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PERSONAL INCOME TAX REFORM IN THE FEDERATION OF BOSNIA AND HERZEGOVINA

DOCTORAL DISSERTATION

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The undersigned Dželila Kramer a student at the University of Ljubljana, Faculty of Economics, (hereafter: FELU), declare that I am the author of the doctoral dissertation entitled Personal Income Tax Reform in the Federation of Bosnia and Herzegovina, written under supervision of prof. dr. Mitja Čok and co-supervision of prof. dr. Andreja Cirman.

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PERSONAL INCOME TAX REFORM IN THE FEDERATION OF BOSNIA AND HERZEGOVINA

SUMMARY

This dissertation addresses the question of what the consequences would be if alternative personal income tax systems are introduced. Therefore, the subject of analysis and the key research question is whether to have a single rate or differential rates in the taxation of personal income in the Federation of Bosnia and Herzegovina. Such exercise includes the creation of a microsimulation model as a useful tool for tax reforms. The results provided by such a model are analysed and compared with theoretical foundations.

The objective of this research is to estimate several aspects of different tax systems. Some of those aspects are revenue collection, simplicity, income inequality consequences, and distribution of tax burden. Based on such evaluation, the most appropriate system, flat versus step progressive, can be chosen using a modern tool, such as a microsimulation model.

The hypotheses are as follows: (1) The system of personal income taxation in the Federation of Bosnia and Herzegovina has different effects regarding personal income tax progressivity and influence on income inequality measures than the personal income tax systems in Slovenia and Croatia. (2) The flat tax system in the Federation of Bosnia and Herzegovina creates a higher after-tax income inequality than the slice system of tax rate. (3) Regarding income distribution in the Federation of Bosnia and Herzegovina, the step progressive system would be more suitable from the point of view of reducing inequality.

From a methodological point of view, decision making is supported through the results provided by the static microsimulation model created in STATA with data from the Tax Administration of the Federation of Bosnia and Herzegovina for the year of 2009, obtained in April 2011.

The structure of the dissertation is as follows. First, I conduct a literature review exploring the theoretical concepts related to personal income taxation and international practice. I also cover the major concepts related to microsimulations, as well as an overview of relevant microsimulation models in the European Union, the former Yugoslavia, Latin America, the United States of America, Canada, Australia, South Africa, Russia, and Namibia. I cover South Africa, Russia, and Namibia because they have the EUROMOD platform. I also cover the personal income taxation system in the Federation of Bosnia and Herzegovina, and compare it to Slovenian and Croatian systems. Next, I explain the microsimulation model of the Federation of Bosnia and Herzegovina. Accordingly, I analyse the current system and possible scenarios for the personal income tax system. I end by providing final recommendations to the government.

In relation to the accuracy of the model, I find that the entire personal income tax from all sources of income estimated through the model is overestimated by 0.63% compared to the real data. Therefore, the discrepancy between the data and the baseline scenario is small. This indicates that the microsimulation model for the Federation of Bosnia and Herzegovina is an appropriate analytical tool.

I simulated 16 scenarios of personal income tax, which were the part of the Government personal income tax reform package. Regarding rates, those scenarios were constructed as derivations from the systems of the European Union countries. Rates in the European Union are spread from 0% to even above 50%. Some countries of the European Union face a very high marginal rate in the top income bracket, but here it was avoided because Bosnia and Herzegovina is not a developed country. Two scenarios might be of interest, which propose three rates (10%, 15%, 20%) and raise personal exemption and dependent deductions. These two scenarios contribute to income redistribution. They put a heavier burden on higher-earning individuals and a lighter burden on lower-earning individuals, while at the same time achieve at least revenue neutrality for the budget. They also reduce income inequality, which I measured through the Gini coefficient, Atkinson index, and coefficient of squared variation. Moreover, their contribution to progressivity, as measured through the Kakwani index, is relatively high. When the parameters of Slovenia and Croatia were applied to data from the Federation of Bosnia and Herzegovina, I learned that the Federation of Bosnia and Herzegovina would experience less after-tax income inequality and a high increase of progressivity compared to the current system in the Federation of Bosnia and Herzegovina.

The evidence from the present study suggests that I cannot reject either of hypotheses, (1), (2), or (3).

When taking all those elements in account, I might recommend movement of the personal income tax system of the Federation of Bosnia and Herzegovina to step progressive rates.

Although the study draws some significant conclusions and creates the microsimulation model as the major contribution to practitioners and science, the study also has important limitations that need to be considered. The most important limitation is the fact that it uses the database that only contains data on taxes, but not on social benefits, real estate and other important factors. Therefore, the model produced is a model of taxes, but not the model of taxes and social benefits. Next limitation is that the tax data include only taxpayers who currently actively pay taxes without potential taxpayers, such as pensioners, who are exempt from payment of personal income tax on pensions. Also, since the data are on the individual level, the analysis on the basis of households in not feasible. The third limitation is the fact that microsimulation model is static.

The limitations give room for further research. Regarding the database, it can be expanded by survey data to cover sources of income not covered by available administrative database, and to enable analysis not only on the individual level, but on the level of households. Further

improvement related to the model is updating the tax model with benefits and creating a tax-benefit model. Also, other types of taxes such as corporate income tax and value added tax could be added, and make the comprehensive tax-benefit model. Another movement could be the introduction of dynamic elements in the current microsimulation model, and linkage to macro-models in order to include behavioural element in analysis.

Key words: personal income taxation, flat tax, step progressive tax, microsimulations, redistributive effects, inequality measures, progressivity measure

REFORMA DOHODNINE V FEDERACIJI BOSNE IN HERCEGOVINE

POVZETEK

V disertaciji obravnavam možne posledice uvedbe drugačnih dohodninskih sistemov. Predmet analize in glavno raziskovalno vprašanje je, ali bi bilo pri obdavčitvi osebnih dohodkov v Federaciji Bosne in Hercegovine bolje vpeljati dohodnino z eno samo davčno stopnjo ali progresivno dohodnino z več davčnimi stopnjami. Raziskava vključuje tudi oblikovanje mikrosimulacijskega modela kot zelo uporabnega orodja za vpeljavo davčnih reform. Rezultate modela v disertaciji analiziram in primerjam s teoretičnimi osnovami.

Cilj raziskave je oceniti določene vidike različnih davčnih sistemov, med drugim pobiranje prihodkov, preprostost sistema, posledice dohodkovne neenakosti in porazdelitev davčne obremenitve. Na podlagi te ocene se lahko z uporabo sodobnega orodja, kot je mikrosimulacijski model, izbere najprimernejši sistem dohodnine.

Oblikovane so naslednje hipoteze: (1) dohodninski sistem v Federaciji BIH drugače vpliva na progresivnost dohodnine in dohodkovno neenakosti kot dohodninska sistema v Sloveniji in na Hrvaškem; (2) sistem obdavčitve v Federaciji BIH z eno samo davčno stopnjo povzroča večjo neenakost dohodka po obdavčitvi kot sistem progresivne obdavčitve z več davčnimi stopnjami; (3) glede na porazdelitev dohodka v Federaciji BIH bi bil sistem progresivne obdavčitve z več davčnimi stopnjami primernejši, saj bi zmanjšal neenakost.

Z metodološkega vidika odločanje temelji na rezultatih statičnega mikrosimulacijskega modela, ki je bil izdelan v programu STATA na podlagi podatkov Davčne uprave Federacije Bosne in Hercegovine za leto 2009, ki so bili pridobljeni aprila 2011.

Disertacija je zgrajena tako, da je najprej predložen pregled literature, s katerim ugotavljam teoretične koncepte v zvezi z obdavčitvijo osebnih dohodkov (dohodnine) ter pristope k temu problemu v drugih državah. Pregledala sem najpomembnejše koncepte o mikrosimulacijah in relevantne mikrosimulacijske modele v Evropski uniji, nekdanji Jugoslaviji, Latinski Ameriki, Združenih državah Amerike, Kanadi, Avstraliji, Južni Afriki, Rusiji in Namibiji. Južno Afriko, Rusijo in Namibijo sem vključila, ker uporabljajo EUROMOD platformo. Temu sledi opis sistema obdavčitve osebnih dohodkov v Federaciji BIH in primerjava s sistemov v Sloveniji in na Hrvaškem. V nadaljevanju sem razložila mikrosimulacijski model v Federaciji BIH. Pri tem sem analizirala obstoječi sistem in mogoče scenarije dohodninskega sistema. Na koncu predstavim priporočila za vlado.

Ugotovila sem, da je celotna dohodnina za vse vire dohodkov, ki smo jo ocenili z modelom, za 0,63 % višja od dejanskih podatkov. To pomeni, da gre za majhno odstopanje ter da je mikrosimulacijski model za Federacijo BIH primerno analitično orodje.

Simulirala sem 16 scenarijev dohodnine, ki so bili del vladnega paketa reform na področju obdavčenja osebne dohodnine. Z vidika davčnih stopenj so scenariji oblikovani na podlagi sistemov v drugih državah EU. Davčne stopnje v EU se gibljejo med 0 in celo več kot 50 %. Za nekatere države EU je značilna zelo visoka mejna stopnja v najvišjem dohodkovnem razredu, Bosna in Heryegovina pa se je temu izognila, saj ni razvita država. Ustrezala bi lahko dva scenarija, po katerih bi uvedli tri davčne stopnje (10, 15 in 20 %) ter dvignili osebno olajšavo in olajšavo za vzdrževane družinske člane. S tem bi ustrezno prerazporedili dohodke. Po teh dveh scenarijih so bolj obremenjeni posamezniki z višjimi dohodki, obenem pa v primerjavi z obstoječim sistemom, ki se uporablja v Federaciji BIH, zagotavljata vsaj enak priliv prihodkov kot izhodiščni scenarij. Z njima se zmanjša tudi dohodkovno neenakost, ki jo merim z Ginijevim količnikom, Atkinsonovim indeksom in kvadratom koeficienta variacije. Poleg tega scenarija tudi močno povečata progresivnost, ki se meri s Kakvanijevim indeksom. Ko sem parametre slovenskega in hrvaškega sistema uporabila na podatkih Federacije BIH, sem ugotovila, da bi se v primerjavi z obstoječim sistemom neenakost dohodka po obdavčitvi v Federaciji BIH zmanjšala, progresivnost pa bi se močno povečala.

Na podlagi opravljene raziskave ugotavljam, da ne morem zavreči nobene hipoteze.

Ob upoštevanju vsega opisanega bi bilo priporočljivo dohodninski sistem Federacije BIH spremeniti v sistem progresivne obdavčitve z več stopnjami.

Čeprav sem z raziskavo prišla do nekaj pomembnih ugotovitev in oblikovala mikrosimulacijski model, ki bi ga lahko praktiki in znanstveniki koristno uporabili, se je izkazalo, da ima vsaj tri pomembne omejitve, ki jih je treba upoštevati. Najpomembnejša omejitev je dejstvo, da uporabljena podatkovna zbirka vsebuje samo podatke o davkih, ne pa tudi o socialnih prejemkih, nepremičninah in drugih pomembnih dejavnikih. Zato je izdelani model le model davkov, ne pa tudi model davkov in socialnih prejemkov.

