DISTRIBUTIONAL EFFECTS OF ENVIRONMENTAL TAXES IN ESTONIA

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Abstract

This paper analyses the distributional effects of Estonian environmental taxes in 2000-2007 and recent reforms in 2008 using Estonian Household Budget Survey data and a microsimulation model. The results show that the share of environmental taxes in consumption expenditures is about 1-1.5%. Environmental taxes in 2000-2007 were progressive due to the progressivity of motor fuel excises, which was the largest component of the environmental taxes until 2007. Since 2008, the taxes are less progressive, because of the new electricity excise and increased taxes on gas and other inputs used for distance domestic heating. To minimize the disproportionate effect of future ecological tax reform on low-income households, close monitoring of tax developments is required and necessary compensatory policies need to be implemented.

Keywords: environmental taxes, distributional effect, microsimulation model, Estonia

1. Introduction

In past years environmental taxes have been a popular instrument to tackle environmental problems. However, there is a strong opposition to rising environmental taxes, caused by a fear of reduced international competitiveness and a disproportionately bigger impact on low-income households. In order to address the regressivity concerns, several countries have implemented ecological tax reform, which includes increase of environmental taxes and decrease of labour taxes.

In Estonia environmental taxes have attracted wider attention since 2005, when the Ministry of the Environment and the Ministry of Finance initiated the ecological tax reform. The main reason was that energy and resource use in Estonia is inefficient and not sustainable in a long-run. The energy intensity of the Estonian economy measured by gross inland consumption of energy divided by GDP is one of the highest in the EU and exceeded the EU-27 average by more than four times in 2006. Although Estonia has implemented pollution charges for more than 15 years, the rates have been too low to give firms and households compelling signal to change their behaviour. According to the principles of the ecological tax reform adopted by the Estonian government in 2005 introduction of new taxes and increase of existing ones was agreed.

The share of environmental taxes was initially very low in Estonia compared to the EU average, but it started to increase quickly. In 1995 the revenue from environmental taxes was 0.8% of GDP (EU-15 average 2.7%). By 2000 it had increased to 1.7% and by 2006 to 2.2% of GDP (EU-25 was 2.6%) (Eurostat 2008).

In 2007 environmental taxes formed 6.5% (4.4 billion EEK) of state budget revenues. The main environmental tax in Estonia is fuel excise, which formed 98% of state budget revenues from environmental taxes. In addition to environmental taxes Estonia uses environmental charges levied on firms for the use of natural resources and emission of pollutants into air, groundwater or soil and upon waste disposal. Environmental charges are managed by the Ministry of the Environment and the revenues are used only for environmental purposes (e.g. investments). In 2007 state budget revenue of environmental charges was 840 million EEK. The impact of these charges on households is not analysed in this article.

Deriving from the agreed ecological tax reform principles and from the need to impose the minimum excise rates of the EU, the level of fuel excises has risen quite significantly in recent years. However, the distributional effect of environmental taxes has not been assessed in Estonia. There are two studies that briefly mention the issue: analysis of energy products taxation (Tallinna Tehnikaülikool 2007) and macroeconomic analysis of the implementation of a carbon tax (Strateegiliste Algatuste Keskus 2004). The analysis of energy products taxation focuses mostly on the impacts on primary energy supply, electricity production and environmental effects of different taxation scenarios. The objective of macroeconomic analysis of the implementation of a carbon tax is to compile different scenarios of CO_2-tax and to assess, among other impacts, their socioeconomic effect. However, the latter is constrained to the effect on employment. In general it can be said that no clear conclusions can be made on the distributional effects of the taxes researched.

Distributional effects of environmental taxes are important to consider in Estonia, because inequality is already relatively high and introducing new taxes or raising existing ones should not widen the income distribution. In 2007 Gini coefficient of disposable income was 0.33 in Estonia, higher than the average of the EU-25 (0.30), but similar to United Kingdom, and considerably higher than in Nordic countries: Sweden 0.24, Norway 0.24, Denmark 0.25, and Netherlands 0.28 (Eurostat 2009).

The objective of this paper is to assess the distributional effects of environmental taxes on Estonian households. To our knowledge, it is the first time distributional effects are analysed in post-soviet countries. It is a general trend in Eastern European countries that energy intensity is very high and energy taxes are low. In order to make economy more efficient, these countries are raising energy taxes, but their distributional effects have not been analysed. The relevant literature covers developed countries. An overview of these studies is presented in the next section.

To assess the distributional impacts of environmental taxes in Estonia we use a static non-behavioural microsimulation model ALAN. The model has been developed to evaluate distributional effects of income and consumption taxes and social benefits. The data used for simulation are from Household Budget Survey conducted by Statistics Estonia, from the period 2000-2007. From consumption and income data we impute both taxes and benefits. The tax policies we consider are from years 2000-2008.

The rest of the paper is organised as follows. In the next section there is an overview of the previous work on distributional effects of environmental taxes. The third section gives an overview of the microsimulation model and the data used, and the results are in section four. Section 5 concludes.

