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Taxable income elasticity estimation of top earners in Hungary

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Abstract

The aim of my thesis is to investigate the reported income elasticity of the top 5 percent high income segment in Hungary. The 2006 introduction of the additional 4 percent surtax burden on taxpayers earning more than the pension ceiling allows me to estimate the elasticity coefficients. I will apply both dif-in-dif and 2SLS regression methods for the Tax and Financial Office Control two period (2005, 2008) random sample panel data containing more than 16.000 high income taxpayers. My empirical research finds reported income elasticity coefficient of 0.14 for top earners in Hungary. This fits into the lower range of empirical elasticity findings for top income groups.

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Introduction

In most cases the aim of increasing tax rates is to generate more tax revenue. However it might happen that the final outcome does not meet with the planned budget figures. One reason is that tax rate changes usually also generate behavioral effects. Top income people contribute to the tax revenues with a disproportionate share. For example in Hungary the top 5 percent pay the 36 percent of the total income tax revenue. That is why it is crucial to understand their behavior responses connected to tax rate changes.

According to Slemrod(2002), the following behaviorial responses can emerge due to tax rate changes. The first group includes real behavioral responses such as labor supply, work efficiency decisions, saving and investment alterations. The second group includes changes in timing and income shifting across tax bases and even across countries. The magnitude of real responses is much smaller then responses belonging to the second group. Furthermore, tax rate rise may fuel tax evasion.

A marginal top tax rate increase will have the following effects on the total society. First, without behavioral response it will enlarge the government revenue. The total society will benefit, as it is assumed that the government will use the revenue for higher transfers. This is called the mechanical effect. Second, the top earners will reduce their declared earnings due to the substitution effect. This behavioral effect reduces the government revenue, so it is a cost to the total society. Finally, the welfare of the top taxpayers will be lowered.

Hence, top earners elasticity estimates are not only interesting phenomena for economists but also for policy makers. Empirical study results suggest that top income elasticity seem to be

rather country and time specific. That is why in my paper I seek to find the taxable income elasticity estimate of the top earners in Hungary. In 2006 an additional surtax was levied for people earning more than the actual pension ceiling contribution. This segment of the population equals approximately the top 5 percent of the income distribution. By comparing the reported income of the effected group before and after the tax reform I can estimate their average elasticity parameter. I both use a usual dif-in-dif and a more sophisticated 2SLS IV regression method. My empirical research finds reported income elasticity coefficient of 0.14 for top earners in Hungary. This fits into the lower range of empirical elasticity findings for top income groups. However, as I will show with a back of envelope calculation in the last subchapter, even this small behaviorial response might alter the central revenue income by several billion forints. As far as I know my paper is among the first empirical studies on the elasticity of top earners in Hungary.

Chapter 1 contains the literature review of the most relevant empirical studies on taxable income elasticity. Chapter 2 summarizes the tax trends of top income taxpayers in the OECD countries and in Hungary. The methodology is presented in Chapter 3, and the results in Chapter 4. The final Chapter concludes the results of my research.

1. Literature review

Both economists and policy makers seek to investigate the elasticity of taxable income. This shows the percentage change in the reported taxable income related to one percent change in the net-of-tax rate (MRT) or "tax-price". The net-of-tax rate equals one minus the marginal tax rate. In practice the MRT shows that part of the next unit of reported taxable income that the taxpayer might take home.

In the empirical research methodology on income elasticity I observed that researchers follow three prevalent estimation approaches. The first is the Feldstein(2005) style dif-in-dif approach. He measures elasticity with relation between the percentage change in the net of tax rates and the percentage change in the average taxable income. Auten and Caroll(1998) regress the income change on the difference of log MRT and other controls. They construct the synthetic marginal tax rate and use it as IV to exclude endogeneity problems. The synthetic marginal tax rate is the marginal rate that would have been applied if the income had remained the same as before the tax change. The third methodological approach originates from Gruber and Saez(2002). They further include the average tax rate changes in their regression to control beside the substitution effect, also for the income effect of the tax reform. My thesis consists of the analyses of the Hungarian panel data for the top earners income elasticity with all three methods. I will I briefly summarize these methods in Chapter 3. In the next subchapters I review the estimation results of the most relevant empirical studies on top earners' reported income elasticity using the above mentioned methodological methods.

1.1 Empirical studies on taxable income elasticity of top earners

In this section I review the most relevant empirical studies on different countries' top income elasticity. It seems that top income elasticity is rather country and time specific. The estimated top earners' elasticity coefficients range approximately between one and near to zero. I am reviewing the literature from the higher results toward the lower figures.

Gottfried and Schellhorn(2004) follow the Gruber and Saez regression approach to estimate the effect of 1990 German income tax reform. For the top income range they obtain 1.042 substitution elasticity and insignificant 0.008 income elasticity. They also investigate the elasticity for different income types. For the high income earners group the substitution elasticity of business and self-employed income is around 1, while for regular employment it is 0.17. The income effect is very close to zero for the first two income groups and -0.085 for the regular employment income.

Using the same methodological approach, Gottfried and Witczak(2009) focus on the 2004 German tax change with a new detailed panel data set. They differentiate between the wage, self-employed and business income within the high earner group. Their elasticity result for the first group is a surprisingly high, 1.48, then for the next two groups 0.4 and 0.25, respectively.

Auten(2009) analyzes a long panel between 1979 and 1995 to analyze the behavioral responses of the top one percent tax filling population to the several tax changes that occurred in the USA during this time period. He finds the short run elasticity for taxable income 1.3 and the long run elasticity 0.6. After controlling for mean reversion he obtains slightly lower 0.94 short run elasticity. Heim(2006) also focuses on USA in the same period, between 1987 and 1996. He also obtains large short run elasticity and negative long run elasticity,

suggesting that taxpayers react to tax changes by shifting income, deductions and exclusions across years. Heim includes the tax rate and income group deciles interactions in the regression. The observed elasticity of the top decile is 0.6 on the total taxable income.

Selén (2002) analyzes the 1990/1991 Swedish tax reform change both with the Feldstein dif-in-dif approach and with the Gruber and Saez regression approach. Selén uses household survey data linked with tax data of prime age men. Depending on the included control variables and instruments, he receives taxable income elasticities for the top income group between 0.1-0.4.

Goolsbee(2000) seeks to shed light on the corporate executives' behavioral responses for the 1993 marginal tax rate increase in the USA. His result shows larger than one short run elasticity, which after one year drops to 0.4. The main response comes from the highest income top executives owning stock options. The elasticity response is just 0.15 of the executives receiving only wage and bonuses. Hall and Liebman(2000) also focus on the American CEO's during the 1980s. During this earlier period they find insignificant close to zero elasticities.

Nada and Giertz(2006) apply Goolsbee's regression specifications for a panel of executives including also firm specific data from the 1990s till the 2000s. For the early 1990s tax reform they find a 0.19 earned income elasticity, while their estimate for the later period is negative. The authors highlight that their elasticity estimates are sensitive for the time-period, data set and the econometric specifications. They conclude that other non-tax factors are also extremely important.

