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MASTER THESIS

The Effect of Czech 2008 Flat Rate Personal Income Tax on Tax Evasion

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Declaration of Authorship

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Abstract

The main goal of this thesis is to examine the effect of Czech's 2008 flat rate personal income tax reform on consumption, income and tax evasion since there is a belief that personal income tax rates are partially responsible for high levels of tax evasion. We use the gap between household expenditures and reported income as a proxy for tax evasion with the Czech microeconomic data from the 2006-2008 Household Budget Survey. Employing difference-in-difference approach, we find no effect of the Czech flat personal income tax rate on tax evasion for households with one economically active individual in the year 2008 relative to households experiencing no change.

JEL Classification H20, H21, H24, H26, H29,
Keywords Tax Evasion, Personal Income Tax, Optimal Taxation, Flat Tax

Abstrakt

V této diplomové práci si klademe za cíl vyšetřit vliv české rovné daně z příjmů fyzických osob z roku 2008 na spotřebu, příjem a daňový únik, neboť teorie naznačuje, že daň z příjmů fyzických osob je částečně zodpovědná za vysokou úroveň daňového úniku. Užitím českých mikroekonomických dat ze Statistiky rodinných účtů odhadujeme rozdíl mezi výdaji a přiznanými příjmy domácnosti jako proxy pro daňový únik. Použitím ekonometrické metody difference-in-difference jsme zjistili, že se daňové úniky v prvním roce přijetí rovné daně z příjmů fyzických osob nezměnily pro domácnosti s jedním ekonomicky aktivním členem vzhledem k domácnostem, které změnu nepociťují.

Klasifikace JEL H20, H21, H24, H26, H29,
Klíčová slova daňový únik, daň z příjmů fyzických osob, optimální zdanění, rovná daň

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Chapter 1

Introduction

The objective of this thesis is to find the effect of Czech 2008 flat rate personal income tax on tax evasion,[1] since there is a belief that personal income tax rates are partially responsible for high levels of tax evasion. The Czech Republic has adopted a flat tax which came into effect on the January 1, 2008. The new personal income tax has been imposed at a flat rate of 15%, replacing the old system of four rates (12%, 19%, 25%, and 32%). The method which this thesis uses helps to assess the effect of changes in personal income tax on the rate of tax evasion by using consumption and income from the Czech microeconomic data from the 2006-2008 Household Budget Survey.

By adopting the flat tax reform, the Czech Republic joined other European countries (Estonia, Slovak Republic, Bulgaria, Lithuania, Latvia, Romania, Serbia, Ukraine, and Macedonia) which have adopted flat rate income tax reforms. However, no study has been made so far, after the Czech 2008 flat tax reform, to show the effect of this reform on tax evasion.

The Czech economy experienced a solid above 6% economic growth before the flat tax reform while the real GDP in 2008 grew only 2.5%. The collection from the personal income tax declined from 20% in 2007 to 19% in 2008. This decline in collection could be explained by worse performance of the real economy or by worsen voluntary compliance from taxpayers. Moreover, the average real monthly income grew by 1.9% from 2007 to 2008. Knowing all this we try to find whether there is an effect of flat tax reform that stands behind the decline in collections from the personal income tax.

Tax evasion is not traceable by tax authorities because it bears a problem of identification and therefore it is hard to measure any rate of it. However,

[1] Tax evasion is an illegal practice of intentional avoidance of paying true tax liability. On the contrary tax avoidance is legal practice of lowering tax payments, usually at some cost.

there is a growing number of studies with several attempts to measure and/or estimate the extent/effect of tax evasion. In this thesis, we, inspired by the study of Gorodnichenko *et al.* (2009), use the difference between reported consumption and reported income, which Gorodnichenko *et al.* (2009) call the consumption-income gap, as a proxy of tax evasion. The approach used in this thesis is the difference-in-difference approach with identified treatment group based on after-reform reported income because a taxpayer experiencing the flat marginal tax rate should not have behavioral response to the pre-reform tax rate treshold.

This thesis contributes to the empirical public finance literature by providing estimates of tax evasion in the Czech Republic by exploiting natural experiment that occured because of the tax reform.

In our thesis we give a brief overview of the theoretical concept of flat tax and describe principles of good tax policy. It helps us to understand the flat tax which the Czech Republic introduced and see that there still are several features of the Czech flat tax that make it an imperfect flat tax. In particular there is still some double taxation of corporate income, and the personal income tax is still biased against saving and investment.

Next, we present Hindriks & Myles (2006) version of theoretical Allingham and Sandmo model to explain why people evade taxes and what variables make taxpayers evade. This model is the simple application of individual choice under uncertainty firstly introduced by Allingham & Sandmo (1972). The variables that have an effect on taxpayers decision to evade taxes are changes of the probability of detection, fine rate, income level, and tax rate. Theoretical results suggest that an increase in probability of detection, in fine rate and in tax rate decrease evasion rate while an increase in income level rises the amount of evaded income.

We continue with a description of the Household Budget Survey the micro-level data. We do so in order to replicate the study of Gorodnichenko *et al.* (2009). Their article is probably the first article to examine the effect of flat rate income tax on consumption, income, and tax evasion. They find, using micro-level data, that the Russia's 2001 flat rate income tax reform decreased the difference between consumption and reported income by about 9 to 12 percent for households that experienced a reduction in marginal tax rates. Following their econometric specification we find that the Czech Republic 2008 flat personal income tax rate had, in the first year of the reform, no effect on tax evasion for households with one economically active individual experiencing

a reduction in marginal tax rates.

The thesis is structured as follows: Chapter 2 reviews previous theoretical and empirical work on tax evasion as well as combination of tax evasion with flat tax. Chapter 3 describes principles of good tax policy highlighting equity, efficiency, and simplicity; and discusses the theoretical concept of flat tax. Chapter 4 introduces the modified flat tax of the Czech Republic and its important changes in corporate income tax, personal income tax, and other taxes. Chapter 5 presents the basic theoretical model of the taxpayer's evasion decision focusing on the effect of change of the probability of detection; fine rate; income level; and tax rate. It also touches the government's policy decision against tax evasion. Chapter 6 describes the Czech individual-level data on household consumption and income from the Household Budget Survey and defines the key variables. Chapter 7 describes and replicates the Gorodnichenko *et al.* (2009) approach of analyzing tax evasion based on the permanent income hypothesis suggesting the equality of consumption and permanent income. The econometric specification is developed here and adjustment steps for baseline dataset are described. Furthermore, this chapter describes the assignement of households into treatment group. Chapter continues with estimates of the tax evasion response and with comparing of results. Chapter 8 concludes.

Chapter 2

Literature Survey

The first method to measure tax evasion is survey evidence, either direct or indirect. However, surveys asking directly whether a taxpayer does evade or does not evade are not very credible because of the simple fact that those respondents who already evade taxes will not provide truthful answers. To eliminate this problem the survey should be indirect, and most studies are. In other words collected information should be about attitudes toward evasion. The second method is to measure tax evasion via measurable economic variables. Usually this method is used to measure size of shadow economy the tax evasion is connected with. This measure of shadow economy is determined by the total economic activity from which the measured activity is subtracted. There are two approaches: the direct input approach and the monetary approach. The former employs electricity as an input to production from which the output is predicted. The latter employs the demand for cash because all transactions in shadow economy are done via cash. (Bank accounts are easily traceable.) Then the estimation of shadow economy is estimated due to the relationship between the quantity of cash and the level of economic activity.

The connection of flat tax with tax evasion is not new to the literature, however, probably the only paper measuring the tax evasion under flat tax is Gorodnichenko *et al.* (2009). Gorodnichenko *et al.* (2009), using the micro-level data (1998, 2000-2004 rounds of the Russian Longitudinal Monitoring Survey), examine the effect of Russia's 2001 flat rate income tax reform on consumption, income, and tax evasion. They use the difference between reported consumption and reported income, which they call the consumption-income gap, as a proxy for tax evasion. They find large and significant changes in tax evasion following the flat tax reform which are associated with changes in voluntary

compliance and cannot be explained by changes in tax enforcement policies. More about their approach is written later in this paper, since we base our analysis based on their approach.

There are studies concerned with tax evasion in the Czech Republic by Hanousek & Palda (2008), Hanousek & Palda (2002a), and Hanousek & Palda (2002b), however, none of these are in connection with flat tax. On the other hand, the first two mentioned studies model how tax evasion evolves and do not explain why people evade taxes as most of studies do. Hanousek & Palda (2008) provide the first study to use individual data to track aggregate dynamics of tax evasion in the Czech Republic since 1995, because as they say: 'understanding the dynamics of evasion is crucial for predicting future evasion'. They conducted their own survey every second year for six years since 2000 asking individuals whether they were presently, two, and five years ago evading taxes. They find that the number of evaders rose and then fell calling this 'inverse-U' path an 'evasional Kuznets curve'. As for the evolution of tax evasion in the Czech Republic they suggest, using the estimates of Markov transition probabilities, that the number of evaders will 'flatten or fall in the decade to come'.

Earlier study by the same authors (Hanousek & Palda (2002a)) forecasted the evolution of tax evasion in the Czech Republic based on dataset of 1062 individuals by asking them whether they evade taxes often, occasionally, or never, and on the finding of Engel & Hines (2000), using the American data, that tax evasion converges to a steady state. They predicted a rising tide of tax evasion in ten consecutive years after their study. Individual characteristics that Hanousek & Palda (2002a) mention are key for tax evasion decision are the individual's age, income, sex, and whether she lives in a town or in a village. They show that tax evasion raises with age of individuals. However, their finding is not supported by Clotfelter (1983) who concludes that common findings in indirect studies are that tax evasion declines with age and adds that it is more likely among individuals who know others who evade taxes. Hanousek & Palda (2002a) also provide suggestion to policymakers that they could fight tax evasion by lowering taxes or by making individuals believe that their reported money are spent on public goods of high quality.

The Czech Republic introduced flat tax in 2008 which was the year of global financial crisis. It can imply that, based on Engel & Hines (2000) study, rates of tax evasion in the Czech Republic fall due to the crisis. Engel & Hines (2000) when talking about the aggregate tax evasion behavior, point out that

if there is an observable aggregate economic shock influencing most taxpayers the pattern of tax evasion is predictable. As an example they give recession years because during those tax evasion rates are likely to fall because taxpayers' past evaded incomes appear to be large relative to their current incomes which are lower.

Talking about the current income, Bloomquist (2003) in his empirical analysis of the US data tests the hypothesis that a rise in income inequality leads to tax evasion. His hypothesis is similar to Christie & Holzner (2006). On the contrary, Christian (1994), as Slemrod (2007) cites, reports results that are consistent with the old saying that 'the poor evade and the rich avoid.' His non-conclusive findings say that relative to the size of people's true income higher-income people evade less than lower income people. He explains that rich do so through legal means such as avoidance because they can afford it while poor evade.

Studies measuring the responsivness of taxable income to changes in marginal tax rates relying on the econometric method which compares the relative change in taxable income of the highest-income taxpayers with other taxpayers. However, these studies, mostly focusing on high-income taxpayers, are not in connection with tax evasion but can be partly attributed to tax evasion under flat tax since the flat tax also usually changes marginal tax rates for the highest-income taxpayers. Goolsbee (2000) using panel data finds that the higher marginal rates lead to a significant decline in taxable income. Feldstein (1995) also using panel data suggests thath taxable income increases more for high income people than for low income ones. Lindsey (1987) use repeated cross sections and find that higher income taxpayers have higher elasticities. Another empirical study which estimate the sensitivity of taxable income to marginal tax rates is presented by Feenberg & Poterba (1993).

The flat tax eliminates double taxation on savings and investments which is a great incentive for individuals to save and invest more of their income. Grecu (2004) claims that the flat tax considerably reduces the time and cost of completing tax forms. Other benefits of a flat tax system presented by Grecu (2004) are that the flat tax exempts the poor from paying any tax by providing a generous personal exemptions; the flat tax may increases government revenue; and that the flat tax reduces tax evasion by lowering the opportunity cost of avoiding taxes. He supports this last benefit by saying that individuals are less willing to cheat and risk under a flat tax. He also claims that the government spends less money on monitoring and auditing a simpler fiscal system.

The theory behind the increase of government revenue is the 'Laffer curve'[1] which shows the trade-off between tax rates and tax revenues. Government can maximize tax revenue by setting a tax rate at a point T^*. Any increase of tax rate after this point will cause taxpayers to evade or work less leading to the reduction of total revenue. If the government, hypothetically, taxed people with 100% rate, no one would have incentives to work at all. However, this does not need to be true in the real life. Kim *et al.* (2006) find that the empirical evidence of the flat taxes that have been adopted bear no sign of Laffer-type behavioral responses generating revenue increases from the tax cut. Hall & Rabushka (1995) and Hall & Rabushka (2007) claim that under the single taxation rate it is easier to collect tax due, and that tax avoidance and evasion are discouraged. They say that high tax rates reduce economic output and also foster tax avoidance and evasion. Hall & Rabushka (1995) also present three reasons of Lawrence B. Lindsey why lower rates increased the share of taxes paid by the rich. The first reason is that the highest income group of taxpayers will shift money from consumption or tax-sheltered investments into more productive, taxable investments, implying that the tax avoidnace declined and efficiency increased. The second reasons claims that taxpayers become more honest as evasion become less rewarding which imply decrease of tax evasion. The final reason is that incentives improved because some taxpayers, who gain higher after-tax returns, simply work harder.

Lastly, Feld & Frey (2006) argue that a psychological tax contract which establishes a fiscal exchange between the state and the citizens shapes tax compliance to a large extent. They find, through the study conducted in Switzerland, that the more respectfully Swiss citizens are treated, the more they acknowledge it by higher tax compliance.

[1]The Laffer curve was not invented by Arthur B. Laffer but named after him, when he drew the curve to illustrate the concept.

Chapter 3

Principles of Good Tax Policy & Flat Tax

In this chapter we describe principles of good tax policy and discusses the theoretical concept of flat tax.

3.1 Principles of Good Tax Policy

When the Czech Republic build the new tax policy it had to cope with the traditional measures of effective taxation such as equity, simplicity, and economic efficiency which are all difficult to fulfil simultaneously. Already Adam Smith in 1776 established so called 'four maxims with regard to taxes', one of which was the need for equity in a tax system. Many authors cite Adam Smith's maxims and add their attributes for an ideal system such as simplicity, transparency, neutrality, economic efficiency, etc. Authors who follow are for example: Hall & Rabushka (1995) or Hunter & Entin (2005).

Tax equity has been the most frequently discussed characteristics among scholars who define an ideal tax system. For example, Hall & Rabushka (1995) define equity as equal treatment to equals. Another definitions of equity can be in levels so that everybody pays the same amount, or in percentage terms so that everybody pays the same fraction, or in the ability to pay. Equity has the same interpretation as fairness which can have different meanings to different people, especially when considering an income tax. Tax equity thus can be understood in two different ways: vertical equity and horizontal equity. Vertical equity means that people with different income should be treated equally. However, Hall & Rabushka (1995) claim that vertical equity is not rooted in

the philosophy of fairness because this approach is a twentieth-century phenomenon that has come to mean that individuals with above-average incomes, in other words successful individuals, should pay higher fraction of their income in taxes. As for horizontal equity, Hall & Rabushka (1995) define horizontal equity as that individuals under similar circumstances should bear equal tax burdens. To say it in other words, it means that people with equal incomes are taxed equally. They argue that a flat tax satisfies this norm.

Efficiency means that taxes should not interfere with relative prices. Whenever an individual responds to changes in relative prices due to taxation, then we talk about distortion. Hagemann *et al.* (1988) explain relative prices change based on so called 'wedges' between the before and after tax prices of goods, services and factors of production. They say that relative prices change when these wedges are of different sizes. Hagemann *et al.* (1988) claim that tax rates, and elasticities of supply and demand for goods and factors of production, and the elasticities of substitution in production between factors, influence the size of distortions. Efficiency is sometimes reffered to as economic neutrality because taxation should not distort economic processes and influence individuals decisions.

Simplicity means that taxes should be designed in a way that tax authorities have as minimal cost to administer and enforce the tax as possible, and that individuals have minimal cost to comply with the tax. When tax rules are complicated it is difficult and costly for individuals to understand it and correctly file their tax return. A complicated tax system also makes it hard for tax authorities to monitor tax collections and creates possibility for loopholes.

3.2 Flat Tax

In 1985, Robert Hall and Alvin Rabushka's book, *The Flat Tax*, developed a tax reform that is based on a single tax rate, a flat tax, for all sources of 'earned' income. Their proposal achieves simplicity, and fairness as explained in previous section.

The individual income tax is, under the Hall-Rabushka proposal, defined as the flat tax rate times wages, salaries and pensions, less personal allowance. And the business income tax is the multiple of the flat tax rate and the total revenue from sales of goods, less purchases of inputs from other firms, less wages, pensions paid to workers, less purchases of plant and equipment.

Flat tax should have one basic tax rate for all income, and there should

be very few deductions. The deductions that are allowed should be necessary for calculating income correctly without favoring source of income or one kind of economic activity or one taxpayer over another. Another, more important, way in which a true flat tax has to be flat is in the choice of tax base.