2. Previous literature

The empirical literature on the distributional effects of environmental taxes can be divided in two: the research that focuses only on direct effects of taxation and the research that covers direct and indirect effects. The latter means that taxes posed on producers are transferred to consumer prices and then the distributional effect on households is assessed. In this approach input-output tables are used together with microsimulation method. The examples are Canada (Hamilton, Cameron 1994), the UK (Symons *et al.* 1994), Australia (Cornwell, Creedy 1996), Spain (Labandeira, Labeaga 1999), Denmark (Wier *et al.* 2005) and Netherlands (Kerkhof *et al.* 2008).

Our research belongs to the branch of direct effects of environmental taxes, which is also carried out for example in Italy (Tiezzi 1999), Germany (Bork 2003), Denmark (Jacobsen *et al.* 2003), the United Kingdom (Dresner and Ekins 2006) and Ireland (Callan *et al.* 2009). Before giving an overview of the results of the work done in these countries, a question of why and how to measure distributional effect deserves attention.

Vertical equity usually refers to the idea that people with a greater ability to pay taxes should pay more, which reduces the inequality in the society. Such tax system, carried by the idea of vertical equity, is called progressive tax system. The question is how to measure such progressivity.

It is generally agreed that tax is progressive when the average tax rate rises with income; proportional when the average tax rate is constant and regressive, when the average tax rate falls with rising income. The difficulties arise, when talking about the redistributive effect. Different methods are used to gauge that. The use of different measures depends on the research question: if the objective is to analyse income distribution, then the measures showing the relation between post-tax and pre-tax income distribution should be used. Such measure is for example Reynolds-Smolensky index, based on Gini index. If the research interest is more in tax progressivity meaning the percentage distribution of taxes compared to percentage distribution of income, measures like Kakwani index could be used. Kakwani tax progressivity measure is the difference between the concentration index of taxes and the Gini index of the before-tax income (Kakwani 1977).

The environmental tax studied in distributional analysis is usually the carbon tax. Carbon tax is mostly levied on energy use based on the carbon content of energy. Climate change is recognized as one of the most challenging environmental issue and the Kyoto Protocol of UN Framework Convention on Climate Change sets specific national targets of reducing greenhouse gas emissions. Therefore the literature about distributional effects of environmental taxes has focused on carbon

taxes that could be applied in order to achieve the greenhouse gas emission reduction. Another common feature that can be noted is the use of revenue-neutral ecological tax reforms in many studies, meaning that not only the impact of applying new environmental tax is analysed, but also the effect of lowering labour taxes.

The earliest study of European carbon tax was done by Pearson and Smith (1991) who estimate the distributional impact of the tax in seven European countries (France, Germany, Italy, Netherlands, Spain, the UK and Ireland). In the first five they find that the burden of carbon tax payment is only weakly related to income, if at all, but in the UK and Ireland there is evidence of a significantly regressive pattern.

The work of Pearson and Smith was upgraded by Terry Barker and Jonathan Köhler in 1998 using the European energy-environment-economy model (E3ME). The countries covered are Belgium, Spain, Netherlands, Ireland, Italy, Luxembourg, Portugal, France, Germany, Great Britain, and Denmark. The researchers analyse the impact of a revenue neutral ecological tax reform and find that the taxation of fuels used for domestic heating is regressive. But if only transport fuels were taxed, the tax reform would be progressive in most of the studied countries (Barker, Köhler 1998).

More recently, the European researchers of environmental taxes' distributional effects have focused on a single country and use mostly microsimulation methods.

The evidence of the regressivity of environmental taxes has been found in Germany (Bork 2003), Great Britain (Dresner, Ekins 2006) and Ireland (Callan *et al.* 2009). In case of Germany taxes on heating fuels and electricity as well as tax on motor fuel show the regressive pattern, i.e. higher income classes bear smaller proportion of tax burden as compared to lower income classes. The regressive nature of taxes holds even with revenue-neutral tax reform via lowering social insurance taxes. In case of Great Britain the carbon tax imposed on gas and electricity in itself is regressive, but when compensation schemes are used, then the tax system on average is progressive, i.e. makes the average low-income household better off. However, as the variation in low income deciles is very big, there are still a significant proportion of low-income households that remain losers. In Ireland, it has been found that carbon tax is regressive, but a modest increase in welfare payments would offset the negative impacts of the tax in the lower half of the income distribution.

No evidence on regressivity has been found in Italy (Tiezzi 1999). The authors suggest that this is so due to the tax's bigger impact on motor fuels and smaller impact on domestic heating fuels.

Jacobsen and co-authors have shown the aggregate result is dependent on the variable used: according to disposable income the environmental taxes are regressive, but according to expenditures the environmental taxes are progressive (Jacobsen *et al.* 2003). However, if environmental taxes are further split, it appears that transport-related taxes are progressive and energy taxes are regressive. They

find also the Gini coefficients of different taxes and find that taxes on petrol and registration duty reduce inequality. Energy taxes increase inequality slightly more than VAT but less than duties on alcohol and tobacco.

Although in tax policy the wide tax base is preferred, some authors have argued that in case of environmental taxes a differentiated tax system could be more effective environmentally and distributionally (Aasness, Larsen 2003). They argue that if vertical equity principle is aimed, then the products with high income elasticity have to be taxed more and products with lower elasticity have to be taxed less. The authors illustrate their arguments with elasticises of transportation goods and show that taxing motor fuel could have adverse effects on low-income households, as its Engel elasticity is quite low (0.7). The examples of luxury goods, which could be taxed high, are air flights (income elasticity is 2.00), road tolls (2.00), taxi rides (1.74) and automobile (1.6). The authors claim that lower-income households spend less on the car quality, but more on gasoline. The higher-income households spend more on the car quality. If indirect taxes should also fulfil the redistribution objective, higher tax should be imposed on air flights, taxi drives and cars and lower taxes on mopeds, public transport, motor fuel and bicycles.