Naslednja omejitev je, da davčni podatki obsegajo samo davkoplačevalce, ki trenutno dejavno plačujejo davke, brez potencialnih davkoplačevalcev, kot so upokojenci, ki so po veljavnem davku o dohodnini v Federaciji BIH oproščeni plačila dohodnine za pokojnine. Ravno tako, ker so podatki na ravni posameznikov, ni mogoče izpeljati analize za gospodinjstva.

Tretja omejitev je statičnost izdelanega mikrosimulacijskega modela.

Hkrati te omejitve ponujajo priložnost za nadaljnje raziskave, pri katerih bi bilo mogoče davčni model razširiti na socialne prejemke ter tako oblikovati model davkov in socialnih prejemkov. Samo bazo podatkov bi bilo možno razširiti s podatki iz anket glede dohodkov, ki niso zajeti v obstoječi podatkovni bazi ter tako omogočiti analizo, ne le na ravni posameznikov, pač pa na ravni celotnih gospodinjstev. Prav tako bi v model lahko vključili še druge davke, na primer davek od dohodkov pravnih oseb ali davek na dodano vrednost.

Poleg tega bi lahko v obstoječi mikrosimulacijski model vključili še dinamične elemente in ga povezali z makromodeli ter tako v analize vključili vedenjski element.

Ključne besede: dohodnina, ena sama davčna stopnja, več davčnih stopenj, mikrosimulacije, prerazdelitveni učinki, mere neenakosti, mera progresivnosti

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INTRODUCTION

1 Subject and Objectives of the Dissertation

Bosnia and Herzegovina is one of the countries that formed the former Socialist Federal Republic of Yugoslavia (hereinafter: Yugoslavia). Yugoslavia consisted of six republics: Slovenia, Croatia, Serbia, Montenegro, Macedonia, and Bosnia and Herzegovina. After the breakdown of Yugoslavia, six republics of the former Yugoslavia are now independent countries. Based on the Dayton Peace Accords, Bosnia and Herzegovina (hereinafter: BH) consists of two entities: the Federation of Bosnia and Herzegovina (hereinafter: FBH) and Republic of Srpska (hereinafter: RS).

All republics have been going through the reform process in taxation, including the personal income tax (hereinafter: PIT). Slovenia and Croatia made the major reforms during the nineties (Čok & Urban, 2007), while Bosnia and Herzegovina introduced the first reforms in 2006. In 2006, the major reform happened in indirect taxation, which was the introduction of value added tax (hereinafter: VAT; Law on Value Added Tax in BH, 2015). The reforms moved forward, and reformed Law on Corporate Income Tax (hereinafter: CIT) was in effect from 2007 in the RS (*Zakon o porezu na dobit u RS* [Law on CIT in the RS], 2006), and 2008 in the FBH (*Zakon o porezu na dobit u FBiH* [Law on CIT in the FBH], 2007). Reformed Personal Income Tax Law was in effect from 2007 in the RS (*Zakon o porezu na dohodak u RS* [Law on PIT in the RS], 2006), while only from 2009 in the FBH (*Zakon o porezu na dohodak u FBiH* [Law on PIT in the FBH], 2008).

In 2009, the FBH introduced the comprehensive personal income tax for the first time. Prior to that, the FBH faced the schedular system (Sahinagic & Bosnic, 2005). Schedular system is when the different sources of income are taxed at different rates (Paulus & Peichl, 2008). It caused horizontal inequity because the same level of income was taxed at different rates depending on the source of income. It also caused regressivity of the tax system because sometimes higher earning individuals paid lower taxes than lower earning individuals because they made an income that was taxed at the lower rate. The new PIT system has a single flat tax rate of 10%.

All systems, flat rate and progressive rates, have their pros and cons. To explore, if the flat tax is the most suitable option for the FBH, it is necessary to investigate the alternative systems, what is essentially the research question.

The idea of flat tax goes back to eighties with Hall and Rabushka (1983; 1985). They first used the term flat tax for the special version of cash flow tax that covers the single tax rate for both personal income tax and corporate income tax. However, Keen (2006) argues that the flat tax generally means the personal income tax with the single rate. The flat tax started to be popular in Eastern Europe, after the collapse of communism (Keen, 2006). It was introduced in Russia (Ivanova, Keen, & Klemm, 2005) and most of the countries of former

USSR (Evans & Aligica, 2008). It was also introduced in other countries of Central and Eastern Europe (Taxes in Europe – Tax reforms, 2014) such as Bulgaria, Czech Republic, Hungary and Romania. Some countries of former Yugoslavia and Albania, also introduced the flat tax, such as Macedonia, Montenegro and both entities of Bosnia and Herzegovina (KPMG's Individual Income Tax and Social Security Rate Survey 2011, 2012; Tax Rates around the World 2012, 2012; World Tax Rates 2010/2011, 2012). Therefore, the most of developed countries have progressive tax rate schedule.

As I mentioned above, all systems have pros and cons, leading to the question of equity vs. efficiency (Stiglitz, 2008). The progressive system should lead to an increase in equity, but it is also known from the theory that progressive rates might lead to a decrease in efficiency, i.e. increase of the deadweight loss (Stiglitz, 2008).

Although, the flat tax was introduced only in the countries of Central and Eastern Europe, it was simulated in the other places, for example USA (Skipper & Burton, 2008), Slovenia (Čok, Majcen, Verbič, & Košak, 2008), Germany (Fuest, Peichl, & Schaefer, 2008), and through cross-country analysis for other countries of Western Europe, such as Austria, Belgium, Germany, Luxembourg, the Netherlands, Finland, the United Kingdom, Greece, Portugal, and Spain (Paulus & Peichl, 2008). Looking at the both sides, Eastern and Western countries, it is necessary to evaluate which system is the most suitable for the Federation of Bosnia and Herzegovina. The rationale behind this research question is an agenda of the Government of the FBH to introduce the step progressive rates, with an aim to have a fairer distribution of taxes and income.

For the simulation of alternative tax systems, the microsimulation models have been used. To the best of my knowledge, the model for microsimulations which has been developed as the part of this dissertation is the first model for personal income tax in BH. Microsimulation models date back to 1950s (Orcutt, 1957). The models are tools used to replicate the real situation. Through the results produced by microsimulation models such as redistributive and revenue effects, policy decisions should be made (Buddelmeyer, Creedy, & Kalb, 2007). Therefore, the models are mostly used to estimate public revenue collection by income levels, and income distribution. They are also useful to convince the public to favour reform, because numbers are facts that tell an important story. Microsimulation models are not used only for tax reform, but also for analysis of current systems (Mitton, Sutherland, & Weeks, 2000). Microsimulation models serve not only as practical policy advisors, but also as research and teaching tools (Merz, 1991).

Traditionally, models are divided into two groups: static (accounting or arithmetic; deterministic, probability=1) and dynamic (probability<=1). A static model is one where the changes in tax regulations are simulated. Static models operate in time when underlying data were collected (Mitton et al., 2000). They can usually simulate the past, present, and near future. Dynamic models are used when changes in birth and age would be considered. Therefore, ageing is very important for dynamic models, because each unit is older for a year

every year one wants to upgrade or update the model (Mitton et al., 2000). Dynamic models can simulate the distant future.

Which model should be used basically depends on the policy question that is being addressed and the amount of time disposable to gain the answer. Static models are usually used when one cross-section is needed, i.e., modelling for changes in tax rates, whereas dynamic models need repeated cross-sections, e.g., pension reform or care system. In both types of models one can include a behavioural component. If one wants to see the first order of results with, for example, tax reform, one does not need a behavioural component. However, if one wants to see changes in behaviour after introducing such reform, one needs to include a behavioural component. For example, if one wants to see the effects on labour supply, one uses a behavioural microsimulation model (Creedy & Kalb, 2006). Another very useful part of introducing behavioural components is the measurement of deadweight loss produced by changes in the tax system (Mitton et al., 2000).

Research of the literature showed that there are numerous models throughout the world (static, dynamic and behavioural). Most of the countries have more than one model.

To do this exercise that will evaluate the current and alternative tax systems, I create the objectives of this dissertation. The first objective is a creation of a microsimulation model. The model has not existed in the entire country so far, as already mentioned above. The model is a valuable tool to produce numbers that create a platform to make diverse analyses and draw conclusions. The second objective is research of theoretical foundations. Microsimulation models provide certain information in the form of numbers. These numbers are facts that tell an important story. However, if one does not know how to interpret them, they might be useless. Therefore, besides the results of microsimulation models, a strong theoretical background is needed to help reading the numbers. Such research provides input for a thorough analysis of personal income tax. It creates a complete big picture, including both empirical evidence and theoretical foundations. Therefore, I may say that this project is the first serious analysis of the personal income tax system in Bosnia and Herzegovina, supported by numbers, international comparison, and theoretical evidence. The third objective is education which means capacity building in both, the Federation Ministry of Finance and the Ministry of Finance of the Republic of Srpska, enabling them, through education, to make such models and carry out such analyses by themselves.

I believe the subject of analysis and its objectives are up to date in this country, and this dissertation has come at just the right time. Most important here, however, is the practical utilization of such work. The microsimulation model is new for the BH governments, and they recognized the seriousness of the model and the complete analysis it can provide. Besides the practical purpose, this analysis contributes to science, as the model presents the first microsimulation model in Bosnia and Herzegovina.

2 Hypotheses of the Dissertation

Based on the fact that Slovenia, Croatia, and Bosnia and Herzegovina are three countries that belonged to the former Yugoslavia, it means that all three countries have a joint past and come from similar backgrounds, which is communism. One would expect that all three of them have similar solutions to the personal income tax system and influence on income inequality. Although, the flat tax is a characteristic of the former communist countries (Mencinger, 2006) where everyone was treated equal, Slovenia and Croatia have never introduced the flat tax. Therefore, it is interesting to investigate if FBH system of personal income tax has different effects on the tax progressivity and income inequality measures compared to Slovenian and Croatian system.

Based on theory, progressive rates might create higher deadweight loss and reduce the social welfare (Stiglitz, 2008), while concurrently they change the income (re)distribution as compared to the flat tax system. The progressive tax has an influence on the equalizing effect (Lambert, 2001). Therefore, the progressivity reduces the income inequality.

Based on the evidence from the *Chapter 1 Subject and Objectives of the Dissertation*, and thoughts in this chapter, I derive three hypotheses which should answer the key question of the research which is whether to have a single rate or differential rates in the taxation of personal income in the Federation of Bosnia and Herzegovina. Those three hypotheses are:

1 The system of personal income taxation in the Federation of Bosnia and Herzegovina has different effects regarding personal income tax progressivity and influence on income inequality measures than the personal income tax systems in Slovenia and Croatia.

2 The flat tax system in the Federation of Bosnia and Herzegovina creates a higher after-tax income inequality than the slice system of the tax rate.

3 Regarding income distribution in the Federation of Bosnia and Herzegovina, the step progressive system would be more suitable from the point of view of reducing inequality.

3 Methodology of the Dissertation

To answer the research question that covers the suitability of proportional versus step progressive system of personal income taxation, the microsimulation model is necessary. The microsimulation models are used to support the tax reforms and changes to the tax laws.

