

Tax incentives applied against externalities: international examples for the public health product tax and the carbon tax

This study assesses in practice the Pigou taxes introduced as a response to negative externalities. We will assess the international practice and effectiveness of two areas, the taxation of food products harmful to health and that of carbon emission, harmful to the sustainable environment. We focus on the opportunities and the efficiency-reducing factors of these two tax types.

1. Introduction

Economic thinking discovered relatively early that one of the sources of the imperfectness of the market is that economic transactions affect not only the participants, but also others, either favourably or adversely. Marshall (1820) describes this effect by the concept of external costs and external economy. The theories generally focus on negative externalities, i.e. those unintended and undesirable costs and adverse impacts that derive from economic activity and affect parties not involved in it. According to Mátyás (1999), Pigou (1920) enhances the external economy model of Marshall and distinguishes between the private and social marginal productivity and marginal cost of an economic transaction. By this pair of concept we can describe the negative externality: The marginal productivity of an economic activity is bigger than its social one, and its private marginal productivity is smaller than its social one. As is implied from the theoretical introduction of Kerekes (1990), it is the quite tangible, material pollution that is the first and most common in analyses of the professional literature. The question is how the additional cost of the society can be made the private costs of the individual who incurred it. The answer is very simple: the loser, i.e. the party who sustained the damages, must be compensated from the profit gained. Pigou (1920) provided a seemingly very simple solution for this: The cost of society must be turned into a cost, in the form of tax, on the party who caused the damage or losses. Coase (1969) strongly disputes this approach, stating that if we increase the marginal cost by the tax and thereby restrict the party who caused the loss, then it will lose the profit because of the activity not performed by it. For that reason, Coase proposes that instead of levying a tax, the title to the vulnerable resource must be assigned to a party who sustains the damage and is willing to price it. That way the externality is priced at a market rate, as a cost on the party who created it.

It has been assessed from the aspect of microeconomics as well, why negative externalities do not disappear by themselves. Economics supposes a rational consumer whose purpose is to maximize their utility (Varian 2005). According to the generally accepted economic model, consumers are rational, but in reality they do not possess all information, do not know all consequences and possibilities, so they may not even recognize the problem. According to O'Donoghue and Rabin (2006), as opposed to the general opinion of economics, their decisions and preferences are inconsistent in time: at a given moment their welfare at two points of time in the future is equally important, at the same time, when they reach the earlier, first such point of time, their welfare experienced at the given moment becomes much more important for them than their welfare at the next point of time (although at a point of time earlier than both, both had been equally important). In other words, the instant utilities

become much more important than the future ones, i.e. economic participants discount their long-term benefits and costs more strongly. (Varian 2005) The adverse health and environment impacts assessed by us occur in the long term, while the customers and producer benefits in the short term. That is why some kind of regulatory intervention is necessary in their case.

In the following part we will analyze two ways for the practical implementation of the Pigou tax.¹ The taxation of CO₂ emission is related to the well-known problem of environment pollution, as the presumed source of global warming, which changes the climate and by that, transforms the economic and living opportunities in a geographical sense. The other area of taxation that we have assessed is the internalization of social costs deriving from inappropriate lifestyle, a concept considered more novel, through the popular health product tax (fat tax). Although these topics are far from each other in technical and industrial terms, but in terms of economic problem and impact analysis there are many factors justifying a similar treatment of the fat tax and the carbon tax. Both of these tax types are intended to charge social costs (negative externalities) on the party causing the cost. All that is based on the price sensitivity (price elasticity) of the consumer or the producer. However, in reality there are several factors that prevent this price effect from playing out, in the case of both the food industry and the polluting activities. Another factor that also causes difficulties in the mitigation of negative effects in both areas is that those discoveries of natural science that implicate the individual foods in the incurrence of health costs and carbon dioxide emission in global warming are part of the prevailing scientific discourse, but there are still scientific debate is going on about whether these assumptions are justified. Therefore, from the aspect of taxation the justification for levying the tax can be disputed. Furthermore, an economic policy applying this to tax types must also anticipate other short and medium-term economic opportunity costs. What will be the effects on welfare and income if foods currently consumed in a great volume and considered fundamental are made more expensive or if the costs of the processing industry are raised? Furthermore, if the tax eliminates not only the negative externalities, but together with them the tax base as well, will it harm the general government funding? Such dilemmas also cause uncertainty in the economic policymakers who levied the taxes, as a result, the roles and weights of the two assessed tax types may remain marginal. As can be inferred from the analysis of Takács et al. (2014), the application of tax incentives is a marginal tool in the European taxation trends, although according to the assessment of Pesuth (2014), in the 2010s the need for equitable and fair taxation increased, which is an important principle for the acceptable public sharing of external social costs.

2. The nature of the Pigou tax

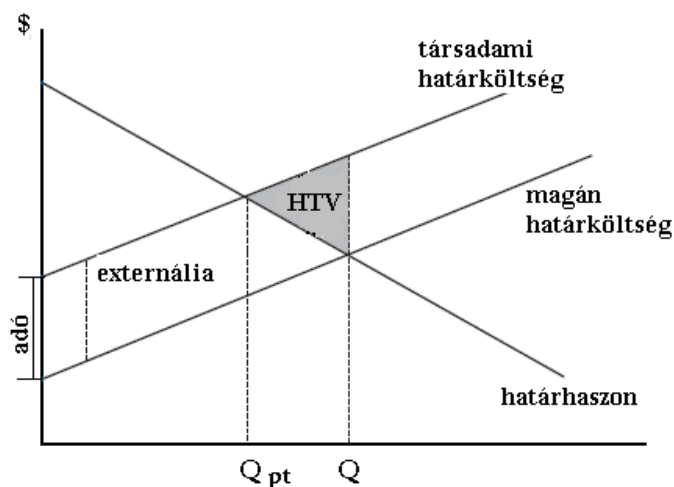
The tax proposal of Pigou (1920) was developed after realizing that the market is not capable of internalizing the undesirable social costs in the case of certain economic activities. The Pigou tax may be levied on market activities that result in negative externalities. The purpose of the tax is to adjust the outcome of the economic activity. In this approach the externalities divert the economy from its Pareto efficient state, while the appropriate tax restores the Pareto optimal state. The tax burden must be the same as the incremental marginal cost caused by the externalities. This is where the economic challenge lies. Is economic policy capable of

¹ The research of Gábor Kutasi was enabled by support from Bolyai János scholarship of the Hungarian Academy of Sciences, the European Union and Hungary, with the co-financing of the European Social Fund and in the framework of the National Excellence Program (SROP 4.2.4.A/2-11-1-2012-0001) highlighted project.

determining the rate of the tax accurately, in order to trigger the desired effect? Wrong tax rates, institutional failures in legislation and implementation, political lobbies, the granting of exceptions negate the effect of the Pigou tax.