In general it can be said that the studies on distributional impact of environmental taxes are very different. Most of the studies analyse the impact of hypothetical carbon tax, only in Denmark the implemented carbon tax has been analysed. Also the studies differ in whether the focus is on environmental tax alone or revenue-neutral tax reform. The microsimulation models used for analysing environmental taxes do not include behavioural effects. Most of the studies described above have used the proportion of tax burden in different income classes to show the progressivity/regressivity of a tax. Only in Jacobsen *et al*. (2003) Gini coefficient is also used.

In addition to the research on distributional analysis of environmental taxes, there are very many papers on the empirical evidence of double dividend of ecological tax reform. Double dividend refers to two simultaneous benefits: combining a cleaner environment with economic improvement, see Patuelli *et al*. (2005) for an overview of such papers. However, these studies use mostly general equilibrium and macroeconomic models and do not handle the distributional effect, which is the main focus of the other strand of the literature. An interesting exception is the study of a hypothetical carbon tax in South Africa, where in addition to traditional double dividend also triple dividend has been included – alleviating poverty. The measure used is the total consumption by the poor. The study shows that different versions of carbon tax reduce CO_2 emissions, and in conjunction with a food tax decrease, they all increase GDP and reduce poverty (Van Heerden *et al.* 2006). This is also one of the few studies about impact of environmental taxes in developing countries. A vast majority of relevant literature is done in developed countries.

We acknowledge the importance of analysing the possible effects of new taxes. However, the issue of the distributional effects of the existing environmental taxes has not deserved sufficient attention. It is important to study different implications of

different taxes to build up a fair and effective tax system, especially in post-soviet countries, where the tax systems are constantly changing.

3. Data and the model

The model used in this research is the microsimulation model ALAN. The development of the model was started in 2005 to assess the redistributive impact of direct taxes and transfers by Alari Paulus and Andres Võrk. The earlier versions of ALAN model has been used to evaluate the impact of direct taxes and benefit system on income distribution (Paulus 2006), poverty and inequality (Võrk, Paulus 2007), work incentives (Võrk, Paulus 2006) and financing health care system (Võrk 2007). The model is continuously developed and improved. The version used in this article is from January 28, 2009. The detailed description of the model, all the assumptions and validation results are available in Võrk, Paulus, Poltimäe (2008).

The ALAN model is based on data from Household Budget Surveys 2000-2007 carried out by the Statistics Estonia. The data include monthly after-tax income and household consumption expenditures. The model simulates gross income, social benefits, payroll and income taxes, value-added tax, excise taxes on tobacco and alcohol, and environmental taxes for years 2000-2007 and for some taxes and benefits up to 2012. As the environmental excises are related to quantities, but the Household Budget Survey includes only expenditures in monetary terms, we use average prices of commodities to calculate quantities. The model calculates disposable income of all households. The households are compared using OECD modified household equivalence scale 1:0.5:0.3. All income deciles presented below include equal number of persons.

As the Household Budget Survey records household data during one month, it may happen that expenditures are higher than income of the same month, for example, when people are on vacation or sickness leave. The result is unusually high share of consumption taxes in the first income decile. Therefore in this article we use the environmental tax burden as a share of consumption expenditures, which includes monetary consumption expenditures and repair costs of dwellings and does not include purchase of fixed assets (houses, real estate) and savings. The alternative would be to leave out the observations where income is significantly lower than expenditures or forecast expenditures that would be accordant with income. The proportion of environmental taxes in income is a proxy of short-term effect, because income is very fluctuating in short term. The proportion of environmental taxes in expenditures gives a longer-term perspective, as expenditures fluctuate less than income, as by saving and borrowing people smooth their expenditures of different periods.

We stimulate the following taxes: excise on motor fuels (gasoline and diesel) and excise on fuels used for domestic heating. The domestic consumers have to pay excises for light fuel oil and heavy fuel oil and since 2008 also for gas and electricity. We have also calculated the implicit excise of distance domestic heating. It is assumed that the excises the producer has to pay are transferred to the

consumers via higher prices and thus we can calculate the excise based on the composition of fuel used in distance heating.

4. The distributional effect of Estonian environmental tax

The fuel excise proportion to other indirect taxes is given on Figure 1. It can be seen that the biggest share of disposable income forms VAT (13.6% on average). The share of excises is quite modest. According to the share in disposable income the indirect taxes are regressive, as they form the highest proportion of the income of the first decile. The reason is the monthly data of Household Budget Survey, where for some months income is significantly lower than expenditures, as people are on vacation or on sickness leave. Therefore we analyse also the proportion of indirect taxes of consumption expenditures (Figure 2).