Bosnia and Herzegovina did not possess any microsimulation model at any level of government (state, entity, cantons). Based on such a fact, I was motivated to construct the

first microsimulation model in Bosnia and Herzegovina. The model covers only one entity which is the Federation of Bosnia and Herzegovina. The model is static and covers only personal income tax and social security contributions (hereinafter: SSC) without social benefits (hereinafter: SB) and other taxes. The model also does not possess the dynamic (e.g. ageing) and behavioural elements (e.g. effect on labour supply).

To build a microsimulation model, data are mandatory. When preparing data for a microsimulation model it is always a question of whether individual or household units should be used. Most of the models are based on administrative data that treat the fiscal unit set by law. So, data are based on tax forms filed by fiscal units-taxpayers (Decoster & Van Camp, 1998).

The model produces results that are important for the policy decision making. The static tax microsimulation model of the Federation of Bosnia and Herzegovina (FBHMOD) was created in the software STATA with data from the Tax Administration of the Federation of Bosnia and Herzegovina for the year of 2009, obtained in April 2011. The year of 2009 is the first year of the implementation of the Law on Personal Income Tax. Therefore, that is the first year when the data about personal income tax were available.

The data I possess are the entire taxpayers' database for the personal income tax (entire population), registered with the Tax Administration of Bosnia and Herzegovina. It consists of 495,076 individuals. Those tax records are about those taxpayers who paid the personal income tax. In the database, there are no records about the taxpayers who are not subject to personal income taxation.

I received the data in the form of the "flat table", where each row represents one taxpayer with multiple columns representing characteristics of a taxpayer. Columns are the fields from the different tax declarations set by the Rulebook on Implementation of the Law on Personal Income Tax (*Pravilnik o primjeni Zakona o porezu na dohodak*, 2008). Essentially, each column is a variable. The variables I have are about the dependent spouse, dependent children, other dependent close family members, gross wage, social security contributions, and all other sources of income, their respective social security contributions and standardized costs. Those data are from the tax declarations filed for advance payments of taxes in 2009, tax declarations filed for payments of taxes that are considered as a final liability (not advance payment) without obligation of filing the annual tax declaration, and annual tax declaration filed in 2010 for income received in 2009.

Moreover, in the database there is no linkage between taxpayers, so I cannot make estimations on the household level, only individually. However, it is important to emphasize the high quality of data because they come from an entire tax database with all characteristics of each individual.

On the basis of the model I analyse the current tax system and simulate different scenario options of the alternative personal income tax systems, and associated inequality/progressivity measures such as Gini coefficient, Atkinson index, the coefficient of squared variation, and Kakwani index. I check the validity of the model by comparing the results produced by the baseline scenario to real data provided by the Tax Administration database through observed variables. I also compare the accuracy of the FBHMOD to some models in other countries.

4 Limitations of the Dissertation

Although this dissertation draws some significant conclusions and creates the static tax microsimulation model that is a valuable tool both for researchers, and the government to do tax reforms, the study also has its limitations that need to be taken into account. I can divide two sets of limitations. One set is related to the limitations of the data I use while another set is related to the model itself.

In the first set of limitations which is related to the data as mentioned above, the most important one lies in the fact that database used is only the tax database without social benefits, property, and other significant factors. Therefore, the model built is only a tax model, not a tax-benefit model. Another limitation is that tax data covered only taxpayers currently actively paying taxes, without those who could be potential taxpayers such as pensioners for pensions who are exempt according to current Law on Personal Income Tax in the Federation of Bosnia and Herzegovina (*Zakon o porezu na dohodak u FBiH*, 2008). Pensioners are exempt from paying taxes on pensions, but not if receiving income from other sources such as property, temporary independent activities based on the contract, and so on. Therefore, the pensions are exempt, but not pensioners. Also, another income not taxed at the moment is not included in the database, such as dividends. The third limitation of data is no possibility of doing analysis on the basis of households, but only on the basis of individuals.

In the second set of limitations which are related to the model itself, the first limitation is the fact that microsimulation model is static. It means that I can see only the immediate effects. There is no dynamic dimension that would include ageing of individuals, or behavioural element that would measure incentives to work if labour taxes were increased. Another limitation is that there are no other taxes included such as corporate income tax or indirect taxes. The inclusion of other taxes besides personal income tax and social security contributions would make the model more comprehensive.

However, limitations give room for further research. The first set of limitations that was related to the data as mentioned above could give way to improvements. The administrative data (tax records) that I currently have should be expanded by survey data to fill the gaps that administrative data have. From this year, Bosnia and Herzegovina plans to publish the BH version of Statistics of Income and Living Conditions (SILC). Using the survey data, I

could make an analysis on the household level. Also, I could overcome the issue of inclusion of those who are not currently the taxpayers.

In the second set of limitations which are related to the model itself, as mentioned above, the most important one is updating the tax model with benefits and creating a tax-benefit model. Another movement could be the introduction of dynamic elements into the current microsimulation model, and linkage with macro-models that would include behavioural element. Also, a comprehensive tax-benefit model can be created that would encompass the entire tax-benefit system.

5 Structure of the Dissertation

This dissertation is divided into five parts. At the beginning is the *Introduction* that covers the subject and objectives of the dissertation, hypotheses of the dissertation, methodology in brief and limitations of research.

The *first part* is the *Literature Review*, which consists of three chapters. The *first chapter* is about theoretical concepts which first covers the concepts of income for tax purposes. The major dilemma is if the income for tax purposes should follow the Haig-Simons definition (Rosen & Gayer, 2008) which incorporates all sources of income including the income from capital or take consumption as the tax base instead of income (Kaldor, 1955; Meade, 1978). Another dilemma is if income from capital should be taxed equally as labour income (Reforming the tax system for the 21st century: The Mirrlees Review, 2012).

Furthermore, in this chapter, I also cover other elements besides income necessary for the determination of personal income tax, such as tax allowances and types of tax rates. I give an overview of different types of tax rates (Kesner-Škreb, 1997). It is important to stress that statutory tax rate that is set by law does not say much for analytical purposes as effective and average tax rates do. Accordingly, I do a review of types of taxation: progressive, proportional, and regressive. With progressive taxation, marginal rates are greater than average rates, with proportional taxation those two types of rates are the same while in regressive taxation marginal rates are less than average rates (Bailey, 2002). The proportional tax rate is known as a flat tax (Hall & Rabushka, 1983; 1985).

Flat tax started to be very popular in Eastern Europe after the collapse of communism, causing the tax competition (Evans and Aligica, 2008). I also show that some countries of Western Europe and the United States of America simulated different flat tax options, but they have never been implemented. On the other hand, even flat tax systems are not flat because they usually incorporate tax allowances in their systems making those systems essentially progressive.

I also introduce the concept of the worldwide income and its treatment in different jurisdictions. I investigate theoretical principles of a good tax system (Bailey, 2002; R. A. Musgrave & P. B. Musgrave, 1993; Stiglitz, 2008) which I follow when making decisions about the suitable system of taxation in the FBH, besides the empirical evidence.

Furthermore, I make an overview of the tax rates worldwide and investigate which parts of the world have one or another system of taxation, i.e. flat vs. step progressive system of personal income taxation. Apparently, most taxes make distortions to the system, so I also look at the tax effects investigating important properties such as distribution and redistribution of income, losers and winner from reform. This is related to never ending dilemma of equity vs. efficiency. In theory, equity is presented through re(distribution) of income, while efficiency is presented through the deadweight loss caused by taxation. Deadweight loss depends on the height of the tax rates, as well as on the elasticity of labour supply and labour demand (Rosen & Gayer, 2008; Stiglitz, 2008).

Finally, in this first chapter of the Literature Review, I cover inequality and progressivity measures, as important tool for making decisions about alternative tax systems of personal income taxation. The measures I am covering are Gini coefficient/Coefficient of concentration, Atkinson index, generalized entropy measures, and Kakwani index, including advantages and drawbacks.

The second chapter of the *Literature Review* covers the concepts of microsimulations, which date back to fifties (Orcutt, 1957). I cover three types of models: static that are used for the day after effect, the dynamic that include dynamism such as ageing, and behavioural models that measure behavioural effects such as labour supply when laws change. Therefore, the microsimulation models are used for simulating changes in the laws.

Moreover, I present an overview of the relevant microsimulation models in the European Union, countries of former Yugoslavia which are not the members of the EU, Latin America, the Unites States, Canada, Australia, South Africa, Russia and Namibia. I included South Africa, Russia and Namibia, because they have the EUROMOD platform.

The *third chapter* of *Literature Review* includes the case of Bosnia and Herzegovina. In the chapter, I explain the complex structure of Bosnia and Herzegovina, which consists of the Federation of Bosnia and Herzegovina, Republic of Srpska, and Brčko District. The Federation of Bosnia and Herzegovina consists of ten Cantons, which consist of municipalities. The Republic of Srpska does not have cantons, only municipalities. Here, I also explain authority over direct and indirect taxes by different levels of government. I focus attention on personal income tax and make an overview of personal income taxation in the Federation of Bosnia and Herzegovina, presenting the Law on PIT in the FBH, with a brief description of the reform process. I also make a comparison of the PIT in the FBH to Slovenian and Croatian PIT systems.

The *second part* of the dissertation is *Methodology*. This part consists of five chapters. The *first chapter* explains the purpose of construction of the FBHMOD, which is the static tax microsimulation model developed as a part of this dissertation. In the *second chapter* of *Methodology*, I describe the data I use. The data are administrative and are covering the tax records in database provided by the Tax Administration in the FBH. Thus, I provide an overview of all variables available in the database along with their meaning. The *third chapter* of *Methodology* explains the steps in the creation of the baseline scenario through the microsimulation model of the FBH, basically steps in the creation of the FBHMOD. In the *fourth chapter* I investigate the accuracy of the model. I also compare discrepancy of baseline scenario and real data to some other models in other countries. In the *fifth chapter*, I analyse the current system of personal income taxation through parameters such as the share of income by decile groups in total income, share of taxes by decile groups in total taxes, and effective tax rates.

The *third part* is *Results of the Microsimulations*. This part consists of four chapters. The *first chapter* explains the scenarios used in microsimulations. Those scenarios are the part of the reform personal income tax package considered by the Government of the Federation of Bosnia and Herzegovina. Regarding rates, European Union practice was followed, but at the same time avoiding very high rates. The rates in the European Union are even higher than 50% in some countries. The income brackets were set as a different combination of the average net annual wage in the Federation of Bosnia and Herzegovina. For some scenarios, instead of a combination of the average net annual wage in the FBH, it has been taken the average net annual wage in the public sector in the FBH. The Government wants to achieve fairer tax system, with higher vertical equity.

In the *second chapter*, I present results of the microsimulation scenarios whose parameters are presented in the *first chapter of the Results of the Microsimulation*. I consider all scenario results regarding the estimated revenue collection and effective tax rates. I learn that the sources of income that are withheld at the source, and on which I apply the top marginal rate, are causing the horizontal inequality. I pay attention to those scenarios that contribute to income redistribution, through shifting the tax burden from the lower earning individuals to the higher earning individuals. In those scenarios, I have both, winners and losers from the reform. At the same time, I have to keep the budget stability.