Figure 1 illustrates the effect of the Pigou tax, which - similarly to any levied tax in general - increases the prices of the goods of the production creating the externalities and reduces the demand for them, depending on the price elasticity of supply and demand. Naturally, parallel with that, unrealized consumption or procurement will result in lost profit, which is realized as deadweight loss. (Varian, 2005). However, the ease by which a Pigou tax can be levied also makes it vulnerable. For example, the application of this tax disregards the intensity of market competition. Is the chips tax going to be incorporated into the product prices of the multinational retail chain stores, or the entire burden will be charged on the producer companies? Is it possible that a freight shipping company is able to pass on the tax paid on CO2 emission to the same extent on its customers as a steel factory can? The equilibrium prices of a competitive market and that of a monopoly are different, which would justify the implementation of different tax rates if the aim is to reduce the externality. Buchanan (1969) highlights the monopoly of oil exporters and the inelasticity of demand as an example. Edlin and Karaca-Mandic (2006) highlight the different externality volumes owing to technological heterogeneity and the elasticity of demand/supply, which make the calculation of the optimal tax rate uncertain.

Figure 1 impact of the Pigou tax on the externality



Source: Nye (2008). Note: Q_{pt} = output with the tax burden, Q = output without the tax burden, HTV = deadweight loss

tax
social marginal cost
externality
private marginal cost
marginal utility

It is also questionable how the deadweight loss indicated on Figure 1 (HTV) compares to the saved social costs. This is also dependent on the price elasticities. In the case of taxes we should never forget the importance of budget revenues. It is not uncommon that legislators start to increase the rate of an implemented tax owing to the hunger of the public finances for revenue. This is the typical behaviour of excise duties, (also) owing to the price inelasticity of demand. The anticipations concerning future tax hikes could even increase the activity

causing the negative externality in the present, despite the intention of the politicians imposing the tax, since it is anticipated that these goods will become more expensive in the future. (E.g. see the green tax paradox of Sinn (2008), which was, however, empirically refuted by Edenhofer and Kalkuhl (2011).) In terms of social costs it is the advantage of the Pigou taxes that they reduce social marginal costs through two channels simultaneously. On the one hand, they finance the social costs by tax revenues, on the other hand, depending on price elasticity, they attempt to discourage negative externalities. This latter means in our example that the appropriate taxes encourage the persons causing social costs for lifestyle changes, owing to a diet causing health risks, and for technological adaptation owing to the emission of carbon dioxide causing climate change.

It is an important feature and weak point of the Pigou tax that it serves two conflicting purposes. On the one hand, it is designed to reduce negative externalities, on the other hand, as a tax, to secure government revenues. In practice, a spending opportunity will be found for every bit of additional tax revenue, therefore it would be naive to suppose that the only function of any Pigou tax applied in practice would be to “re-educate” the society. The operating mechanism of the trade-off between the externality and the budget revenue is the following: If the externality cannot be reduced, then the tax revenue will be sustainable and naturally, the social cost will not be eliminated. If, on the other hand, the externality can be reduced, then the tax base and the tax revenue built on it will be eliminated. This latter case can be mitigated by raising the tax rates, which could naturally reduce the tax base even more efficiently.

3. International experiences with the popular health product tax (NETA)²

3.1. The economic basis of NETA

The health hazards of foodstuffs and the welfare costs of these, furthermore, the national level working capacity problems arising from diseases motivated the policymakers to take certain influencing steps in the field of nutrition as well. This is not easy for a number of reasons, including the fact that significant industries are built on the mass manufacturing of products made from sugar, starch, trans fats and other ingredients considered harmful. Health policy has two options to influence the consumers: education and incorporating the risks in the prices of foodstuffs by the popular health product tax (fat tax in English, commonly called chips tax in Hungary). Practical experiences imply that educational campaigns aimed at consumers are insufficient concerning the health effects. In the opinion of Kuchler et al. (2004) and Philipson and Posner (1999) it is not necessarily true that a rational consumer should live a healthy lifestyle. Brownell et al. (2009) raises the point that a significant part of people may not be really aware of the consequences of the consumption of certain nutrients in large quantities, that way, what causes the market failure is the fact that consumers have incomplete information and appreciate present, instant utilities more, which is especially true for children and young people. Concerning utilities, Lusk and Schroeter (2012), who treated the ideal weight of the people as one of the elements of their utility, have come to the conclusion that NETA may increase the welfare of the consumer if the amount they are willing to pay for one unit of loss of excess weight is higher than the ratio between the amount paid for taxable products and the excess weight lost as a result of the tax.

² The abbreviation NETA applied in the article does not apply to the Hungarian tax (Act CIII of 2011) anywhere, rather it means the tax commonly called chips tax, fat tax or otherwise, levied on food ingredients considered harmful.

By modelling the soda tax, a tax originally levied on carbonated refreshments, Dolan (2010) demonstrated that NETA may reduce the volume of products sold by the food industry. If we take into account that according to Jensen and Smed (2007) the consumers of the food industry are generally price-sensitive, then this statement may be applicable to the entire food industry. Price sensitivity can be used to force a healthy diet in such a manner that the prices of more harmful foodstuffs are distorted by taxes.