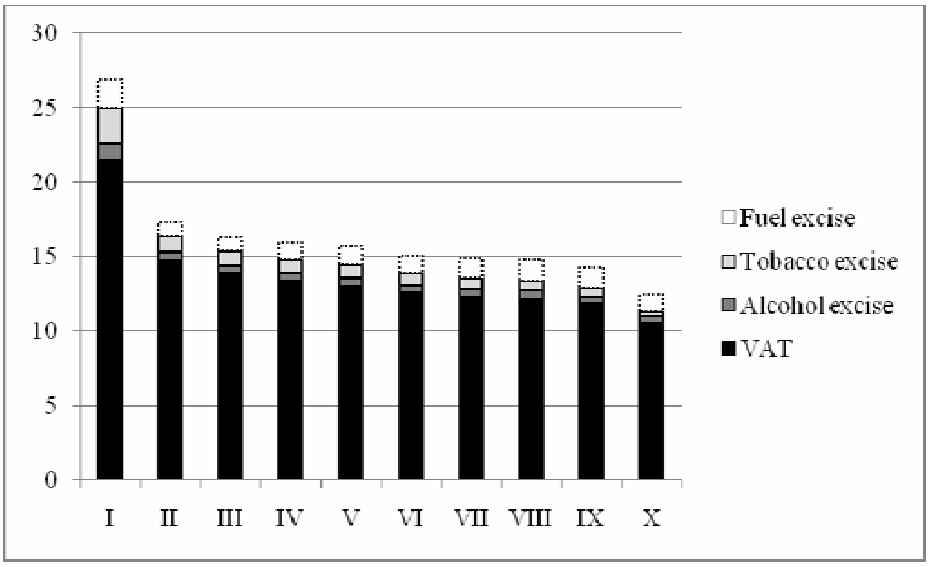

Figure 1. The share of consumption taxes in disposable income by deciles, average for 2000-2007, % of disposable income.

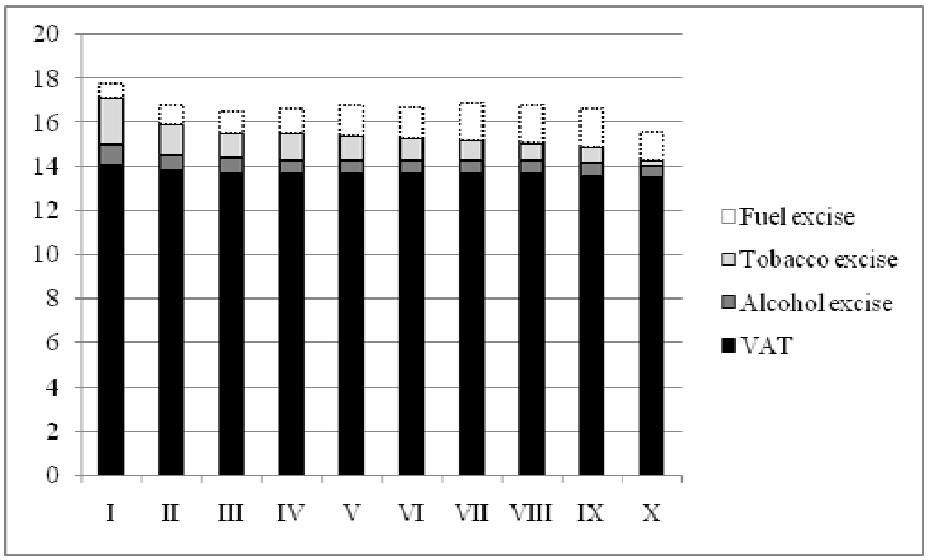

Figure 2. The share of consumption taxes in consumption expenditures by deciles, average for 2000-2007, % of consumption expenditures.

If the share of consumption taxes is compared to consumption expenditures, VAT is quite proportional (around 14%). Tobacco and alcohol excise show a regressive pattern, i.e. form a larger share in lower deciles. Fuel excise is progressive, but the highest share is not born by the tenth decile, but deciles VII-IX.

On average, environmental taxes constitute about 1-2% of household consumption expenditures in different deciles. The share of environmental taxes is larger in high-income groups (Table 1), except in decile X where it is lower again (1.5% in 2007). In 2000-2004 the proportion of environmental taxes in expenditures did not practically change, but since then the share of taxes has increased. This is driven by excise rate increase in 2004 for gasoline and diesel, and light fuel oil in the following year.

Table 1. The share of environmental taxes in expenditures by deciles, 2000-2007, %

	I	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**	**IX**	**X**
2000	0.6	0.7	0.7	0.8	1.0	1.1	1.2	1.2	1.5	1.3
2001	0.5	0.7	0.8	0.9	1.1	1.1	1.3	1.5	1.7	1.1
2002	0.6	0.9	0.7	0.9	1.0	1.1	1.3	1.3	1.5	1.1
2003	0.5	0.8	1.0	1.0	1.0	1.5	1.5	1.6	1.5	1.4
2004	0.5	1.0	0.8	1.2	1.5	1.7	1.7	2.0	1.8	1.7
2005	0.9	1.1	1.3	1.4	1.6	1.8	2.0	2.3	2.2	1.4
2006	0.8	0.8	1.2	1.2	1.5	2.1	2.0	1.9	1.9	1.1
2007	1.1	1.1	1.3	1.1	1.5	1.9	1.7	2.3	1.9	1.5

The majority of environmental tax burden on households is caused by excise on gasoline, which in 2000-2007 was on average 1% of expenditures (Figure 3). The highest share of gasoline excise is in VIII and IX deciles. The proportion of diesel excise is significantly lower, as the share of households owning diesel motor vehicles is not so big as compared to gasoline motor vehicles. Diesel excise is also progressive; the highest share is born by the VIII-X deciles.