In the *third chapter*, I put all scenario results in the context of theoretical foundations, i.e. principles of a good tax system (Bailey, 2002; Musgrave, R. A., & Musgrave, P. B., 1993; Stiglitz, 2008) and measures of inequality and progressivity. All scenarios, I put in the context of the collected revenues compared to the current system. Further, I estimate the possibility of increasing the deadweight loss, which is a characteristic of progressive systems (Stiglitz, 2008). Although, the microsimulation model that I created is a static model, and it cannot estimate the size of the deadweight loss, at least I have to be aware of the possibility based on the theoretical foundations. I also estimate, if each of the scenarios contribute to the income distribution and income redistribution. This means that I want to see both the

winners and the losers from each possible reform and an increase in the vertical equity. Furthermore, I have to be aware that any change to the system might cause an increase in the costs, both of a taxpayers' compliance and the costs of the Tax Administration. Also, simplicity is one of the principles of a good tax system. Therefore, I do not want a too complex tax system that leads to a decrease of transparency. Finally, if the government collects more revenues when introducing the new system, the government should have the development goals before the taxpayers. Each taxpayer should see the utility of paying taxes. Also, I put the empirical results in the context of the inequality and progressivity measures (Gini coefficient, Atkinson index, coefficient of squared variation, Kakwani index).

The *fourth chapter* shows the results of policy switching, where Slovenian and Croatian parameters of personal income taxation are applied on the FBH data, and completely different levels of inequality and progressivity are proven, as assumed in the stated hypothesis.

Finally, I conclude the dissertation showing the research implications and their impact on the decision whether to reject or not to reject the above-stated hypotheses. I also give the final recommendations to the Government of the Federation of Bosnia and Herzegovina.

1 LITERATURE REVIEW

1.1 Theoretical Concepts

1.1.1 Income and Personal Income Taxation

Income taxation in general levies the tax on individual or corporation income. Income tax started to be a mass tax during World War II (Pechman, 1987). When tax is levied on individual income, it is personal income tax; otherwise it is corporate income tax. In the entire dissertation I will keep attention to personal income tax. The income of an individual consists of income received from wages and all other sources such as temporary contracts, author's contracts, property, and so on. Deductibles (e.g., social security contributions, standardized costs, personal exemption, dependent deductions) should be deducted from income to get to the tax base. The tax rate should be applied to the tax base. Some jurisdictions allow for tax credit which lowers the tax liability, as opposed to the tax allowances (personal exemptions, dependent and other deductions) which lower the tax base. The basic calculation structure should be (Rosen & Gayer, 2008):

Gross income – Expenses incurred in earning the income
= Income before tax (and deductions) – Personal exemptions, dependent and other deductions
= Taxable income or Tax base
= Tax before tax credit = Tax base x Tax rate - Tax credit
Tax

However, troubles arise when defining income for tax purposes.

Historically, there have been debates about the proper base for annual taxation. One approach is to have total income (Haig-Simons) as the base, whereas another approach is to have consumption as the base. Kaldor talked about direct consumption tax back in 1955 (Kaldor, 1955). Meade (1978) continued working on this idea. Mirrlees (2010) moved the dilemma from income and consumption as a tax base to how income from capital should be taxed.

Haig-Simons defined income as follows: "Income is the money value of net increase in an individual's power to consume during a period. This equals the amount actually consumed during the period plus net additions to wealth. Net additions to wealth-saving must be included in income because they represent an increase in potential consumption" (Rosen & Gayer, 2008, p. 382).

Therefore, the Haig-Simons definition of income covers income from employment, business profits, income from property, interests, dividends, royalties, any other receipts either from government or employer, and realized and unrealized capital gains and capital losses (Rosen & Gayer, 2008).

The Institute for Fiscal Studies in the United Kingdom set up a committee chaired by Nobel Laureate professor James Meade to investigate the UK tax structure and reform of direct tax. In the Committee's report, Meade (1978) differentiates between two types of tax base: income as a tax base and consumption as a tax base. Meade (1978) advocates two definitions (A and B) of income as a tax base. Definition A states: "...taxpayer's income in any one year is the value of what he could have consumed during the year without living on and so diminishing his capital wealth in process" (Meade, 1978, p. 31). Income defined in such way covers the following receipts: wages, dividends, rents, profits, capital gains, capital losses, and any other windfall receipts. Definition B states: "This is to define an individual's income not as the amount which he could consume in any one year without diminishing his capital wealth in the course of that year, but as the amount which he could consume in any one year and yet be left with the resources and expectations at the end of that year which would enable him to maintain that same level of consumption indefinitely in the future" (Meade, 1978, p. 31). As opposed to Definition A, Definition B relies upon expectations of future earning and consumption that are hard to determine. Definition A is more realistic when suggesting the comprehensive income for tax base, because it provides the definition of income as receipts realized in specific year, whereas Definition B puts the choice among different future expectations. In these two definitions, capital gains are treated differently. In Definition A capital gains are added to other income, whereas in Definition B capital gains do not have an effect on taxable income. Unlike Definitions A and B where income is treated as the tax base, Meade (1978) proposes consumption as an alternative to income as a tax base. It would mean that a taxpayer who consumes more and saves less would bear a heavier burden than a taxpayer who consumes less and saves more, although their ability to pay is the same at that moment. However, when considering tax on consumption, one should not look at that specific moment, but on the entire lifecycles of both taxpayers, because a taxpayer who saves more now will spend the money eventually and pay tax on consumption. Meade (1978) maintains that through tax on consumption, whereas one avoids the difficulties involved in finding an adequate treatment of windfall receipts and capital gains. Through tax on consumption, the system taxes what a taxpayer takes out of the economic production (consumption) and not what one brings in (income). It avoids issues arising from the distinction between earned and investment income.

Around thirty years later, again, the Institute for Fiscal Studies in the United Kingdom also supported the Mirrlees Review (Reforming the tax system for the 21st century: The Mirrlees Review, 2012). The Mirrlees Review was prepared in 2010 by international experts under the chairmanship of Nobel Laureate Sir James Mirrlees. The main idea covered is identification of the features of a good taxation system in the 21st century and an assessment on how the UK system is consistent with these models, and possible movements towards

such models. The Mirrlees Review consists of two volumes: Dimensions of Tax Design and Tax by Design. As a part of the Mirrlees Review, Banks and Diamond (2010) explored the issue of base for direct taxation. They changed the major question of whether income or consumption should be taxed to the question of how to tax the income from capital. They shared Meade's view (1978) that both consumption and wealth should be taxed annually. However, they did not think that the tax base should be the total of capital income and labour income, which is a tax base for Haig-Simons income. They doubted that positively relating marginal tax rates on labour and capital incomes is superior to taxing those two sources of income separately.

Besides the debate above on what income is composed of, the final tax base also depends on personal exemption, and dependent and other deductions, as shown above in the basic calculation structure. They are also named as tax allowances. Personal exemption (or basic tax allowance) is an amount that is deducted from the income before tax to reduce the tax base. It belongs to each taxpayer in most cases. Dependent deductions are also deducted from income before tax. Taxpayers who support dependent family members, such as children, spouse, and other close family members, have the right to claim such deductions. Other deductions might be claimed by those who have, for example, housing loans. Accordingly, the purpose of such exemptions and deductions is to reduce the tax base and the tax due consequently.

Back in 1991 there was a study that proposed the elimination of child tax deductions and the introduction of children's allowances for each unmarried child that was eligible for dependent child tax deduction in the United States (Meyer, Phillips, & Maritato, 1991).

After defining the tax base through income and deductions, one needs to calculate personal income tax. To do that, one needs to define different types of tax rates.

The literature points to a few types of rates[1] (Kesner-Škreb, 1997). The first one is the statutory tax rate, which is one set by law, but it does not say much for analytical purposes, because almost each law assigns personal exemption, dependent deductions, and other deductions. The second one is the average tax rate which is calculated as the ratio of tax paid and taxable income, i.e., tax base. Thus, it puts into ratio the real tax liability and tax base. The average tax rate is useful for analytical purposes and for defining whether the system is proportional, progressive, or regressive, even if the statutory rate is proportional (flat). The third one is the effective tax rate. As opposed to the average tax rate that puts in the ratio tax liability to taxable income, effective tax rate puts into ratio, instead of taxable income, the income before deductions, i.e., income before tax. Such kind of rate shows real burden, whereas average rate shows the burden to be higher. The fourth type of rates is the marginal tax rate which represents the rate on an additional unit of base. And finally, the basic tax rate is known in a step progressive system. The difference between basic and marginal rates is

[1] Those listed types of rates apply not only to personal income, but also to corporate income.

that most people are taxed through one basic rate, whereas only the minority in the highest income bracket has a higher rate.

1.1.2 Types of Taxation

Each type of tax can be progressive, proportional, or regressive. An example of a progressive tax is usually personal income tax, whereas a good example of a regressive tax is usually value added tax.

Sometimes the word "progressivity" causes confusion in the public, because it is not clear if progressivity means progressivity in marginal rates or in effective (or average) rates. Therefore, it is always necessary to define what type of tax rates are taken when analysing a tax system (Kesner-Škreb, 1997).

Thus, two approaches to this matter might be differentiated. One approach looks only at the rates, i.e., if there are progressive marginal[2] rates, the system is progressive; if there is one statutory rate, the system is proportional; and if there are regressive marginal rates, the system is regressive. Another approach compares income and tax paid. Basically, this approach puts in relation tax paid and income before or after deductions (income before tax or tax base) recognized for tax purposes. If one uses income before deductions (income before tax) for such relation, one gets to the effective tax rate. If one uses income after deductions (tax base), one calculates the average tax rate. If effective or average tax rates increase as income (tax base) increases, regardless of what the marginal rates are (progressive, proportional, regressive), the system is progressive. If it is constant, the system is proportional. When rates are going down, the system is regressive.

Therefore, the first approach says that taxation is progressive when the statutory tax rate increases as the tax base increases. As opposed to progressive taxation, there is regressive taxation when the statutory tax rate decreases as the tax base increases. The second approach says that a progressive tax structure has a rising share together with income (marginal rates > average rates), whereas a regressive tax structure has lowering share as income rises (marginal rates < average rates) (Bailey, 2002).

It is mathematically shown as follows (Lambert, 2001):
- The income of a unit is x.
- The tax of a unit that has income x is $t(x)$.

Thus,

$t(x)$ is progressive $\Leftrightarrow t(x)/x$ rises with x, and
$t(x)$ is regressive $\Leftrightarrow t(x)/x$ declines if x increases.

[2] Marginal tax rate is a rate applied on an additional unit of tax base.

In other words, the tax is progressive if its average tax rate increases with income, whereas it is regressive if its average tax rate decreases if income increases.

Stanovnik (2008) defines progressivity also through average tax rate (ATR):

$$ATR = \frac{T}{X}, \quad (1)$$

where T is the tax liability, and X is the tax base.