Simplicity of flat tax is reflected in the fact that the tax form requires only a few calculations. One of the most important features of the flat tax system is that it taxes all income once only and this income tax is applied to its source as close as possible. Another fundamental feature of the flat tax is that it taxes income uniformly. There are no rate differentials between different types of income and this is equitable.

As for efficiency, Hall and Rabushka do not discuss the implications of single tax rate for efficiency. Efficiency in taxation implies different tax rates but flat tax as proposed by Hall and Rabushka eliminates the consumption bias in income taxation.

Hall *et al.* (1996) say that the tax system Hall and Rabushka developed would put a low 19 percent tax rate on a comprehensive definition of income[1] which would raise the same revenue as the current tax system and that the proposed tax is fair to families. The poor would pay no tax at all. This is the single exception that makes Hall-Rabushka's proposal progressive but far less progressive than a system of rising tax brackets. The families having the income above the allowance pay tax on the income above the exemption level. In other words, the proportion of income paid in taxes rises with income.

There is a significant distinction between income-based taxes and consumption-based taxes. A true flat tax is based on the amount of national income used for consumption. Consumption-based taxes do not discriminate (they are 'neutral') between income that is used for consumption immediately and income that is used for saving and investment, and consumed at a later date. The present value of the tax on current and future consumption is the same in either case. By contrast, income-based taxes are biased against saving and investment. They are imposed on income and on returns to saving. That places a higher present value tax on income saved now and consumed later than on income consumed right away.

All income taxes are biased against saving or investment. Saving puts a cost on the saver. He must defer consumption to buy the assets that earn

[1]Comprehensive income or the Haig-Simons income is, as it is defined, a measure of economic income as a sum of consumption (purchase or acquisition of goods and services of any kind without capital expenditures and the full spending is amortized) and change in wealth.

future income. The loss of consumption is the opportunity cost of the saving. Another way to say this is that the income tax ignores the time value of money by taxing the basic risk-free return on saving. If inflation is zero, and the real discount rate is 3%, then a Czech crown saved today, under the risk free interest rate, is worth exactly the same thing, in present value, as CZK 1.03 next year. The .03 CZK difference received next year is not a real income gain for the saver. If we tax the crown when it is first earned, and then also tax the CZK .03 in interest, there is a higher present value of income tax on the crown that is saved (and spent later with its interest) than on a crown earned and spent immediately.

There are two ways to eliminate this basic income tax bias against saving. One way is to defer the income tax on saving, taxing it only when the saving and its interest earnings are withdrawn for consumption. An alternative way is to tax the amount of income that is saved when it is first earned, but then not tax the future earnings of the savings. Either method makes the tax have the same present value for saving and for immediate consumption. In many countries, there are pension or personal retirement arrangements, or tax free government bonds, that have one of these kinds of neutral treatment. (In all these cases, the consumption is hit again by the VAT and any excise taxes that exist in the country whenever the consumption occurs.)

In addition to the basic income tax bias against savings, there are usually additional taxes imposed on saving. These include the corporate taxes and estate taxes. In a true flat tax system, the income from corporations would either be taxed at the corporate level, or at the individual level, but not both. If there is a corporate tax, there would be no tax on dividends or capital gains due to reinvested corporate income. If the income is not taxed at the corporate level, then the individual would pay tax on dividends or when he sells his shares (unless he saves the money to defer the tax). There would be no separate estate tax in a neutral tax system. If the income had been taxed when it was first earned, there would be no tax at the time of the transfer.

Another issue is that the income tax uses depreciation to calculate the amount that businesses are allowed to deduct against revenue to reflect the consumption of capital. Depreciation over time is always lower in present value than the immediate cost of the investment. It leads to the overstatement of the profit now, which over-taxes the profit. The correct treatment of capital consumption to avoid over-taxing the profit is to allow a deduction for the full cost of the asset in the same year as the asset was purchased. That is called

'expensing'. Alternatively, the tax authorities could allow delayed write-offs to be expanded by some interest rate to keep the present value equal to the original purchase price.

There are several forms of tax that are consumption-saving neutral. They include consumed-income or saving-deferred income taxes, returns-exempt income taxes, the value added tax (VAT), or a retail sales tax. All of them tax the amount of national income used for consumption. These taxes tax only above-normal returns, not the time value of money. If these taxes are imposed evenly, and are not doubled-up on some income but not other income, they are truly neutral or flat in all respects. Under consumption-based taxes, all saving is given either deferred taxation, or the returns are tax exempt. Consumption taxes have no added corporate taxes or transfer taxes. All consumption taxes (consumed-income tax, saving-deferred tax, returns-exempt tax, VAT and sales tax) have expensing.

Chapter 4

The Modified Flat Tax of the Czech Republic

The Czech Republic has adopted a new tax system that may best be described as a 'modified flat tax'. It has some features of a broad-based income tax, and some features of neutral or consumed-income tax. The public finance reform package was approved by the lower house of the Czech Parliament by a very close vote on August 21, 2007. On September 19, 2007 it was approved by the upper chamber. It was signed into law by President Václav Klaus on October 5, 2007. The new tax system became effective January 1, 2008.

The reform package made major changes in the personal income tax and in the corporate income tax. Although it is referred to as a 'flat tax', it is not a true flat tax for a number of reasons. A true flat tax would impose a single tax rate on all income, allowing only those deductions necessary to measure income correctly, with no exemptions (except for some form of personal or family allowance to shelter the poorest citizens). There would be no double taxation of corporate and individual income, and no tax bias against income saved as opposed to income used for consumption. The result would be a saving-consumption neutral tax, sometimes called a consumed-income tax.

The Czech Republic has adopted a modified flat tax. It has two flat rate taxes, one on personal income and one on corporate income. It allows for some deductions. It has a system of pension savings deductions and matching government contributions for personal saving plans that take the income tax bias off some of the savings done by individuals. It includes corporate dividends in personal income, as well as imposing a corporate income tax. However, it exempts long term capital gains from income. In effect, there is a double tax on

corporate income paid out as dividends, but not on corporate income reinvested to raise the value of the corporation and its stock. Capital cost recovery for businesses involves depreciation rather than immediate expensing, but with some acceleration of write-offs. Consequently, the system is a hybrid between a 'broad-based income' tax and a 'consumed-income' tax.

Certain social benefits has been trimmed to offset losses in Government revenues due to the reform. Other offsets to the income tax cut include the VAT; introduction of environmental taxes; abolition of sick-leave compensation for the first three days of sick leave; and decreasing the tax relief for mortgages and life insurance policies.

All Czech residents and foreigners with permanent residence in the Czech Republic who are physically present in the Czech Republic for at least 183 days within a calendar year are considered as Czech residents for tax purposes and pay income tax on their worldwide income. Non-residents are those individuals who do not have permanent residence or spent less than 183 days in a calendar year in the Czech Republic. Non-residents pay income tax only on Czech-source income.

Following subsections introduce important changes in tax system.

4.1 VAT

Under the tax reform, the lower VAT tax rate rises from 5% to 9% to balance the cost of lowering other rates. The standard VAT remains at the rate of 19%. The reduced rate of 9% applies to food, medications, services for the provision of water and heating, newspapers and books.

Some types of economic activity are exempt from the VAT tax, and do not count as VAT-deductible expenses by purchasers; exempt items include postal services, broadcasting services such as radio and television, services of financial institutions such as banks or insurance companies, planning and instructions, upbringing and education, health services and goods, welfare services, lotteries and games of chance, and non-profit making organizations.

A VAT is inherently neutral in its treatment of income that is used for consumption and income that is saved for investment. The consumer pays no VAT until he or she spends the income, so saving is tax deferred as far as VAT is concerned. At the various stages of production, the VAT exempts investment spending. This is because each business receives a rebate of VAT that it pays on purchases from other businesses. That includes the purchase

of capital investment goods such as vehicles, machinery, buildings, and other structures. The result is a tax that is imposed on total consumption spending, but not on investment.

4.2 Corporate Income Tax

The corporate income tax rate has been reduced from 24% to 21%; it had been scheduled to be successively reduced to 20% in 2009 and to 19% in 2010. The reduction of the corporate income tax is designed to maintain competitiveness with other Central and Eastern European countries. The tax-reform package also widened the tax exemption for dividends received by a Czech parent firm or a unit of an EU company to avoid taxing income moved between companies twice. The package also exempts companies from capital gains taxes. Interest outlays are normally deductible on primary debt; however the Czech tax system imposes some limits on the deduction of interest to discourage over-leveraging of business.

4.3 Personal Income Tax

The new personal income tax has been initially imposed at a flat rate of 15%, replacing the old system of four rates (12%, 19%, 25%, and 32%), see Table 4.1. The flat personal income tax rate is a cornerstone of the tax-reform package. However, the amount of income subject to tax has increased to include social insurance contributions that were formerly deductible. Personal income tax is no longer calculated on an employee's net wage (the gross wage less the individual's social and health insurance contributions). It is calculated from the so-called super-gross wage, which includes the compulsory insurance contributions paid by the individual and the individual‘s employer. The super-gross wage is 135% of the gross wage. This makes the 15% tax rate equivalent to a rate of 22.4% on the net wage that was taxable under the old system.[1] The

[1]Under the old system, the social insurance tax was deductible, and the income tax was imposed on the remaining wages. Under the new system, the income tax is imposed on the so called super-gross wage, which is a tax payer's gross income increased by social and health insurance paid by employer. The super-gross wage (the tax base) for an unmarried taxpayer with no child and with a monthly gross income of CZK 20,000 is CZK 27,000 (a gross income increased by 35% of gross income, in our case it is CZK 7,000). The 15% tax then is CZK 4,050 from which the tax allowance of CZK 2,070 (estimated by Tax Income Law) is subtracted. The amount of money the tax payer should pay is then CZK 1,980 but a tax payer must in addition pay 12.5% of his gross wage for social and health insurance.

increase in the tax base has been partly offset by an increase in the personal allowances, which are subtracted as credits from the tax owed. The overview of personal allownaces for year 2008 is in Table 4.2.

Table 4.1: Personal Income Tax Rate Schedule

2006-2007 Tax Base over	**But not over**		**Of the amount over**
CZK 0	CZK 121 200	12%	-
CZK 121 200	CZK 218 400	CZK 14 544 + 19%	CZK 121 200
CZK 218 400	CZK 331 200	CZK 33 012 + 25%	CZK 218 400
CZK 331 200	and more	CZK 61 212 + 32%	CZK 331 200
2008 Tax Base over	**But not over**		**Of the amount over**
CZK 0	and more	15%	-

Source: § 16 of Act No. 586/1992 Coll. Income Tax

Table 4.2: Personal Allownaces 2008

Annual Allowance	**Amount in CZK**
Annually for each taxpayer	24,840
Pensioner	24,840
Incomeless wife/husband	24,840
Incomeless wife/husband - disabled	49,680
Disabled person with partial disability pension	2,520
Disabled person with full disability pension	5,040
Disabled person	16,140
Student	5,040
Child	10,680
Disabled Child	21,360

Source: § 16 of Act No. 586/1992 Coll. Income Tax

The 2007 reform also introduced the so-called ceiling, or a maximum assessment base, for the calculation of health and social insurance contributions. The insurance tax is imposed on wages and salaries up to a maximum base of 4.8 times the average national wage.

The personal income tax is one of the most important revenue sources for

It makes it for our case CZK 2,500. Adding the tax CZK 1,980 we get the amount of CZK 4,480. The tax payer's net income then is only CZK 15,520 which makes the personal income tax higher than 15%. In reality it makes it 22.4%. With true 15% income tax the tax payer's net income would be CZK 17,000 not CZK 15,520. If our taxpayer's income was CZK 30,000 her net income would be CZK 22,245 which makes the income tax even higher with the rate of 25.85%.

the national budget.[2] It is imposed on individuals' labor and capital income. It is paid by employees, savers, and owners of non-corporate businesses on income from employment such as salary, wages, or other compensation for work; profits and other income from non/corporate businesses and other self-employment activities; dividend and interest income and short term capital gains from capital assets; income from rentals and leases; and other income. Because long term capital gains (on property owned for more than six months) are not subject to tax, and because private pension contributions are partly tax-deferred, the system has some of the features of a consumption-based tax.

Income from employment is taxed at the source in most cases in the form of a payroll withholding calculated and paid by the worker's employer to the Financial Office. Barring any special designation, it is normally calculated at a rate of 15% on income which exceed CZK 5,000 per calendar month. However, because there are certain tax deductions, and credits in the form of personal allowances, that reduce the average tax rate below 15%, each worker is allowed to designate one employer who may take account of the worker's allowances in calculating a reduced withholding rate. (The designation of only one employer to take account of the allowances is necessary because many workers have two or more employers in the course of a year.)

4.4 Other Taxes

The other taxes that existed under the old tax system have been kept: the excise taxes, road tax, real estate tax, real estate transfer tax of 3%, and the inheritance and gift taxes that range from 1% for related persons to 40% for non-related persons.

4.5 The Czech Tax System: Improved, But Still in Need of More Reform

The Czech Republic has moved some way from an income tax system with high, graduated tax rates, especially on capital income, toward one that is both flatter and more consumption-based and less harmful to saving and investment.

[2]Taxes on individual or household income including capital holding gains were 20% of total tax receipts in 2007 (153,372 million CZK out of 740,931 million CZK) and in 2008 it counted 19% (136,469 million CZK out of 712,305 million CZK).

However, several features of the Czech flat tax make it an imperfect flat tax that retains some of the tax biases against savings of progressive income tax. There is room for more improvement. Income that is used for saving and investment outside of the limited pension arrangements is taxed more than once in the Czech tax system. Income is taxed once when first earned. If the after-tax income is not spent, but saved, then its returns are taxed (except for long term capital gains). In addition, if the saving is in corporate stock then the profit is taxed as corporate income tax at a rate of 21%. After-corporate-income tax dividends paid to shareholders are taxed again at a 15% rate as personal income. This means that there is a double taxation of corporate income. Small amounts of investment by businesses may be immediately expensed (tangible assets with useful life more than one year and a purchase price up to CZK 40,000). Larger investment outlays must be depreciated, which delays the claiming of the cost against the business's income. This adds to the cost of capital for the firm, and is one of the differences between a saving-consumption neutral tax (in which all investment in expensed) and an income tax. Consequently, there are some fundamental changes that the Czech Republic should still try to adopt. All saving should get the same treatment as pensions now receive. On saving that is not given the tax treatment of pension arrangements, there should be no tax on interest, dividends, or capital gains. If dividends are to remain taxable, then corporations should be allowed to deduct them, or the corporate income tax should be abolished. There should be no additional inheritance tax or gift tax beyond what the ordinary income tax imposes. There should be no tax on income from abroad (with careful steps taken to prevent 'transfer pricing' abuses to artificially shift income to lower tax countries).

In conclusion, when we look at the 2008 Czech tax system and compare it to what economists would call real flat tax concepts, we realize that the Czech tax system does not perfectly match to any of them. There is still some double taxation of corporate income, and the personal income tax is still biased against saving and investment because it taxes saving and the earnings of savings, except in limited pension arrangements or the case of long term capital gains. Firms are taxed on all their worldwide income, instead of having a territorial tax system. There are still inheritance and gift taxes. With some additional changes to further reduce the elements of the tax system that discriminate against saving and investment, the Czech tax system could become even simpler and more friendly to rapid economic growth.

Chapter 5

Theoretical Model: The Evasion Decision

In this chapter we try to explain why people evade taxes based on theoretical model presented by Hindriks & Myles (2006) who derive it from Allingham & Sandmo (1972). Allingham and Sandmo model, also known as A-S model, is the application of individual choice under uncertainty which captures the decision of a taxpayer to evade part of her income given some probability of being caught evading. However, this model is not directly linked to flat tax framework, we illustrate this model here to outline what assumptions/parameters make taxpayers evade.

Similar work to Allingham & Sandmo (1972), are presented by Watson (1985) and Jung *et al.* (1994) who also see the choice of a taxpayer to evade as a risky decision. Tax evading individuals see the expected utility of doing so and compare it to the probability of being caught by the tax authority. Individual's benefit is in case of not being detected significant while when the individual is caught evading then she must pay a fine. In the worst scenario the individual may go to prison if the evasion is large enough. In such case the individual is clearly worse off than individual who is honest and trully report all of her income. Therefore individual must ask herself how much to evade. She has to weight both possible outcomes, the chance of not being caught and gain, and the chance of being caught and bear all losses. Hanousek & Palda (2002a) critize this work for their static modeling of tax evasion over extended period.