The implicit excise on distance domestic heating is not significant: only about 0.03% of expenditures on average in 2000-2007. However, this excise shows a regressive pattern, as it forms higher share in the lowest deciles. The share of light fuel oil in expenditures is almost non-existent.

To analyse the change in 2000-2007, we group fuel excises into two groups: domestic heating excise and motor fuel excise. The proportion of motor fuel excises has been increasing in all deciles, from the average 1% to the average 1.5%. However, the most significant increase has taken place in the lowest decile: 2.1 times, in the highest decile the increase has been 1.1 times. Thus the gap between the richest and the poorest is narrowing. In 2007 the tax burden for the first decile was 1.1%, for the tenth decile 1.4%. The largest share of tax burden was for decile IX (2.2%). The tax burden of indirect taxes is strictly caused by a consumption of

the taxed good. The growth of gasoline consumption in households in 2000-2007 is largest in the lowest decile (187%) and lowest in decile X (37%). However, there is still a big difference in the absolute consumption level: the lowest income group consumed on average 30 litres of gasoline per household member in 2007, the highest income group 158 litres. Partly this may be due to different household age structure as there are more children and pensioners in the lower deciles.

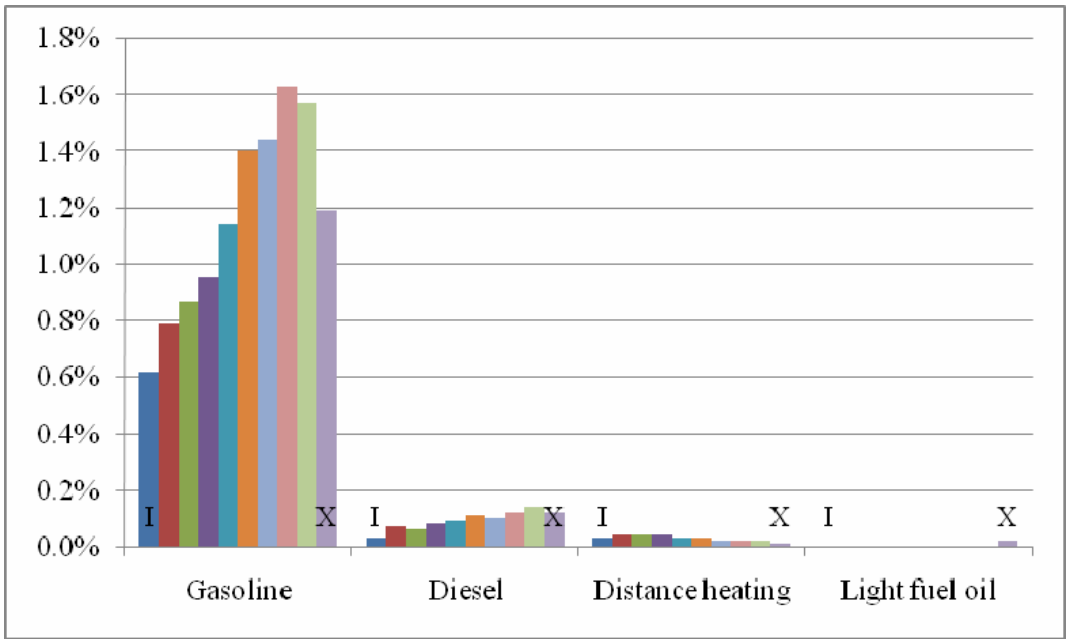

Figure 3. Share of environmental taxes in expenditures by deciles and by fuels, average for 2000-2007, % of consumption expenditures.

The proportion of domestic heating excise has also increased in 2000-2007, from the average 0.02% in 2000 to 0.04% in 2007. The biggest increase has taken place again for the poorest households: 5.4 times, for the richest the increase has been 3.6 times. The level of domestic heating excise is still very low.

In 2008 the fuel excise rates were raised quite significantly in Estonia: for gasoline the increase was 25%, diesel 35% and light fuel oil 39%. In addition, new excises were imposed on natural gas and electricity. In order to assess the impact of the fuel excise increase, we assume that all increase in excises will be transferred to consumer prices and that the consumption quantities of 2007 will remain unchanged. Total nominal consumption expenditures are assumed to increase uniformly at the average rate of 17.2% (predicted average nominal growth rate of income in 2008).

Figure 4 presents the impact of additional excises as a share of consumption expenditures by deciles. The increase of gasoline and diesel excises affects higher income groups more than lower ones. However, the electricity excise affects lower income groups significantly more than higher ones. Also the fuel excise on gas has a bigger impact on lower income groups, but its level is much lower than for electricity excise.