Tax is progressive if the average tax rate rises when the tax base rises:

$$\Delta \left(\frac{T}{X} \right) > 0. \quad (2)$$

There are two types of progressivity: strict and weak (Lambert, 2001). If tax liability $t(x)$ is differentiable, strict and weak progressivity can be mathematically presented in the following way:
- strict progressivity: $d[t(x)/x] / dx > 0$, where $x>0$;
- weak progressivity: $d[t(x)/x] / dx \geq 0$, where $x>0$.

Weak progressivity covers two scenarios. The first one is when $d[t(x)/x] / dx \equiv 0$. In that case there is no progressivity, there is only a proportional tax system (flat tax). The second scenario is when there is some threshold x_0 and up to that threshold the tax is flat, whereas later it is progressive for income $x>x_0$, so there is $d[t(x)/x] / dx > 0$.

Moreover, the introduction of personal income tax has an impact on income distribution and income redistribution. Personal income tax systems are usually structured in a manner to fit into the progressivity principle. Progressive tax has an influence on the equalizing of income, and tax liabilities are often distributed more unequally than the respective income. The equalizing effect on income is known as the redistributive effect (Lambert, 2001).

There are some studies that do not advocate such relationship, i.e., that progressivity reduces income inequality. One of them is by Ju and Moreno-Ternero (2008). If the rule of consistency and either revenue continuity or revenue monotonicity are satisfied, then equality stays the same. Consistency means that the tax payment for each taxpayer belonging to any group of taxpayers depends solely on own taxable income, not on others. Revenue continuity means that small changes in tax revenue do not cause big changes in tax schedule. Revenue monotonicity means that with tax revenue increase no one pays less.

After explaining progressive and regressive tax, I proceed with an explanation of proportional tax.

According to one approach, tax is proportional (single, flat) when the statutory tax rate is the same no matter how high the tax base is. Based on another approach, a proportional tax structure has constant share for all income (marginal rates and average rates are the same) (Bailey, 2002). Therefore, tax is proportional if the average tax rate is constant, meaning that it stays unchanged although tax base rises (Stanovnik, 2008):

$$\Delta \left(\frac{T}{X} \right) = 0. \quad (3)$$

The term for proportional tax is flat tax. This term ("flat tax") is also used by Hall and Rabushka (1983; 1985) for a special version of cash flow tax, which covers personal income tax and corporate income tax with a single tax rate. The cash flow tax is a direct consumption tax. As already mentioned in the Meade (1978) and Mirrlees (2010) approaches, the main idea of a direct consumption tax is that income consists of savings and consumption. That means that if one deducts all types of savings from income, one gets to consumption. That kind of consumption at the individual level can be taxed as direct tax on consumption (expenditures) (Rosen & Gayer, 2008; Stanovnik, 2008).

Murphy (2006, pp. 1-2) summarized the major characteristics of flat tax as suggested by its proponents: "(1) simplification (simplify the tax code, reduce the burdens on individuals that have to file tax declarations, simplify business administration, cut the number of state employees who administer tax, reduce the number of taxpayers); (2) taxation (reduce the tax rate, reduce the incentive for tax evasion, cut or eliminate tax avoidance, close all loopholes for tax abuse, increase the fairness of the tax system); (3) economics (stimulate the economy, increase tax yields in the long term, reduce inflationary pressure, reduce interest rates, encourage saving, stimulate investment, encourage international competition, improve corporate transparency); (4) social (provide an incentive to work, protect wealth, support the family, enhance the status of government)."

Murphy (2006), as professional accountant, did not agree with the previous statements and drew the following conclusions about the flat tax: (1) It favours the rich by letting them pay little or no taxes. (2) The state gets less income and shrinks in size. (3) It is an attack on the whole structure of society.

In practice, the term "flat tax" generally means a personal income tax system with a single tax rate (Keen, 2006). The flat tax system started to be very popular after the collapse of communism in post-communist countries.

Brada (2008) published the *Editor's Introduction to Eastern European Economics* summarizing the inputs that increased the competitiveness of transition countries. According to the paper of Evans and Aligica (2008), the flat tax reform is very specific to Central and Eastern Europe. The advantages of the flat tax are less tax avoidance and better incentives for producers and owners of factors of production. In other parts of Europe, the flat tax was

seen as tax competition. Different rates of taxation in neighbouring countries cause that investments go to the country with lower tax rates. Therefore, the capital flows out of nations with higher tax. Accordingly, the countries of the former USSR followed each other in introduction of the flat tax.

Other advantages of flat tax systems are the under burdening of the economy through the reduction of labour costs and the increase of business profits, and the creation of conditions for an increase in competitiveness through the reduction of highly skilled workers' relative price to low-skilled workers, thus improving the employability of highly skilled workers (Caprirolo, 2006).

However, from the second part of the nineteenth century, progressive tax systems became common worldwide, except in former communist countries where everybody was considered equal, and where flat taxation still exists after reforms to post-communist societies (Mencinger, 2006). Mencinger (2006) also maintains that there is no evidence that a change in tax system will increase profits and accordingly costs for research and development, and if there is an increase in research and development there is no proof that it will increase growth and employment. Moreover, there is no evidence that flat rate income tax can reduce the gap between labour supply and labour demand.

The famous reform in the direction of flat tax was in Russia, where an increase of revenues from personal income tax was recorded. It is hard to prove, however, if other factors had influence on increased collection of revenues (Ivanova, Keen, & Klemm, 2005).

Experiences regarding flat tax in Estonia have been very positive for the many years of its implementation. There are no clear disadvantages. Most taxpayers in Estonia like the flat tax. Most political parties support the flat tax, and it is unlikely that progressive tax will be reintroduced. The plan for the future is to shift the tax burden from income to consumption and environmental taxes (Vanasaun, 2006). So far, Estonia kept the flat tax.

Experience from the flat tax in Romania is simplification of the system of personal income tax, reduction of bureaucracy, increase of transparency in tax collection, and fiscal relaxation (Videanu, Ghizdeanu, Stanica, & Plavicheanu, 2006).

On the other hand, one cannot say that a flat tax will certainly increase revenues, because none of the taxpayers will be in worse position compared to progressive personal income taxation (Camida & Goudswaard, 2001; Larsen, 2006; Peichl, 2006).

Although the implementation of flat tax is limited to Eastern Europe, simulations of flat tax have been done in other places.

Skipper and Burton (2008) simulated options of flat tax in the United States. According to followers, the flat tax would increase the simplicity of the tax system, whereas opponents

say that the tax burden would shift to the middle class. Based on their simulations, it was confirmed that tax burden would shift to the middle class.

There were also simulated options of flat tax in Slovenia (Čok et al., 2008). The reason for that were the complex personal income tax system and the high tax burden on labour. The proposal offered one rate for all taxes (personal income tax, corporate income tax, and value added tax). The evidence shows that taxpayers who belong to the lowest income quintile group would pay higher income taxes by 1.4% compared with what they paid prior to the planned reform. However, such proposal faced disapproval from trade unions, mostly because of the fear that two VAT rates would be replaced by one.

Fuest, Peichl, and Schaefer (2008) simulated the flat tax for Germany (which was, however, not introduced in practice). The evidence shows that a scenario with a high basic tax allowance and a single rate will do less harm to distributional effects than would a flat tax with a low rate. However, the latter scenario leads to positive welfare and labour supply effects.

Paulus and Peichl (2008) simulated the effects of flat tax reform in Western Europe on income distribution and work incentives. They used EUROMOD (EU tax-benefit microsimulation model) to compare results across countries (Austria, Belgium, Germany, Luxembourg, the Netherlands, Finland, the United Kingdom, Greece, Portugal, and Spain). In their simulation they required revenue neutrality with the existing basic tax allowance. The winners in such reform would be the higher-earning individuals, the burden shifting to the low and middle classes with the consequence of higher inequality and poverty. In contrast, the revenue-neutral flat tax rates needed to keep inequality unchanged are quite high. In general, a flat tax cannot overcome the efficiency-equity trade-off. Mediterranean countries (Greece, Portugal and Spain) with small middle classes would benefit most from such reform through an increase in incentives and equity. There is a distinction between countries analysed in the sense of inequality, (relative) poverty, and richness. These are more emphasized in Southern European countries (Greece, Portugal and Spain) and the United Kingdom, whereas they are low in Continental Europe (Austria, Belgium, Germany, and Luxembourg) and Finland. A strong middle class that would mostly bear the burden of reform can explain why flat tax reform is still not successful in Western Europe.

However, even with flat taxes majority of systems has a level of income that is not subject to taxation, meaning that such income is taxed by a 0% rate. Therefore, all flat taxes do not have a single flat tax, but two tax rates, zero and non-zero.

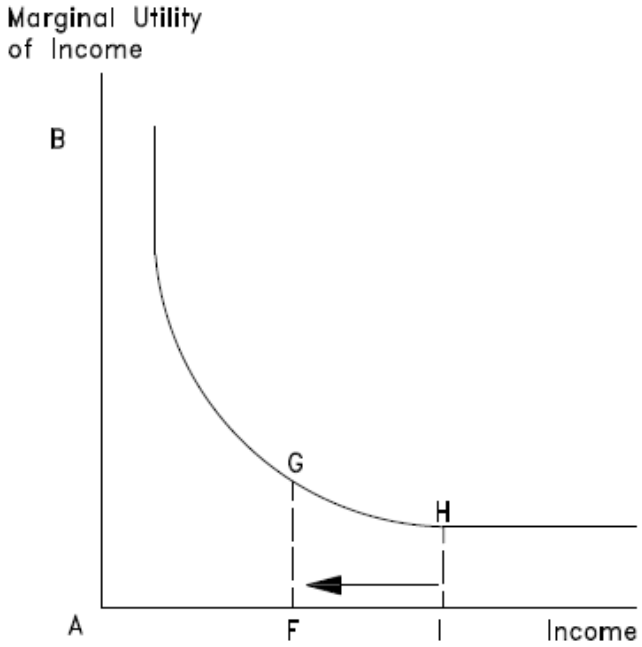
A simple tax system is one of the most important principles of good taxation. Simplifying income tax is more important than simply introducing a flat tax. A crucial part of each personal income tax reform is restructuring the progressive rate schedule (Zee & Hameed, 2006). This means simplifying the system by reducing the number of marginal tax rates,

reducing the marginal tax rates, and expanding equity by raising the tax allowance and in that way raising the progressivity through average tax rates.

However, one of the important impacts of progressive taxation is the loss of marginal utility of income (Stanovnik, 2008), meaning that utility of income decreases as marginal rates increase.

Figure 1 shows marginal utility of income.

Figure 1. Marginal Utility of Income



Source: T. Stanovnik, *Javne finance*, 2008, p. 55

The area below the curve equals total utility of income for an individual. It stands:

$$\int \frac{dU}{dY}\, dY = \int dU = U. \qquad (4)$$

Three types of sacrifice can be differentiated (Stanovnik, 2008):

1. Equal absolute sacrifice: equal absolute loss of utility for each individual. Area FGHI, which is the loss of utility with tax introduction, is equal for everyone. One should bear in mind that individuals are located in different spots in abscissa in accordance with their income before tax. Therefore, the function of marginal utility of income will look different for each individual.
2. Equal relative sacrifice: equal relative loss of utility for each individual. The ratio of two areas (FGHI and ABHI) must be equal for all individuals.
3. Equal marginal sacrifice: loss of social welfare or utility would be such that individuals after taxation will have the same marginal utility of income.