On the other hand, Clark and Dittrich (2010) indicate the problem arising from the complexity of foodstuffs, who argue that it would be wrong to treat NETA in the same way as, for example, the excise duty levied on tobacco. The main difference is that in the case of the tobacco tax only those consumers pay the tax who smoke, on the number of cigarettes smoked. The tax serves its purpose, since in the case of smoking the relationship between the cause (the smoked cigarettes) and the effect (diseases caused by the smoked cigarettes) is clear. At the same time, in the case of NETA the relationship between the given nutrient (for example: fat) and the consequence (obesity) is less clear at scientific level. On the one hand, it is not certain that in the case of the given consumer the problems are caused by the consumption of a given quantity of fat (since they might not get enough exercise or consume excess sugar, rather than excess fat), on the other hand, the tax is also levied on persons who do not experience the consequence (obesity). (Clark – Dittrich 2010) In addition, going off a harmful addiction may involve taking up another. For example, it is quite frequent that ex-smokers become obese owing to the change in the processes in their bodies and displacement activities. (Philipson – Posner 1999)

Obesity is both a demand and supply-related problem of the market of calories available in the form of foodstuffs. (Philipson – Posner 1999) If we assess foods as consumer goods, their costs is made up of two items: the costs of the base materials and the time costs necessary for preparation and consumption. The costs of the utilization, i.e. burning of the calories varies individually. If someone does manual work, their calorie burning time cost will be lower, because it happens during working hours. On the other hand, for a white collar worker burning calories is relatively expensive, because they have to devote some of their free time to exercising. Similarly, the higher an intellectual worker gets paid, the higher the alternative cost of calorie burning is, since he could do some work instead of exercising (Muriel 2008).

3.2. The practical implementation of NETA

In certain countries NETA is not levied separately, rather it is incorporated in the VAT. In several countries (such as Canada, the United Kingdom, France) foodstuffs are basically subject to zero VAT, except some sectors (such as soft drinks or sweets, see Leicester – Windmeijer 2004). This method is not transparent for the consumer and leaves little room for the fine-tuning of taxation. This type of taxation is not equitable, also because even within one tax regime in the food market the content of harmful ingredients of the individual products varies significantly, thus taxation by the same rate is capable of shifting customers behaviour towards products with a lower content of harmful substances.

Clark and Dittrich (2010) identified the following forms of implementation:

(1) Composite Commodity Fat Tax (CCFT): The „composite” part of the acronym refers to the food group. In this version an entire food group is taxed because of an ingredient that is considered unhealthy, on the basis of the characteristic average fat content of the food group. This scenario is criticized because the tax does not change, orient the mindset of the consumers. For instance, it may happen that as a result of a tax levied evenly on an entire food group, the consumers will opt for a product with higher fat content with price (A), as opposed

to the product with a lower fat content consumed before, with price $(A+x, A; x>0)$, since the price of $(A+x+t)$ is no longer acceptable for them as a result of the tax (t) , as opposed to the price of $(A+t)$. The authors also highlight that the only benefit of this tax is low administrative costs.

(2) Nutrient tax (NFT): This tax is levied on every type of food, depending on their fat content. That is, it would not use “food groups”, the only characteristic it takes into account is the fat content of the given food. The weak point of this tax version is that it disregards the causal relationship between obesity and nutrients: the reason cannot only be fat, but also, for example, sugar, thus the “restriction” (discouragement) may result in the increase of the consumption of the other base material (sugar) several times over if it is not restricted by taxes.

(3) Nutrition Index Fat Tax (NIFT): NFT responded to the problem that was the main deficiency of CCFT: instead of food groups and generalization it made taxation dependent on the specific composition of a given product. Yet another model, NIFT is intended to resolve the main deficiency of NFT: it takes into account the fact that obesity is not the result of a specific nutrient, rather the complex relations of mutually substitutable nutrients.

The essence of NIFT is that it takes into account the impact arising from the ratios and relations of the ingredients of the given food on obesity, which is assessed by an index and it is the index that is taxed. The index would represent the marginal impact of the individual components, thus the consumer would see a product with proportionately increased price in the case of substitution as well. In addition, if the marginal impact of the given food is positive, i.e. the food is useful for the human body, its sale could be subsidized. There are two methodological difficulties concerning such an index: On the one hand, the marginal impact of a food on health depends on the age and other characteristics of the individual. On the other hand, just because someone buys something, they are not sure to actually eat every element of it. Therefore, it is difficult to regulate by tax a complex set of problems in a perfect and sophisticated manner. Let us review the international experiences.

Denmark has been the first country in the world where a tax was introduced on saturated fatty acids in October 2011. Among others, such products were targeted by the tax as margarine, meat or dairy products. (Abend 2011) Denmark is a unique example, not only because this was the first country, but also because here NETA was not introduced because of the high ratio of overweight persons. In Denmark 42.9% of the population belong to the overweight (12.9%) or obese (29.9%) categories, which can be considered a below average result compared to other OECD countries (OECD, 2013). NETA was introduced in Denmark because the country lost several positions in the country ranking of life expectancy. In response, the leaders of the country set up a “Prevention Committee”, with the purpose of extending life expectancy by several years. At the same time, the revenue increasing effect could also play out, since Denmark also attempted to use the introduced tax as compensation for revenues lost through the personal income tax. (Jensen and Smed, 2012)

In total, if we assess this aim, the “extension of life expectancy” can certainly be considered a superior aim: it goes beyond reducing the number of overweight persons - it was meant to bring about an improvement in quality of life. Reducing the number of overweight persons is just one way to accomplish higher quality of life and longer life expectancy. The levying of this tax had been preceded by lots of debates and changes. According to the first plans meat and milk would have been tax-exempt, but since it was challenged by several parties, including the European Commission, after a review these were also made subject to the tax law. According to experts it would have been a mistake to leave out meat and milk. The main problem with meat was that it presented a difficult methodological problem to define the tax

payable on meat fairly. There were two options: 1.) using special scales it is possible to determine the exact fat content of a slice of meat, and this will be the tax base; 2) the tax is payable according to the average data characteristic of the given type of meat (Smed 2012).

Finally, the tax was abolished in 2012, one year after its introduction (The Economist 2012). Experts debate a lot on whether or not it was effective. According to optimistic opinions, the consumption of saturated fatty acids decreased by 4%, therefore it would be wrong to claim that the tax did not work (Bosoley 2013). Experts claim that the failure of NETA in Denmark does not mean that these taxes are not effective, since Denmark is a special place from many aspects: the country is small and it is very easy to cross the border for some shopping (Frum 2013).