5.1 Taxpayer's Decision Problem

Following Hindriks & Myles (2006) the decision problem an individual is facing can be modeled as follows: Let us have a taxpayer whose income is Y which is unknown to the tax collector, who declares X, where $0 \leq X \leq Y$. If there is no tax evasion then $X = Y$. The amount of underreported income is then given as $0 \leq Y - X$. Let t denote the marginal tax rate, then the total benefit of evading is $t(Y - X)$ if not caught. If our individual evades and is not caught, , which happens with probability $(1 - p)$, then her income is $Y^{nc} = Y - tX$ while when caught, with probability of p, all her income is taxed and has to pay fine: $Y^c = (1 - t)Y - Ft(Y - X)$ where F represents the fine levied on unpaid tax and the cost of evasion is then $(t + F) \cdot (Y - X)$.[1]

The maximized expected utility for optimal declaration X of our individual can be written as:

$$max_X E[U(X)] = max_X \left[(1 - p)U(Y^{nc}) + pU(Y^c)\right] \tag{5.1}$$

or equivalently:

$$max_X E[U(X)] = max_X \left[(1 - p)U(Y - tX) + pU((1 - t)Y - Ft(Y - X))\right]. \tag{5.2}$$

Let us consider that our individual is not declaring at all so that $X = 0$, then her income is Y in the case of not being caught and $[1 - t(1 + F)]Y$ if caught. If our individual is not evading and declares the whole income so that $X = Y$, then in both cases her income is $(1 - t)Y$. See Figure 5.1.

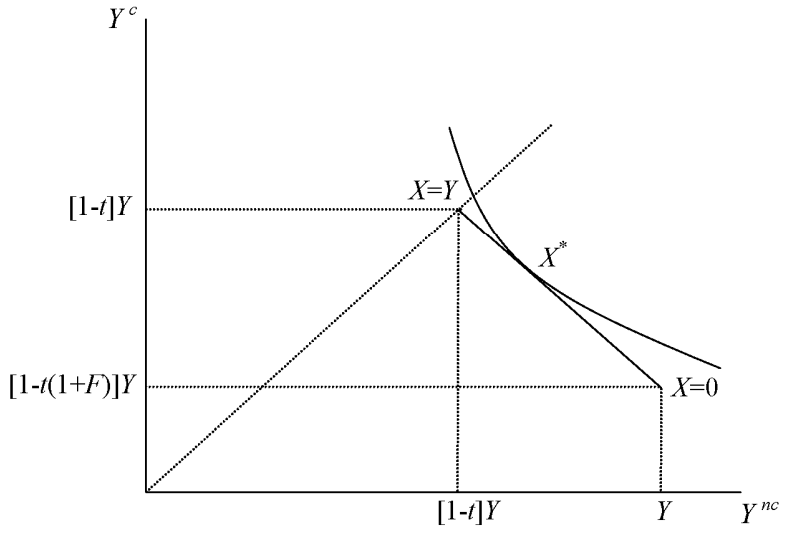
Figure 5.1 shows the income when the individual is not caught against income when caught. The individual can also choose any option that is on the line connecting points $X = 0$ and $X = Y$ based on her utility function which provides a set of indifference curves, one of which is depicted in the figure. Our individual chooses to declare X^*, achieving the highest indifference curve, which is the interior point with $0 < X^* < Y$.Therefore she declares less than her total income.

The corner solution is also possible. In the Figure 2a there is a choice of the individual to declare her whole income thus the optimum is $X^* = Y$. In the Figure 2b the individual evades the whole income and the optimum is $X^* = 0$.

The evasion occures when the indifference curve is steeper than the budget

[1] Sandmo (2005), who retrospectively presents the A-S model, denotes p as the taxpayer's subjective probability of detection.

Figure 5.1: The Evasion Decision: Interior Choice



Source: Hindriks & Myles (2006)

constraint where it crosses the 45° line. The slope of the indifference curve is:

$$\frac{dY^c}{dY^{nc}} = -\frac{[1-p]U'(Y^{nc})}{pU'(Y^c)}, \tag{5.3}$$

where $U'(Y)$ is the marginal utility of income at level Y. Taking into account that on the 45° line $Y^c = Y^{nc}$, so that $U'(Y^c) = U'(Y^{nc})$, the slope of the indiferrense curve where it crosses the 45° line is:

$$\frac{dY^c}{dY^{nc}} = -\frac{1-p}{p}. \tag{5.4}$$

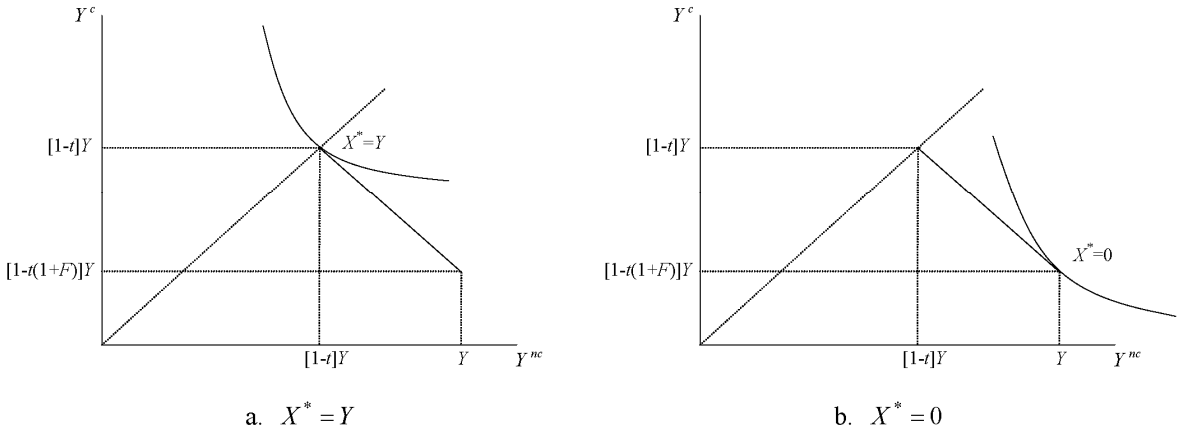
The slope of the budget constraint is $-F$.

From these properties the indifference curve is steeper than the budget constraint on the 45° line if

$$\frac{(1-p)}{p} > F. \tag{5.5}$$

However, this condition does not say anything about the extent of tax evasion, it only says whether evasion occures or not. The condition does not depend on the utility function U therefore, if any individual evades then all individuals should evade. From these conditions we can partially answer the question why people evade taxes. People evade when the probability of detection is too small relative to the fine rate.

Figure 5.2: The Evasion Decision: Corner Solutions

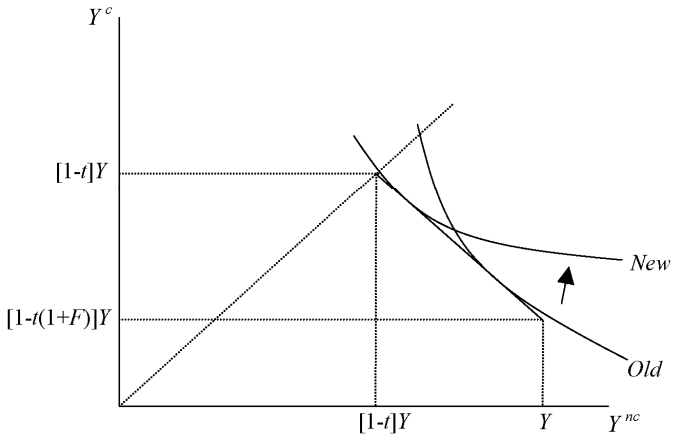


Source: Hindriks & Myles (2006)

Consider a scenario when the probability of detection p increases. Intuitively, one would expect that the evasion rate will decrease since no individual wants to be caught evading and be worse off, under the assumption of non zero fine rate, than honest individuals. According to Hindriks & Myles (2006) an increase in probability of detection reduces the gradient of the indifference curves where they cross the 45° line. This effect will lead to the shift of optimal point closer to the point $X = Y$ where the individual evades less because her income lowers whenever she is caught evading. Therefore the evasion rate decreases whenever the probability of detection rises. See Figure 5.3. This is supported by Engel & Hines (2000) who find, using the annual observations for the United States between 1947-1993, that higher audit intensity should discourage evasion.

Now let us consider change in fine rate. The fine rate plays a role only when the individual is being caught evading. When F increases then the budget constraint becomes steeper while indifference curves do not change at all. Unchanged shape of the indefference curves under an increase of F makes our individual moves again closer to the point where $X = Y$. See Figure 5.4. The Figure 5.4 depicts the shift from initial choice of declaration X^{old} under the fine rate F to the new choice of declaration X^{new} under the increased fine rate $\widehat{F}$. Therefore, as it is shown in the Figure 5.4, the increase in fine rate F reduces the level of tax evasion. However, Bayer & Sutter (2009) suggest that policy makers who care about welfare losses should do something with tax rates

Figure 5.3: The Evasion Decision: Increase in Detection Probability



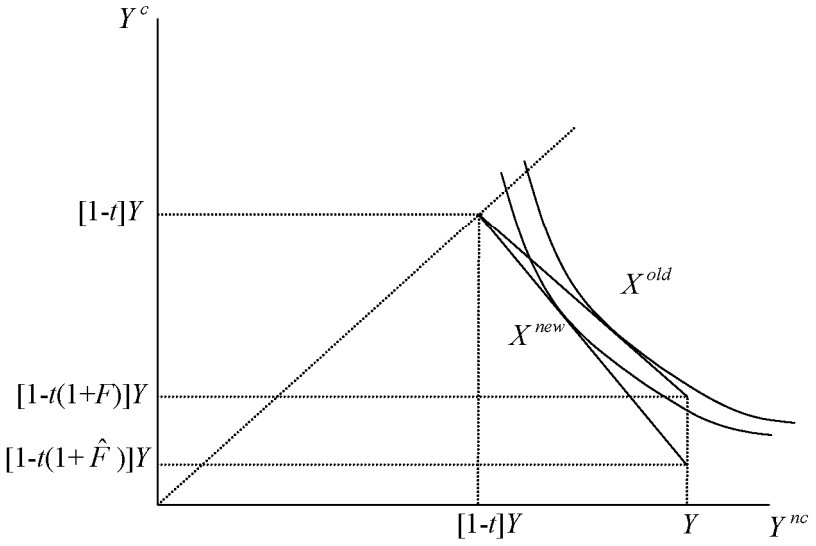
Source: Hindriks & Myles (2006)

rather than with penalty rates. They claim so based on their empirical attempt to measure the concealment and detection costs associated with tax evasion. They show that the welfare losses from a concealment-detection contest depend positively on the prevailing tax rate, but not on the penalty which is imposed in case of detected tax evasion.

Previous effects of an increase in probability of being caught, and of an increase in fine rate on the level of reported income are intuitive. Effect of change in income level and tax rate on the level of tax evasion are not as intuitive. We examine what happens if the individual becomes richer when her income increases from the initial level Y to the level $\widehat{Y}$. Such increase will lead to the parallel shift of the budget constraint further from the origin. The optimal choice is then depicted in Figure 5 which shows the shift from the initial choice of declaration X^{old} with the initial income to the new choice of declaration X^{new} with the higher income.

The measure of absolute risk aversion of the utility function, as Hindriks & Myles (2006) define it, $R_A(Y) = -\frac{U''(Y)}{U'(Y)}$, plays the most important role in how the evasion decision is affected. This absolute risk aversion measures the willingness to get involved in small bets with fixed size. Whenever Y increases and in the same time $R_A(Y)$ remains constant, the optimal choice is on a locus parallel to the 45° line. Although, Hindriks & Myles (2006) argue that there is evidence that in practice, $R_A(Y)$ decreases as income increases. Therefore, individulas with higher income are more willing to get involved in small bets

Figure 5.4: The Evasion Decision: Increase in the Fine Rate



Source: Hindriks & Myles (2006)

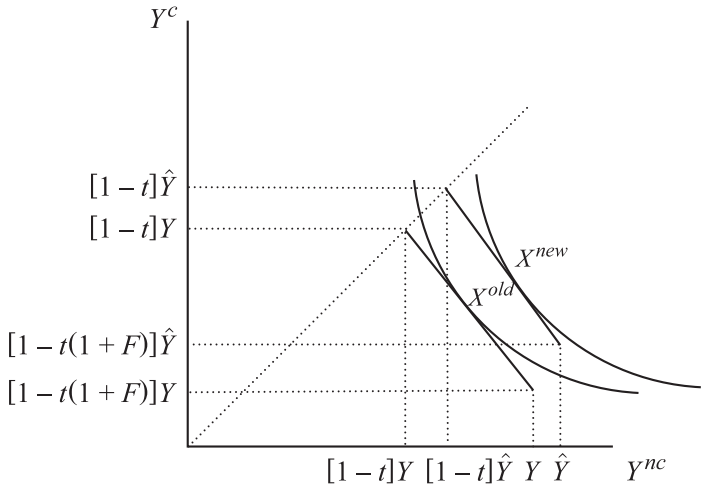
which means that the locus of choices shifts away from the 45° line and the amount of evaded income rises as income increases. See Figure 5.5.

The last variable to consider is the tax rate. Intuitively, whenever the government increases the tax rate the individual has to give away more of her income and her budget constraint is smaller.[2] Formally, let us have an increase in the tax rate from the initial rate t to the new tax rate $\widehat{t}$. There is negative income effect implying that higher taxes make the taxpayer poorer and, therefore, less willing to take risk. So the shift from the initial choice of declaration X^{old} with the initial tax rate to the new choice of declaration X^{new} is as shown in Figure 5.6. Hindriks & Myles (2006) say that this result is still questioned because it is against to what seems reasonable. The model predicts that with higher tax rate individuals evade less due to the definition of the fine paid by the individual as tF. Both having the same effect on each other. With an increase in the tax rate having effect of raising the penalty. Therefore, when an individual is caught, she has to give up more of her income. Hence, this is the scenario that a higher tax rate can reduce evasion.

To summarize effects of income and tax rate on tax evasion we can say that

[2]Clotfelter (1983) investigates the relationship between marginal tax rates and tax evasion and finds that the marginal tax rates do have a significant effect on the amount of tax evasion; and Tanzi (1980) found, based on the study of the underground economy in the United States, that evasion rises with marginal tax rates.

Figure 5.5: The Evasion Decision: Income Increase



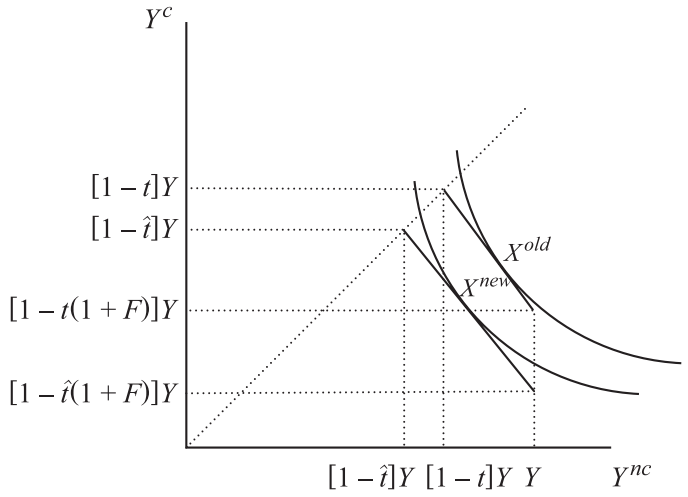
Source: Hindriks & Myles (2006)

an increase in Y has similar effect as decrease in t. Moreover, Engel & Hines (2000) based on empirical study claim that positive income and tax changes should increase evasion rates.

In addition if a common assumption that the measure of absolute risk aversion is decreasing is made, then the original A-S model predicts that a higher gross income increases evasion. An increase of the tax rate has in the A-S model also a substitution effect next to the income effect. Both effects have ambiguous result on tax evasion. The substitution effect that in this context means that with an increase of marginal tax rate the evasion also increase because an individual substitutes the risk of being penalized with the underreported income. The substitution effect, as Allingham & Sandmo (1972) present, has been criticised by Yitzhaki (1974). Yitzhaki (1974) claims that the substitution effect depends on the assumption that the penalty is imposed on the amount of income evaded. But, there is no substitution effect if the penalty is imposed on the evaded tax.

Sandmo (2005) criticises by pointing out one unrealistic simplification of A-S model which is the assumption that all income is unknown to the tax collector. Therefore, the whole A-S model is applied on the taxpayer's income that can be evaded with the possibility of detection. The case where the probability of being caught depends on the amount reported: $p = p(X)$ is also considered. A-S considers two alternatives as to the slope of the $p(X)$ function. First, the

Figure 5.6: The Evasion Decision: Tax Rate Increase



Source: Hindriks & Myles (2006)

collection agency has no information about Y then it is assumed that $p'(X) > 0$ meaning that the collection agency believes that rich individuals engage more in evasion. Second, the assumption that collecting agency is not partially informed about individual's Y may be, according to Sandmo (2005), unrealistic because it is possible to know the individual's profession and hence the average level of income for the particular profession. Therefore, the assumption is such that $p'(X) < 0$ meaning that the probability of being caught is zero whenever the reported income reaches the average level.