These three sacrifices are hypothetical, because they keep other parameters, such as leisure, constant. In reality, through taxation, the quantity of leisure changes, and no one is on the same curve of marginal utility of income anymore.

1.1.3 Worldwide Income and International Taxation

Based on Rosen and Gayer (2008), there are two types of treatment of worldwide income in the sense of international taxation. These are the global and territorial systems.

In the global system (Rosen & Gayer, 2008), the tax authority of the country of citizenship puts the tax on the worldwide income of an individual, no matter where the income has been made. For the tax paid in jurisdictions other than country of citizenship, one can use the tax credit. Therefore, the global system relates to the citizenship of the country, and it is very specific for the United States of America.

In general, other countries use the territorial system (Rosen & Gayer, 2008) which is organized in such a manner that a citizen who earns income abroad is a taxpayer only in the country where the income has been made.

For example, if a US citizen works in Singapore, he/she will be subject to both Singaporean taxation and US taxation with the right to use the tax credit for the tax paid in Singapore. At the same time, a UK citizen will be subject only to Singaporean taxation. This creates the horizontal inequality between different citizens.

There is another approach to global and territorial systems different from one explained by Rosen and Gayer (2008). Residential, territorial, and system based on citizenship can be differentiated (Ernst & Young, 2013). Most countries have residential system where they tax their residents (resident citizens and resident foreigners) on their worldwide income. The definition of residency is different from country to country, but it is usually related to the place of living interests. As opposed to residents, non-residents (non-resident citizens of the country or non-resident foreigners) are taxed for income earned in the country. Some countries have territorial system which means that only income earned in the country is taxed, no matter if a taxpayer is a resident or non-resident. Under territorial system, foreign income is not taxed. And the third system is based on citizenship which is explained above in the US case.

Therefore, most countries in the world have a residential system, whereas few countries have a territorial system, such as Angola, Botswana, Costa Rica, Congo, Georgia, Guatemala, Hong Kong, Lebanon, Macau, Malawi, Malaysia, Namibia, Nicaragua, Palestinian Authority, Panama, Paraguay, Seychelles, Singapore, Syria, and Zambia (Ernst & Young, 2013).

The Federation of Bosnia and Herzegovina has a residential system of international taxation. Exceptions are six sources of income taxed at the source, and tax withheld is considered as final liability. They are not filed in the annual tax declaration. More on that may be found in the *sub-section 1.3.2.1 The System of Personal Income Taxation in the Federation of Bosnia and Herzegovina*. However, it is not valid in practice. In practice, the Federation of Bosnia and Herzegovina does not include income received abroad or in another entity or Brčko District in the total income of a residential individual.

To ensure that double taxation does not appear when income is made in different countries, international tax treaties are signed between countries. Bosnia and Herzegovina has international tax treaties with 40 countries[3]. These treaties mostly regulate withholding tax rates for interests, dividends, and copyrights.

1.1.4 Principles of a Good Taxation System

Through the literature, seven key principles of a good taxation system can be summarized.

First, the tax system should be set in such a manner as to collect sufficient public revenues (R. A. Musgrave & P. B. Musgrave, 1993).

The second key principle is equity (Bailey, 2002). The system should be fair to all taxpayers; those who make the same amount of money should be treated equally, and those who earn more pay more (Stiglitz, 2008). Thus, those who have a higher ability to pay should pay higher taxes and contribute more to overall tax collection (principle of ability to pay in taxation) (R. A. Musgrave & P. B. Musgrave, 1993). This is basically a redistributive function. Therefore, two different types of equity can be differentiated (R. A. Musgrave & P. B. Musgrave, 1993): horizontal and vertical. Horizontal equity is when people with the same income pay the same taxes, whereas vertical equity is when people with higher income have a higher ability to pay and should pay higher taxes.

Therefore, equity is put in to justify progressivity that raises the revenues. Progressivity is closely connected to vertical equity, i.e., progressivity arises from vertical equity. As opposed to horizontal equity where equals should be treated equally, vertical equity treats unequal unequally. The tax system "should be designed in a way to equalize everyone's sacrifice in utility terms" (Lambert, 2001, p. 175).

The third key principle is efficiency (Bailey, 2002). Taxation should not distort the efficient allocation of resources (Stiglitz, 2008). Therefore, efficiency is related to excess burden of

[3] Albania, Algeria, Austria, Azerbaijan, Belgium, China, Croatia, Cyprus, Czech Republic, Denmark, Egypt, Finland, France, Germany, Greece, Hungary, Iran, Ireland, Italy, Jordan, Kuwait, Macedonia, Malaysia, Moldova, Montenegro, Netherlands, Norway, Pakistan, Poland, Qatar, Romania, Serbia, Slovakia, Slovenia, Spain, Sri Lanka, Sweden, Turkey, United Arab Emirates, United Kingdom (Bosnia and Herzegovina Ministry of Finance and Treasury, 2015).

taxation (deadweight loss), explained in the section *1.1.6 Tax Effects*. Through analysis of excess burden, one should differentiate statutory incidence and real incidence (R. A. Musgrave & P. B. Musgrave, 1993). Statutory incidence refers to who has been defined as a taxpayer according to law, whereas real incidence refers to who really bears the burden.

The fourth key principle is costs. Tax collection and administration entail costs that influence economy. The costs should be as low as possible compared with yields. This applies to government as well as to taxpayers. Therefore, the tax system should not be expensive to implement (Stiglitz, 2008). The system should also not be complex to administer (Stiglitz, 2008), which is the fifth key principle. The tax system should be flexible in a sense that it is able to react to the economic environment and should be transparent, meaning that taxpayers know what they pay for (Stiglitz, 2008), this being the sixth key principle.

Finally, the seventh key principle is that fiscal policy should be used for stabilizing and development goals. Taxpayers should see the projects behind taxes they pay, with those taxes not just filling the budget for public expenditures. This is based on the principle of utility in taxation. The principle of utility says that a fair tax system is a system in which each taxpayer contributes in accordance with benefits gained from the public sector. Usually, people will not accept a specific tax system if they do not gain some benefit out of it. However, different people will require different benefits, and there is no unique formula for that. However, it is normal that some people will be happier than others regarding benefits received. Nonetheless, overall, people will get benefits for paying taxes, and such benefits should be noticeable by them. The principle of utility is based on public expenses (R. A. Musgrave & P. B. Musgrave, 1993).

1.1.5 International Tax Rates and Practice

In this section, I look at the tax rates for personal income taxation worldwide and draw general conclusions about system of taxation most countries use.

I do the analysis in a manner that I make groups of countries according to their geographical positions, their importance in the world, and their specific characteristics.

Those groups are the following:

1. Countries of the European Union;
2. Countries of the former Yugoslavia and Albania;
3. Countries of the former USSR;
4. USA and Canada;
5. Countries of the Far East;
6. Latin America;
7. Middle East and North Africa;
8. Countries of South Asia;
9. Sub-Saharan Region.

I should point out that I have not treated all countries, either because they are too small, or access to data was not easy.

It is very noticeable that almost all former socialist countries, i.e., countries of the former Eastern European Bloc, and countries of the former Yugoslavia and Albania (except Poland, Azerbaijan, Uzbekistan, Croatia, Slovenia) have one rate of personal income tax, whereas developed countries of the European Union have differential rates (see Tables 1, 2, and 3). Serbia, also a country of the former Yugoslavia, still has schedular, not comprehensive[4], system of personal income taxation, although the Law on PIT has been implemented since 2001 (*Zakon o porezu na dohodak građana u Srbiji* [Law on PIT in Serbia], 2001).

Therefore, around three-fourths of EU countries have differential rates, based on the data from 2014. Data for EU countries are for 2014, but for the rest of the countries are for 2011 throughout this section. Differential rates go to or over 50% in Austria, Belgium, the Netherlands, Portugal, Slovenia, Spain, Sweden, and the United Kingdom, whereas single rates go from 10% in Bulgaria to 24% in Latvia (see Table 1).

Table 1. Countries of the European Union, 2014

Country	Income brackets in EUR	Personal income tax %	Basic allowance in EUR
Austria	0 –11,000	0	11,000
	11,000 – 25,000	36.5	
	25,000 – 60,000	43.21	
	> 60,000	50	
Belgium	0 – 7,900	25	6,570
	7,900 – 11,240	30	
	11,240 – 18,730	40	
	18,730 – 34,330	45	
	> 34,330	50	
Bulgaria		10	
Croatia[5]	0 – 3,552	12	3,552
	3,552 – 14,208	25	
	> 14,208	40	
Cyprus	0 – 19,500	0	
	19,500 – 28,000	20	
	28,000 – 36,300	25	
	36,300 – 60,000	30	
	> 60,000	35	
Czech Republic		15	

[4] Comprehensive tax is when the tax schedule applies the same rate on all sources of income, while schedular tax is when different rates apply to different sources of income (Paulus & Peichl, 2008).
[5] Converted from local currency to EUR on 18.1.2014.

Denmark[6]	0 – 5,749	0	
	5,749 – 52,248	5.83	
	> 52,248	15	
Estonia		21	1,728
Finland	0 – 16,100	0	2,880
	16,100 – 23,900	6.5	
	23,900 – 39,100	17.5	
	39,100 – 70,300	21.5	
	70,300 – 100,000	29.75	
	> 100,000	31.75	
France	0 – 5,963	0	
	5,963 – 11,896	5.5	
	11,896 – 26,420	14	
	26,420 – 70,830	30	
	70,830 – 150,000	41	
	> 150,000	45	
Germany	0 – 52,882	14	8,130
	52,882 – 250,730	42	
	> 250,730	45	
Greece	0 – 25,000	22	
	25,000 – 42,000	32	
	> 42,000	42	
Hungary		16	
Ireland	0 – 32,800	20	32,800
	> 32,800	41	
Italy	0 – 15,000	23	
	15,000 – 28,000	27	
	28,000 – 55,000	38	
	55,000 – 75,000	41	
	> 75,000	43	
Latvia		24	768
Lithuania[7]		15	2,781
Luxembourg	0 – 11,264	0	

[6] Converted from local currency to EUR on 15.1.2013.
[7] Ibid.

	11,264 – 13,172	8	
	13,172 – 15,080	10	
	15,080 – 16,988	12	
	16,988 – 18,896	14	
	18,896 – 20,804	16	
	20,804 – 22,712	18	
	22,712 – 24,620	20	
	24,620 – 26,528	22	
	26,528 – 28,436	24	
	28,436 – 30,344	26	
	30,344 – 32,252	28	
	32,252 – 34,160	30	
	34,160 – 36,068	32	
	36,068 – 37,976	34	
	37,976 – 39,854	36	
	39,854 – 41,792	38	
	41,792 – 99,999	39	
	> 99,999	40	
Malta	0 – 8,500	0	
	8,500 – 14,500	15	
	14,500 – 19,500	25	
	> 19,500	32	
Netherlands	0 – 19,645	37	
	19,645 – 33,363	42	
	33,363 – 55,991	42	
	> 55,991	52	
Poland[8]	751 – 20,786	18	
	> 20,786	32	
Portugal	0 – 7,000	14.5	
	7,000 – 20,000	28.5	
	20,000 – 40,000	37	
	40,000 – 80,000	45	
	>80,000	48 (+2.5% surtax if >80,000 and <=250,000; 5% surtax if >250,000)	
Romania		16	
Slovak Republic	0 – 34,401.74	19	3,735.94
	> 34,401.74	25	
Slovenia	0 – 8,021.34	16	(1) 6,519.82 if income <=10,866.37

[8] Converted from local currency to EUR on 15.1.2013.