Finland imposed an excise duty on the confectionery industry in 2011, the purpose of the tax was to reduce consumption and improve popular health. Two years after its introduction, in 2013 the statistics showed that the effect of the tax was negligible - after an initial decrease in consumption, it returned nearly to its former level - one citizen of Finland consumes 200 grams of chocolate per week on average. At an annual level the tax generated a sales revenue of EUR 78 million (Yle 2013). In addition to chocolate, ice cream is also taxable in Finland, since the country shows the highest consumption level of ice cream in the world. A high level of tax, 30-40% on average (0.75 euros/kg) applies to this high ice cream consumption (Stone 2013). Originally imposed on chocolate and ice cream only, the tax was later also levied on crackers, and a team is working on changing the logic of taxation: the new concept would require payment on sugar contents, and not on product groups. This would be beneficial because it would make such products taxable as yoghurt with sugar content or fine bakery ware (Repo 2012).

Similarly to the Finns, Norway also imposed an excise duty on sugar, products containing added sugar and chocolate (Deloitte 2011). It is interesting to note that the “chocolate tax” was introduced in Norway back in 1922 - the purpose was not the promotion of healthy eating, rather the taxation of luxury goods (AmCham Norway 2007).

Mexico is on top of the list among OECD countries in terms of obesity: only 30.5% of the population have a body mass index lower than the limit considered healthy, while 69.5% belong to the overweight (30%) or obese (39.5% group.) (OECD, 2013) In order to curb this problem and increase tax revenues, in 2013 the legislation adopted taxes payable on products with high calorie content, including soft drinks, sweets and candies, potato chips and products containing sugary cereals (Villegas 2013). Prior to the introduction of this tax Mexico had analyzed what would be the potential harm caused to the economy by the decrease of sales in the affected industries, but they had come to the conclusion that this loss of sales would be much lower than the damage that could be caused to the country within 10 years by the increase of obesity (Bosoley 2013).

To sum up the experiences, assessment of NETA is not a simple task. On the one hand, it was introduced in a small number of countries, and where it was, introduction of the tax happened only a few years ago, and this period is not long enough to draw the appropriate conclusions. The available research findings all relate to the various segments of the food industries of various countries (Thow et al. 2010).

In fact, NETA tries to influence the consumer through price. According to Slutsky's equation, the change in demand in the case of a price change is composed of two effects, (i) the

substitution effect and the (ii) income effect. According to (Varian 2005)³ Eyles et al. (2012) it especially applies to the food industry that when the price of something goes up, the consumers start purchasing substitute products - which are often just as unhealthy as the originally consumed product.⁴

After assessing several tax types, Clark and Dittrich (2010) arrived at the conclusion that the main problem is that the applied taxes disregard the following:

- 1) interactions, relations among nutrients found in individual foodstuffs (for example, products with low fat but high sugar content),
- 2) individual factors causing obesity and determining nutrient needs (age, gender, body composition),
- 3) interactions, substitutions among food groups (for example, when someone switches from chocolate to sugary dairy products),
- 4) just because a nutrient is part of the product upon purchase, the consumer is not certain to actually eat it (for example, fat is removed from the meat before cooking).

In the case of NETA, in addition to assessment of the product's own price elasticity, the assessment of cross-price elasticity is also important prior to the introduction of the tax. In many cases what causes the biggest problem is not NETA's inability to reduce the consumption of a product, since the consumers are basically price-sensitive, rather the high number of substitution options by other food industrial products. According to an impact study, if the tax was levied on saturated fatty acids in the United Kingdom, this would have the effect of slightly increasing the consumption of salt, which is also harmful to health (Mytton et al. 2007).

One of the most comprehensive studies on the price elasticities typical of the food industry has been prepared by Andreyeva et al. (2010): In 2010, based on a study and research published in the US on price elasticity in the food industry, foodstuffs were assigned to 16 groups and the average price elasticity of each group was determined. The result was surprising: the price of each category is inelastic, it was below 1.

Chouinard et al. (2007) assessed the market of dairy products in the US. Milk is an excellent example of a food concerning which it is uncertain whether society considers or acknowledges it as a harmful product or not. It was primarily its fat content and not its lactose content why it was made subject to the taxes that we have cited. Returning to the analysis of the American dairy market, the results show that the demand of households for dairy products is relatively inelastic, that way a tax of 10% could generate a high revenue easily. According to their calculations, the welfare loss of the consumers and the amount of NETA paid would be nearly identical, at an annual level it would mean 4.45 billion USD. At the same time, consumption would only decrease by 1%. The analysis of Allais et al. (2010) demonstrates that NETA is not capable of significantly influencing the nutrient intake of households and its impacts are not clear. According to the research of Eyles et al. (2012), in the case of soft drinks with high carbohydrate (sugar) content, a price raise of 1% would decrease consumption by 0.93%. According to their results, in the case of a price raised by 1% the

³The substitution effect means that if the price of a product goes up, its substitution rate by other products changes. The income effect means that the purchasing power of the consumer decreases as a result of the price change.

⁴Often these taxes must only be paid on a particular product group, and the consumers switch to the consumption of a similarly unhealthy product group: for example, the product tax levied on fat makes them consume more sugar. Another instance of this is when the tax is levied on a specific nutrient, but not within the entire industry, which makes the effect negligible: for example, chocolate with high sugar content is taxable, but crackers remain tax-exempt.

energy taken into the body by saturated fatty acids would decrease by 0.02%. According to their analyses, a decrease of 1% in the price of fruits and vegetables would result in a demand increase of 0.35%. On the other hand, according to Kotakorpi et al. (2011) in Finland the demand for products with sugar content is elastic, and they proposed that a "sugar tax" of €1/kilogram should be levied, which could significantly decrease the number of diabetics in Finland. According to Putnam et al. (2002), people do not like the flavour of low-fat substitutions. According to research, those NETA that only tax high sugar or high fat content often result in negative externalities. Specifically, the decrease of fat consumption results in the increase of sugar consumption, and vice versa. Chouinard et al. (2007) highlights that the tax will not only result in the exact opposite of its intended purpose (people start eating more sugar and fat), but could also reduce the welfare of the consumer.

The introduction of NETA as a step in tax policy starts from the assumption that in the case of food purchases the decision is strongly determined by the price, therefore a higher price means discouragement (PHEIAC 2013). At the same time, if we want to raise the price optimally, we must know the cross-price elasticities and the demand changing as a result of the tax, which are almost impossible to predict accurately according to experts (Mytthon et al. 2007).