5.2 Government's Policy Decision Against Tax Evasion

The previous section introduced the factors involved in the decision to evade tax under uncertainty. We showed that with an increase of the probability of detection p and/or the rate of the fine levied when caught evading, F, the tax evasion decreases. Government can change p by increasing the frequency of audits and F. Since government is the collector of taxes, it decides the optimal level of p and F in order to gain certain level of revenue. Revenue is defined as the taxes paid plus the money received from fines:

$$R = tX + p(1+F)t[Y - X]. \tag{5.6}$$

The effect on revenue of an increase in the probability of detection is:

$$\frac{\partial R}{\partial p} = (1+F)t[Y-X] + t[1-p-pF]\frac{\partial X}{\partial p} > 0 \tag{5.7}$$

if $pF < 1-p$.[3] Under the same condition, an increase in F raises revenue:

$$\frac{\partial R}{\partial F} = pt[Y-X] + t[1-p-pF]\frac{\partial X}{\partial F} > 0. \tag{5.8}$$

Therefore, government revenue raises under tax evasion whenever it increases the probability of detection p and fine F. However, increasing p is costly, increasing F is free of charge. Government is tempted to go for the policy called 'hanging taxpayers with probability zero' but as Hindriks & Myles (2006) say it is not observed in practice.

Anderson & Carasciuc (1999), providing an empirical evidence from the former Soviet Union Republic of Moldova, also claim that an increase in in the real value of fines and penalties applied to tax evasion are one of the possible causes of the decreased tax evasion phenomenon. They, based on the classic model of tax evasion behavior by Allingham & Sandmo (1972), estimate the net benefit of tax evasion and analyze the trade-off between audit frequency and marginal fine for a tax collection in a transition economy. They conclude that increased audit frequency has a direct proportional impact on the amount of evasion detected. Anderson & Carasciuc (1999) also consider the fact that auditors are not paid regularly and therefore, as Shleifer & Vishny (1993) describe, tax auditors abuse their power and accept bribes from audited individuals.

[3]There is no effect on revenue if $pF \geq 1-p$ because there is no evasion.

Chapter 6

Czech Data on Household Income and Consumption

This chapter presents and describes the Czech data on household income and consumption from the Household Budget Survey (HBS) which we use for our analysis.

6.1 Czech Household Budget Survey

The Household Budget Survey is one of the most comprehensive household surveys conducted in all Member States of the European Union. The HBS samples private households annually under the responsibility of the Czech Statistical Office (CZSO). The HBS provides detailed information about household consumption expenditure on goods and services. It also provides information on income[1], possession of consumer durable goods and cars, basic information on housing, and demographic and socioeconomic characteristics. As for characteristics that HBS provide for head of household include: sex, age, economic activity, education, occupation, and coefficient of unemployment.[2] It is a possible source of information about household expenditures and income. The main objective of the HBS in the Czech Republic is a detailed view of spending patterns of various kinds of households. The main application of HBS is to collect information on household consumption expenditure in order to update

[1]CZSO admits that the income data should be regarded as supplementary information and should not be used for in-depth analyses because of the changes of the income level. More about HBS is available at the official web-pages of CZSO.

[2]The coefficient of unemployment is the portion of the number of months in reporting period when the head of household was unemployed.

the 'weights' for the basket of commodities used in the consumer price indices. Other uses include the social and economic research or decision making in designing social policies. Moreover, this paper assumes that households believe in the anonymity of the survey and therefore households trully fill the survey out. Also, since HBS requires private informations from households, the survey is based on voluntary participation.

There are two samples in the HBS. The basic reporting sample consists of about 3000 households that correspond in structure to households in the Czech Republic. The main household characteristics are economic activity of the head of household, age, occupation, education, net money income, number of dependent children in the household, pension per person in the households of economically inactive pensioners. The sample also includes several types of households which were not covered before year 2006. These households are households of unemployed, and household of pensioners with or without economically active members. The second supplementary sample of about 400 households represents households with minimal income that are also in the elementary set.[3]

To better understand the data structure, we present the aggregate statistics about household income and consumption expenditures. The CZSO publishes these statistics every year using indicators such as the status of economic activity and age of the head of household, municipality size or income brackets. Table 6.1 presents key statistics on household consumption, incomes and expenditures from the 2008 HBS by deciles of net money income per person. CZSO classifies the gross money income as net of borrowings, credits received and savings drawn; and net money income as gross income excluding health and social insurance payments and income tax. For expenditures classification CZSO takes gross money expenditure as net of deposits, cash-free paid up loans, paid up credits and borrowings. The difference between gross expenditure and net money expenditure is health and social insurance payments and income tax. The classification of consumption expenditure in the HBS is the international standard COICOP (Classification of Individual Consumption by Purpose). Expenditures in compliance with CZ-COICOP are arranged in 12 categories: 01 Food and non-alcoholic beverages, 02 Alcoholic beverages, tobacco, 03 Clothing and footwear, 04 Housing, water, electricity, gas and other fuels, 05 Furnishing, household equipment and routine maintenance of the house, 06 Health,

[3]Households in supplementary sample are defined to live on at most 1.9 multiple of the subsistence minimum.

07 Transport, 08 Communication, 09 Recreation and culture, 10 Education, 11 Restaurants and hotels, 12 Miscellaneous goods and services, and there is additional category 13 Non-consumption expenditures which are characterized mainly as purchases or reconstruction of dwelling. More about COICOP is available at at the official web-pages of CZSO. COICOP has been used since 1999 to ensure international comparability of statistical indicators.

Table 6.1: HBS 2008 - Household composition, income and expenditures

annual averages per capita in CZK

		Households by net money income per person									
	Households, total	Lowest 10 %	Second 10 %	Third 10 %	Fourth 10 %	Fifth 10 %	Sixth 10 %	Seventh 10 %	Eighth 10 %	Ninth 10 %	Highest 10 %
Households - weighted	2,839	283	284	284	284	284	285	284	284	283	284
in sample	2,839	312	271	236	237	248	271	299	314	326	325
Per household averages:											
Members	2.29	3.23	2.69	2.30	2.35	2.15	2.29	2.20	2.12	1.86	1.69
economically active (without unemployed)	1.03	0.87	0.90	0.60	0.67	0.72	1.01	1.22	1.44	1.49	1.40
dependent children	0.58	1.57	0.99	0.58	0.61	0.50	0.56	0.44	0.32	0.14	0.13
pensioners not working	0.52	0.18	0.57	0.99	0.96	0.82	0.63	0.45	0.30	0.18	0.12
other members	0.16	0.61	0.23	0.13	0.11	0.11	0.09	0.09	0.06	0.05	0.04
Equivalencies (OECD scale)	1.83	2.36	2.06	1.84	1.87	1.74	1.85	1.80	1.75	1.59	1.47
Equivalencies (EU scale)	1.58	1.92	1.72	1.58	1.60	1.51	1.59	1.56	1.53	1.42	1.33
GROSS MONEY INCOME, TOTAL	156,598	73,964	101,934	113,001	123,849	135,845	150,561	171,876	202,960	246,813	363,431
NET MONEY INCOME, TOTAL	137,497	69,551	93,224	104,971	114,021	123,130	133,765	149,316	172,158	204,656	305,097
Income from employment	77,464	34,003	48,708	41,967	46,854	58,316	72,174	89,918	113,942	148,844	188,089
Income from self-employment	13,227	10,786	9,712	7,233	9,715	6,851	14,531	13,999	18,921	18,299	29,115
Social income	36,755	19,734	30,718	50,821	52,431	53,019	41,436	37,710	30,222	26,442	29,184
Pensions	29,158	6,115	21,008	44,582	46,156	46,722	36,128	31,653	23,465	20,677	22,918
Sickness benefits	2,251	967	1,826	1,536	1,561	1,961	1,956	2,920	3,565	4,085	3,538
Unemployment benefits	367	670	516	236	379	181	325	205	336	232	404
State social support benefits	4,150	10,494	5,948	4,052	3,670	3,362	2,409	2,220	2,127	1,198	1,647
Other social income	829	1,488	1,421	414	664	792	617	711	729	250	677
Other income	10,051	5,029	4,085	4,952	5,021	4,946	5,623	7,689	9,072	11,072	58,709
including: income from sale of (im)movables	3,477	99	181	274	526	259	199	769	2,306	2,761	37,922
gifts from relatives	2,724	1,736	1,774	1,658	2,034	2,386	2,380	2,839	2,213	2,852	9,767
VALUE OF DECILE	x	85,596	100,065	109,480	118,809	127,571	140,648	158,705	185,950	225,632	x
GROSS MONEY EXPENDITURE, TOTAL	143,055	77,898	97,068	108,260	116,373	128,077	137,974	161,218	179,007	220,360	297,204
Income tax	7,545	-96	1,873	2,122	3,115	4,361	6,130	9,051	13,259	19,083	28,839
Health and social insurance	11,556	4,508	6,838	5,907	6,713	8,353	10,667	13,509	17,544	23,073	29,495
NET MONEY EXPENDITURE, TOTAL	123,955	73,485	88,357	100,230	106,545	115,363	121,178	138,657	148,205	178,204	238,871
by purpose:											
A. Consumption expenditure	112,256	67,345	83,529	93,245	99,652	105,892	112,250	123,723	136,016	159,068	198,962
B. Non-consumption expenditure	11,698	6,140	4,829	6,985	6,892	9,471	8,928	14,934	12,189	19,136	39,909
by type of expenditure:											
Food, beverages, public catering	28,895	19,943	23,702	26,087	27,931	28,737	29,656	31,704	32,853	37,048	40,990
Other consumer goods	38,333	18,485	27,931	29,636	32,384	35,583	35,975	43,215	48,902	56,376	80,102
Services	41,127	25,211	29,159	34,322	35,547	38,369	41,442	46,105	49,467	57,567	75,611
Payments and other expenditure	15,600	9,847	7,565	10,186	10,682	12,674	14,105	17,633	16,983	27,213	42,167
INCOME IN KIND	7,200	6,288	6,448	6,209	6,479	7,182	7,247	8,183	7,055	8,487	9,931
EXPENDITURE IN KIND	6,244	1,769	2,939	4,694	5,528	9,000	5,803	6,415	7,467	10,009	14,356
BALANCE ITEMS											
Balance of deposits withdrawn and deposits made	-10,783	6,195	-1,700	-1,172	-5,458	-3,918	-9,267	-8,737	-23,574	-22,198	-62,950
Balance of loans received and credits repayed	-1,622	-1,394	-1,939	-2,309	-757	-2,758	-2,286	-1,082	703	-3,097	-1,468

Source: Czech Statistical Office

The HBS data are repeated cross section since the CZSO does not necessarily observe the same households every year. We have available HBS data from year 2006 to year 2008. Also we convert all consumption and income data into constant 2005 prices, using the CZSO CPI, see Table 6.2.

Table 6.2: CPI basic indices, (year 2005=100).

Year	2006	2007	2008
Annual average CPI	102.5	105.4	112.1

Source: Czech Statistical Office

6.2 Key Variables

For our analysis, following Gorodnichenko *et al.* (2009), the key variables are household consumption and household reported income. The expenditure items which are considered as non-durable items are aggregated into non-durable items (C1) which is the baseline measure of consumption. These items are: more than 50 items of food at home and away from home (restaurants, cafeterias, etc.), alcoholic and non-alcoholic beverages, tobacco, expenses on clothing and footwear, gasoline and other fuel expenses, rents and utilities, subcategories of servicies including transportation, communication, repair, education, entertainment, recreation, health care services, insurance, hobby, etc. The second consumption measure (C2) adds various contributions in money and in kind to individuals outside the household unit.[4] Even though, Gorodnichenko *et al.* (2009) admit that these kinds of expenditure are not typically considered as part of consumption because households may derive extra utility from altruistic motives by transferring resources to relatives. The third consumption measure (C3) adds more than 40 durable consumption items consisting of furniture, appliances, vehicles, entertainment equipment, etc. Gorodnichenko *et al.* (2009) also check the importance of borrowing for the consumption-income gap by calculating net savings as the difference between the net change in financial astes and the net change in liabilities.[5] Adding this net savings to the baseline measure of consumption (C1) Gorodnichenko *et al.* (2009) and we following their example get the fourth (alternative) measure of consumption C4.[6]

Gorodnichenko *et al.* (2009) use the combined income of all household members after taxes from all jobs and other regular sources as the total household

[4]Gorodnichenko *et al.* (2009) include alimonies but HBS does not offer this information.

[5]The net change in financial assets is computed as the difference between purchase and sales of stocks, bonds, and other securities, and between current cash savings and the amount of withdrawn savings. The net change in liabilities is calculated as the difference between the money borrowed and money lent (outside the household), and between the amount of money received from debtors and payments to creditors.

[6]This alternative measure of consumption is negative for 33 observations, which will be excluded from our analysis.

income. Therefore, we will use the net reported income calculated as the gross reported income less the income tax expenditures and mandatory health and social insurance. Following Gorodnichenko *et al.* (2009), the base income measure (Y1) is the combination of the labor and non-labor income. The labor income is reported as after-tax payments received by all household members from all places of work in the form of money, goods and services. The non-labor income includes pensions, rental income, sale of securities, stipends, unemployment benefits, child care benefits, and other social benefits.[7] Thus, income consisting of wage revenues, enterprise revenues, rental income, sale of securities, and inkind income is used for Y1. The second income measure (Y2) adds irregular revenues such as lump sum payments from insurance, amounts received from the sales of material assets, subsidies and other incomes of social character, gifts from relatives, and other incomes.[8] The last, third, income measure (Y3) adds to Y1 income from selling household-grown (agricultural) products because households may, according to Gorodnichenko *et al.* (2009), derive supplementary income from household production.

[7]Originally Gorodnichenko *et al.* (2009) use interests and dividends instead of sale of securities but because HBS does not offer these variables we use sale of securities.

[8]Gorodnichenko *et al.* (2009) add 11 subcategories of contributions from persons outside the household unit, including contributions from friends, charity, international organizations, etc. We do not have these specific data available, however, we assume that the ones we have mostly cover irregular revenues. Gorodnichenko *et al.* (2009) also claim that households do not have much of incentives to conceal private transfers, such as contribution from relatives, because this source of income is not taxed and thus adding these transfers should not affect tax evasion directly.

Chapter 7

Analysis of Tax Evasion

This chapter describes the Gorodnichenko *et al.* (2009) approach of analyzing tax evasion. The main theoretical hypothesis that Gorodnichenko *et al.* (2009) start with for the derivation of tax evasion function is the permanent income hypothesis (PIH) which says that permanent income is equal to consumption.[1] Consumption is the crucial information carrier giving away the income available to households. If, *ceteris paribus*, consumption deviates from reported income then there is a misreporting of the income. Therefore, the discrepancy between consumption and income provides certain information about the extent of household tax evasion.

The general understanding of the difference between consumption and reported income is savings, however, Gorodnichenko *et al.* (2009) claim that the gap between the reported income and consumption cannot be refered as savings in Russia for two reasons. First, the majority of Russian households had negligible stocks of financial assets by the mid 1990s. Second, the saving rate computed as the difference between reported income and expenditures would imply large dissaving on average over ten years which they say is impossible to last for such long period. They conclude that the difference between reported income and consumption should not be used as a measure of savings. As for the Czech Republic we will show that the same assumption can be safely made for Czech data.

Gorodnichenko *et al.* (2009) develop an econometric specification of the tax evasion function as follows. Household h at time t receives a true income Y^*_{ht}. Such household decides how much of its income to report and how much to evade. Therefore the reported income is a fraction of the true one: $Y^R_{ht} = \Gamma_{ht} Y^*_{ht}$,

[1] Here, Gorodnichenko *et al.* (2009), by permanent income mean the present discounted value of lifetime income.

where Γ_{ht} is the fraction of true income reported. The fraction of true income reported Γ_{ht} is a function of observable characteristics S_{ht} which influence tax compliance and can include government policies, such as 2008 flat tax reform: $\Gamma_{ht} = \Gamma(S_{ht}) = exp(-\gamma S_{ht} + error)$.

Gorodnichenko *et al.* (2009) assume that the true income Y^*_{ht} is related to permanent income Y^P_{ht} as $Y^*_{ht} = H_{ht}Y^P_{ht}$, where $H_{ht} = H(X_{1,ht}) = exp(\eta X_{1,ht} + error)$. H_{ht} includes deviations of true income from permanent income due to life cycle factors $X_{1,ht}$ such as age, schooling, employment participation, number of children, etc. and due to transitory shocks absorbed in the error term.

Another assumption made by Gorodnichenko *et al.* (2009) is about expenditures on non-durable goods. They assume that the consumption of non-durables is correctly reported as it is their preffered measure of consumption. We assume the same. The expenditure on non-durables C_{ht} is a fraction of permanent income: $C_{ht} = \Theta_{ht}Y^P_{ht}$.[2] The fraction Θ can vary across households: $\Theta_{ht} = \Theta(X_{1,ht}) = exp(\theta X_{2,ht} + error)$, where $X_{2,ht}$ includes the number of household members and number of children in order to account for economies of scale, and the number of elderly members, age, schooling, and marital status are included as taste shifters.

