and trade names, it turned into a structure of monopolistic competition. Especially after the introduction of e-cigarettes that uses a sort of advertising, signalling quality in a sense: "e-cigarette is less harmful, it is healthier". This way differentiates the product and creates a positive externality that traditionally conveys to the consumer.

Next, the paper provides an example of a managerial approach to the issue of elasticity. The preciseness of calculation makes results clear for it depends on the quality of data and detailed distinction of subgroups of consumers.

Small dataset available shows results for almost a decade in Table 1. The variability surprised a bit. The price of a package of cigarettes was used, and the price was averaged for all federal states (Arel-Bundock, 2014). The data on consumption, i.e. demanded quantity was personal consumption in billions of dollars, seasonally not adjusted. That could have caused results to diverge as well, although the primary reason was taxes.

Tab. 1: Price elasticity of demand for cigarettes in the United States of America

Year of observation	Elasticity	Comment
01.01.1985	-1.59122	
01.01.1986	-3.35562	
01.01.1987	-0.23268	Less than one
01.01.1988	-2.72391	
01.01.1989	-1.28394	
01.01.1990	-1.07325	Close to unitary
01.01.1991	-5.13118	Unusually high for taxes in the USA increased from 26 to 33 %, but the real price increased by 154% over 1980-1991 (Townsend, 1996)
01.01.1992	-0.61969	Less than one

Source: own based on data of US Bureau of Economic Analysis, Personal consumption expenditures: Nondurable goods: Tobacco [DTOBRC1A027NBEA], retrieved from FRED, Federal Reserve Bank of St. Louis; <https://fred.stlouisfed.org/series/DTOBRC1A027NBEA>, February 3, 2020. and dataset retrieved from Arel-Bundock, V. Rdatasets r datasets: An archive of datasets distributed with r, 2014. URL <http://vincentarelbundock.github.io/Rdatasets>.

For comparison: some results of British medical bulletin express elasticity for different groups of workers. The lowest close to zero were professionals, and managerial group and highest elasticity were in a group of unskilled, manual workers till -1.0 (data refers to 1994 In (Townsend, 1996)). Elasticity across Europe was measured around -0.4 (as of the year 1988). The United Kingdom -0.5 / 0.4, USA -0.7 / 0.5 (price elasticity / income elasticity respectively). Elasticity below one does not apply for teenagers, e.g. the USA reports -1.4; another example of a sensitive group are women (Ibid.). According to income elasticity, it is an essential good (range zero to one) that tends to confirm addiction as well as status in the socioeconomic group for that matter.

This overview emphasizes that distinguishing the groups and categories of products is meaningful.

3 Elasticity at service of health

"Cigarettes represent more than 90% of the value in the traditional Tobacco Products market. The mainstay of Big Tobacco has come under heightened scrutiny from regulatory bodies and the public, which has led to an enduring decline in volume sales. Due to high levels of taxation, roughly half of all revenues go directly to the state in the form of various excise duties and sales taxes." ³ The Compound annual growth rate is 2.7%. Possible substitutes are cigars or e-cigarettes. Statista⁴ expressed that "the E-Cigarettes segment amounts to US\$19,280.70m in 2020. The market is expected to grow annually by 7.8%" till 2023. Own price elasticity of e-cigarettes or Electronic Nicotine Delivery System (ENDS) was estimated around -1.4. Taxation is suggested in the various range that shall primarily discourage the use of teenagers. Cross-price elasticity (also points out on interdependence of companies), as well as taxation sensitivity, was calculated (Pesko, Huang, Johnston, & Chaloupka, 2018). ENDS are studied for possible help of ending addiction on traditional cigarettes even though e-cigarettes are most probably harmful as well. They were banned in Japan, Singapore and other countries. Reusable e-cigarettes elasticities have been measured for -1.9 according to the research of EU countries (Stoklosa, Drope, & Chaloupka, 2016).

We may agree that a ban is more beneficial than tax when it comes to proving it with the price elasticity of demand (Corrigan, O'Connor, & Rousu, 2020).

Tobacco was worth more than silver already four centuries ago. Already for a long-time tax regulation was to prevent negative impact on the health of the population. It was not successful. One could assume that neither tax nor ban would help. Or thinking about changing the cigarettes for ENDS could end-up in using both. As economist expects: could it be that tobacco companies would advertise healthy living and that this advertising would be also beneficial for the company.