Bakos, Benczúr, Benedek (2008) follow the Gruber-Saez regression approach to estimate the reported income elasticity of the total Hungarian population. They analyze the 2005 tax reform variation and obtain 0.336 reported income elasticity for taxpayers earning more than 2 million forints. This figure is much larger compared to my 0.14 income elasticity estimate for the top 5 percent income segment earning more than 5.5 million forints. This suggests that taxpayers earning below the top 5 percent segment react more to tax change. One reason could be that top earners are already on the effort margin and can not work more. Other reason might be that tax authorities control high earners who tend to work as CEOs at big companies more severely than medium income earner. However, I can not control for the severeness of the Hungarian Tax Authorities as I do not have available data on it.

1.2 Empirical studies on income factor elasticity

This section contains empirical studies on income factor elasticities in different countries. The authors examine separately the elasticity of the different income components. In some cases they differentiate between the type of income, e.g. employed, entrepreneur or business income. Other studies focus on the comparison between the income components, e.g. wage, bonus and transfer.

Sillamma and Veall(1999) followed the Austen and Caroll methodology to seek the effect of the 1988 Canadian tax reform. Their elasticity result for regular employment is 0.08 and for self-employment 1.3. They find that the top earners are more responsive, with a 1.67 elasticity coefficient compared to the lower income groups. Saez and Veall(2005) examines the evolution of top income groups in Canada during the period of 1920-2000. Compared to the previous paper they obtain even larger behavioral response among the top 1 percent income

group to tax changes. However, after including the log U.S. top income share as an independent variable in the regression, the total top income elasticity decreases to 0.177. They conclude that the Canadian wage increase among the top earners was only modestly related to the tax decrease and more related to the U.S. trends.

Saez (2004) analyzes the effect of marginal tax rate decrease on the top income groups' income composition between 1960 and 2000. He finds 0.32 income elasticity for the 10% top income group and a twice as high 0.6 elasticity for the top 1% group with the 2SLS method. In the paper Saez also differentiates between the wage, S-corporation profit, partnership profit, sole proprietor profit, dividend, interest and other income components. During this period he finds noticeable wage income component growth. After including time controls in the regression he obtains 0.4 wage income elasticity for the top 1% group and 0.1 for the top 10% group. The other detected trend was that high income corporate owners shifted their income towards S-corporation (which are taxed at individual level and are not subject to corporate taxation) to take advantage of the lower top individual tax rate relative to the corporate tax rate. On the contrary, the dividends component decreased gradually.

Riihela at al (2005) were seeking to find answer for the significant income share increase of the top one percent in Finland between 1966 and 2002. In their paper they differentiate between labor income, entrepreneur income, capital income and transfers received. From their data it is clear that especially the capital income including dividends and interests grow most rapidly. They conclude that the reason was the introduction of the dual income tax system, where the flat rate on capital income was much lower than the top marginal tax rate on labor income.

In short, then it is notable that different empirical studies obtain various elasticities for the high income groups depending not only on the country but also on the analyzed time period, type of econometric specification, and data sets. According to Saez et al (2009) there are two categories of explanation. One explanation might be that there is not a common structural elasticity parameter for the high income group. Kopczuk(2003) provides empirical evidence on that the elasticity of taxable income depends not only on the marginal tax rates and preferences, but also on the size of tax base and on the structure of tax policy such as tax avoidance and administration. The other explanation might be that elasticity varies depending on the estimation method. Grietz(2009) shows that his estimates for the 1990s USA tax reform were rather sensitive to several factors such as time interval, income restriction on the sample, control variables and weighting scheme.

2. Tax systems

2.1 The implemented debate on The Economist website

Recently, an online debate was opened on The Economist[1] website about the taxation of the rich. The two opponents were Thomas Piketty, arguing for higher taxes on the rich and Chris Edwards, reasoning for that the rich already pay a disproportionate share.

Piketty suggests introducing an approximately 80 percent marginal tax rate on income exceeding one million euro. This segment only represents the 1 top percent of the population. His first reason is that the middle-class is getting more and more irritated by the governmental bail-outs of financial institutions and corporations, while the executives and managers of these institutions receive very high bonuses and salaries. With the tax increase his aim is not increasing budget revenue, but halting the grabbing hands. He further argues that there is no empirical evidence on the connection between the executive compensation and productivity at the top end of the labor market. Piketty's final argument is an example from the US history. Although, for a half century till the 1980s the marginal tax rate for the very top earners on average equaled 80 percent, this did not halt economic growth.

On the other hand, Edwards strongly objects increasing the tax for the top earners. He reasons that governments can not spend and allocate the revenues as efficiently as the market. Edwards argues that the top income percent already contributes a disproportionate share to the budget. Furthermore, he claims that too high tax rates would set back the entrepreneurial segment, causing the slowdown of the economy.

[1] http://www.economist.com/debate/days/view/293

The moderator, Saugato Datta, points out that there are two basic disagreements among the opponents' arguments. While Piketty defines the rich as the top 1 percent, Edwards considers them as the top quintile. Moreover, they disagree on the composition of the very top segment of income distribution. Piketty argues that this mainly consists of CEOs, whose marginal product is unknown. On the other hand, Edwards claims that this segment mainly consist of entrepreneurs who create positive externalities for the whole society and imposing higher taxes on them would set back their productivity, even causing lower economic growth.

2.2 Revenue maximizing top tax rate

Saez et al. (2008) and Saez et al.(2009) demonstrate a small model to calculate the budget revenue maximizing top tax rate. This section contains the summary of their model and its implications for the revenue maximizing top tax rate in the Hungarian tax system.

In a simple labor supply model the utility maximizing agents solve the loss of leisure time and reward of working trade off problem. Taxes and transfers might affect the labor supply decision through two channels. The first is the substitution effect. In case of a marginal tax rate increase, the net-of-tax rate decreases, causing that the reward of work that people can take home decrease. This persuades individuals to substitute some leisure for work. The second channel is the income effect. A tax increase reduces the available income, which persuades people to work more. For simplicity Saez et al assume that there is no income effect. This way the elasticity of earnings *(z)* with respect to the net-of-tax rate *(1-τ)* is calculated the following way:

$$e = \frac{1-\tau}{z}\frac{\partial z}{\partial(1-\tau)}$$

Higher elasticity means that earnings respond more to the net-of-tax rate change.

How to calculate the revenue maximizing optimal marginal effective tax rate for the top earners? A small change in the marginal tax rate induces both positive and negative effects on the government revenue. We will obtain the maximum MTR if no Pareto improvement is possible, e.g. the sum of the positive and negative affects equal zero.

A marginal top tax rate increase will have the following effects. First, without behavioral response it will enlarge the government revenue. The total society will benefit, as it is assumed that the government will use the revenue for higher transfers. This is called the mechanical effect. Second, the top earners will reduce their declared earnings due to the substitution effect. This behavioral effect reduces the government revenue, so it is a cost to the total society. Finally, the welfare of the top taxpayers will be lowered. If the government favors redistribution then this last effect will be relatively very small compared to the revenue generating mechanical effect.