According to Craven et al. (2012), the main problem with NETA is that the state and the persons who develop the rules (tax rates) do not know what is the optimal tax rate, what is the tax rate that will bring the market into equilibrium. In their opinion the private sector offers much better solutions for obesity as an externality (fitness clubs, food producers promoting a healthy lifestyle).

According to Allais et al. (2010), manufacturers have two options of responding if NETA is levied on their goods: 1.) They change nutrient quality, by which they produce their goods at lower material costs, so that the impact of the tax should not be strongly reflected in the gross consumer prices and thus sales should not plummet. 2.) They change the ingredients of their products, the earlier ones get replaced by more expensive ingredients, they change technology - which might make the product "healthier", but probably also more expensive, therefore persons with lower income may not afford them. This could lead to the establishment of inequalities in nutrient value at social level, depending on what goods the individual income groups can afford.

In the case of NETA it means a clear methodological difficulty, owing to the mixed nutrient needs of the human body, that not the consumption, rather the overconsumption of these nutrients should be penalized (Leicester – Windmeijer 2004).

Based on Stone (2013) and Muriel (2008), one of the big mistakes of taxes similar to NETA, i.e. the so-called "sin taxes" is that they mainly afflict the poorer social classes, which does not comply with the principle of equitable taxation, as outlined by Bánfi (2014). In West Europe a strong correlation has been registered between obesity and poverty. Persons with low income are much more likely to be obese, which may partly indicate that cheaper products purchased by the poor are also more unhealthy. At the same time, this makes the tax even more regressive: if poor persons consume more goods with higher sugar and fat content, this will impose a heavier tax burden on persons with lower income, not only because the ratio of food purchases is higher compared to their incomes, but also because they purchase unhealthy, taxable foods more frequently.

4. The international experiences of the carbon tax

4.1. The economic basis of the carbon tax

Natural science presumes a relationship between the carbon dioxide contents of the atmosphere of the Earth and global warming. In any case, it can be experienced in practice that the average temperature characteristic of a particular geographical area keeps rising. This is coupled by various economic damages requiring prevention or handling - such as the loss of real properties owing to rising sea level, lower agricultural crop yields owing to the drier climate, agricultural infections and pests spread faster owing to the higher temperature, increased human hazards owing to the heat, etc. If natural science assumes correctly a relationship between CO² emission and warming, then in economics the economic damages mentioned above will be the undesirable and adverse side effects of economic activities resulting in intensive CO² emission (negative externalities). In this case the approach of Pigou for internalizing the externality is the carbon dioxide tax (also called green tax or carbon tax), while the approach of Coase is the carbon dioxide quota. From this point on we will be dealing with the approach of Pigou.

The demand-modifying effect itself of the carbon tax is not simple or clear. As we have mentioned, Buchanan (1969), Edlin and Karaca-Mandic (2006), Nye (2008) wrote about the concentrated nature of the mineral oil sector and the international technological heterogeneity of the energy industry. The demand-reducing effect of the carbon tax also raises the problem of deadweight loss, on the other hand, it can be easily offset by the prevented damages. Furthermore, the replacement of the polluting technology enables in the long term the maintenance of demand in the quantity of energy production. In addition, in the medium-term the demand of the energy and transport sector shows no price elasticity, which reduces the effectiveness of the tax on the one hand and minimizes the deadweight loss on the other hand.

Based on Kim et al. (2011), Cooper (1998), Pizer (1997), Pearce (1991), Nordhaus (2007), Gerlagh and Lise (2005), Bossier and Bréchet (1995) and Edlin and Karaca-Mandic (2006), the benefits and drawbacks of the carbon tax can be summarized as follows: it is a benefit of the tax that it specifies the price of pollution, encourages the polluters to reduce their per unit consumption and pollution, forces the producers and users to change their technologies, in order to retain their competitiveness in pricing, the existing institutes of taxation are available for the collection of the tax, furthermore, the tax burden of the economic participants adapts to the current status of the economic cycle. In contrast, drawbacks of the carbon tax include the costs of additional administration, increase of the total tax burden, owing to the price elasticity mentioned above, it is questionable whether the desired reduction of pollution can be accomplished, furthermore, this homogeneous tax affects the heterogeneous branch and technology level unevenly.

Owing to the price inelasticity of demand mentioned above, the empirical analyses are sceptic about the motivating, influencing capability of green taxes. According to the research of Sipes and Mendelsohn (2001), Davis and Kilian (2009) and Kim et al. (2011), pollution hardly decreases as a result of taxes in the energy or transport branches. The fear of deteriorating competitiveness also makes practical application uncertain. As a new tax burden, pollution tax could make energy-intensive production more expensive, which results in the loss of international competitiveness. This is why Baranzini et al. (2000) and Zhang and Baranzini (2004) recommend that green taxes should be introduced as part of a tax reform, quasi replacing or reducing other taxes on production.

4.2. Carbon tax in the European practice

The green taxes were first applied by Nordic countries, Norway, Sweden, Denmark, Finland, and by the Netherlands, from the 1990s. Additional countries have joined this practice from the beginning of the 2000s (Baranzini et al. 2000). Concerning that, according to Barker et al.

(2007) the problem occurred that those countries that do not apply green taxes deteriorate the efficiency of those who apply them, also at the level of the international community, since the polluting activities creep over to the tax-free countries. In fact, global warming can only be controlled at global level, since its side effects are negative externalities realized at international level. Therefore, in this case we have an international public good problem, as opposed to healthy eating, which burdens the national health funding systems, therefore increases social marginal cost only at national level. At the same time, probably because of the negligible tax rates applied, both Barker et al. (2007) and Zhao (2011) found a very weak connection between the tax burden and the above competition-distorting fears, as well as between the tax burden and the reduction of pollution.