From the above mentioned Gorodnichenko *et al.* (2009) obtain three relationships:

$$lnY^R_{ht} - lnY^*_{ht} = -\gamma S_{ht} + error \tag{7.1}$$

$$lnY^*_{ht} - lnY^P_{ht} = \eta X_{1,ht} + error \tag{7.2}$$

$$lnC_{ht} - lnY^P_{ht} = \theta X_{2,ht} + error \tag{7.3}$$

The true income Y^*_{ht} as well as the permanent income Y^P_{ht} are for obvious reasons not observable, however, combinig equations (7.1), (7.2) and (7.3) Gorodnichenko *et al.* (2009) obtain the final specification as:

$$lnC_{ht} - lnY^R_{ht} = \gamma S_{ht} + \beta X_{ht} + \upsilon_h + \varepsilon_{ht}, \tag{7.4}$$

where γ represents the effect of S_{ht} on tax evasion; X_{ht} is the union of $X_{1,ht}$ and

[2]Gorodnichenko *et al.* (2009) consider the fraction of permanent income fixed if the consumption aggregator for durables and non-durables has a Cobb-Douglass form in the utility function. They assume constant unitary income elasticity of consumption because they consider the total consumption of non-durables goods. They also note that households have strong incentives to underreport consumption/ownership of durables because it is visible and indicative of true income. Therefore the total consumption based on durables would probably lead to overestimation of tax evasion.

$X_{2,ht}$ because vectors $X_{1,ht}$ and $X_{2,ht}$ are overlapping; υ_h is a time-invariant component of the error term that accounts for risk aversion, preferences, and other constant household and local characteristics affecting consumption and/or income; and ε_{ht} is a random error term.[3]

The explanatory variables on the right-hand side of the (7.4) are two vectors of covariates S and X. The vector S accounts for individual variation and together with X account for individual variation in tax evasion due to age, schooling, tenure, marital status, type of job (enterprise versus self-employment), the firm size where the head of the household is employed, private versus public sector, number of household members, number of children, number of elderly members, and year dummy.[4]

7.1 Data Adjustment: Household Drop-Out

This section describes how the 2006-2008 HBS data set is adjusted to get the baseline dataset for the upcoming analysis. We do not have available data for year 2009 for our analysis. Nevertheless, data for year 2009 could capture the true effect of the household's response to flat tax because taking households as backward-looking, households need time to get used to the flat tax implications. Therefore, including data for year 2009 opens the posibility for improvement of our work.

Before we move to the adjustment steps themselves, the definition of household made by HBS must be presented. The household is a group of individuals who live and housekeep together. Joint housekeep means that individuals give their incomes, or its portion, into common usage from which they pay expenditures that are intended for satisfaction of needs of the whole household (rent, food) or expenditures of individuals, including needs of dependent children or other persons. Therefore, households have to fullfil certain conditions in order to remain in the sample.

One note to the overall adjustments must be made. Since the HBS is very detailed and households are to report every item they purchase on a daily basis, households have the propensity to drop-out which leads to the attrition bias.

[3]The interpretation of the coefficients in this equation is a percentage deviation of the consumption-income ratio from the steady state, since the consumption-income ratio should be equal to one and the log of this ratio is zero.

[4]Gorodnichenko *et al.* (2009) define vectors S and X in a way that factors such as age, schooling, and marital status are in both vectors therefore the estimates can not be attributed only to tax evasion.

As Miller & Hollist (2007) say the bias arises if those who drop-out of the survey are systematically different from those who remain in the survey, the remaining sample becomes different from the original sample. They add two consequences of how the sample can be biased. The first one threatens external validity of the study meaning that if some groups, households in this case, drop-out of the survey more frequently than others, the remaining sample is not generalizable to the original population that was sampled. The second attrition bias can negatively affect the internal validity of the survey by altering the correlations among variables in the survey. It raises the question whether those households who drop-out are also more prone to evade. This attrition bias should not invalidate our results due to the quota selection done by CZSO. On the other hand, each household is financially motivated. It receives a financial reward for every properly filled-out record for every month according to the number of household members, and according to the extent of filling-out. This financial motivation is why attrition bias might be an issue since households of various income weight the financial reward differently, however, we will assume that it does not.

The first adjustment step is to eliminate all households that were not in the HBS for the whole year. This is done so because the quality of final data is dependent on the quality of income and expenditure reports of individual households. These reports must include all incomes and all expenditures on behalf of all memebers of the household and are reported on a daily basis since reporting that is delayed by few days may result in high probability of mistakes and inaccuracy. Including households that do not stay in the HBS for the whole year would add noise to results. Therefore, households for which the number of months of reporting is less than twelve are dropped. This decreased the number of observations by 923 from the original number of 9,982 down to 9,059. Table 7.1 shows how many households are eliminated for each year.

The second adjustment step is to eliminate those households in which there is no economically active individual because these households are not relevant for the purpose of this paper. According to HBS an economically active individual is employed individual or unemployed individual who is actively searching for an occupation. Dropping households with economically inactive individuals brings the data set down by 1,885 observations to 7,174. Since households with economically active head of household include also unemployed head of household, also these households must be eliminated because such head of household

receives support for an unemployment allowance from the state. This elimination decreases the data set by another 97 observations to 7,077.

The third adjustment step is done due to the way the HBS is structured. Thus, we do not follow Gorodnichenko *et al.* (2009) because they can separate information about income of different household members and define the head of household as a person with the largest one. HBS data does not allow us to separate each individual in household individually and determine how much is each individual earning. To be more precise we, from the data, do not know household members' income separately but different kinds of income, such as labor income, non-labor income etc., for the household as a whole. Knowing the household mebers' income separately will be crucial for defining treatment group in the following section. Therefore, since we do not know it, we eliminate all households where there is more than one economically active individual. This elimination decreases our data set to 3,414 observations, however it brings several pros. We are able to determine the labor income of this remaining economically active individual which, as already said, will be crucial for next analysis in the following section. By leaving only one economically active individual we solve the problem with joint taxation of married couples with children.[5] However, assuming that the average household is a married couple, where the married individuals are both economically active, we admit that this weakens our findings.

Previous adjustment leaves only one economically active individual in the household but Gorodnichenko *et al.* (2009) for their analysis use the head of household. Therefore, we eliminate households which heads of household are not wage earners. Such elimination brings the data down to 3,036 observations.

Table 7.1: Household Drop-Out

Year	**2006**	**2007**	**2008**	Remaining observations
Original observations	3377	3334	3271	9982
Non-Reporting the whole year	294	301	328	9059
Economically inactive individuals	649	632	604	7174
Unemployed	30	36	31	7077
More than one economically active individual in HH	1263	1221	1179	3414
Not wage earning head of HH	122	136	120	3036
Observations	1019	1008	1009	3036

Note: HH denotes household.

[5]The Czech Republic introduced a joint taxation of married couples with children in 2005. The Czech Republic abandoned joint taxation of spouses in 2008.

7.2 Data Adjustment: Panles

Previous Section 7.1 described the necessary data adjustments of HBS data so that we can use them for treatment and comparison group identification. Although, before we move to the treatment and comparison group identification itself, we make one more data adjustment due to the econometric specification described in the next Section 7.3.

We create three panels because it allows us to compare our key variables, consumption and reported income, for the same households before and after the tax reform which we need for our analysis. The first panel is including years 2006, 2007 and 2008, the second panel years 2006 and 2008, and the third panel years 2007 and 2008. We create three separate panels because the HBS does not include the same household every year and thus having all three panels has an effect of various number of observations (households) in each panel. Therefore, we expect the lowest number of observations (households) for panel including all three years and the highest number of observations for panel including years 2007 and 2008. We will use all three panels for analysis that follows Gorodnichenko *et al.* (2009) although, we will prefer panel including years 2006 and 2008 to panel with years 2007 and 2008 because households could have possibly anticipated the change of marginal tax rate. Table 7.2 presents number of households for each panel and confirms our expectation about the number of observations for each panel. The advantages of having panel data compared to repeated cross-section data are that it allows us to create more realistic and more complex models, and it provides better identification. On the other hand there is a disadvantage of having panel data because when we observe the same cross-section unit over time, then the assumption that each observation is independent is no more realistic. Another drawback of construction of these three panels is that we drop all observations with data not available for all three years for panel including years 2006, 2007 and 2008, for both years for panel including years 2006 and 2008, and for both years for panel including years 2007 and 2008.

Table 7.2: Number of households in panel

	panel 2006-2007-2008	**panel 2006-2008**	**panel 2007-2008**
Number of households	384	388	538

As mentioned at the beginning of this section, the difference between reported income and consumption should not be used to measure savings. Gorod-

nichenko *et al.* (2009) calculate gross savings as the sum of purchases of stocks, bonds, and other securities, current cash savings, and money lent. Computing the saving rate as the difference between households' net reported incomes and total consumptions on our three panels the same way Gorodnichenko *et al.* (2009) do it, we get that the saving rate is equal to -5.63%, -5.13%, and -5.10% of income on average in the three panels while the savings provided in HBS have positive values for all three panels. Therefore we also conclude that the difference between reported income and consumption should not be used as a measure of savings.

7.3 Econometric Specification

In this section we introduce the econometric method called difference-in-difference. Difference-in-difference method is widely used in studies called 'natural experiments' which examine outcome measures for observations in treatment groups and comparison groups that are not randomly assigned. A good natural experiment is according to Meyer (1994) a study in which there is a transparent exogenous source of variation in the explanatory variables that determine the assignment into treatment group. In other words natural experiments occur when some exogenous event changes the environment of treatment group but not of control group. Thus, the policy change in form of the flat tax adoption that the Czech Republic experienced in 2008 is a good example for the use of natural experiment approach because it allows us to obtain exogenous variation in the main explanatory variables.

Difference-in-difference method is a regression in which dependent variable of a treatment group, experiencing a tax change at some time period T, is compared to the same variable for a comparison group, not experiencing the same tax change. The method measures the average effect of change in tax policy on the treatment group by removing unobservable individual effects and common macro effects. The comparison group is according to Blundell & Dias (2002) difficult to choose due to the two assumptions needed for the method to be valid. The first assumption says that a common time effects must hold across the groups (treatment and comparison group) and the second says that there are no systematic composition changes within each group.

Gorodnichenko *et al.* (2009) use the difference-in-differencce approach taking the higher tax brackets as a treatment group and lower tax brackets as a

control group. They estimate following specification:

$$lnC_{ht} - lnY_{ht}^{R} = \gamma S_{ht} + \beta X_{ht} + \mu d_{ht}^{treat} + \alpha(d_{ht}^{treat} \times D_p) + \psi D_p + \upsilon_h + \varepsilon_{ht}, \quad (7.5)$$

where $d_{ht}^{treat} = I(\tau_{ht} < \tau_{ht-1})$ is a dummy variable indicating if the head of the household is in the treatment group which experiences a decline in marginal tax rates conditional on Y_{ht}^{*}; and D_p is a dummy variable for the post-reform period 2008. Coefficient μ captures the underlying difference between treatment and comparison group; α captures the effect of the treatment; and ψ captures the underlying difference between the pre and post-reform periods.

Taking the specification (7.5) we will make an attempt to describe the difference-in-difference estimatior based on Blundell & Costa Dias (2008) who use panel data to describe diffrence-in-difference method since we will apply this method on our panel data. Inspired by Blundell & Costa Dias (2008) we get following expected conditional outcomes, where, for the simplicity, we substitute $y_{ht} = lnC_{ht} - lnY_{ht}^{R}$:

$$E[y_{ht}|d_{ht}^{treat}, T] = \begin{cases} \gamma + \beta + E[\mu|d_{ht}^{treat} = 1] + E[\alpha|d_{ht}^{treat} = 1] + \psi, \\ \quad \text{if } d_{ht}^{treat} = 1 \text{ and } T = t \\ \gamma + \beta + E[\mu|d_{ht}^{treat}] + \psi, \\ \quad \text{otherwise.} \end{cases}$$

The difference-in-difference identification strategy of above mentioned expected outcomes is:

$$\begin{aligned} \alpha^{ATT} &= E[\alpha|d_{ht}^{treat} = 1] \\ &= \left\{E[y_{ht}|d_{ht}^{treat} = 1, T = t] - E[y_{ht}|d_{ht}^{treat} = 1, T = t-1]\right\} \\ &\quad - \left\{E[y_{ht}|d_{ht}^{treat} = 0, T = t] - E[y_{ht}|d_{ht}^{treat} = 0, T = t-1]\right\}, \quad (7.6) \end{aligned}$$

where ATT identifies the average effect on individuals that were assigned to treatment group.[6] The difference-in-difference estimator is sample analogy of (7.6) and is in the following form:

[6]Weakness of difference-in-difference is the differential macro trends which says that difference-in-difference does not consistently estimate the ATT if treatment and comparison groups do not experience the same macro shocks.

$$\hat{\alpha} = [\bar{y}^1_{ht_t} - \bar{y}^1_{ht_{t-1}}] - [\bar{y}^0_{ht_t} - \bar{y}^0_{ht_{t-1}}], \tag{7.7}$$

where $\bar{y}^{d^{treat}_{ht}}_{ht_T}$ is the average outcome over group d^{treat}_{ht} at time T, and the estimator is on average correct: $E[\hat{\alpha}] = \alpha$. The estimator is defined as the difference in average consumption-income gap in the treatment group before and after tax reform less the difference in average consumption-income gap in the control group before and after tax reform.

There are three assumptions for the difference-in-difference estimator to be unbiased. First, the model in equation is correctly specified. Second, the error term ε_{ht} is on average zero: $E[\varepsilon_{ht}] = 0$. The last, also known as the parallel-trend assumption, the correlation of error term with the other variables are zero: $cov(\varepsilon_{ht}, d^{treat}_{ht}) = 0$, $cov(\varepsilon_{ht}, D_p) = 0$, $cov(\varepsilon_{ht}, d^{treat}_{ht} \times D_p) = 0$.

Rewriting now the specification (7.5) into the full extent, one gets following specification which we estimate:

$$\begin{aligned} lnC_{ht} - lnY^R_{ht} &= \varphi_1 age_{ht} + \varphi_2 schooling_{ht} + \varphi_3 marital\ status_{ht} \\ &+ \varphi_4 enterprise_{ht} + \varphi_5 private\ sector_{ht} \\ &+ \varphi_6 number\ of\ household\ members_{ht} \\ &+ \varphi_7 number\ of\ children_{ht} + \varphi_8 number\ of\ seniors_{ht} \\ &+ \mu d^{treat}_{ht} + \alpha(d^{treat}_{ht} \times D_p) + \psi D_p + \upsilon_h + \varepsilon_{ht}, \end{aligned} \tag{7.8}$$

where *age* is the age of individual; *schooling* is the number of years of study; *marital status* is the marital status; *enterprise* is the type of job that individual works in; *private sector* is the sector where individual works; *number of household members* is the number of household members; *number of children* is the number of children; *number of seniors* is the number of elderly members; $d^{treat}_{ht} = I(\tau_{ht} < \tau_{ht-1})$ is a dummy variable indicating if the head of the household is in the treatment group which experiences a decline in marginal tax rates conditional on true income Y^*_{ht}; and D_p is a dummy variable for the post-reform period 2008.

Variable *schooling* is adjusted for number of years of study because HBS gives only codes from 0 to 9 for the type of education - zero for no education, and nine for post-graduate. Therefore, number of years of study of the head of household is based on codes and the Czech school system. In particular, no education means zero years; the first level of elementary school means five

years; the second level of elementary school means nine years; training schools without leaving certificate means twelve years; high schools with leaving ceritificate means thirteen years; extended study means fourteen years; higher vocation school means sixteen years; bachelor degree means sixteen as well; master's degree means eighteen years; and doctoral degree means twenty-two years of study. Variable *marital status* is a dummy variable with value 1 indicating whether the head of the household is married, and 0 otherwise. Variable *enterprise* is also dummy variable with value of 1 if the head of the household is an employee at enterprise and 0 otherwise. Variable *private sector* is a dummy variable as well and indicates whether the head of the household works in private sector either as an employee or as self-employed.

Specification (7.8) is different from the original one made by Gorodnichenko *et al.* (2009) because HBS data-set does not offer the firm size for the head of household and a trend variable for the after-reform period. Also variable *tenure*, which means number of years the head of household has been staying with current employer, is not included because of nonavailability of the data.

7.4 Treatment and Comparison Groups

We follow Gorodnichenko *et al.* (2009) and define treatment and comparison groups based on post-reform reported income which they do due to concerns that the dummy variable d_{ht}^{treat} in equation (7.5) can be correlated with the error term ε_{ht} due to the correlation between the pre-reform marginal tax rates and pre-reform level of current income.[7]

As for the actual definition of treatment group Gorodnichenko *et al.* (2009) use the household heads' four year average of contractual earnings in the post-reform period to define treatment and comparison groups. They use contractual earnings because they have smaller transitory component than the earnings received last month.[8] The definition of contractual earnings as stated in Gorodnichenko *et al.* (2009) is the average monthly earnings after taxes over the last 12 months that the employee is supposed to receive regardless of whether or not it was paid on time. We also define the treatment group on the basis of post-reform earnings but earnings received for the whole year 2008 not as the

[7]See Appendix A for explanation of sources of biases between using the pre-reform and post-reform reported income.

[8]Data which Gorodnichenko *et al.* (2009) use allows them to know monthly earnings of each head of household

monthly average because we can not identify from the HBS how much money the head of household earned each month.