The revenue maximizing highest marginal tax rate for the top income group will be obtained if the mechanical effect and the behavioral effect cancels out. The following equation shows the revenue maximizing top marginal tax rate:

$$\tau^* = \frac{1}{1 + e * z/(z - \bar{z})}$$

where e denotes the taxable income elasticity of taxpayers in the top bracket, z is the average reported income of the top taxpayers and $\bar{z}$ is the threshold for the top bracket. Levying more than τ^* is inefficient, as it would both reduce the utility of the top bracket taxpayers and also decrease government revenue.

If income effect is present also, then it will motivate top income people to work more. So their behavioral response, e.g. *e* will be smaller and the optimal top tax rate will be larger. Employer social security contribution (SSC) is also part of the Hungarian tax system. It is defined as a percentage of the reported earnings. Hence the modification of the top marginal rate might change the reported earnings, which will also change the base for the employer social security contribution. The adjusted formula is:

$$\tau^* = \frac{1 - e * z/(z - \bar{z}) * SSC}{1 + e * z/(z - \bar{z})}$$

Then according to this formula what is the maximum revenue generating marginal tax rate in Hungary for the top income group above the pension ceiling, e.g. above 7.137 million? After substituting the 29 percent employer social security contribution, 10.2 million average income and my benchmark 0.14 percent elasticity, the maximum revenue maximizing tax rate is 59 percent. This is higher compared to the 47.5 percent rate in force in 2008 for income above the pension ceiling.

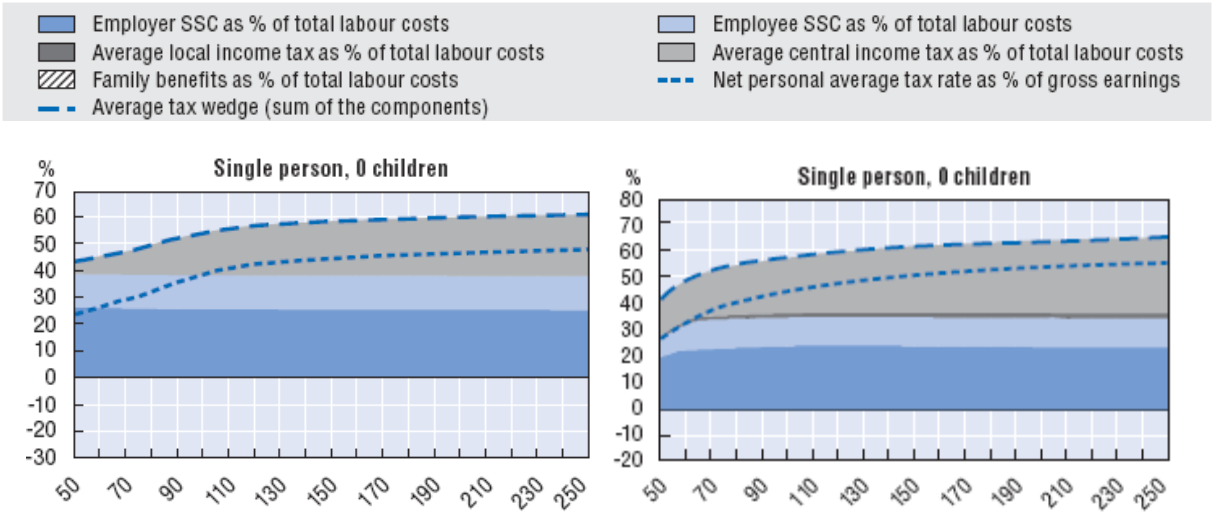
2.3 Taxing the top earners in the OECD countries

In Hungary not only is the average tax wedge (income tax, plus employee and employer social security contributions) the second highest in the OECD countries[2], but we are among the countries with the largest tax burden for high income people. The recent OECD Taxing Wage 2008 booklet contains graphs on the calculated tax of labor income for gross wage

[2] For a single person with average wage level the tax wedge is 54.1 percent in Hungary leaving well behind the 37.4 OECD average., Only Belgium outrun us with a 56 percent tax wedge.

earnings between 50 and 250 percent of the average wage. Hence, the tax wedge for top earners can be seen on the right part of graphs.

The OECD booklet contains the tax burden estimates for four different groups: single person without children, single parent with two children, one-earner married couple without children and one-earner married couple with two children. I will present some OECD country graphs calculated for a single person without children, as excluding family benefits ease the comparison. However, it is interesting that when the family benefit is also taken into account for one-earner married couples with two children, then the net personal average tax rate below a certain threshold is negative in some countries. For example, this threshold is 84 percent of average wage in Canada, 118 percent of average wage in Ireland and 119 percent of average wage in the Czech Republic.

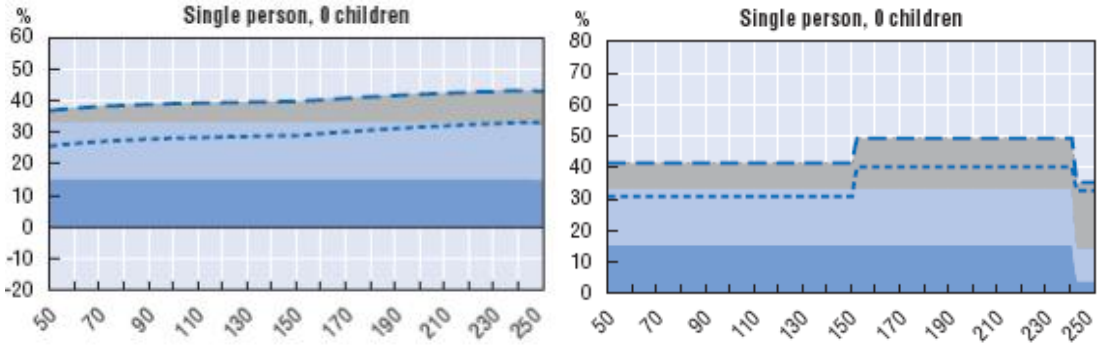


Graph 1: OECD Taxing Wages 2008 booklet: average tax burden rate for singles without children in Hungary and Belgium. The horizontal axis shows the gross wage earning in percentage of the average wage, while the vertical axis shows the total tax burden.

The graphs contain the tax wedge components respectively, employer social security contributions, employee social security contributions, average local income tax, central

income tax and family benefits as a percentage of total labor cost. The net personal average tax rate and the average tax wedge (the sum of all components) are also present on the graphs.

As it can be seen on Graph 1, for a single high income taxpayer without children the net personal average tax rate is above 50 percent in Hungary in 2008, while the total average tax wedge exceeds 60 percent. Belgium is among the few countries where the tax wedge is even higher for top earners groups. As seen on the above right graph their tax wedge approaches 65 percent. The structure and proportion of taxes for high income person in Belgium is similar to Hungary, apart from that the central income tax is higher and also they also levy local income tax. On the other hand, Australia, Canada, Iceland and Korea are among the countries which levy the lowest tax wedge close to 30 percent for high income groups.