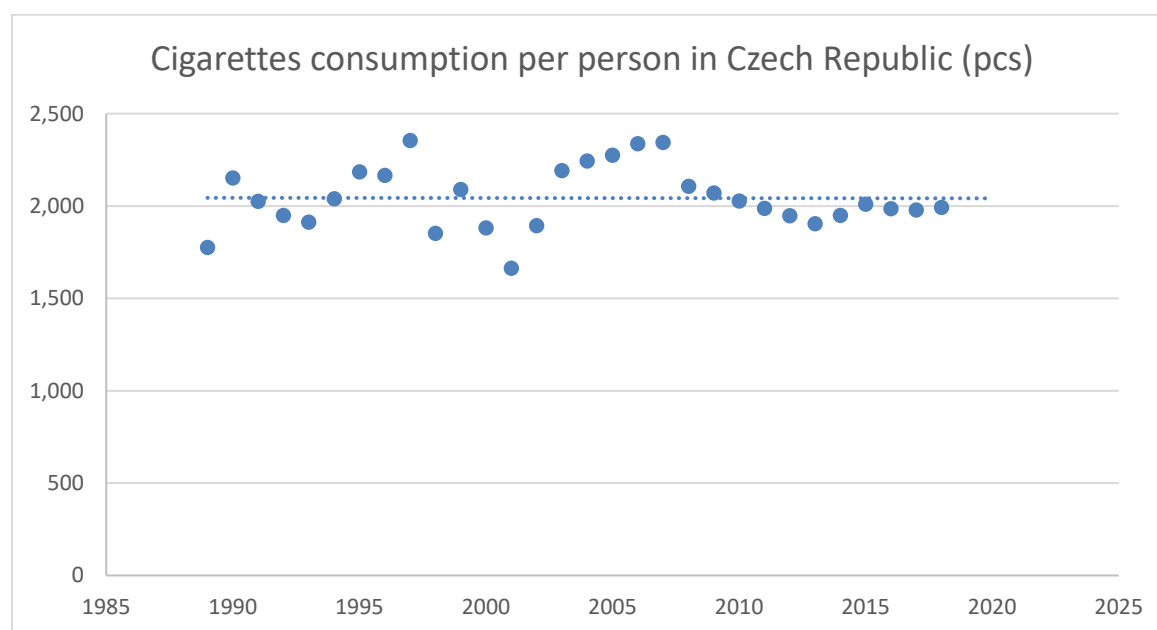
³As stated In: Cigarettes – worldwide. (n.d.). Retrieved February 28, 2020, from <https://www.statista.com/outlook/50010000/100/cigarettes/worldwide>⁴ E-cigarette market share worldwide in 2016 and 2025, by product type, BIS research, 2018, Global E-cigarette and T-Vapor Market, Analysis and Forecast, page 3

⁴ E-cigarette market share worldwide in 2016 and 2025, by product type, BIS research, 2018, Global E-cigarette and T-Vapor Market, Analysis and Forecast, page 3

4 Elasticity at service of taxes

From the standpoint of economic theorist, it is legitimate to show the product description. In short, it is good that is addictive. Therefore, its consumption is steady (Fig. 1, see also trend line) as well as inelastic for most of the consumer groups.

Fig. 1: Steady cigarette consumption pattern



Source: own based on data of Czech Statistical Office, retrieved from <https://www.czso.cz/csu/czso/graf-spotreba-cigaret-na-1-obyvatele-v-ceske-republice>

It is considered, among medical doctors, for unhealthy addiction. This steadiness of consumption in most of the consumer groups is in contradiction to the results of the National Cancer Institute. If we consider the Czech Republic being a high-income country, then it shall apply that the reaction for an increase of a price in tobacco product – cigarettes will result in a decrease in consumption. (NCI, 2016).

To prevent health issues and thus expenses on health care one imposes taxes on cigarettes. It is meant that a higher price would prevent higher doses of nicotine absorbed by smokers and reduce smoking-induced fatalities. This linkage was pointed out in several types of research (NCI, 2016; Stoklosa et al., 2016; Townsend, 1996), especially for the Czech Republic it was (Levy et al., 2012). In agreement with the latter cited paper, a tax increase could reduce smoking prevalence.

Reduction in consumption does not seem to be the trend, despite the fact of the tax increase, as shown in Table 2 (too soon to justify). Apart from taxes, it illustrates also prices in line with the theoretical formula (1) and (2). Prices have two levels lower and higher price of cigarettes. Years 2019 and 2020 are illustrative as data were not available yet. It can be mentioned that thanks coronavirus prices were kept stable in 2020.

Tab. 2: Taxes and prices for cigarettes in the Czech Republic

Year	Tax %	Minimal tax per piece	Minimal tax per pack 20 pieces	Weighted price average ⁵	Brand L lower price	Brand H (higher price)
2014	27	2.25	45	73.74	82	89
2015	27	2.37	47.4	76.48	87	96
2016	27	2.52	50.4	80.14	92	100.14
2017	27	2.57	51.4	83.96	94	102
2018	27	2.63	52.6	86.00	98.78	105.89
2019	27	2.63	52.6	89.72	99 ⁶	106 ⁴
2020	30	2.9	58	91.12	101 ⁴	109 ⁴

Source: Based on data from CSU, Custom Administration of the Czech Republic, Taxud and prices in shops.