We define the treatment group as households whose heads, the economically active individual in our case, earned in year 2008 more than (gross) 218,400 CZK from labor income.[9] This amount is equivalent to the upper threshold for the second tax bracket in year-period 2006-2007. It means that we use the first and the second tax bracket as the comparison group. This simplicity in treatment and comparison groups determination has been made because the design of the Czech reform does not provide a clean comparison group by keeping the same marginal tax rate for the lowest tax brackets.

7.5 Estimates of the Tax Evasion Response

In following sections we present results for our three panels. The first panel including years 2006, 2007 and 2008, the second panel including years 2006 and 2008, and the last panel including years 2007 and 2008. Before we move to results themselves we discuss the use of fixed-effects model.

Since we deal with panel data we can use either fixed effects-model (FE) (the individual effect υ_h is fixed, correlated with explanatory variables) or random-effects model (RE) (the individual effect υ_h is random variable, uncorrelated with explanatory variables). FE technique assumes that all household characteristics as well as cross-section specifics are captured in the intercepts which can not change across household or over time because it is fixed in time. While RE approach assumes random variation around the intercepts.

In order to decide which model to use, we run the Hausman specification test. Hausman specification test tests null hypothesis H_0 that the difference in coefficients between FE and RE are not systematic which means that the disturbances are not correlated with explanatory variables. While coefficients of FE are consistent under H_0 and also under H_a meaning that household specific effects are jointly zero $\upsilon_h = 0$ (unbiased), and coefficients of RE are efficient under H_0 and inconsistent under H_a.[10] Accepting null hypothesis we prefer RE to FE because RE estimate is more efficient than FE one and rejection of null hypothesis means that we should use FE estimates. There is always tradeoff

[9]Labor income consists of wage and enterprise revenues because the way HBS is structured, we are unable to classify who of the individuals in household have what revenue.

[10]FE controls for all time-invariant differences between households, so the estimated coefficients of FE cannot be biased because of omitted time-invariant characteristics.

between robustness (FE) and efficiency (RE). Table 7.3 presents p-values of Hausman specification test for all specifications presented. Since p-values are in most cases lower than 5% significance level, except for the consumption measure C4, we reject the null hypothesis and we, therefore, prefer fixed-effects model to random-effects model. Our test is consistent with Gorodnichenko *et al.* (2009) who also use fixed-effects model.

Table 7.3: Results of Hausman test (p-value)

	Panel 2006-2007-2008	*Panel 2006-2008*	*Panel 2007-2008*
	(1)	(2)	(3)
lnC1-lnY1	0.0001	0.0019	0.0001
lnC2-lnY1	0.0001	0.0004	0.0002
lnC1-lnY2	0.0022	0.0164	0.0572
lnC2-lnY2	0.0011	0.0117	0.0629
lnC3-lnY1	0.0172	0.0060	0.0068
lnC4-lnY1	0.5666	0.5668	0.5976
lnC1-lnY3	0.0001	0.0019	0.0001

7.5.1 Panel 2006-2007-2008

Table 7.4 reports selected summary statistics describing treatment and comparison groups for 2006-2007-2008 panel. Households in the treatment group consist of about 41% of all households and have more members and children but less seniors than households in comparison group. The heads of households in treatment group are younger, more educated, less likely to be married and work more often at enterprise or in private sector than those heads of households in comparison group. Our summary statistics of treatment and comparison group are almost the same to the ones made by Gorodnichenko *et al.* (2009), except for the fact that our treatment group is less likely to be married. Table 7.4 also shows p-values of parametric Student's t-test difference of means to measure whether the means are statistically different between comparison and treatment group. We employ two-group mean comparison test to test the significance of the difference of means. We test the null hypothesis that there is no difference of means between comparison and treatment group, $H_0 : \theta_1 - \theta_2 = 0$, against the alternative hypothesis that there is, $H_1 : \theta_1 - \theta_2 \neq 0$. We expect to have the difference of variables *number of HH members*, *number of children in HH*, and *married* insignificant due to the adjustments of data we made because we dropped all observations from HBS where there were more than one econom-

ically active individual in the household so that we could assign the head of household into the treatment and comparison groups. Eliminating more than one economically active individual in the household affects both, the variable *married* since married individuals are usually both economically active, and the variable counting the number of children in the household because married couples usually have children.

Table 7.5 reports the estimates with household fixed effects of the following specification:

$$\begin{aligned} lnC_{ht} - lnY_{ht}^{R} &= \varphi_1 age_{ht} + \varphi_2 schooling_{ht} + \varphi_3 marital\ status_{ht} \\ &+ \varphi_4 enterprise_{ht} + \varphi_5 private\ sector_{ht} \\ &+ \varphi_6 number\ of\ household\ members_{ht} \\ &+ \varphi_7 number\ of\ children_{ht} + \varphi_8 number\ of\ seniors_{ht} + \varphi_9 year_{ht} \\ &+ \alpha(d_{ht}^{treat} \times D_p) + \psi D_p + \upsilon_h + \varepsilon_{ht}, \end{aligned} \tag{7.9}$$

which adds to (7.8) year dummy variable $year_{ht}$ for year 2006 and drops d_{ht}^{treat} because when using the fixed effects estimator in the context of panel data models this regressor varies only across households and not over time for a given household. The fixed effect estimator is unable to provide a consistent estimate of μ because there would be multicollinearity with the individual fixed effect.

We find no effect in the consumption-income gap for the treatment group because all estimates of α are not statisticallly significant. It suggests that, *cetereis paribus*, consumption has not changed from income in our treatment group relative to comparison group. Significant results for actual consumption-income gap suggest that, *cetereis paribus*, the income declined by approximately 5.0% in 2007 relative to 2006 more than consumption and then grew by 4.4% in 2008 relative to 2007 for consumption measure C1, implying that consumption-income gap increased by less than 1.0% in 2008 relative to 2006. As for the consumption measure C3, our results show that the consumption-income gap declined approximately 3.8% in 2007 relative to 2006 and then grew 3.5% in 2008 relative to 2007 implying that it has not changed much in 2008 relative to 2006.

Gorodnichenko *et al.* (2009) suggest that the consumption-income gap should decline more for skilled workers than for unskilled ones after the reform because the skilled and high earning workers are compensated by private firms in Rus-

sia in ways that these workers reduce their wages reported for tax purposes. This 'tax purpose reducing' compensation is not as big after the reform, therefore Gorodnichenko *et al.* (2009) modify the baseline specification (7.5) with additional interaction terms such as private vs. public sector or blue collar workers vs. white collar workers, assuming that the consumption-income gap should decline less for unskilled workers than for skilled ones. Applying this suggestion to the Czech Republic and to our data we report results in Table 7.6. Our results do not show significant decline in the consumption-income gap, nor increase, but no change at all.

Lastly, Gorodnichenko *et al.* (2009) in supplementary specification, extend their baseline estimates of the consumption-income gap dynamics by accounting for changes in expenditures on durables, savings and home production due to high volatility of durable purchases and net savings. They expect an increase in the consumption-income gap in treatment group if there is a growth of durable purchases and if there is a decline in home production. They expect a decline in the consumption-income gap in treatment group if there is a decrease in net saving. They use alternative definition for purchases of durable goods (C3), net savings (C4), and income from home production (Y3) for this suplementary specification. Table 7.7 reports the estimates for these alternative measures of income and expenditures. We do not find any significant increases or decreases in the consumption-income gap for the treatment group relative to comparison group as Gorodnichenko *et al.* (2009) suggest. Our estimates of α are not statisticallly significant which is consistent with results for our baseline definition of income and consumption reported in Table 7.5. As for the consumption-income gap we find significant growth in for all alternative measures of consumption and income in 2007 relative to year 2006 and significant decline in 2008 relative to 2007. However, estimates for consumption-income gap in 2008 relative to 2006 show various results.

7.5.2 Panel 2006-2008

Table 7.8 reports selected summary statistics describing treatment and comparison groups for panel including years 2006 and 2008. Households in the treatment group consist of about 41% of all households and have more members and children but less seniors than households in comparison group. The heads of households in treatment group are younger, more educated, less likely to be married and work more at enterprise or in private sector than those heads

of households in comparison group. Our summary statistics of treatment and comparison group are the same as the previous panel including years 2006, 2007 and 2008. Last column of Table 7.8 reports p-values of parametric Student's t-test difference of means with significance levels. We have insignificant differences of variables *number of HH members*, *number of children in HH*, and *married* as in panel including years 2006, 2007 and 2008, and for the same reason.

Table 7.9 reports the estimates of equation (7.8) for panel including years 2006 and 2008 without variable d_{ht}^{treat} for the same reason as in previous panel that when using the fixed effects estimator on panel data there would be multicollinearity of the coefficient μ with the individual fixed effect. The estimates of α are not statistically significant for either of consumption or income measure suggesting that, *cetereis paribus*, for the treatment group in year 2008 the consumption has not changed from income relative to comparison group. We do not find significant effect for treatment group but we find significant estimates for consumption-income gap in 2008 relative to 2006. We find a decline in the consumption-income gap suggesting that, *cetereis paribus*, income grew more than consumption in 2008 relative to 2006.

Table 7.10 reports the estimates of α for modified baseline specification with additional interaction terms for panel including years 2006 and 2008. The results are, as in previous panel, without any change in the consumption-income gap for treatment group relative to comparison group.

The estimates of α for the consumption-income gap using the alternative measures of consumptions and income are reported in Table 7.11. The results for panel including 2006 and 2008 are not statistically significant suggesting that, *cetereis paribus*, there is not an effect in the consumption-income gap in the treatment group relative to comparison group. Looking at the estimates for after reform dummy, we see a significant decline in the range between -0.31 and -0.18 in the consumption-income gap suggesting that, *cetereis paribus*, income grew by approximately 31-18% more than consumption in 2008 relative to 2006.

7.5.3 Panel 2007-2008

Selected summary statistics describing treatment and comparison groups for panel including years 2007 and 2008 are reported in Table 7.12. Households in the treatment group consist of about 43% of all households and have more members and children but less seniors than households in comparison group.

The heads of households in treatment group are younger, more educated, more likely to be married and work more at enterprise or in private sector than those heads of households in comparison group. Our summary statistics of treatment and comparison group are the same as for the summary statistics made by Gorodnichenko *et al.* (2009). As in previous two panels, the last column of Table 7.12 reports p-values of parametric Student's t-test difference of means with significance levels, showing the same insignificant differences of variables *number of HH members*, *number of children in HH*, and *married*.

As in previous panel Table 7.13 also reports the estimates of equation (7.8) for panel including years 2007 and 2008 without variable d_{ht}^{treat}. The estimates of α are as in previous cases not statistically significant for either of consumption or income measure suggesting that, *cetereis paribus*, consumption has not changed from income in treatment group relative to comparison group. The estimates of after reform dummy are significant for the consumption-income gap using the consumption measure C2 and insignificant for C1, suggesting that, based on the significant estimates, the income declined in 2008 relative to 2007 more than consumption.

Table 7.14 reports the estimates of α for modified baseline specification with additional interaction terms for panel including years 2007 and 2008. The results are, as in previous panels, without any change in the consumption-income gap for treatment group relative to comparison group.

As for the alternative measures of consumptions and income for the consumption-income gap, the estimates of α are reported in Table 7.15. The results are again as in previous cases not statistically significant in treatment group suggesting that, *cetereis paribus*, there is not an effect in the consumption-income gap relative to comparison group. As for the actual consumption-income gap, we can say that the it declined by 17% in 2008 relative to 2007 for alternative measures of net savings and grew by 1.5% for purchases of durables.

7.6 Further Analysis

Previous sections showed analysis with household fixed effects. In this section we present analysis without household fixed effects and compare results with previous ones. We do the analysis on the same three panel data using the same comparison and treatment groups. We apply the same econometric difference-in-difference method but specifications are not estimated with household fixed

effects but we use first differences. We present results only for combination of consumption measures C1 and C2, and income measures Y1 and Y2.

Table 7.16 presents the estimated specifications of the following specification:

$$\begin{aligned} lnC_{ht} - lnY_{ht}^{R} &= constant + \varphi_1 age_{ht} + \varphi_2 schooling_{ht} + \varphi_3 marital\ status_{ht} \\ &+ \varphi_4 enterprise_{ht} + \varphi_5 private\ sector_{ht} \\ &+ \varphi_6 number\ of\ household\ members_{ht} \\ &+ \varphi_7 number\ of\ children_{ht} + \varphi_8 number\ of\ seniors_{ht} + \varphi_9 year_{ht} \\ &+ \mu d_{ht}^{treat} + \alpha(d_{ht}^{treat} \times D_p) + \psi D_p + \varepsilon_{ht}, \end{aligned} \tag{7.10}$$

which is not what Gorodnichenko *et al.* (2009) use for their analysis, however it is based on (7.5) where we drop the time-invariant component of the error term and add *constant*.

Table 7.17 and Table 7.18 presents the estimated specifications of the specification that is also as (7.10) originally based on (7.5) but it differs from (7.10) by not including dummy variable for year 2006. Thus the econometric specification is as follows:

$$\begin{aligned} lnC_{ht} - lnY_{ht}^{R} &= constant + \varphi_1 age_{ht} + \varphi_2 schooling_{ht} + \varphi_3 marital\ status_{ht} \\ &+ \varphi_4 enterprise_{ht} + \varphi_5 private\ sector_{ht} \\ &+ \varphi_6 number\ of\ household\ members_{ht} \\ &+ \varphi_7 number\ of\ children_{ht} + \varphi_8 number\ of\ seniors_{ht} \\ &+ \mu d_{ht}^{treat} + \alpha(d_{ht}^{treat} \times D_p) + \psi D_p + \varepsilon_{ht}, \end{aligned} \tag{7.11}$$

Looking at the results of our analysis from all three panels, we do not find a significant response in the estimates of α for neither of our combination of consumption and income measures. Our results are in line with consumption-income gap analysis that followed Gorodnichenko *et al.* (2009). However, results from our analysis show significant estimates of the treatment group specific effect μ.

7.7 Results Summary

This section summarizes results obtained from previous analyses.

In Section 7.1 we describe necessary adjustements of HBS data for analysis

that is inspired by study of Gorodnichenko *et al.* (2009). We eliminated all households that: were not reporting for full 12 months; all households consisted of only unemployed individuals; all households where the head of household was not economically active; and where there were more than one economically active individuals in household. Last data adjustment was made because of the way HBS is structured. We did so because it was crucial for us to identify households into treatment group for difference-in-difference method based on head of household's reported post-reform earnings received over the whole year, as described in Section 7.4.

Another adjustment we made, in order to construct panel data, was to drop all observations that were not in all years, for years that were included in the panel. We created three panels which we used for finding the effect of flat tax on tax evasion. Our first panel includes years 2006, 2007 and 2008, the second panel includes years 2006 and 2008, and the third panel includes years 2007 and 2008. For the analysis, we include all three panels because of the number of households in each one, having the most households in panel including years 2007 and 2008.

Summary statistics in Tables 7.4, 7.8, and 7.12 report same results for treatment and control groups as Gorodnichenko *et al.* (2009), except for the marriage results in panels including year 2006. Possible explanation to it is the data adjustment which excludes all households where there is more than one economically active individual since the average household in the Czech Republic consists of married couple with children.

To examine the differences between comparison and treatment group we run the parametric Student's t-test difference of means and find that differences of variables *number of HH members*, *number of children in HH*, and *married* are not statistically different. The explanation to it is again data adjustment which excludes all households where there is more than one economically active individual.

We employed difference-in-difference specification with household fixed-effects to find the effect in the consumption-income gap using various measures of consumption C1, C2, C3, and C4, in combination with various measures of reported income Y1, Y2, and Y3. Next, we added another three difference-in-difference specifications with first differences. These analyses use the same variables as previous ones but are performed on the baseline combinations of consumption measures C1 and C2 with income measures Y1 and Y2.

We find that consumption-income gap in 2008 relative to pre-reform years

are ambiguous for panel including all three years, negative for panel including years 2006 and 2008, and mostly positive for panel including years 2007 and 2008 with fixed household effect but negative for estimations in first differences. As for the actual effect of flat tax on tax evasion, we find no statistically significant results for neither of our provided analysis implying that, *ceteris paribus*, consumption has not changed from income for households that experienced a reduction in marginal tax rates, relative to those households that did not.