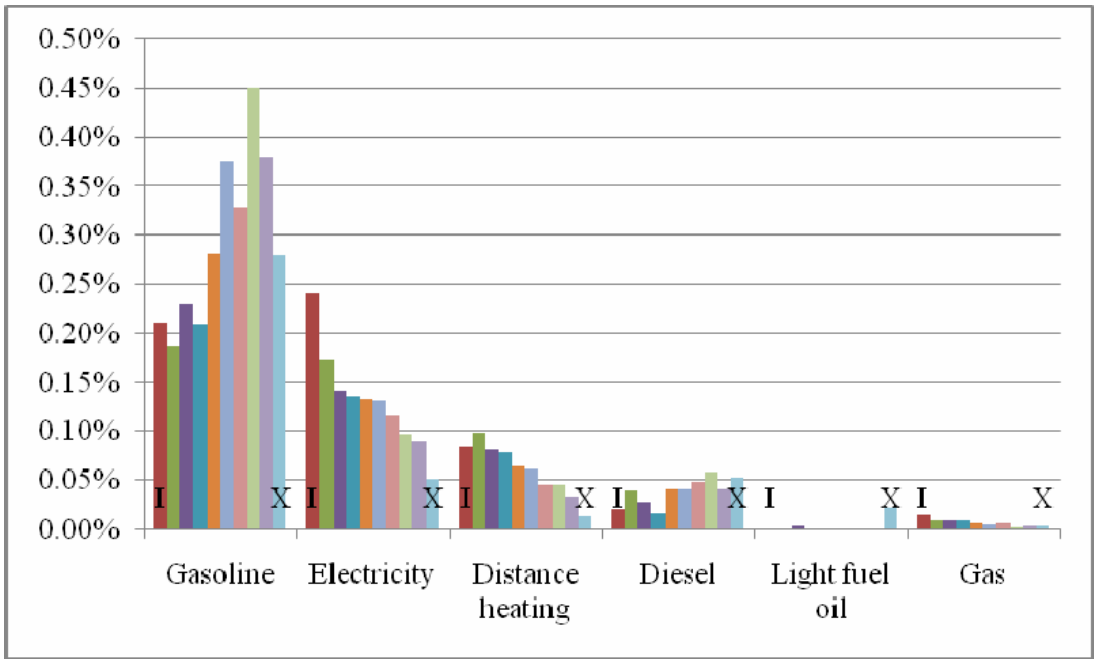

Figure 4. The increase of tax burden in 2008 as a share of consumption expenditures by deciles.

In addition to tax burden distribution across different income groups it is also important to analyse the distribution according to different sociodemographic characteristics of the households, which is done based on 2000-2007 data.

To analyse which social group is most affected by the environmental taxes, the environmental tax burden is analysed in five groups: households with one working member, households with two or more working members, unemployed, retired, other inactive. The results show that the motor fuel excise affects more these households that have working members, but the domestic heating excise affects relatively more unemployed and retired people (Figure 5). However, the level of domestic heating excise is significantly lower than that of the motor fuel excise.

One can suspect that the excise burden is different for urban and rural households, as rural households depend more on cars, they have to travel longer distances and the public transportation is not very developed. Also their income is lower. Our analysis supports that argument: rural households bear motor fuel excise which is almost twice as high as in urban households (Figure 6). The income of rural households is about 10-15% lower than in urban households.

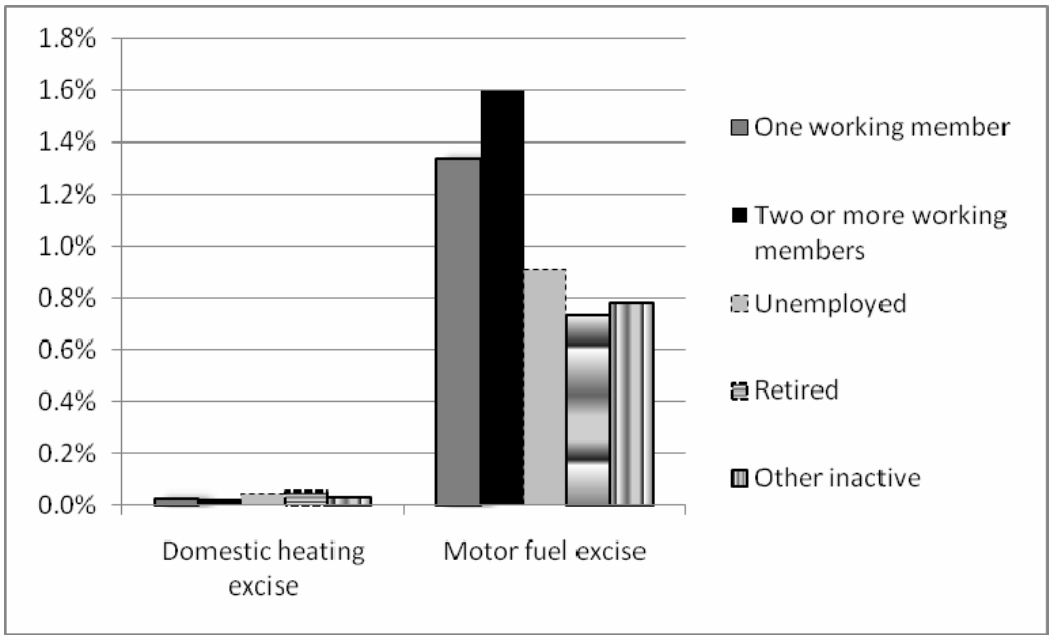

Figure 5. Share of fuel excise in consumption expenditure by the social group of household, average for 2000-2007.