Graph 2: OECD Taxing Wages 2008 booklet: average tax wedge and marginal tax wedge rate for singles without children in Poland. The horizontal axis shows the gross wage earning in percent of the average wage, while the vertical axis shows the marginal tax burden.

It is interesting that the progressive taxation scheme is not valid in all countries. For example, in Poland both the employer and employee social security taxes decrease after the 240 percent of average income, as can be seen on Graph 2.

2.4 Hungarian tax system and the 2006 tax change

This subchapter contains the description of the Hungarian tax regulations for the years 2005 and 2008 for taxpayers having more then 4 million yearly income. The Hungarian tax dues include employer social security contributions, employee social security contributions and personal income tax payable for the central budget. In this section I focus on the change in the employee social security contributions and personal income tax between 2005 and 2008. This variation allows me to estimate the behavioral response, e.g. the reported income elasticity of the taxpayers.

The payable personal income tax is calculated in the following way:

Personal income tax for the reported income

- employee tax credit deductions
- tax on the non taxable items
- tax allowances
- tax credit for children
- serious disability allowances

The personal income tax was 38 percent in 2005, which was reduced to 36 percent in 2008 for income above 4 million HUF. In both years taxpayers earning income in the examined range were not eligible for employee tax credit deductions. The non taxable items include such income as scholarship and maternity benefits. In 2008 the taxpayers receiving pension had to declare this among the non taxable items, however in 2005 it was not compulsory to declare pension income.

The tax allowances include deductions for insurance schemes, education-related expenses, computer-related expenses, house loan installments and grants made for public purposes. The

income limit for the tax allowances was 6 million HUF in 2005. However, this was decreased below 4 million HUF for 2008, apart from education-related expenses paid before 2007.

The limit for tax credit for children was 6 million in 2005. In 2008 the limit was determined depending on the number of children. As my data source does not contain the number of children, I will eliminate all those people who declared any tax credit for children in 2008. There was no income limit for serious disability allowance in either year. The maximum deductible amount was 34.200 HUF in 2005 and 41.400 HUF in 2008. Even the 2% of people earning income above 4 million requested this allowance too.

Table 1 includes the employee social security contribution rates for both years. The pension contribution ceiling was 6 000 600 HUF in 2005, which was raised to 7 137 000 HUF for 2008. From 2006 the government introduced an additional 4 percent surtax on the income above the actual pension tax ceiling.

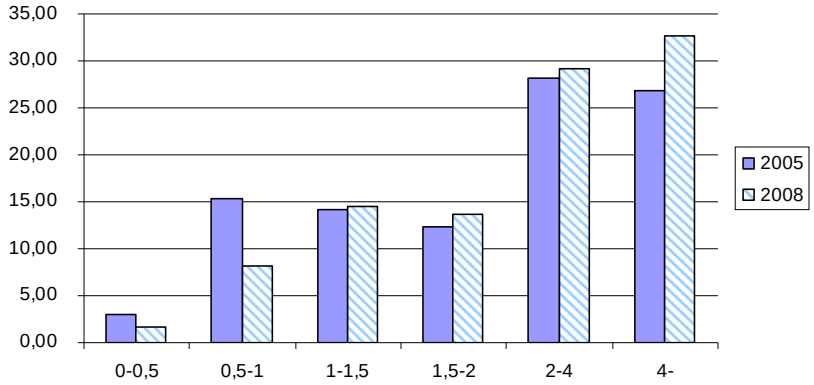
Table 1: Tax payable by the employee on income above 4 million HUF in years 2005 and 2008

	Gross annual earnings	
2005	4000 k- 6000k	above 6000k
personal income tax	38	38
employee ssc		
pension	8,5	0
sickness	4	4
unemployment	1	1
Total MRT	**51.5**	**43**

	Gross annual earnings	
2008	4000 k- 7137k	above 7137k
personal income tax	36	36
surtax	0	4
employee ssc		
pension	9,5	0
sickness	6	6
unemployment	1,5	1,5
Total MRT	**53**	**47.5**

Source: Hungarian Tax and Financial Control Office (Apeh) statistics
http://www.apeh.hu/adokulcsok_jarulekmertekek/fizetendo_jar

Graph 3 shows the percentage income distribution among the different income range groups in Hungary. The 5% high income people above the 4 million threshold received 27 and 33 percent from the total income share in year 2005 and 2008, respectively.



Graph 3: Total income distribution based on the Apeh Report on tax payment between 2003-2008. The horizontal axes shows the income groups in million HUF. The vertical axes shows the percentage total income of the taxpayers in the indicated groups.

The share of personal income tax contribution among the different income groups is presented in Table 2. 38.65 percent of the total personal income revenue contribution is collected from the examined top 5 percent highest income people. Since their tax share is relatively much larger, it is very important to know their behavioral responses to tax reforms.

Table 2: Share of personal income tax contribution among the different income groups

Income groups	Share from total income	Total reported income	Income tax burden	Share of income tax revenue contribution
0 - 0.5	1.7 %	148 253	26 686	1.01%
0.5 - 1	8.23%	713 521	128 434	4.88%
1 - 1.5	14.53%	1 259 716	226 749	8.61%
1.5 - 2	13.7%	1 187 757	320 694	12.18%
2 - 4	29.23%	2 534 171	912 302	34.66%
4 -	32.6%	2 826 342	1 017 483	38.65%

Source: own calculation based on the Apeh Report on tax payment between 2003-2008

In the next chapter I will summarize the estimation methods to obtain the income elasticity and also I will describe my dataset.

3. Methodology

3.1 Dif in dif approach

Both economists and policy makers seek to investigate the elasticity of taxable income (ETI). The ETI shows the percentage change in the reported taxable income related to one percent change in the net-of-tax rate (MRT) or "tax-price". The net-of-tax rate equals one minus the marginal tax rate (METR). In practice the MRT shows that part of the next unit of reported taxable income that the taxpayer can take home. There are three relevant approaches to estimate the elasticity of income. In this section I present the dif-in-dif method, while the next section contains two regression method specifications.