Table 7.4: Summary Statistics 2006-2007-2008

	Conmparison Group	Treatment Group	Total	p-value
C1	149934	183619	163882	0.000
	(50895)	(60214)	(57375)	***
C2	164421	201653	179837	0.000
	(57768)	(69765)	(65601)	***
C3	172268	228493	195549	0.000
	(64425)	(97289)	(84335)	***
C4	142969	181908	159092	0.000
	(183075)	(183032)	(183981)	***
Y1	190245	263455	220559	0.000
	(65866)	(91158)	(85313)	***
Y2	199318	293276	238222	0.000
	(69646)	(143492)	(116186)	***
Y3	190298	263497	220607	0.000
	(65826)	(91142)	(85286)	***
Number of HH members	1.910	1.922	1.915	0.849
	(1.138)	(1.119)	(1.130)	-
Number of children in HH	0.534	0.593	0.559	0.275
	(0.927)	(0.857)	(0.899)	-
Number of seniors in HH	0.212	0.138	0.181	0.001
	(0.412)	(0.367)	(0.396)	**
Age	48.45	45.26	47.13	0.000
	(12.99)	(10.58)	(12.15)	***
Years of schooling	12.48	14.37	13.27	0.000
	(3.770)	(3.600)	(3.814)	***
Married	0.281	0.247	0.267	0.198
	(0.450)	(0.432)	(0.443)	-
Works at enterprise	0.757	0.927	0.827	0.000
	(0.429)	(0.261)	(0.378)	***
Works in private sector	0.258	0.627	0.411	0.000
	(0.438)	(0.484)	(0.492)	***
Works in public sector	0.742	0.373	0.589	0.000
	(0.438)	(0.484)	(0.492)	***
Observations	675	477	1152	

Note: All income and consumption measures are in 2005 prices. HH denotes household.

Mean of each variable with standard deviation in parentheses.

***, **, and * denote significance at the 1%, 5%, and 10% levels

Table 7.5: Tax Evasion Function: Difference-in-Difference Approach 2006-2007-2008, FE

	lnC1-lnY1	lnC2-lnY1	lnC1-lnY2	lnC2-lnY2
	(1)	(2)	(3)	(4)
Number of HH members	-.008	-.013	-.050	-.055
	(.067)	(.070)	(.085)	(.086)
Number of children in HH	-.077	-.109	-.071	-.104
	(.058)	(.060)*	(.054)	(.057)*
Number of seniors in HH	-.064	-.070	-.053	-.059
	(.085)	(.085)	(.084)	(.083)
Age	.045	-.038	.044	-.039
	(.008)***	(.008)***	(.008)***	(.008)***
Years of schooling	-.001	-.001	-.001	-.001
	(.003)	(.003)	(.003)	(.003)
Married	-.226	-.215	-.196	-.185
	(.078)***	(.074)***	(.084)**	(.080)**
Works at enterprise	.026	-.013	.028	-.012
	(.093)	(.105)	(.094)	(.105)
Works in private sector	-.006	.031	-.020	.017
	(.051)	(.052)	(.050)	(.051)
Year = 2006	.051	-.038	.052	-.036
	(.010)***	(.011)***	(.014)***	(.014)***
After reform dummy	-.044	.035	-.044	.035
	(.008)***	(.008)***	(.008)***	(.008)***
$d^{treat} \times D_p$	-.026	-.018	-.009	-.0003
	(.018)	(.019)	(.021)	(.021)
Obs.	1152	1152	1152	1152

Note: Robust standard errors in parentheses

***, **, and * denote significance at the 1%, 5%, and 10% levels

All income and consumption measures are in 2005 prices. All specifications are estimated with household fixed effects (FE). HH denotes household. Treatment and control group are defined on the basis of post-reform earnings. C1=expenditures on non-durable goods, C2=C1+transfers, Y1=regular income, and Y2=Y1+irregular payments.

Table 7.6: Treatment Effect in the Difference-in-Difference Approach 2006-2007-2008: Heterogeneous Response

	lnC1-lnY1	lnC2-lnY1	lnC1-lnY2	lnC2-lnY2
	(1)	(2)	(3)	(4)
Public vs. Private sector				
$d^{treat} \times D_p$	-.026	-.018	-.003	.005
(Public sector is omitted)	(.026)	(.027)	(.027)	(.027)
$d^{treat} \times D_p \times Private$	-.016	-.010	-.010	-.004
	(.021)	(.022)	(.028)	(.027)
Obs.	1152	1152	1152	1152
Blue collar vs. white collar				
$d^{treat} \times D_p \times private$	-.009	-.002	-.004	.004
(blue collar workers are omitted)	(.022)	(.023)	(.031)	(.029)
$d^{treat} \times D_p \times private \times white\ collar$	-.054	-.063	-.049	-.058
	(.063)	(.063)	(.058)	(.058)
Obs.	1152	1152	1152	1152

Note: Robust standard errors in parentheses

***, **, and * denote significance at the 1%, 5%, and 10% levels

All income and consumption measures are in 2005 prices. Reported are the estimated coefficients on the interaction term between the treatment group and post-reform dummy using different measures of earnings. All specifications are estimated with household fixed effects (FE) and include the same variables as in equation (7.9). HH denotes household. Treatment and control group are defined on the basis of post-reform earnings. C1=expenditures on non-durable goods, C2=C1+transfers, Y1=regular income, and Y2=Y1+irregular payments.

Table 7.7: Tax Evasion Function with Alternative Measures of Income and Expenditures: Difference-in-Difference Approach 2006-2007-2008, FE

	lnC3-lnY1 with Purchases of Durables	lnC4-lnY1 Net Savings	lnC1-lnY3 Home Production
	(1)	(2)	(3)
Number of HH members	.002	.058	-.009
	(.073)	(.069)	(.067)
Number of children in HH	-.077	-.019	-.076
	(.071)	(.077)	(.058)
Number of seniors in HH	-.077	.002	-.063
	(.074)	(.038)	(.085)
Age	.070	.139	.045
	(.009)***	(.010)***	(.008)***
Years of schooling	.00002	-.002	-.001
	(.004)	(.005)	(.003)
Married	-.264	-.014	-.226
	(.058)***	(.082)	(.078)***
Works at enterprise	.027	.035	.026
	(.101)	(.123)	(.093)
Works in private sector	-.042	-.018	-.006
	(.049)	(.049)	(.051)
Year = 2006	.064	.157	.051
	(.012)***	(.023)***	(.010)***
After reform dummy	-.079	-.125	-.044
	(.010)***	(.014)***	(.008)***
$d^{treat} \times D_p$	-.010	.026	-.026
	(.024)	(.036)	(.018)
Obs.	1152	1119	1152

Note: Robust standard errors in parentheses

***, **, and * denote significance at the 1%, 5%, and 10% levels

Omitted categories are the public sector and year 2006. All income and consumption measures are in 2005 prices. All specifications are estimated with household fixed effects (FE). HH denotes household. Treatment and control group are defined on the basis of post-reform earnings. C1=expenditures on non-durable goods, C3=C1+purchases of durable goods, C4=C1+net savings, Y1=regular income, and Y3=Y1+income from selling home grown goods.

Table 7.8: Summary Statistics 2006-2008

	Conmparison Group	Treatment Group	Total	p-value
C1	150249	183347	164068	0.000
	(50896)	(61219)	(57760)	***
C2	164463	200742	179610	0.000
	(57158)	(68272)	(64532)	***
C3	172437	226780	195127	0.000
	(64657)	(88555)	(80126)	***
C4	141011	192226	162394	0.000
	(217769)	(130990)	(188115)	***
Y1	190131	265701	221683	0.000
	(67565)	(94921)	(88331)	***
Y2	199739	292331	238399	0.000
	(72319)	(128870)	(109785)	***
Y3	190172	265736	221722	0.000
	(67529)	(94908)	(88308)	***
Number of HH members	1.920	1.963	1.938	0.610
	(1.143)	(1.159)	(1.149)	-
Number of children in HH	0.543	0.622	0.576	0.238
	(0.940)	(0.889)	(0.919)	-
Number of seniors in HH	0.213	0.135	0.180	0.006
	(0.414)	(0.359)	(0.394)	**
Age	48.36	45.14	47.02	0.000
	(13.05)	(10.57)	(12.17)	***
Years of schooling	12.49	14.23	13.22	0.000
	(3.420)	(3.309)	(3.480)	***
Married	0.281	0.262	0.273	0.566
	(0.450)	(0.441)	(0.446)	-
Works at enterprise	0.754	0.926	0.826	0.000
	(0.431)	(0.262)	(0.379)	***
Works in private sector	0.254	0.617	0.406	0.000
	(0.436)	(0.487)	(0.491)	***
Works in public sector	0.746	0.383	0.594	0.000
	(0.436)	(0.487)	(0.491)	***
Observations	452	324	776	

Note: All income and consumption measures are in 2005 prices. HH denotes household.

Mean of each variable with standard deviation in parentheses.

***, **, and * denote significance at the 1%, 5%, and 10% levels

Table 7.9: Tax Evasion Function: Difference-in-Difference Approach 2006-2008, FE

	lnC1-lnY1	lnC2-lnY1	lnC1-lnY2	lnC2-lnY2
	(1)	(2)	(3)	(4)
Number of HH members	.019	.028	-.042	-.033
	(.090)	(.094)	(.107)	(.110)
Number of children in HH	-.084	-.129	-.065	-.110
	(.078)	(.083)	(.066)	(.073)
Number of seniors in HH	-.052	-.058	-.048	-.054
	(.095)	(.095)	(.088)	(.088)
Age	.090	.010	.086	.007
	(.010)***	(.010)	(.010)***	(.009)
Years of schooling	-.001	-.0008	.0006	.001
	(.004)	(.004)	(.004)	(.004)
Married	-.184	-.183	-.089	-.088
	(.116)	(.114)	(.129)	(.128)
Works at enterprise	-.049	-.076	-.041	-.068
	(.122)	(.129)	(.119)	(.126)
Works in private sector	.035	.076	-.002	.040
	(.057)	(.064)	(.050)	(.059)
After reform dummy	-.189	-.029	-.183	-.023
	(.012)***	(.012)**	(.011)***	(.011)**
$d^{treat} \times D_p$	-.008	.003	.0008	.012
	(.022)	(.022)	(.025)	(.025)
Obs.	776	776	776	776

Note: Robust standard errors in parentheses

***, **, and * denote significance at the 1%, 5%, and 10% levels

All income and consumption measures are in 2005 prices. All specifications are estimated with household fixed effects (FE). HH denotes household. Treatment and control group are defined on the basis of post-reform earnings. C1=expenditures on non-durable goods, C2=C1+transfers, Y1=regular income, and Y2=Y1+irregular payments.

Table 7.10: Treatment Effect in the Difference-in-Difference Approach 2006-2008: Heterogeneous Response

	lnC1-lnY1	lnC2-lnY1	lnC1-lnY2	lnC2-lnY2
	(1)	(2)	(3)	(4)
Public vs. Private sector				
$d^{treat} \times D_p$	-.021	-.015	-.004	.002
(Public sector is omitted)	(.029)	(.031)	(.031)	(.032)
$d^{treat} \times D_p \times Private$	.006	.016	.004	.014
	(.025)	(.026)	(.033)	(.033)
Obs.	776	776	776	776
Blue collar vs. white collar				
$d^{treat} \times D_p \times private$	.014	.028	.012	.026
(blue collar workers are omitted)	(.026)	(.026)	(.036)	(.036)
$d^{treat} \times D_p \times private \times white\ collar$	-.049	-.071	-.048	-.070
	(.071)	(.070)	(.058)	(.057)
Obs.	776	776	776	776

Note: Robust standard errors in parentheses

***, **, and * denote significance at the 1%, 5%, and 10% levels

All income and consumption measures are in 2005 prices. Reported are the estimated coefficients on the interaction term between the treatment group and post-reform dummy using different measures of earnings. All specifications are estimated with household fixed effects (FE) and include the same variables as in equation (7.8). HH denotes household. Treatment and control group are defined on the basis of post-reform earnings. C1=expenditures on non-durable goods, C2=C1+transfers, Y1=regular income, and Y2=Y1+irregular payments.

Table 7.11: Tax Evasion Function with Alternative Measures of Income and Expenditures: Difference-in-Difference Approach 2006-2008, FE

	lnC3-lnY1 with Purchases of Durables	lnC4-lnY1 Net Savings	lnC1-lnY3 Home Production
	(1)	(2)	(3)
Number of HH members	.030	.029	.018
	(.100)	(.099)	(.090)
Number of children in HH	-.134	.022	-.083
	(.092)	(.107)	(.078)
Number of seniors in HH	-.034	-.018	-.052
	(.091)	(.066)	(.095)
Age	.152	.097	.090
	(.011)***	(.014)***	(.010)***
Years of schooling	.002	-.009	-.002
	(.005)	(.006)	(.004)
Married	-.256	.024	-.184
	(.091)***	(.094)	(.116)
Works at enterprise	-.082	.135	-.049
	(.117)	(.079)*	(.122)
Works in private sector	.021	.024	.035
	(.051)	(.055)	(.057)
After reform dummy	-.317	-.189	-.189
	(.014)***	(.017)***	(.012)***
$d^{treat} \times D_p$	.015	.009	-.008
	(.027)	(.037)	(.022)
Obs.	776	756	776

Note: Robust standard errors in parentheses

***, **, and * denote significance at the 1%, 5%, and 10% levels

All income and consumption measures are in 2005 prices. All specifications are estimated with household fixed effects (FE). HH denotes household. Treatment and control group are defined on the basis of post-reform earnings. C1=expenditures on non-durable goods, C3=C1+purchases of durable goods, C4=C1+net savings, Y1=regular income, and Y3=Y1+income from selling home grown goods.

Table 7.12: Summary Statistics 2007-2008

	Conmparison Group	Treatment Group	Total	p-value
C1	151946	194938	170486	0.000
	(50708)	(65550)	(61366)	***
C2	166242	215245	187373	0.000
	(58220)	(76538)	(70987)	***
C3	176883	245496	206471	0.000
	(67920)	(109352)	(94487)	***
C4	144863	179297	159712	0.007
	(206069)	(210585)	(208630)	**
Y1	193313	282917	231953	0.000
	(67816)	(100758)	(94644)	***
Y2	208547	313076	253623	0.000
	(117966)	(169726)	(151654)	***
Y3	193377	282951	232003	0.000
	(67795)	(100736)	(94619)	***
Number of HH members	1.980	2.091	2.028	0.133
	(1.140)	(1.254)	(1.191)	-
Number of children in HH	0.610	0.700	0.649	0.116
	(0.925)	(0.944)	(0.934)	-
Number of seniors in HH	0.199	0.136	0.172	0.008
	(0.407)	(0.361)	(0.389)	**
Age	47.58	44.45	46.23	0.000
	(12.84)	(10.74)	(12.07)	***
Years of schooling	12.54	14.10	13.21	0.000
	(3.304)	(3.396)	(3.430)	***
Married	0.273	0.313	0.290	0.156
	(0.446)	(0.464)	(0.454)	-
Works at enterprise	0.761	0.899	0.821	0.000
	(0.427)	(0.302)	(0.384)	***
Works in private sector	0.257	0.571	0.392	0.000
	(0.437)	(0.495)	(0.488)	***
Works in public sector	0.743	0.429	0.608	0.000
	(0.437)	(0.495)	(0.488)	***
Observations	612	464	1076	

Note: All income and consumption measures are in 2005 prices. HH denotes household.

Mean of each variable with standard deviation in parentheses.

***, **, and * denote significance at the 1%, 5%, and 10% levels

Table 7.13: Tax Evasion Function: Difference-in-Difference Approach 2007-2008, FE

	lnC1-lnY1	lnC2-lnY1	lnC1-lnY2	lnC2-lnY2
	(1)	(2)	(3)	(4)
Number of HH members	-.139	-.161	-.082	-.104
	(.048)***	(.046)***	(.058)	(.053)*
Number of children in HH	-.011	-.014	-.067	-.069
	(.059)	(.057)	(.064)	(.062)
Number of seniors in HH	-.064	-.077	-.078	-.091
	(.112)	(.107)	(.106)	(.099)
Age	.001	-.084	-.008	-.093
	(.006)	(.007)***	(.010)	(.010)***
Years of schooling	-.002	-.003	-.002	-.002
	(.003)	(.003)	(.004)	(.004)
Married	-.180	-.152	-.240	-.212
	(.052)***	(.054)***	(.062)***	(.062)***
Works at enterprise	.092	.091	.106	.105
	(.105)	(.115)	(.100)	(.109)
Works in private sector	.003	.039	-.056	-.020
	(.062)	(.067)	(.059)	(.066)
After reform dummy	.002	.085	-.005	.078
	(.006)	(.006)***	(.006)	(.006)***
$d^{treat} \times D_p$	-.022	-.020	.017	.019
	(.016)	(.017)	(.024)	(.023)
Obs.	1076	1076	1076	1076

Note: Robust standard errors in parentheses

***, **, and * denote significance at the 1%, 5%, and 10% levels

All income and consumption measures are in 2005 prices. All specifications are estimated with household fixed effects (FE). HH denotes household. Treatment and control group are defined on the basis of post-reform earnings. C1=expenditures on non-durable goods, C2=C1+transfers, Y1=regular income, and Y2=Y1+irregular payments.