Every assessment of the European examples could only demonstrate a minimum connection between pollution reduction and green taxes. In fact, a significant reduction of CO² emission can be demonstrated, but it is not clear whether this occurred owing to the taxes or rather because of technological development. Floros and Vlachou (2005) assessed the carbon tax levied on the Greek processing industry and demonstrated that demand for energy itself is price inelastic. They could not separate significantly in this case, either, to what extent the drop in the emission of CO² by 17.6% after the implementation of the tax was a consequence of the tax, and to what extent it was caused by technological change. Giblin and McNabola (2009) assessed the vehicle tax applied in Ireland, which is based on CO² emission. They also arrived at the conclusion that the reduction of pollution was not forced by the tax, rather - as is implied by the analysis of Wissema and Dellink (2007) - the replacement of technologies and assets in the medium term. In France, in the case of the carbon tax incorporated into fuel prices once again it was not the decrease of consumption that was spectacular, rather, as was demonstrated by Bureau (2011), it resulted in a regressive withdrawal of income at the expense of households with a low income. Concerning the Norwegian carbon tax applied since 1991, we can use the analysis of Bruvoll and Larsen (2004) to get oriented concerning the effect of the tax. If we remove from the analysis the petrol industry which distorts the data significantly, in the case of non-oil extraction and non-oil processing branches the reduction in pollution was a mere 1.5%. The reason was partly the fact that in many branches exceptions were allowed in order to maintain competitiveness. Metal processing and the chemical industry were (not) taxed at a rate of 0%, which deteriorated the impact of the tax substantially, brought it down close to zero.

The above examples show that it is not easy to introduce new types of taxes to a substantial extent in economies where the tax burden had amounted to 40 – 50% of the GDP, already prior to the introduction of the tax. The initial tax level restricts the efficient application of any tax incentives that are not exclusively aimed to generate revenues for the state budget. Precisely for that reason, it is recommended that green taxes - and other tax tools applied against negative externalities - should be introduced as part of a more complex practice. This was also argued in the proposal of Bossier and Bréchet (1995), i.e. that tax policymakers should also pay attention to how the total tax load of the economy and the individual participants of the economy are affected by the introduction of a new tax. If there is an intention not only to increase budget revenues, but also to introduce efficient tax incentives, then significant tax reduction is necessary at another point of the tax burden. This could cause problems because from a fiscal point of view it carries a risk if we reduce proven, large-volume and easily collectible taxes, in order to introduce new and as yet untested taxes. In addition, efficiently functioning tax incentives actually jeopardize government revenues, since if we manage to reduce, for example, CO₂ emission in practice (or sugar consumption, as mentioned in the previous example), then the tax base will also decrease, which means an automatic decrease in tax revenue as well. As has been mentioned, in such cases the two tax

policy aims, i.e. the assurance of revenues and social motivation, are in conflict. As a classical example, the German practice is usually mentioned about the introduction of green taxes incorporated into the tax reform. Concerning that, Kohlhass (2000 and 2005), Bach et al. (2002), Knigge and Görlach (2005) present the effect the impact of the relevant tax law.⁵ The aim was to increase employment parallel with the reduction of pollution. Therefore, the social contribution burdens of employers were reduced while the tax burden of fuels and electricity were increased gradually. By this gradual tax restructuring a certain accumulated change was accomplished in both target figures (CO² emission and employment) in the medium term.

5. Conclusions

We have reviewed two not too simple cases for tax incentives applied against externalities. What is common in these two instances is that the increase of social marginal cost is related to the consumption of non-price elastic products, services (foodstuffs, energy). As a result, tax burden increases, but the desired effect, the mitigation of harmful side effects does not occur automatically.

These two cases also demonstrated that in certain forms of taxation the intention of the legislator is not transparent for the consumers or the producers. The increase of taxes by a few units or a few percent does not carry a message in the case of increasing the VAT of foodstuffs or with fuels subject to complex taxation.

The complexity of products, services in its self reduces the transparency and price effect of what percentage of sugar is contained in a particular product from among a high number of ingredients, or what is the ratio constituted by energy cost in the costs of a particular service.

It is another important lesson that the demand – supply forces in the value chain of the target branch should be surveyed, to determine whether they will allow the price-increasing effect of the levied tax to play out. In this value chain it is also recommended to assess what are the opportunities for technological adaptation or a change in the behaviour of the consumers/producers. (E.g., it also serves the purpose if the producers reduce the sugar content of the product through product development processes, compared to the scenario when the consumers reduce their demands for goods containing sugar).

It is recommended to assess what other, more rigid tools of economic policy can be applied in the case of non-price elastic demands, for which it is not the consumer who decides whether or not they are willing to pay more in order to maintain their level of consumption.

The tax incentive should be significant in order to be considered a serious cost factor by the participants of the economy. In the case of economies in which the tax burden is high to start with, the social costs can and should only be internalized by new taxes if tax policy is able to alleviate other tax burdens meaningfully, so that in total it should not deteriorate the national cost competitiveness and should not impose a deterrence from economic activity. The reason is that such undesirable effects would jeopardize the tax base, and together with it, government revenues.

In order to accomplish the incentive effect, it is not acceptable that market players should resort to alternative substitutions that do not result in the reduction of social marginal cost. In other words, the users, producers should not be able to bypass tax just because certain activities, products, services that are implicated in the creation of negative externalities are tax-free, enjoy an exempt status.

⁵ Gesetz zum Einstieg in die ökologische Steuerreform (24. März 1999, BGBl. I S. 378)