Feldstein(1995) was among the pioneers to estimate the taxable income elasticity with the dif-in-dif method. He assumed that there is a relation between the percentage change in the net of tax rates and the percentage change in the average taxable income. He further assumed that this relation has a constant term among the different marginal tax rate groups. However, in my point of view the latter assumption is not likely to be true for the total Hungarian taxpayer society. Still, it might be reasonable to accept for the top 5% income group. After taking the difference of the below and above 6 million threshold groups' equations, the constant term will drop out and the slope (β) will show the elasticity:

$$\ln \bar{y}_{t+1} - \ln \bar{y}_t = \alpha + \beta\left(\ln\left(1 - MTR_{t+1}\right) - \ln\left(1 - MTR_t\right)\right)$$

$$\beta = \frac{\ln \bar{y}_{t+1} - \ln \bar{y}_t - \left[\ln \bar{y}_{t+1} - \ln \bar{y}_t\right]}{\ln\left(1 - MTR_{t+1}\right) - \ln\left(1 - MTR_t\right) - \left[\ln\left(1 - MTR_{t+1}\right) - \ln\left(1 - MTR_t\right)\right]}$$

To get weighted factor elasticities I included the precise factor income differences instead of the log approximates. See the modified equation below and the calculations in the Appendix.

$$\beta_w = \left(\frac{{w_2}^1 - {w_1}^1}{{y_1}^1} - \frac{{w_2}^2 - {w_1}^2}{{y_1}^2} \right) / \left(\ln\left(1 - MTR_2^1\right) - \ln(1 - MTR_1^1) - \left[\ln\left(1 - MTR_2^2\right) - \ln(1 - MTR_1^2) \right] \right)$$

The mean reversion phenomena might bias the estimated elasticity coefficient. The mean reversion phenomena emerges if somebody by chance received lower income in 2005 but then reversed back to his normal higher income in 2008 independently from the tax changes. Or the other way round. To avoid mean reversion, I have eliminated the large extreme values from my sample. Small extreme values are not present, as the sample is truncated at 4 million HUF annual income.

An important requirement for the dif-in-dif approach is that the two comparable groups experienced the same income growth between the two examined periods. If not then the estimates are biased. I have checked the reported income growth between 2007 and 2008 for taxpayers receiving income in a 2.3 million bracket under and above the 2007 pension ceiling. The average income growth was higher for the below the threshold group. As seen in Table 3 the average income growth was 5 percent for people under the 6.3 million threshold and 2.7 percent for people above the threshold.

Table3: Average income grwoth between 2007 and 2008

Yearly income in 2005	Average income in million HUF 2005	2008	Average income growth
4 - 6 million	4.9	5.15	1.051
6 - 8 million	7.28	7.48	1.027

Source: own calculation based on my sample dataset

Based on the income growth between 2007 and 2008, we can presume that the income growth trend between 2005 and 2008 was rather similar to this pattern. If the income growth equality is violated and the growth rate is larger for the below the threshold group, then the dif-in-dif

estimate will be upward biased. The reason is that this estimation method compares the income growth of group 1 which was affected by the 4 percent surtax and group 2, which was not. With the same income growth assumption it anticipates the lower income growth trend as part of the behaviorial reaction to the levied surtax.

3.2 Regression method approach

To capture the taxable income elasticity, the regression specification suggested by Auten and Caroll (1998) is the following:

$$\Delta \log(y_i) = \alpha_0 + \beta \Delta \log(1 - MTR_i) + \delta \log(y_{0i}) + \varepsilon X_i + u_i$$

They regress the difference of the individuals' log reported incomes (y_i) on the difference of the individuals' net-of-tax rate. The MTR may change due to exogen reasons such as tax reforms or due to endogen reasons. An example for the latter is a positive income shock, which is very likely to increase the MTR also. So the $\text{cov}(\Delta \log(1 - MTR_i), u_i) = 0$ condition is violated.

To solve the endogeneity problem Auten and Caroll construct an instrumental variable for the $\Delta \log(1 - MTR_i)$. The IV is the difference between the synthetic tax price in the second period and the actual tax price in the base period. The synthetic marginal tax rate (SMTR) is the second year marginal tax rate that would be valid for the base year income inflated to the second year (e.g. for the real income without behavioral change).

$$IV : \log(1 - SMTR_i) - \log(1 - MTR_i)$$

The regression approach also allows controlling for different individual non-tax factors which might influence the reported income level such as age, occupation, wealth, family, gender.

In addition, Gruber and Saez(2002) add the difference of the log one minus individual average tax rate to the regression to capture the income effect also. Hence, β is the compensated elasticity parameter showing the substation effect and γ is the income effect parameter.

$$\Delta \log(y_i) = \alpha_0 + \beta \Delta \log(1 - MTR_i) + \gamma \Delta \log(1 - ATR_i) + \delta \log(y_{0i}) + \varepsilon X_i + u_i$$

To exclude the bias due to mean reversion and total income distribution changes, they also include the log initial income among the right hand side variables.

The average tax rate (ATR) equals the total individual tax amount divided by the reported income. So by construction the $\Delta \log(1 - ATR_i)$ is correlated with the error term including income shocks. To eliminate the endogeneity problem the authors use the following IV:

$$IV : \log(1 - SATR_i) - \log(1 - ATR_i)$$

where SATR is the individual synthetic average tax rate equaling the total tax amount due in the second period if the taxpayer real income did not change from the base period to the second period. To have valid instrumental variables they should fulfill two conditions. First, the IV should be uncorrelated with the error term. Both IV fulfill this condition by construction. Secondly, the IV should correlate with the instrumented variable after netting

out other explanatory variables. It can be easily checked by Stata as it shows the first stage of the regressions also.

3.3 Data

My estimations are based on the data provided by the Hungarian Tax and Financial Control Office (APEH) to the Budget Office Council. The data set contains panel data of tax returns for 2005 and 2008. The random sample covers the total personal income tax forms of approximately 422 000 individuals both in 2005. This equals 14% of all taxpayers in that year.[3] 62 800 taxpayers were dropped from the sample, as their panel data was unbalanced.

The sample contains individual tax payers, individual agricultural manufacturers and individual entrepreneurs. For the regressions I excluded individual entrepreneurs and also the agricultural manufacturers from the sample, as only part of their income is shown on this income-tax return form. I further excluded those few people who had income declared also abroad as their behavior might be rather different. I also exclude people declaring pension income, child allowances, and housing benefits in 2008 due to the reasons explained in the Hungarian tax system subchapter. Finally, I have limited my sample for those whose reported base income was above 4 million in 2005. This fragment of the sample contains 16 400 people, representing the top 5 percent of the taxpayers.

As suggested by Austen and Caroll(1998), I control for different individual non-tax factors which might influence the reported income level. I follow the Bakos, Benczur and Benedek(2008) regression specification. The taxpayer's wealth is very likely to affect the

[3] Based on the APEH (Hungarian Tax and Financial Control Office) statistics the total number of taxpayers were 3.025.639 in 2005.

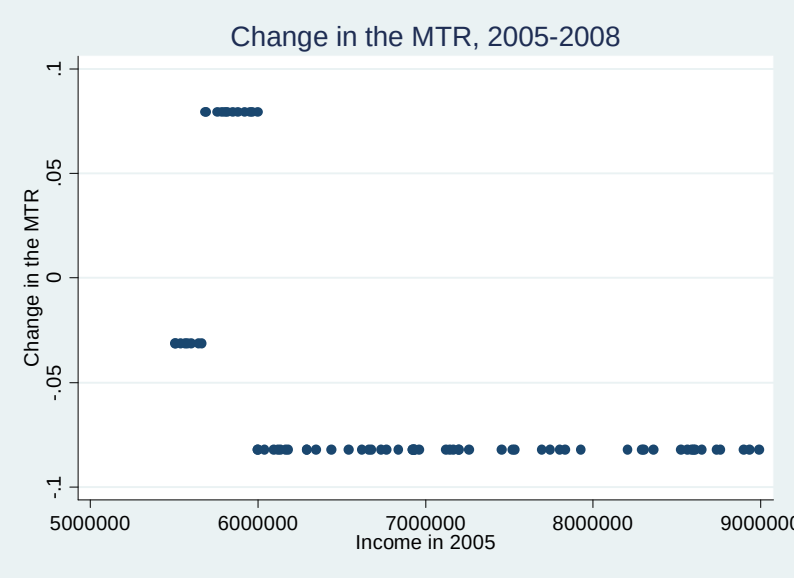
ability and possibility to change his portfolio and labor decisions. But there is no data on wealth in the tax return form. However, I can use the data on dividend, shareholder, renting income or saving data as an indicator for wealth. I also include the age and age square to control for the life cycle effects.