Table 7.14: Treatment Effect in the Difference-in-Difference Approach 2007-2008: Heterogeneous Response

	lnC1-lnY1	lnC2-lnY1	lnC1-lnY2	lnC2-lnY2
	(1)	(2)	(3)	(4)
Public vs. Private sector				
$d^{treat} \times D_p$	-.006	-.002	.007	.011
(Public sector is omitted)	(.023)	(.023)	(.024)	(.023)
$d^{treat} \times D_p \times Private$	-.026	-.026	.018	.017
	(.020)	(.022)	(.035)	(.033)
Obs.	1076	1076	1076	1076
Blue collar vs. white collar				
$d^{treat} \times D_p \times private$	-.021	-.019	.027	.029
(blue collar workers are omitted)	(.021)	(.023)	(.039)	(.036)
$d^{treat} \times D_p \times private \times white\ collar$	-.049	-.058	-.046	-.056
	(.066)	(.073)	(.066)	(.072)
Obs.	1076	1076	1076	1076

Note: Robust standard errors in parentheses

***, **, and * denote significance at the 1%, 5%, and 10% levels

All income and consumption measures are in 2005 prices. Reported are the estimated coefficients on the interaction term between the treatment group and post-reform dummy using different measures of earnings. All specifications are estimated with household fixed effects (FE) and include the same variables as in equation (7.8). HH denotes household. Treatment and control group are defined on the basis of post-reform earnings. C1=expenditures on non-durable goods, C2=C1+transfers, Y1=regular income, and Y2=Y1+irregular payments.

Table 7.15: Tax Evasion Function with Alternative Measures of Income and Expenditures: Difference-in-Difference Approach 2007-2008, FE

	lnC3-lnY1 with Purchases of Durables	lnC4-lnY1 Net Savings	lnC1-lnY3 Home Production
	(1)	(2)	(3)
Number of HH members	-.206 (.058)***	.020 (.163)	-.140 (.048)***
Number of children in HH	.031 (.072)	.094 (.168)	-.011 (.059)
Number of seniors in HH	-.139 (.104)	.133 (.120)	-.064 (.112)
Age	-.012 (.008)	.190 (.014)***	.001 (.006)
Years of schooling	-.001 (.004)	.0009 (.006)	-.002 (.003)
Married	-.042 (.067)	-.031 (.169)	-.179 (.051)***
Works at enterprise	.123 (.101)	-.172 (.199)	.092 (.105)
Works in private sector	-.027 (.060)	.002 (.076)	.003 (.062)
After reform dummy	.015 (.007)**	-.177 (.011)***	.002 (.006)
$d^{treat} \times D_p$	-.015 (.022)	.009 (.039)	-.022 (.016)
Obs.	1076	1037	1076

Note: Robust standard errors in parentheses

***, **, and * denote significance at the 1%, 5%, and 10% levels

All income and consumption measures are in 2005 prices. All specifications are estimated with household fixed effects (FE). HH denotes household. Treatment and control group are defined on the basis of post-reform earnings. C1=expenditures on non-durable goods, C3=C1+purchases of durable goods, C4=C1+net savings, Y1=regular income, and Y3=Y1+income from selling home grown goods.

Table 7.16: Tax Evasion Function: Difference-in-Difference Approach 2006-2007-2008

	lnC1-lnY1	lnC2-lnY1	lnC1-lnY2	lnC2-lnY2
	(1)	(2)	(3)	(4)
Number of HH members	-.087	-.116	-.054	-.084
	(.042)**	(.041)***	(.041)	(.040)**
Number of children in HH	.185	.186	.112	.113
	(.048)***	(.044)***	(.045)**	(.043)***
Number of seniors in HH	-.026	-.026	-.056	-.056
	(.042)	(.043)	(.042)	(.043)
Age	.003	.005	.004	.005
	(.001)***	(.001)***	(.001)***	(.001)***
Years of schooling	-.003	-.002	-.005	-.004
	(.003)	(.003)	(.003)	(.003)
Married	-.047	-.006	-.010	.030
	(.043)	(.043)	(.042)	(.042)
Works at enterprise	-.098	-.076	-.118	-.097
	(.031)***	(.031)**	(.031)***	(.031)***
Works in private sector	.009	.007	.012	.010
	(.024)	(.025)	(.024)	(.025)
Year = 2006	.009	.005	.011	.007
	(.009)	(.010)	(.012)	(.011)
After reform dummy	-.004	-.010	-.003	-.009
	(.011)	(.011)	(.012)	(.012)
Treatment group	-.102	-.104	-.133	-.135
	(.024)***	(.024)***	(.025)***	(.024)***
$d^{treat} \times D_p$	-.029	-.019	-.016	-.006
	(.019)	(.020)	(.021)	(.021)
Const.	-.213	-.190	-.252	-.229
	(.083)**	(.080)**	(.089)***	(.086)***
Obs.	1152	1152	1152	1152

Note: Robust standard errors in parentheses

***, **, and * denote significance at the 1%, 5%, and 10% levels

All income and consumption measures are in 2005 prices. HH denotes household. Treatment and control group are defined on the basis of post-reform earnings. C1=expenditures on non-durable goods, C2=C1+transfers, Y1=regular income, and Y2=Y1+irregular payments.

Table 7.17: Tax Evasion Function: Difference-in-Difference Approach 2006-2008

	lnC1-lnY1	lnC2-lnY1	lnC1-lnY2	lnC2-lnY2
	(1)	(2)	(3)	(4)
Number of HH members	-.085	-.113	-.057	-.085
	(.043)**	(.041)***	(.041)	(.039)**
Number of children in HH	.180	.179	.107	.106
	(.049)***	(.044)***	(.045)**	(.042)**
Number of seniors in HH	-.031	-.030	-.066	-.065
	(.044)	(.044)	(.044)	(.044)
Age	.003	.005	.004	.005
	(.001)***	(.001)***	(.001)***	(.001)***
Years of schooling	-.004	-.002	-.005	-.003
	(.003)	(.003)	(.003)	(.003)
Married	-.040	.0005	.001	.042
	(.043)	(.043)	(.042)	(.042)
Works at enterprise	-.105	-.083	-.122	-.100
	(.032)***	(.032)***	(.031)***	(.031)***
Works in private sector	.010	.011	.012	.013
	(.025)	(.025)	(.025)	(.025)
After reform dummy	-.019	-.022	-.017	-.020
	(.014)	(.014)	(.014)	(.013)
Treatment group	-.117	-.123	-.142	-.147
	(.026)***	(.025)***	(.027)***	(.026)***
$d^{treat} \times D_p$	-.012	.0003	-.009	.003
	(.022)	(.023)	(.025)	(.025)
Const.	-.178	-.160	-.232	-.213
	(.086)**	(.082)*	(.089)***	(.085)**
Obs.	776	776	776	776

Note: Robust standard errors in parentheses

***, **, and * denote significance at the 1%, 5%, and 10% levels

All income and consumption measures are in 2005 prices. HH denotes household. Treatment and control group are defined on the basis of post-reform earnings. C1=expenditures on non-durable goods, C2=C1+transfers, Y1=regular income, and Y2=Y1+irregular payments.

Table 7.18: Tax Evasion Function: Difference-in-Difference Approach 2007-2008

	lnC1-lnY1	lnC2-lnY1	lnC1-lnY2	lnC2-lnY2
	(1)	(2)	(3)	(4)
Number of HH members	-.161	-.180	-.098	-.117
	(.041)***	(.041)***	(.040)**	(.040)***
Number of children in HH	.271	.263	.162	.154
	(.047)***	(.048)***	(.046)***	(.046)***
Number of seniors in HH	.042	.047	-.006	-.0009
	(.040)	(.042)	(.039)	(.041)
Age	.003	.005	.003	.005
	(.001)***	(.001)***	(.001)***	(.001)***
Years of schooling	-.002	-.001	-.006	-.005
	(.003)	(.003)	(.003)*	(.004)
Married	-.041	-.015	-.019	.007
	(.038)	(.040)	(.037)	(.039)
Works at enterprise	-.127	-.116	-.137	-.126
	(.032)***	(.032)***	(.031)***	(.031)***
Works in private sector	.027	.029	.022	.023
	(.022)	(.022)	(.021)	(.022)
After reform dummy	-.001	-.006	-.015	-.019
	(.009)	(.009)	(.013)	(.013)
Treatment group	-.107	-.094	-.132	-.119
	(.022)***	(.023)***	(.023)***	(.023)***
$d^{treat} \times D_p$	-.023	-.020	.010	.013
	(.017)	(.018)	(.023)	(.022)
Const.	-.123	-.106	-.171	-.154
	(.081)	(.079)	(.085)**	(.084)*
Obs.	1076	1076	1076	1076

Note: Robust standard errors in parentheses

***, **, and * denote significance at the 1%, 5%, and 10% levels

All income and consumption measures are in 2005 prices. HH denotes household. Treatment and control group are defined on the basis of post-reform earnings. C1=expenditures on non-durable goods, C2=C1+transfers, Y1=regular income, and Y2=Y1+irregular payments.

Chapter 8

Conclusion

The contribution of this thesis is to measure the impact of the Czech Republic 2008 flat personal income tax rate on tax evasion. Tax evasion continues to be an issue in many countries. Moreover, tax evasion is not directly observable and thus hard to measure. Following Gorodnichenko *et al.* (2009), we use indirect technique to measure the dynamics of tax evasion. To do so, we use micro-level data on household income and consumption from the Household Budget Survey to estimate the effect of the tax reform on tax evasion because there is an argument that the flat tax reform helps to decrease tax evasion.

We employ the difference-in-difference approach to separate the tax evasion effect of flat rate personal income tax reform from other factors. The consumption-income gap estimates, our proxy for tax evasion, are obtained by using panel data that trace the consumptions and reported incomes of the same households before and after the 2008 tax reform. We find that, *ceteris paribus*, the consumption-income gap has not significantly changed for households with only one economically active individual that experienced a reduction in marginal tax rates in the first year after the tax reform relative to households experiencing no change.

There are couple of directions in which our work can be extended. First, our analysis uses two years before and the first year after tax reform (because of the unavailability of other years after the tax reform). Therefore, adding more consecutive years of after tax reform period, we believe, the effect of flat tax rate on tax evasion could show some effect since it takes time for households to adapt to new tax policy. Second, our work uses the difference-in-difference approach which could be extended by adding regression-discontinuity-type analysis to

provide a consistent estimate of the treatment effect at the point of discontinuity and examine the response around the threshold.

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Appendix A

Endogeneity in Pre-reform Reported Income

To show the endogeneity problem of using the pre-reform reported income to classify taxpayers into treatment and comparison group in the presence of tax evasion they re-write equation (7.5). By considering only two periods $t-1$ as before treatment and t as after treatment and dropping the subscript h to simplify exposition they come to the following equation:

$$\Delta lnC_t - \Delta lnY_t^R = \gamma \Delta S_t + \beta \Delta X_t + \alpha I(\tau_t < \tau_{t-1}) + \Delta \varepsilon_t, \qquad \text{(A.1)}$$

where τ_t is the flat tax rate in year t that is independent of income and τ_{t-1} is the pre-reform marginal tax rate as a function of current income Y^*. Treatment group $I(.)$ includes households that experience a decline in the rate that they face, defined on the basis of their total after-reform income.One note to the rate that households face is that this rate is not the rate upon which households make decision to pay. The estimate of parameter α should be negative, *ceteris paribus*, if the flat tax reform has reduced tax evasion.

Recalling that current income Y^* which consists of reported and hidden income is not observable, Gorodnichenko *et al.* (2008) by using the pre-reform reported income to identify treatment and comparison groups show why the pre-reform reported income is not appropriate to use. The difference between the pre-reform and post reform marginal tax rate as a function of pre-reform reported income is as follows:

$$\begin{aligned}\tau_{t-1}(Y_{t-1}^R) - \tau_t(Y_{t-1}^R) &= \tau_{t-1}(Y_{t-1}^R) - \tau_t(Y_t^*) \\ &= \underbrace{[\tau_{t-1}(Y_t^*) - \tau_t(Y_t^*)]}_{true\ treatment} \\ &\quad \underbrace{- \underbrace{[\tau_{t-1}(Y_t^*) - \tau_{t-1}(Y_{t-1}^*)]}_{productivity\ bias \geq 0} - \underbrace{[\tau_{t-1}(Y_{t-1}^*) - \tau_{t-1}(Y_{t-1}^R)]}_{tax\ evasion\ bias \geq 0}}_{bias(t\text{-}1)}.\end{aligned} \tag{A.2}$$

The first equality in equation (A.3) comes from the flat tax in the post-reform period. If the equality between the first difference, $\tau_{t-1}(Y_{t-1}^R) - \tau_t(Y_{t-1}^R)$, and the second difference, $\tau_{t-1}(Y_{t-1}^R) - \tau_t(Y_t^*)$ holds, then the identification of treatment and comparison groups based on reported income is correct. However, $\tau_{t-1}(Y_t^*) - \tau_{t-1}(Y_{t-1}^*) \geq 0$, which means that the treatment group excludes wage earners that increase productivity and pass the treshold; and $\tau_{t-1}(Y_{t-1}^*) - \tau_{t-1}(Y_{t-1}^R) \geq 0$ which means that the treatment group excludes households whose reported income is in the lower bracket while the current income is in the higher ones. Gorodnichenko *et al.* (2008) conclude that behavioral responses to tax changes affect the comparison group identification which results in an upward bias in the estimate of α. Therefore, the effect of the flat tax reform on tax evasion would be hard to find.

Taking now the post-reform reported income to identify treatment and control groups Gorodnichenko *et al.* (2008) show that under the assumption that $Y_t^R = Y_t^*$, meaning that the post-reform income is trully reported, or that there is no tax evasion, the estimate of α is unbiased. They claim that under the flat tax the identification of treatment and comparison groups is not affected by behavioral responses to tax changes, as it is in previous case, because all taxpayers face the same marginal tax rate. Therefore,

$$\begin{aligned}\tau_{t-1}(Y_t^R) - \tau_t(Y_t^R) &= \tau_{t-1}(Y_t^R) - \tau_t(Y_t^*) \\ &= \underbrace{[\tau_{t-1}(Y_t^*) - \tau_t(Y_t^*)]}_{true\ treatment} - \underbrace{[\tau_{t-1}(Y_t^*) - \tau_{t-1}(Y_t^R)]}_{bias(t)=tax\ evasion\ bias \geq 0}.\end{aligned} \tag{A.3}$$

One can also notice that the difference between *bias(t-1)* in equation (A.3) and *bias(t)* in equation (A.3) is $\tau_{t-1}(Y_t^R) - \tau_{t-1}(Y_{t-1}^R)$. From this difference, under the assumption that post-reform reported income would not change or increases due to better compliance, the pre-reform income tax scale implies

that $\tau_{t-1}(Y_t^R) \geq \tau_{t-1}(Y_{t-1}^R)$, and from that *bias(t-1)* $\geq$ *bias(t)*. Gorodnichenko *et al.* (2009) conclude that using the post-reform income decreases the overall bias in treatment group definition. They also claim that in the post-reform period, there should be fewer people whose reported and current income fall in opposite sides from thresholds because of no incentives of households to fall just below the threshold.

Master Thesis Proposal

Author	Bc. Pavel Hrbek
Supervisor	MRes PhDr. Jan Zápal
Proposed topic	The Effect of Czech 2008 Flat Rate Personal Income Tax on Tax Evasion

Topic characteristics Tax evasion is an illegal practice of intentional avoidance of paying true tax liability. The problem with tax evasion is that it is not traceable by tax authority and therefore hard to measure. However, there have been several attempts to measure and/or estimate the extent of tax evasion. Moreover, these attempts do not measure the extent/effect of tax evasion under the flat tax policy but mostly when there is a decline in marginal tax rate. In my thesis, I would like to contribute to this field of research, by analysis of tax evasion in the Czech Republic in after tax reform in 2008.

Hypotheses At this early stage of my research, there are several questions, which could be potentially answered in the thesis. Firstly, I would like to evaluate the change of tax evasion under the personal income flat tax. More specifically, I want to examine whether the personal income flat tax introduced in the Czech Republic in 2008 increased or decreased tax evasion. Based on previous studies about decreased marginal tax rates and based on study from Russian example examining the effect of Russia's flat rate income tax reaform on tax evasion, there should be a decrease of tax evasion. Next, my research wants to shed the light on the issue of why people evade taxes.

Methodology The corner stone of my work is the difference between reported consumption and reported income (consumption-income gap), which shows the changes in tax evasion after the tax reform. Our approach is fully based on approach presented by Gorodnichenko *et al.* (2009) who firstly identify the

treatment group in difference-in-difference approach based on after-reform reported income and secondly, employ the consumption-income gap function that includes tax evasion determinants, life cycle factors, and consumption composition shifters.

Outline

1. Introduction
2. Literature Survey
3. The Czech Flat Tax
4. The Model of Tax Evasion Decision
5. Analysis based on the work of Gorodnichenko et al.
6. Conclusion

In the first part of the thesis, I will focus on the description of the Czech Republic flat tax and show that it is not flat as it is presented in the theory but rather modified flat. In the second part of the thesis I will present the basic theoretical model of taxpayer's evasion decision explaining why individuals evade taxes. The main part of the thesis will be based on the work of Gorodnichenko *et al.* (2009) who use micro-level data to examine the effect of Russia's 2001 flat rate income tax reform on tax evasion by measuring the gap between household expenditures and reported earnings. I will use the Czech individual-level data on household consumption and income from Household Budget Survey to measure the same.

Core bibliography

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7. Slemrod, J. (2007): "Cheating Ourselves: The Economics of Tax Evasion." *Journal of Economic Perspectives* **21(1)**: pp. 25-48.

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