	8,021.34 – 18,960.28	27	(2) 4,418.64 if income >10,866.37 and <=12,570.89 (3) 3,302.70 if income >12,570.89
	18,960.28 – 70,907.2	41	
	> 70,907.2	50 (for years 2013 and 2014)	
Spain	0 – 17,707.2	24.75	5,151
	17,707.2 – 33,007.2	30	
	33,007.2 – 53,407.2	40	
	53,407.2 – 120,000.2	47	
	120,000.2 – 175,000.2	49	
	175,000.2 – 300,000.2	51	
	> 300,000.2	52	
Sweden[9]	0 – 47,170	0 (+local taxes avg. 31.6%)	1,494
	47,170 – 67,527	20 (+local taxes avg. 31.6%)	
	> 67,527	25 (+local taxes avg. 31.6%)	
United Kingdom[10]	0 – 41,395	20	9,762
	41,395 – 180,660	40	
	> 180,660	50	

Source: *"Taxes in Europe – Tax reforms" database (TEDB/TAXREF)*, 2014; own Table

Norway and Switzerland, which do not belong to any political formation such as the European Union, but belong to the group of most developed countries in the world, also have differential rates up to 47.8% (KPMG, 2012).

Slovenia and Croatia, both EU members and the most developed countries of the former Yugoslavia, have differential rates. Serbia is the only EU candidate country that passed the Law on Personal Income Tax with schedular rates. The rest of the former Yugoslavia has one rate, as does Albania (see Table 2).

[9] Converted from local currency to EUR on 15.1.2013.
[10] Ibid.

Table 2. Countries of the Former Yugoslavia and Albania, 2011

Country	Personal income tax %
BH	10
Croatia	12-40[11]
Macedonia[12]	10
Montenegro[13]	9
Serbia[14]	10-20
Slovenia	16-50
Albania	10

Source: *KPMG's Individual Income Tax and Social Security Rate Survey 2011*, 2012; *Tax Rates around the World 2012*, 2012; *World Tax Rates 2010/2011*, 2012; own Table

Among all countries of the former USSR, Azerbaijan and Uzbekistan are the only countries having more than one rate (see Table 3).

Table 3. Countries of the Former USSR, 2011

Country	Personal income tax %
Armenia	20
Azerbaijan	up to 30
Belarus	12
Estonia	20
Georgia	20
Kazakhstan	10
Latvia	25
Lithuania	15/20[15]
Russia	13
Ukraine	15/17
Uzbekistan	11-22

Source: *KPMG's Individual Income Tax and Social Security Rate Survey 2011*, 2012; *Tax Rates around the World 2012*, 2012; *World Tax Rates 2010/2011*, 2012; own Table

The United States and Canada, which are amongst the top 20 developed countries in the world, also have differential rates that get to 46.4% in Canada (see Table 4).

[11] 12% is the lowest marginal rate, 40% is the top marginal rate.
[12] EU candidate.
[13] Ibid.
[14] Ibid.
[15] 20% is the tax rate for income from capital.

Table 4. USA and Canada, 2011

Country	Personal income tax (%)
Canada	15-46.4
USA	15-35.0

Source: *KPMG's Individual Income Tax and Social Security Rate Survey 2011*, 2012; *Tax Rates around the World 2012*, 2012; *World Tax Rates 2010/2011*, 2012; own Table

Countries of the Far East all have differential rates, whether they are developed countries like Australia and Japan, or undeveloped such as the Philippines, or developing so-called "little Asian tigers" (Hong Kong, Singapore, South Korea). Rates go to 50% in Japan (see Table 5).

Table 5. Countries of the Far East, 2011

Country	Personal income tax %
Australia	17-45
China	3-45
Hong Kong	2-15
Indonesia	5-30
Japan	5-50
Korea (South)	6-35
Macau	7-12
Malaysia	0-26
New Zealand	0-33
Philippines	5-32
Singapore	3.5-20

Source: *KPMG's Individual Income Tax and Social Security Rate Survey 2011*, 2012; *Tax Rates around the World 2012*, 2012; *World Tax Rates 2010/2011*, 2012; own Table

Countries of Latin America also have differential rates that go to 40% in Chile (see Table 6).

Table 6. Countries of Latin America, 2011

Country	Personal income tax %
Argentina	9-35
Brazil	7.5-27.5
Chile	0-40
Columbia	0-33
Ecuador	0-35
Mexico	0-30
Panama	15-25
Peru	15-30
Uruguay	0-25
Venezuela	6-34

Source: *KPMG's Individual Income Tax and Social Security Rate Survey 2011*, 2012; *Tax Rates around the World 2012*, 2012; *World Tax Rates 2010/2011*, 2012; own Table

Countries of the Middle East and North Africa either have 0% or differential rates, except for Libya, which has a single rate, and Saudi Arabia, which has a single rate for foreigners (see Table 7). Those with 0% tax rate are mostly countries that have oil. It is important to stress, however, that all countries with oil do not have 0%, such as the United States, Libya, Saudi Arabia[16], Nigeria, and Iran.

Table 7. Middle East and North Africa, 2011

Country	Personal income tax %
Algeria	0-40
Bahrain	0
Egypt	10-20
Iraq	3-15
Jordan	7-14
Kuwait	0
Libya	15
Morocco	0-41.5
Oman	0
Qatar	0
Saudi Arabia	20
Sudan	up to 15
Syria	0-22
Tunisia	0-35
Turkey	15-35
United Arab Emirates	0
Yemen	0-35

Source: *KPMG's Individual Income Tax and Social Security Rate Survey 2011*, 2012; *Tax Rates around the World 2012*, 2012; *World Tax Rates 2010/2011*, 2012; own Table

[16] Foreigners pay at the rate of 20%.

Countries of South Asia also have differential rates (see Table 8).

Table 8. Countries of South Asia, 2011

Country	Personal income tax %
Afghanistan	up to 20
Bangladesh	0-25
Cambodia	0-20
India	10-30
Iran	15-35
Pakistan	0-25
Thailand	5-37
Vietnam	5-35

Source: *KPMG's Individual Income Tax and Social Security Rate Survey 2011*, 2012; *Tax Rates around the World 2012*, 2012; *World Tax Rates 2010/2011*, 2012; own Table

Countries of the Sub-Saharan Region all have differential rates. It is noticeable that many undeveloped countries have relatively high rates, such as Ethiopia, Botswana, Zambia, and Zimbabwe (see Table 9).

Table 9. Countries of Sub-Saharan Region, 2011

Country	Personal income tax %
Angola	0-17
Botswana	0-25
Cameroon	10-35
Ethiopia	10-35
Ghana	0-25
Ivory Coast	2-36
Kenya	10-30
Mozambique	up to 32
Namibia	0-37
Nigeria	5-25
Senegal	0-50
South Africa	0-40
Tanzania	0-30
Zambia	0-35
Zimbabwe	0-36.1

Source: *KPMG's Individual Income Tax and Social Security Rate Survey 2011*, 2012; *Tax Rates around the World 2012*, 2012; *World Tax Rates 2010/2011*, 2012; own Table

Overall, I can draw the following conclusions. It is visible that the common practice of most countries in the world is to have more than one rate, whether I look at developed or undeveloped countries. The major exception from the previous conclusion consists of countries that belonged to so-called Eastern European Bloc, whether or not they now belong to the European Union, and they mostly have flat tax. The possible reason might be because

these countries did not have comprehensive personal income tax laws during communism, so it was easier for them to implement a simple flat tax, and not something complex as differential rates. Another reason might be the contraction of the shadow economy through a low transparent flat tax rate (Ivanova et al., 2005). According to Paulus and Peichl (2008), the central argument for flat tax reform in developing and transition countries might be the reduction of tax evasion and the increase in tax compliance.

1.1.6 Tax Effects

1.1.6.1 Income (Re)Distribution and Economic Efficiency

"In general, the art of government consists in taking as much money as possible from one class of citizens to give to the other."

Voltaire

Every government decision on taxes draws some questions about income re(distribution). This means that everyone is interested in who bears the burden of tax decisions, and who the winners and the losers are.

Government can behave according to the normative theory or the positive theory of the public sector. When government draws decisions based on the normative theory, government follows publicly accepted norms, whereas in the positive theory government emphasizes incentives generated by government institutions and policies and their economics effects without judging effectiveness in terms of norms accepted by society (Tresch, 2002).

When introducing new taxes or new rates or some other new parameters, the government should be concerned about both efficiency (welfare economics) and income redistribution. It is known from the welfare economic theory that the introduction of, for example, a progressive tax system increases the deadweight loss, i.e., decreases social welfare (Stiglitz, 2008). However, economists might want a higher deadweight loss traded off by better income distribution. Nonetheless, some economists focus only on the social welfare situation, whereas others think only about income redistribution. The best way is to think about both or at least to be aware of both.

Various developed countries have carried out structural reforms of their redistribution schemes over the last 25 years. Different results have been achieved through different models and techniques. The major approach covers the optimal income taxation model that includes a trade-off between efficiency and equity (Spadaro, 2005).

Therefore, policy makers sometimes face difficult a trade-off between economic efficiency, welfare, and simplicity (Cajner, Grobovšek, & Kozamernik, 2006).

However, it is also needed to clarify here who really bears the burden (incidence). According to Rosen and Gayer (2008), there are two types of incidence: statutory incidence and economic incidence. Statutory incidence defines who legally is responsible for paying taxes. However, the side that is legally responsible usually is not responsible in reality. Thus, there is an economic incidence, which states who really bears the burden. It is known as tax shifting.

In terms of distributions, also according to Rosen and Gayer (2008), there are two types: functional distribution of income and size distribution of income. Functional distribution of income takes into focus how the introduction of tax changes influence distribution among capitalists, labourers, and landlords. This is the old-fashion observation of distribution. Nowadays, it is considered how tax influences distribution of income among people, i.e., across income levels.

The demand and supply curves are used for payroll tax to see who statutorily is responsible for tax, and who really bears the burden (tax incidence).