To control for the different income growth possibilities I further include a dummy for Budapest and another dummy for the 19 regional capitals, and a female dummy. Unfortunately, there is no information on occupation in my dataset and neither can I include family dummy, as the marginal effective tax rate is not calculatable for the year 2008. Table 4 shows the descriptive statistics for the regression variables in three relevant selected samples.

Table 4: Descriptive statistics for the regression variables

Variable	Income 4000k-		Income 4000k-6000k		Income 6000k-8000k	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Δlog(taxable income)	0.05	0.59	0.08	0.55	0.04	0.56
Δlog(1-MTR)	-0.02	0.12	0.01	0.10	-0.08	0.13
Δlog(1-synthetic MTR)	-0.03	0.09	-0.02	0.08	-0.05	0.11
Δlog(1-ATR)	-0.05	0.07	-0.05	0.07	-0.04	0.07
Δlog(1-synthetic ATR)	0.08	0.14	0.18	0.08	-0.06	0.03
2005 gross income	7 110 148	6 381 363	4 791 756	558 869	6 856 674	568 160
wealth dummy	0.58	0.49	0.58	0.49	0.57	0.50
gender dummy	0.35	0.50	0.37	0.50	0.35	0.50
age in 2005	40.80	9.06	40.15	9.30	41.21	8.88
age square in 2005	1746.44	748.32	1698.65	759.00	1777.02	738.12
Budapest dummy	0.37	0.48	0.33	0.47	0.38	0.49
regional capital dummy	0.59	0.49	0.56	0.50	0.61	0.49
observations	16 376		9 402		3 393	

Graph 4 displays the marginal tax rate change between 2005 and 2008 in function of the base year income. Those who have positive MTR change experienced marginal tax rate decrease, while whose MTR is negative perceived tax burden increase. The effect of the 6 million pension ceiling is clearly visible on the graph.



Graph 4: change in the MTR between 2005 2008

The top positive line on the graph notes those taxpayers whose total employee social security contribution and income tax fell from 51.5 percent in 2005 to 47.5 percent in 2008, as their income increased above the pension ceiling during this three years. The middle negative line represents those who remained under the pension ceiling but experienced a marginal tax rate increase from 51.5 percent to 53 percent due to the tax changes. The lower line contains those taxpayers who remained above the pension ceiling but were burdened with higher taxes due to the surtax. Although the top and middle lines seem shorter on the graph, in reality most taxpayers belonged here.

4. Empirical results

This chapter contains the dif-in-dif and regression elasticity estimate and factor elasticity estimate results. The third subchapter demonstrates a back of envelope calculation with the estimated elasticites about the budget revenue change in case of a tax reform.

4.1 Elasticity estimate results

I have applied the Feldstein style dif-in-dif approach, the Caroll-Auten and Gruber-Saez regression specification method to my panel data set. Table 5 contains the dif-in-dif comparison between the 4-6 million and the 6-8 million income ranges. As the pension income was only obligatory to report in 2008, I either excluded pensioners or the pension income to be able to compare similar composition groups. The third row contains the elasticity of non entrepreneurs, while the fourth contains employees' with only wage income. Depending on the sample, the estimated reported income elasticities are very similar, ranging between 0.27 and 0.32 percentage point. The last rows display the elasticity for different age groups. On average taxpayers under 30 are much more responsive than people belonging to the 30-55 age group.

Table 5: Dif-in-dif elasticity outcomes for taxpayers with income between 4-8 million in base years

Sample base	Elasticity of reported income	Observation
Pensioners excluded	0.27	15636
Pension income excluded	0.32	18173
Entrepreneurs excluded	0.29	17963
Employee with only wage	0.28	8510
Age -30	1.05	2055
Age 30-55	0.36	12396
Age 55-	-2.76	1192

Table 6 contains the regression outcomes for taxpayers earning above 4 million HUF as in the dif-in-dif estimation. The coefficients of $\Delta\log(1\text{-MTR})$ shows the substitution effect, while

the coefficients of Δlog(1-ATR) shows the income effect. Model 1, the Austen-Caroll regression method, has to closest theoretical framework to the dif-in-dif method containing only the substitution effect. The other models also estimate the income effect following Gruber and Saez. The substitution effects in all regressions are systematically lower than the dif-in-dif 0.27 estimate. The reason is the positive bias in the dif-in-dif estimate due to the higher income growth in the group below the pension ceiling. Model 3 also controls for mean reversion and it shows that mean reversion is present among the top 5 percent. After including the log initial income the income effect sharply drops to -1.8. This does not denote a large income effect, only suggests that the initial income and the average tax are highly correlated. Model 4 controls for various control variables. Only the gender and the regional capital dummies are significant, implying that females experienced less income growth during this period, and people living at big cities experienced higher growth.

Table 6: regression elasticity coefficients for taxpayers who earn more than 4 million

Δlog(taxable income)	Model 1	Model 2	Model 3	Model 4
Δlog(1-MTR)	0.238	0.135	0.092	0.086
	(0.052)***	(0.053)***	(0.055)*	(0.054)*
Δlog(1-ATR)		-0.118	-1.856	-1.778
		(0.015)***	(1.272)	(1.701)
log(2005 gross income)			-0.130	-0.130
			(0.019)***	(0.018)***
wealth dummy				0.024
				(0.017)
gender dummy				-0.073
				(0.028)***
age in 2005				-0.008
				(0.014)
age square in 2005				0.000
				(0.000)
Budapest dummy				-0.019
				(0.017)
regional capital dummy				0.026
				(0.010)**
constant	0.053	1.894	1.994	2.200
	(0.005)***	(0.239)***	(0.260)***	(0.419)
observation	16376	16376	16376	16376

Standerd errors in parenthesis, ** *significant at 1% level, ** at 5% level, * at 10% level

Table 7 displays the regression outcomes for a narrower income range, where people affected by the surtax change are more concentrated. Hence, more precise marginal effect can be detested here. The most sophisticated Model 4 reports 0.14 reported income elasticity. This means that people in the top 5 percent income range on average will decrease their income by 0.14 percent after a 1 percent net-of-tax rate decrease (e.g. marginal tax rate increase). However, as I will show with a back of envelope calculation in the last subchapter, even this small behaviorial response might alter the central revenue income by several billion forints. Mean reversion is also present in this sample. Wealthier and also older people experienced a higher reported income growth. People living at Budapest with high earning experienced a slightly less income growth.