References

- Abend, L. (2011): *Beating Butter: Denmark Imposes the World's First Fat Tax*.
<http://content.time.com/time/world/article/0,8599,2096185,00.html> Lekérdezve:
01.04.214
- Allais, O. – Bertail, P. – Nichele, V. (2010): “The Effects of a Fat Tax on French Households’ Purchases: A Nutritional Approach”. *American Journal of Agricultural Economics* 87: 1159–66.
- AmCham Norway (2007): *"Chocolate tax" Should Go*. <http://www.amcham.no/chocolate-tax-should-go/1837> Downloaded: 01.04.214
- Andreyeva, T. – Long, M. W. – Brownell, K. D. (2010): “The Impact of Food Prices on Consumption: A Systematic Review of Research on the Price Elasticity of Demand for Food”. *American Journal of Public Health* 100(2): 216–222.
- Bach S. – Kohlhaas M. – Meyer B. – Praetorius B. – Welsch H. (2002): “The Effects of Environmental Fiscal Reform in Germany: a Simulation Study”. *Energy Policy* 30: 803–811.
- Bánfi T. (2014): “Ígazságos adó(rendszer) vagy etikus adózó” *Köz-Gazdaság* 9 (3).
- Baranzini, A. – Goldemberg, J. – Speck, S. (2000): “A Future for Carbon Taxes”. *Ecological Economics* 32: 395–412.
- Barler, T. – Junankar, S. – Pollitt, H. – Summerton, P. (2007): “Carbon Leakage from Unilateral Environmental Tax Reforms in Europe, 1995–2005”. *Energy Policy* 35: 6281–6292.
- Bosoley (2013): *Mexico to tackle obesity with taxes on junk food and sugary drinks*.
www.theguardian.com/world/2013/nov/01/mexico-obesity-taxes-junk-food-sugary-drinks-exercise Downloaded: 01.04.214
- Bossier, F. – Bréchet, T. (1995): “A Fiscal Reform for Increasing Employment and Mitigating CO2 Emissions in Europe”. *Energy Policy* 23(9): 789–798.
- Brownell, K. D. – Farley, T. – Willett, W. C. – Popkin, B. M. – Chaloupka F. J. – Thompson, J. W. – Ludwig D. S. (2009): “The Public Health and Economic Benefits of Taxing Sugar-Sweetened Beverages”. *New England Journal of Medicine* 361: 1599–1605.
- Bruvold, A. – Larsen, B.M. (2004): “Greenhouse gas emissions in Norway: do carbon taxes work?” *Energy Policy* 32: 493–505.
- Buchanan, J. (1969): “External Diseconomies, Corrective Taxes, and Market Structure.” *American Economic Review* 59(March)
- Bureau, B. (2011): “Distributional Effects of a Carbon Tax on Car Fuels in France”. *Energy Economics* 33: 121–130.
- Chouinard, H. H. – Davis, D. E. – LaFrance, J. T. – Perloff, J. M. (2007): “Fat Taxes: Big Money for Small Change”. *Forum for Health Economics & Policy* 10(2)
- Clark, J. – Dittrich, O. (2010): “Alternative Fat Taxes to Control Obesity”. *International Advances in Economic Research* 16(4): 388–394.
- Coase, R.H. (1969): “The Problem of Social Cost”. In: Blummer, S.M. (1969): *Microeconomics*. London: TBS The Book Service Ltd.

- Craven, B. M. – Marlow, M. L. – Shiers, A. F. (2012): ‘Fat Taxes And Other Interventions Won't Cure Obesity’. *Economic Affairs* 32(2): 36–40.
- Davis, L. W. – Kilian, L. (2009): ‘Estimating the Effect of a Gasoline Tax on Carbon Emissions’. *NBER Working Paper* 14685,
- Deloitte (2011): *Taxation and Investment in Norway 2011*. <http://www2.deloitte.com/content/dam/Deloitte/global/Documents/Tax/dttl-tax-norwayguide-2011.pdf> Downloaded: 01.04.214
- Dolan, E. (2010): *The Economics of Soda Tax*. <http://dolanekon.blogspot.hu/2010/04/economics-of-soda-tax.html> Downloaded: 01.04.214
- Edenhofer, O. – Kalkuhl, M. (2011): ‘When Do Increasing Carbon Taxes Accelerate Global Warming? A Note on the Green Paradox’. *Energy Policy* 39: 2208–2212.
- Edlin, A. – Karaca-Mandic, P. (2006): ‘The Accident Externality from Driving’. *Journal of Political Economy* 114(5)
- Eyles, H. – Mhurchu, C. N. – Nghiem, N. – Blakely, T. (2012): Food Pricing Strategies, Population Diets, and Non-Communicable Disease: A Systematic Review of Simulation Studies. *PLoS Medicine* 9(12)
- Floros, N. – Vlachou, A. (2005): ‘Energy Demand and Energy-Related CO₂ Emissions in Greek Manufacturing: Assessing the Impact of a Carbon Tax’. *Energy Economics* 27: 387–413.
- Frum (2013): ‘Can Sugar Tax Help Mexico's Obesity Epidemic?’ <http://edition.cnn.com/2013/11/04/opinion/frum-mexico-sugar-tax/> Downloaded: 01.04.214
- Gerlagh R. – Lise, W. (2005): ‘Carbon Taxes: A Drop in the Ocean, or a Drop that Erodes the Stone? The Effect of Carbon Taxes on Technological Change’. *Ecological Economics* 54: 241–260.
- Giblin, S. – McNabola, A. (2009): ‘Modelling the Impacts of a Carbon Emission-Differentiated Vehicle Tax System on CO₂ Emissions Intensity from New Vehicle Purchases in Ireland’. *Energy Policy* 37: 1404–1411.
- Jensen, J. D. – Smed, S. (2012): ‘The Danish Tax on Saturated Fat: Short Run Effects on Consumption and Consumer Prices of Fats’. *IFRO Working Paper* 2012(14)
- Jensen, J. D. – Smed, S. (2007): ‘Cost-Effective Design of Economic Instruments in Nutrition Policy’. *International Journal of Behavioral Nutrition and Physical Activity* 4(10)
- Kerekes Sándor (1995): *A környezetgazdaságtan alapjai*, Budapest: BKE
- Kim, Y-D. – Han, H-O. – Moon, Y-S (2011): ‘The Empirical Effects of a Gasoline Tax on CO₂ Emissions Reductions from Transportation Sector in Korea’. *Energy Policy* 39: 981–989.
- Kohlhaas, M. (2005): *Gesamtwirtschaftliche Effekte der ökologischen Steuerreform. Band II des Endberichts für das Vorhaben: „Quantifizierung der Effekte der Ökologischen Steuerreform auf Umwelt, Beschäftigung und Innovation“*. Berlin: Deutsches Institut für Wirtschaftsforschung
- Kohlhaas, M. (2000): ‘Ecological Tax Reform in Germany. From Theory to Policy’. *Economic Studies Program Series* 6.