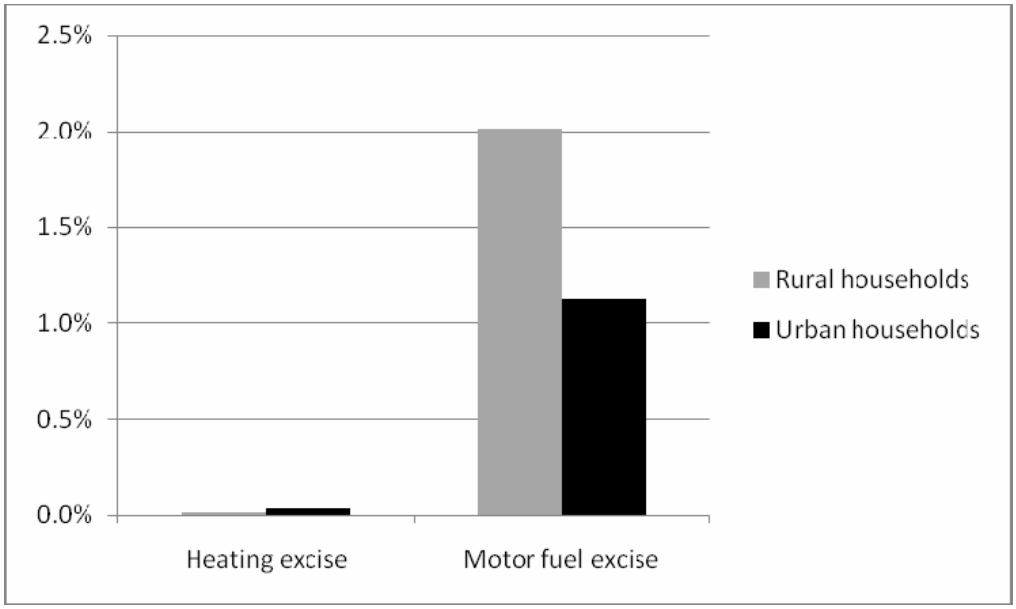

Figure 6. Share of fuel excise in consumption expenditures in rural and urban households, average for 2000-2007.

If we analyse tax burden according to the number of children in a household, we can observe that up to 2004 the share of motor fuel excise was the highest for families with 3 or more children, but since then the share has been falling and by 2007 it is even lower than for families with no children or with 1-2 children (Figure 7). Looking at quantities of consumed gasoline, we can see that households without children or having 1-2 children have been steadily increasing the consumed gasoline per household member in 2000-2007, but in households with three or more children,

the quantities increased up to 2004, but then started to decrease. One of the reasons could be the increase of gasoline prices in 2004 and 2005.

Although at the first glance the result seems favourable for families with several children, it is not clear how the decrease in fuel use in 2007 as compared to 2004 has affected the families' wellbeing. In order to do that, the personal car use needs to be more thoroughly analysed, whether this is a necessity good or convenience good. This could be done by assessing elasticities of car purchase and gasoline consumption, but it is out of the focus of the current article.

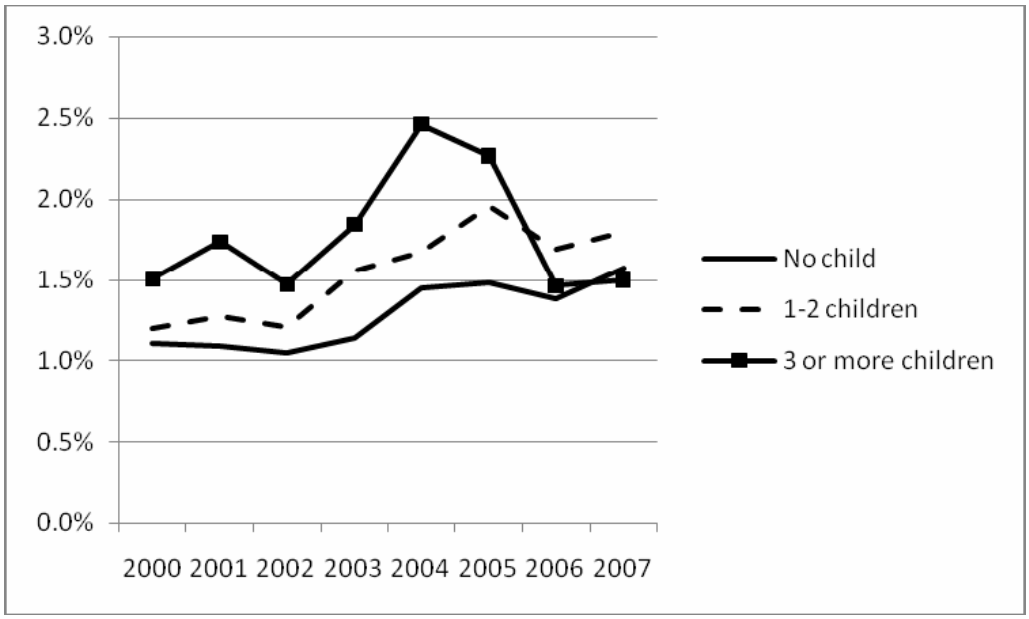

Figure 7. Share of motor fuel excise in consumption expenditures by the number of children in a household, 2000-2007.