Table 7: regression elasticity coefficients for taxpayers who earn more than 5.500.000 million

Δlog(taxable income)	Model 1	Model 2	Model 3	Model 4
Δlog(1-MTR)	0.280	0.147	0.158	0.140
	(0.058)***	(0.059)**	(0.063)***	(0.063)**
Δlog(1-ATR)		-0.149	0.331	0.743
		(0.024)***	(0.724)	(0.802)
log(2005 gross income)			-0.142	-0.148
			(0.030)***	(0.030)***
wealth dummy				0.055
				(0.016)***
gender dummy				-0.132
				(0.021)***
age in 2005				0.019
				(0.011)*
age square in 2005				0.000
				(0.000)*
Budapest dummy				-0.038
				(0.018)**
regional capital dummy				0.028
				(0.017)*
constant	0.031	2.406	2.311	2.023)
	(0.007)***	(0.381)***	(0.463)***	(0.571)***
observation	8354	8354	8354	8354

Standerd errors in parenthesis, ** *significant at 1% level, ** at 5% level, * at 10% level

To check the robustness of my results I also ran the regressions for different age group subsets and for those who only receive wage income. The results for the prime age people in Model 4 are very similar to my benchmark 0.14 elasticity. Model 1 resembles the dif-in-dif results. In

both models it is clear that younger people have higher elasticity than prime age people. This result is logical as younger people without children can react more to changes easily than prime age people with children.

Table 8: Robustness check

For income > 5.5	Model 4			
Δlog(taxable income)	-30	30-55	55-	Only wage income
Δlog(1-MTR)	0.196	0.123	-0.251	0.152
	(0.274)	(0.067)	(1.317)	(0.080)**
Δlog(1-ATR)	0.416	0.282	21.639	0.394
	(2.544)	(0.852)**	(232.840)	(1.013)**
Observation	670	7016	296	5414

For income > 5.5	Model 1			
Δlog(taxable income)	-30	30-55	55-	Only wage income
Δlog(1-MTR)	0.385	0.276	-0.205	0.318
	(0.230)*	(0.061)***	(0.437)	(0.074)***
Observation	670	7016	296	5414

Standerd errors in parenthesis, *significant at 10% level, ** at 5% level, * at 1% level**

4.2 Factor elasticity estimate results

Table 9 contains the income factors for which I will apply the dif-in-dif and regression estimation method. Table 10 displays the former and Table 11 the latter result.

Table 9: Income factors on the tax return form

Employment
PRIME EMPLOYMENT SALARY
Salary from employment including in-kind salary, premium, cafeteria cards, lodgment contribution, social aid from the employer.
FOREIGN DELEGATION
Income for foreign delegation by employment.
OTHER SALARY INCOME
Other income not connected to labor. (e.g. job search subsidy, reservist soldier allowance, sick allowance, volunteer work)
OTHER EMPLOYMENT SALARY
Received salary from a second employment (also if elected member of the Parliament or a local municipality).
Self employed
SELF EMPLOYMENT INCOME
(e.g. intellectual work, rental income,
Other income
OTHER NONTAXABLE INCOME
Income that is part of the tax base, but its tax share is deducted from the calculated tax amount. (e.g. including maternity benefit, university scholarships, pension)
TOTAL INCOME / TAX BASE

Source: Hungarian tax income forms

The factor elasticity results are systematically lower for the regression results (Table 11), as the dif-in-dif results (Table 10) are biased upward due to the different income growth rates between the two groups. The total reported income elasticity with the factor regression estimation is a slightly different from the previous regression elasticity outcomes because the change is calculated in percentage here and in log differences there. The sum of all factor elasticity adds up to the total income elasticity. I only list the components which considerable contribute to the total elasticity. The main conclusion of Table 10 is that the prime employment salary change adds the most to the behaviorial change.

Table 10: Factor elasticities with the dif-in-dif method

	Pensioner excl.	Pension inc. excl.	Employee	No entr	Age -30	Age 30-55	Age 55-
Prime employment salary	0.21	0.30	0.28	0.24	1.35	0.25	-2.79
Foreign delegation	0.03	0.03		0.03	0.09	0.03	0.04
Other salary income	0.02	0.03		0.02	0.03	0.00	0.19
Other employment salary	0.07	0.04		0.07	0.19	0.05	0.16
Self employment income	0.01	0.00		0.01	-0.09	0.04	-0.15
Other nontaxable income	-0.10	-0.10		-0.10	-0.53	-0.05	-0.10
Total income / tax base	0.27	0.32	0.28	0.29	1.05	0.36	-2.76

Foreign delegation, other salary income, other employment salary and self employment salary resemble the same change as the prime employment salary only smaller. In addition, there is a sign difference of the coefficients of non taxable income items between the two estimation approaches due to the bias. Accepting the benchmark regression result of Model 4, the 0.04 percent elasticity of other nontaxable income implicates that after a tax increase the reported non taxable items including maternity benefits, pension, and scholarship will decrease. One reason for this could be that women go back to work earlier from maternity leave or fever women quit the job market to raise children.

Table 11: Factor elasticities with regression method

	Model 1	Model 4	
	Δlog(1-MTR)	**Δlog(1-MTR)**	Δlog(1-ATR)
Prime employment salary	0.17	0.10	-0.58
Foreign delegation	0.01	0.01	-0.03
Other salary income	0.00	-0.01	-0.04
Other employment salary	0.00	0.01	0.30
Self employment income	0.01	0.01	0.09
Other nontaxable income	0.01	0.04	0.93
Total income / tax base	0.19	0.15	0.69

4.3 A back of envelope calculation

This subchapter demonstrates implications due to tax reforms on the taxpayers' income and on the budget revenue change depending on the elasticity. I will use Benczúr's(2007) calculation model. The first calculation resembles the aggregate effect of the actual tax reform including the income tax and employee social security contribution changes and the surtax introduction. This includes the benchmark 0.14 substitution elasticity and shows how different outcomes can emerge depending on the different income elasticity parameters. The second scenario calculates the effect of the additional 4 percent surtax. It estimates the budget revenue difference in 2008 between the new tax system with the surtax and without the surtax. The surtax was levied on taxpayers' earnings exceeding the pension ceiling. My sample contains those people who were above the actual pension ceiling in 2005 and also remained there in 2008. The total effect might be different from my estimation, as some people left and some new ones joined this high income group.

The total effect estimation of the income tax, employee social security contribution and the surtax change is presented in Table 12. The average income for earnings above the pension ceiling was inflated[4] to the 2008 real wage level. While the tax price elasticity is the

[4] I used the Hungarian Statistical Offics's gross nominal wage index growth of 125.6 between 2005 and 2008.

benchmark 0.14, the income effect varies between -0.74 to 1.5 because I have not received an analogous significant result.