- Kotakorpi, K. – Härkänen, T. – Pietinen, P. – Reinivuo, H. – Suoniemi, I. – Pirttilä, J. (2011): „The Welfare Effects Of Health-Based Food Tax Policy”. *Tampere Economic Working Papers Net Series*. 84.
- Knigge, M. – Görlach, B. (2005): *Die Ökologische Steuerreform – Auswirkungen auf Umwelt, Beschäftigung und Innovation Zusammenfassung des Endberichts für das Vorhaben: „Quantifizierung der Effekte der Ökologischen Steuerreform auf Umwelt, Beschäftigung und Innovation“* Berlin: Institut für Internationale und Europäische Umweltpolitik GmbH
- Kuchler, F. – Tegene, A. – Harris, J. M. (2004): “Taxing Snack Foods: What to Expect for Diet and Tax Revenues”. *Agriculture Information Bulletin* 747-08.
- Leicester, A. – Windmeijer, F. (2004): “The 'Fat Tax': Economic Incentives to Reduce Obesity”. *IFS Briefing Notes* BN49.
- Lusk, J. L. – Schroeter, C. (2012): “When Do Fat Taxes Increase Consumer Welfare?” *Health Economics* 21(11): 1367–1374.
- Marshall, A. (1890): *Principles of Economics*. London: Macmillan and Co.
- Mátyás A. (1999): *A modern közgazdaságtan története*. Budapest: Aula
- Muriel, A. (2008): “Tax the Fat?” *Economic Review*, 25(3)
- Mytton, O. – Gray, A. – Rayner, M. – Rutter, H. (2007): “Could targeted food taxes improve health?” *Journal of Epidemiology & Community Health* 61(8): 689–694.
- Nordhaus, W. D., (2007): “To Tax or Not to Tax: Alternative Approaches to Slowing Global Warming”. *Review of Environmental Economics and Policy* 1: 26–44.
- Nye, J. V. C. (2008): *The Pigou Problem. It is Difficult to Calculate the Right Tax in a World of Imperfect Coasian Bargains*. <http://www.cato.org/pubs/regulation/regv31n2/v31n2-5.pdf> Downloaded: 01.04.214
- O'Donoghue, T. – Rabin, M. (2006): “Incentives and Self Control”. In: Blundell, R. – Newey, W. K. – Persson, T. (szerk.) *Advances in Economics and Econometrics: Theory and Applications (Ninth World Congress)* Volume 2, Cambridge: Cambridge University Press
- OECD (2013): *OECD 2013 Factbook*. http://www.oecd-ilibrary.org/economics/oecd-factbook-2013/overweight-and-obesity_factbook-2013-100-en Downloaded: 2014.04.01.
- Pearce, D. W., (1991): “The Role of Carbon Taxes in Adjusting to Global Warming”. *Economic Journal* 101: 938–948.
- Pesuth T. (2014): “Adópolitikai változások a válság után: A bankadók térnyerése” *Köz-Gazdaság* 9 (3).
- Philipson, T. J. – Posner, R. A. (2003): “The Long Run Growth of Obesity as a Function of Technological Change”. *Perspectives in Biology and Medicine* 46(3): 87-108.
- Pigou, A.C. (1920): *The Economics of Welfare*. London: MacMillan and Co.
- Pizer, W.A., (1997): “Prices vs. quantities revisited: the case of climate change”. *Resource for the Future Discussion Paper* 98-02.
- PHEIAC (2013): *Evaluation of the implementation of the Strategy for Europe on Nutrition, Overweight and Obesity related health issues*.

- http://ec.europa.eu/health/nutrition_physical_activity/docs/pheiac_nutrition_strategy_evaluation_case_study_en.pdf Downloaded: 01.04.214
- Putnam, J. – Allshouse, J. – Kantor, L. S. (2002): “U.S. Per Capita Food Supply Trends: More Calories, Refined Carbohydrates, and Fats”. *Food Review* 25(3)
- Repo, P. (2012): *Revenues From Tax on Sweets Exceeded All Expectations*. <http://www.hs.fi/english/article/Revenues+from+tax+on+sweets+exceeded+all+expectations/1329104573279> Downloaded: 01.04.214
- Sinn, H. (2008): “Public policies against global warming: A supply side approach.” *International Tax and Public Finance* 15: 360–394.
- Smed, S. (2012): “Financial Penalties on Foods: The Fat Tax in Denmark”. *Nutrition Bulletin* 37(2): 142–147.
- Stone, L. (2013): *Ice Cream Tax Finishes Melting Finnish Business, Mexico Considers Soda Tax*. <http://taxfoundation.org/blog/ice-cream-tax-finishes-melting-finnish-business-mexico-considers-soda-tax> Downloaded: 01.04.214
- Sipes, K.N. – Mendelsohn, R. (2001): “The Effectiveness of Gasoline Taxation to Manage Air Pollution”. *Ecological Economics* 36: 299–309.
- Takács V. – Máté Á. – Nagy S. Gy. (2014): “Adószervezeti változások az Európai Unióban” *Köz-Gazdaság* 9 (3).
- The Economist (2012): *Denmark's Food Taxes: A Fat Chance*. <http://www.economist.com/news/europe/21566664-danish-government-rescinds-its-unwieldy-fat-tax-fat-chance> Downloaded: 01.04.214
- Thow, A. M. – Jan, S. – Leeder, S. – Swinburn, B. (2010): “The Effect of Fiscal Policy on Diet, Obesity and Chronic Disease: a Systematic Review”. *Bull World Health Organ* 88: 609–614.
- Varian, H. R. (2005): *Intermediate Microeconomics*. New York: W.W. Norton and Co.
- Villegas, P. (2013): *Mexico: Junk Food Tax Is Approved*. <http://www.nytimes.com/2013/11/01/world/americas/mexico-junk-food-tax-is-approved.html> Downloaded: 01.04.214
- Wissema, W. – Dellink, R. (2007): “AGE Analysis of the Impact of a Carbon Energy Tax on the Irish Economy” *Ecological Economics* 61: 671–683.
- Yle (2013): *Sweet Tax Fails to Slow Candy Consumption*. http://yle.fi/uutiset/sweet_tax_fails_to_slow_candy_consumption/6992250 Downloaded: 01.04.214
- Zhang, Z. X. – Baranzini, A. (2004): “What Do We Know About Carbon Taxes? An Inquiry Into Their Impacts on Competitiveness and Distribution of Income” *Energy Policy* 32: 507–518.
- Zhao, Y-H. (2011): “The Study of Effect of Carbon Tax on the International Competitiveness of Energy-intensive Industries: An Empirical Analysis of OECD 21 Countries, 1992–2008” *Energy Procedia* 5: 1291–1302.