To assess the progressivity or regressivity of Estonian excise duties, we use Kakwani index (Table 2). The fuel excise does not have a clear pattern as a whole, but if we analyse it separately, we can see that excise on fuels used for domestic heating is mostly regressive and excise on motor fuels has been progressive. However, the progressivity of motor fuel excise has decreased in recent years. The other excises – tobacco and alcohol are clearly regressive in Estonia, especially in recent years.

Table 2. Kakwani indexes of Estonian excise duties

	2000	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**
Fuel excise	0.08	0.07	0.05	0.07	0.07	0.02	-0.01	0.03
Domestic heating	*-0.01*	*-0.16*	*-0.05*	*-0.22*	*-0.14*	*-0.07*	*-0.15*	*0.05*
Motor fuel	*0.08*	*0.08*	*0.05*	*0.07*	*0.08*	*0.02*	*0.00*	*0.03*
Alcohol excise	0.01	-0.03	0.01	-0.02	-0.02	-0.10	-0.17	-0.18
Tobacco excise	-0.24	-0.23	-0.24	-0.18	-0.28	-0.31	-0.31	-0.30

So, in general we can draw twofold conclusions. First, the tax on domestic heating is regressive, as the level of domestic heating is quite stable over the deciles and, hence, forms bigger share in lower income households' budget. This is supported also by the Kakwani index. Second, for motor fuel excise, the Kakwani index shows decreasing progressivity. Here the Kakwani index hides different issues: improving living standard in all income classes and changing consumption patterns (growing car ownership also among the poor) during the observed period and therefore as a single number the index does not give a clear picture of the reasons of progressivity. Therefore one must be careful with presenting the progressivity or regressivity of a tax in a single number, especially in a country like Estonia, which is still lagging behind as compared to developed countries and consumption patterns are still evolving.

5. Conclusions and discussion

The objective of this paper was to assess the distributional effect of environmental taxes on Estonian households. The most significant environmental tax in Estonia has been fuel excise, contributing 98% of environmental taxes to state budget in 2007. In 2008 the tax base of excises was increased: excise duties on electricity and gas were introduced, taxes on motor fuel and light fuel oil were raised.

In general it can be said that the Estonian results are in line with other studies on distributional issues in Europe. Overall the environmental taxes in Estonia in 2000-2007 were progressive. This is because of the progressivity of motor fuel excises, which is the largest component of the environmental taxes with its level about 1-1.5% of total household consumption expenditures. The share of motor fuel excises is highest in VIII-IX deciles and lowest in bottom deciles. Taxing fuels used for domestic heating is regressive, low-income groups have higher tax burden than high-income groups, because of the larger share of heating costs of their expenditures. However, the level of tax burden of domestic heating excise in consumption expenditures is very low: 0.04% in 2007. Also the Kakwani index shows that taxing domestic heating is regressive and taxing motor fuels is progressive.

The environmental taxes, however, have become less progressive (or more regressive), because of changes in 2008. The new electricity excise is clearly regressive, and also increased taxes on gas and other inputs used for distance domestic heating are regressive. Their contribution to the overall tax burden is still low, but increasing. Electricity excise is still only about 5% of the overall environmental tax burden for households in 2008, but it constitutes about 20% of the increase, even more importantly about 40% for the lowest decile. It shows that close monitoring of future tax developments is required and if necessary, compensatory policies should be implemented either via reduction of income tax for low-earners or increased social benefits.

However, one should be cautious when using such progressivity measures alone. They do not tell anything about adequate level of consumption. For example, motor

fuel tax is slightly progressive: the share of taxes in total consumption expenditures are 1.1% in the first decile and 1.4% for the tenth decile. At the same time gasoline consumed per household member in the tenth decile was 5.3 times bigger than in the lowest decile. We may suspect that the quantities of motor fuel consumed by low-income families may not guarantee the adequate quality of life. The worrying signs of unfavourable effects are also the higher environmental tax burden for rural households and the dropping trend in quantities of consumed gasoline for households with several children.

Our paper focuses on the direct effects of environment taxes, meaning that we consider taxes paid directly by households. Except for distance domestic heating, we do not analyse other secondary effects of taxation: for example rising fuel excise will also raise producer prices and most likely also consumer prices of various goods. As for some goods the impact could be more significant than for the others, the distributional effects are of importance again. Still we do not expect that the overall results and conclusions change much. For example, motor fuel excise influences mostly transportation costs, but data show that household expenditures on transport are higher in high-income households, also when public transport is included. We also assume that excise on electricity, on the other hand, might also indirectly influence more low-income households, where the share of primary consumption goods (e.g. food products) is higher, and the share of labour-intensive services is lower. Further analysis using sectoral input-output tables are required for a precise assessment of indirect effects. The impact of environmental charges, omitted in the current analysis, could be analysed in similar fashion.

Finally, future research should also analyse behavioural effects, demonstrating how households react when environmental taxes and therefore consumer prices rise. Our results on the 2008 increase in excises taxes should be considered as a very short-run effect, where households are not allowed to change the quantities they consume. In long-run, the distribution of tax burden will change, especially when low-income and high-income households react differently. Given the reasonable range of price elasticities we expect that even when the quantitative results might be affected, the main conclusions on who bears the higher tax burden of new environment tax reforms will remain the same.

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