Table 12: effect of total MTR change

2005 - Before reform					
Average income in 2005 for >6000k	11 516 578				
Personal income tax	4 076 300				
Social security contribution	1 085 829				
Total tax in 2005	5 162 129				
Tax price elasticity	0.14	0.14	0.14	0.14	0
Income effect coefficient	-0.75	0	0.75	1.5	0
2008 - After reform					
Change in taxable income (%)	3.727	-1.145	-5.788	-10.212	0
Average income in 2008	11 945 798	11 384 744	10 850 042	10 340 452	11 516 578
Personal income tax	3 994 487	3 792 508	3 600 015	3 416 563	3 839 968
Social security contribution	1 573 950	1 531 871	1 491 768	1 453 549	1 541 758
Surtax	192 352	169 910	148 522	128 138	175 183
Total tax in 2008	5 760 789	5 494 288	5 240 305	4 998 250	5 556 910
Change in paid tax	598 660	332 160	78 176	-163 879	394 781
# of taxpayers in this income range	75 208	75 208	75 208	75 208	75 208
Change in the budget (Billion HUF)	45	25	6	-12	30

The change in taxable income is calculated with the equation below:

$$d\log(\hat{income}) = d\log(1 - MTR) * TPE + d\log(1 - ATR) * IEC$$

where TPE is stands for the tax price elasticity and IEC for income effect coefficient. I calculate the new average income by a two step method. First the pure income effect was calculated, then the change in the taxable income effect was considered. The additional budget revenue or loss varies from -12 billion to 45 billion depending on the income effect.

The fifth column shows that the additional tax revenue would have been 30 billion in case of a no behaviorial answer. The first column displays the scenario where the income effect is stronger than the substitution effect. Hence, people work, earn more and also pay more taxes

http://portal.ksh.hu/portal/page?_pageid=37,592876&_dad=portal&_schema=PORTAL

after the tax increase. As it can be seen in the second column, the plus revenue would be 25 billion in case of only substitution elasticity and no income effect.

Table 13: effect of surtax

2005 - Before reform					
Average income in 2005 for >6000k	11 516 578				
Personal income tax	4 076 300				
Social security contribution	1 085 829				
Total tax in 2005	5 162 129				
Tax price elasticity	0.14%	0.14%	0.14%	0.14%	0%
Income effect coefficient	-0.75%	0%	0.75%	1.5%	0%
2008 - After reform					
Change in taxable income (%) with surtax	3.727	-1.145	-5.788	-10.212	0.000
Change in taxable income (%) without surtax	2.546	-0.123	-2.723	-5.256	0.000
Average income with surtax	11 945 798	11 384 744	10 850 042	10 340 452	11 516 578
Average income without surtax	11 809 817	11 502 381	11 202 949	10 911 311	11 516 578
Δ in average income	135 981	-117 637	-352 907	-570 859	0
Δ in personal income tax	48 953	-42 349	-127 047	-205 509	0
Δ in social security contribution	10 199	-8 823	-26 468	-42 814	0
Δ in surtax	192 352	169 910	148 522	128 138	175 183
Δ in total paid tax	251 504	118 738	-4 993	-120 186	175 183
# of taxpayers in this income range	75 208	75 208	75 208	75 208	75 208
Tax revenue with surtax	45	25	6	-12	30
Tax revenue without surtax	26	16	6	-3	17
Δ in budget (Billion HUF)	19	9	0	-9	13

Table 13 shows a hypothetical budget revenue difference in 2008 between the new tax system with the surtax and without the surtax from people who earned more then the pension ceiling in 2005. The columns of Table 13 demonstrate different tax price elasticity scenarios. The last column shows the additional revenue due to the levied 4 percent surtax without any bahaviorial response. In case of this benchmark no behaviorial model the plus surtax revenue would be 13 billion. As it can be seen in the second column, this additional budget revenue would equal 9 billion with only substitution effect. Depending on the income effect the additional budget revenue or loss varies between 9 and 19 billion forints. It is notable that

even this small behaviorial response might alter the central revenue income by several billion forints.

5. Conclusion

In my thesis I investigate the reported income elasticity of the top 5 percent high income segment in Hungary. The 2006 introduction of the additional 4 percent surtax burden on taxpayers earning more than the pension ceiling allowed me to estimate the elasticity coefficients. I applied both the Feldstein style dif-in-dif and the Gruber-Saez 2SLS regression methods. My empirical study is among the pioneers to analyze the behaviorial responses of the "richest" taxpayers to tax reforms in Hungary.

My benchmark empirical research finds a 0.14 reported income elasticity coefficients for the top earners in Hungary. This fits into the lower range of empirical elasticity findings for top income groups. As seen in the last section, even this small behaviorial response might alter the central revenue income by several billion forints. Further future research is required to investigate the tax reforms effect on the separately taxable items and also to separate the possible tax evasion effect.

Appendix

Upper indexes refer to individuals and lower indexes to time periods.

Income factors equal the total reported income:
$y_t^1 = w_t^1 + z_t^1$

For each person the regression for calculating the reported income elasticity:
$$\beta_y \Delta \ln(1 - MTR) + \alpha_y = \frac{y_2 - y_1}{y_1} = \frac{w_2 + z_2 - w_1 - z_1}{w_1 + z_1}$$

Sum of factors elasticities equal the total rported income elasticity:
$\beta_z + \beta_w = \beta_y$ and $\alpha_z + \alpha_w = \alpha_y$

$$\beta_y \Delta \ln(1 - MTR) + \alpha_y = (\beta_z + \beta_w)\Delta \ln(1 - MTR) + (\alpha_z + \alpha_w) = \frac{w_2^{\,2} - w_1^{\,2} + z_2^{\,2} - z_1^{\,2}}{w_1^{\,2} + z_1^{\,2}}$$

Calculating the elasticity of factor w for both individual by separating the above equation to parts:
$$\frac{w_2^{\,1} - w_1^{\,1}}{w_1^{\,1} + z_1^{\,1}} = \beta_w \Delta \ln(1 - MTR^1) + \alpha_w \quad \text{and} \quad \frac{w_2^{\,2} - w_1^{\,2}}{w_1^{\,2} + z_1^{\,2}} = \beta_w \Delta \ln(1 - MTR^2) + \alpha_w$$

Finally substracting them to get the dif-in-dif formula:
$$\beta_w = \left(\frac{w_2^{\,1} - w_1^{\,1}}{w_1^{\,1} + z_1^{\,1}} - \frac{w_2^{\,2} - w_1^{\,2}}{w_1^{\,2} + z_1^{\,2}} \right) / \left(\Delta \ln(1 - MTR^1) - \Delta \ln(1 - MTR^2) \right) =$$
$$= \left(\frac{w_2^{\,1} - w_1^{\,1}}{w_1^{\,1} + z_1^{\,1}} - \frac{w_2^{\,2} - w_1^{\,2}}{w_1^{\,2} + z_1^{\,2}} \right) / \left(\ln(1 - MTR_2^1) - \ln(1 - MTR_1^1) - \left[\ln(1 - MTR_2^2) - \ln(1 - MTR_1^2) \right] \right)$$

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