The impact of the taxes on the prices of cigarettes is shown in figure 2. As we supposed, there is a strong relationship. Very similar results we can see in the relationship between the prices of two mentioned brands of cigarettes (for low price brand $y=1.8278x$ $R^2=0.9993$ and $y = 1.9787x$ $R^2 = 0.9994$.) Similarly, for the high-priced brand.

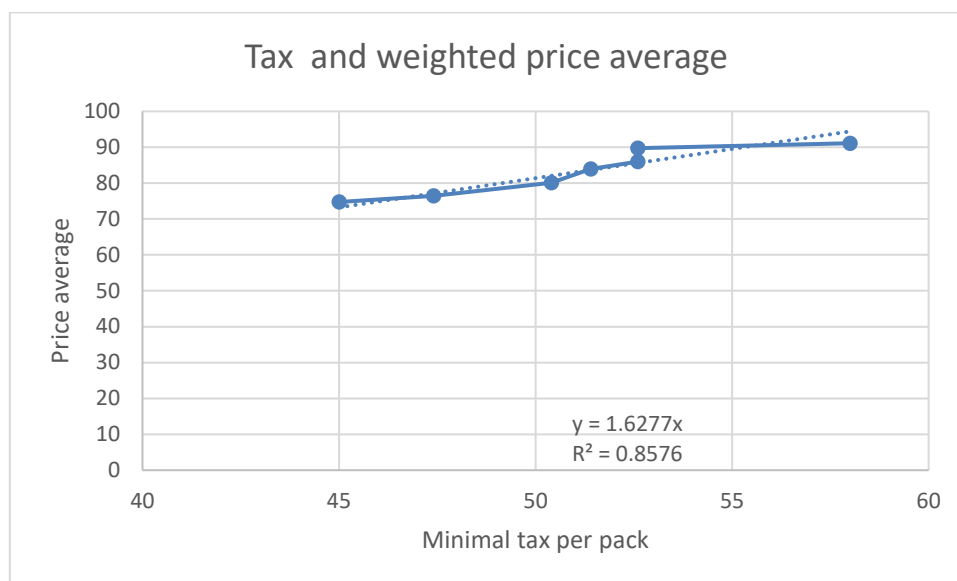
Cigarette consumption data show that taxation and the price of cigarettes are not a significant factor in reducing smoking.

Increasing taxes was significant in the 80s in the USA (Tab. 1) and consumption fall latter on the consumption got again stable and rising. This changes in use and taxes seem to be similar to the trend in the Czech Republic.

⁵ Weighted price average is the price for no- name cigarettes determined by the custom administration

⁶ 2014-2018 average price, 2019, 2020 price in e-shop

Fig. 2 Relationship of tax and weighted price average



Source: own based on data from CSU, Custom Administration of Czech Republic, Taxud and prices in shops

When we observe the consumption and prices of cigarettes, other facts need to be taken into account. It is facts that there was economic growth and also the rise of incomes in the observed period. Due to the lack of statistical data, it is not possible to analyze the impact of the consumption and prices of e-cigarettes on the tobacco market.

Further research should employ prices of e-cigarettes to gain the advantage of cross-price elasticity that could affirm it is becoming a substitute in terms of economics. In the sake of comparison with traditional cigarettes, one would watch for lower and higher price brand as well. Further research shall follow a reinvention of the tobacco industry in terms of loyalty. Consider the cooperation of Chinas monopoly with Zimbabwe farmers (Fang, De Souza, Smith, & Lee, 2020). Cooperation means (1) way of selling - transform the auction by additional contract selling, (2) corporate social responsibility programs – schooling, (3) diversification of farming, other plants for food sufficiency. The latter one will become a necessity in times of starving population and need in times of tobacco industry dusk, no matter the dawn of e-cigarettes.

Conclusion

The limitations of paper are apparent, and one of them we would like to emphasize is that the tobacco industry contributes to information failures as it is supported by Jha and Chaloupka (2000, p. 598). From this study and our small contribution, we agree on that "vast majority of adult tobacco users regret ever having initiated tobacco use." (Ibid.)

Data on price and quantity contribute to the discussion on the elasticity coefficient. Data have to lead to results in the elasticity coefficient and its comments that were a primary goal of the paper. The influence of individual decision making were often prompted by some sort of health information campaign on tobacco product concerning health risks. Not only a personal decision making (on consumption) but also a societies shared decision making (on taxes or ban) was discussed. The interaction between the two points of view created new situations in the market. These situations are as mentioned the reinvention of the tobacco industry itself. Clashes of microeconomics and macroeconomics standpoints determine outcomes in the global market. Global market coefficient might change less quickly compared with changes in local markets. It is also due to the fact of regional differences in community behaviour. The demand for tobacco and cigarettes is usually considered inelastic in microeconomics. Results can be a stimulus for further evaluation of the tobacco regulation.

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