Based on readings from Rosen and Gayer (2008), and Stiglitz (2008), I considered three cases when tax (payroll tax) is:

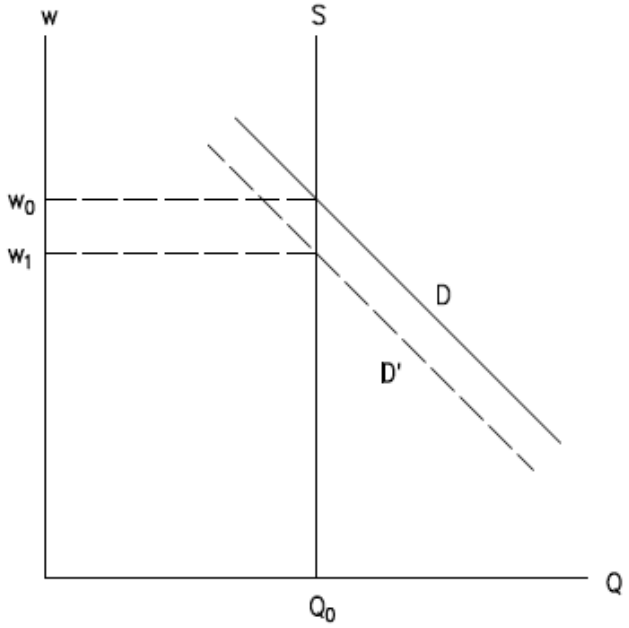
I. borne completely by employees;
II. borne completely by employers;
III. shared between employees and employers.

I. CASE

Tax is completely borne by employees in two cases:

- perfectly inelastic labour supply (see Figure 2);
- perfectly elastic labour demand (see Figure 3).

Figure 2. Perfectly Inelastic Labour Supply



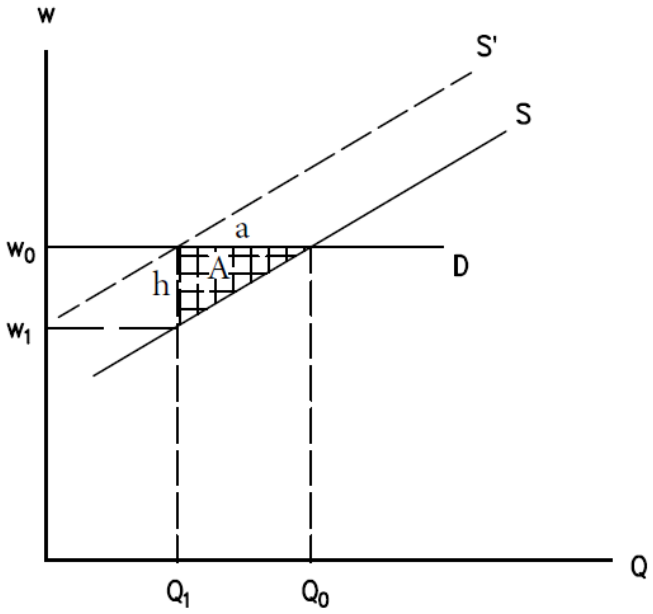
Source: H. S. Rosen and J. E. Gayer, *Public Finance*, 2008, pp. 313, 316

In Figure 2, S is the curve for labour supply. There is an assumption it is perfectly inelastic. D is the curve for labour demand. W_0 is the equilibrium hourly wage rate before tax. If tax has been introduced, the new equilibrium is w_1, expressed by the shift of demand curve from D to D'. Therefore, employers paid w_0 before tax, and the entire amount was received by employees. However, when tax was imposed, employers continued to pay amount w_0, but employees received w_1. Therefore, the entire amount of tax was shifted to employees. Who bears the burden, depends on the elasticity of demand and supply. Smith (2007) states that taxes upon wages of labour are necessarily regulated by the demand for labour. The side that is inelastic bears the burden. Or the side that is less elastic bears the burden. Inelastic supply is definitely true at least in short run.

The introduction of any new tax or new rates affects economic efficiency. As can be seen in Figure 2, tax imposed on labour was borne completely by employees when the supply of labour was perfectly inelastic. When one party is completely inelastic (inflexible), exactly that party bears the complete burden of taxation. Additional to that, when one party is completely inflexible, there is no excess burden (deadweight loss). The deadweight loss is excess in taxation that neither stays with those responsible for the tax nor goes to budget. The higher the rate, the higher the excess burden is.

In Figure 3, I consider the second part of Case I, which is perfectly elastic labour demand.

Figure 3. Perfectly Elastic Labour Demand



Source: H. S. Rosen and J. E. Gayer, *Public Finance*, 2008, p. 343; J. E. Stiglitz, *Ekonomija javnog sektora*, 2008, p. 500

In Figure 3, where I state the hypothetical example, the following situation can be seen. Without tax, the equilibrium hourly wage rate is w_0, and worked hours per year are Q_0. When the government imposes the income tax, the equilibrium take home wage rate goes down to w_1, and worked hours go down to Q_1. Therefore, introduction of tax affects both wages and employments, i.e., wages go down and employment goes down. Again, employers pay w_0, where total amount of tax is borne by employees because employers are completely flexible. However, as opposed to the first part of Case I, it creates triangle A, which is the excess burden of taxation.

According to Stiglitz (2008) the formula of excess burden (deadweight loss) is derived as follows:

From Figure 3, it can be seen that the triangle expressing the deadweight loss is marked by A. Thus, it is needed to calculate the area of triangle A.

The area of A is:

$$A = \frac{1}{2} ah, \tag{5}$$

where *a* is the base, and *h* is the height of the triangle. The base of the triangle is the difference in worked hours, whereas the height is the difference in the hourly wage rate before and after the introduction of personal income tax.

Therefore,

$h = \Delta w = w_0 - w_1 = w_0 - (1-t)\, w_0 = w_0\,(1-1+t) = w_0 t$ (6)

and

$a = \Delta Q.$ (7)

Elasticity is defined as follows:

$$\mu = \frac{\frac{\Delta Q}{Q_0}}{\frac{\Delta w}{w_0}}, \quad (8)$$

$$\mu = \frac{\Delta Q * w_0}{\Delta w * Q_0}. \quad (9)$$

From the formula for elasticity, ΔQ can be expressed:

$$\Delta Q = \mu * \frac{Q_0}{w_0} * \Delta w, \quad (10)$$

which is the elasticity of hours worked.

In equation (6), it is shown that $\Delta w = w_0 t$.

If the elasticity of hours worked is substituted for equation (6), there is

$$\Delta Q = \mu * \frac{Q_0}{w_0} * w_0 t. \quad (11)$$

The w_0 in the numerator and the w_0 in the denominator cancel out. Thus, there is

$$\Delta Q = \mu * Q_0 * t. \quad (12)$$

Based on equations (5), (6), (7), and (12), there is

$$A = \frac{1}{2} * a * h \rightarrow$$

$$\rightarrow A = \frac{1}{2} * (\mu * Q_0 * t) * w_0 t \rightarrow$$

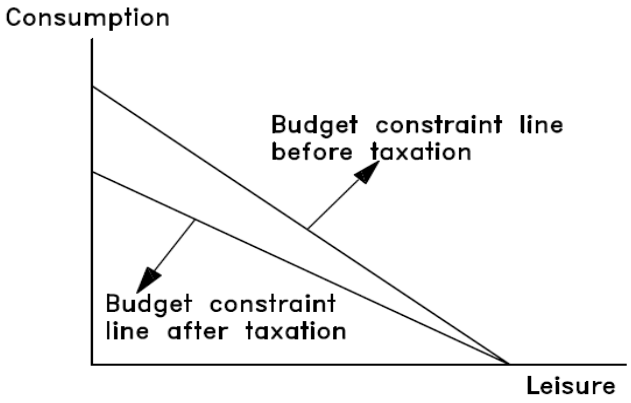
$$\rightarrow A = \frac{1}{2} * \mu * w_0 * Q_0 * t^2. \quad (13)$$

It can be seen from the final formula for the area of the triangle (excess burden, deadweight loss) that the triangle rises quadratically as the tax rate rises. This justifies the discussion

before when it was said that higher rates impose higher deadweight loss and reduce economic efficiency. This only can be justified if the increase in taxes serves to redistribute income between different income levels, redistributing it from higher-earning individuals to lower-earning individuals.

With the introduction of taxation, there should also be looked at the choice between work and leisure through the substitution effect and the income effect. The best way to do so is to look at Figure 4.

Figure 4. Income and Substitution Effects



Source: J. E. Stiglitz, *Ekonomija javnog sektora*, 2008, p. 544

Taxation reduces disposable income. There are two reactions: substitution effect and income effect. The substitution effect reacts in a way that reduces the amount of work, creates enjoyment of more leisure, and reduces consumption. The income effect reacts in a different direction, pushing people to work more in order to have more income. Because these two effects go in different directions, it means they neutralize each other (Stiglitz, 2008).

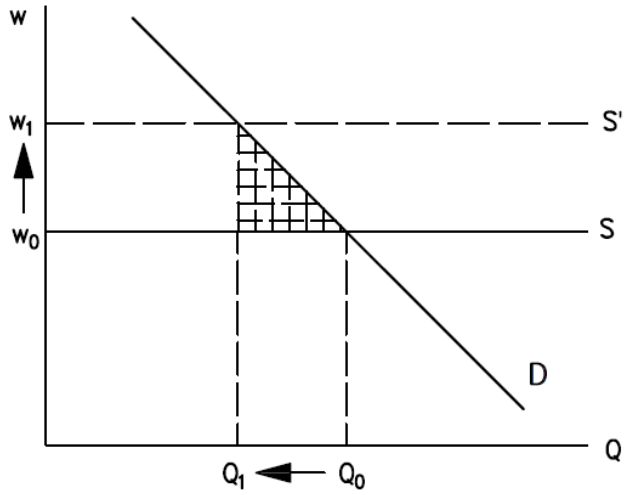
Usually the supply of work force is relatively inelastic, meaning that the substitution effect and the income effect cancel each other (Stiglitz, 2008). It does not mean that tax does not create distortions. It creates distortions as long as the substitution effect exists, because it creates excess burden or deadweight loss.

II. CASE

Tax is completely borne by employers in two cases:

- perfectly elastic labour supply (see Figure 5);
- perfectly inelastic labour demand (see Figure 6);

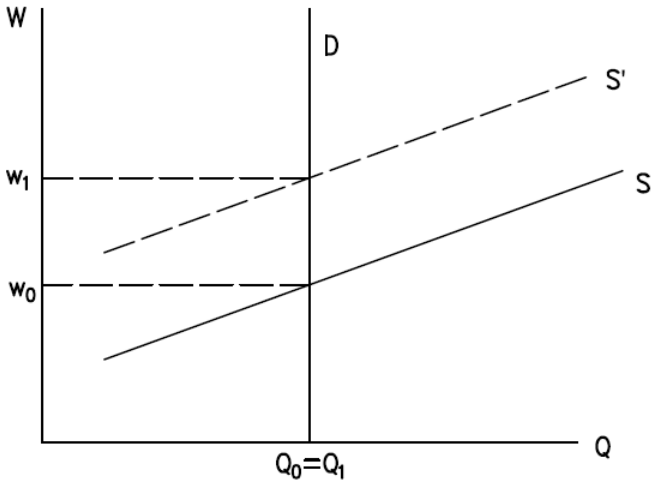
Figure 5. Perfectly Elastic Labour Supply



Source: J. E. Stiglitz, *Ekonomija javnog sektora*, 2008, p. 499

In Figure 5 the labour supply is perfectly elastic, and the entire burden of income taxation is borne by employers. Employees continue to receive w_0, whereas employment goes down from Q_0 to Q_1. There is again a triangle representing deadweight loss.

Figure 6. Perfectly Inelastic Labour Demand



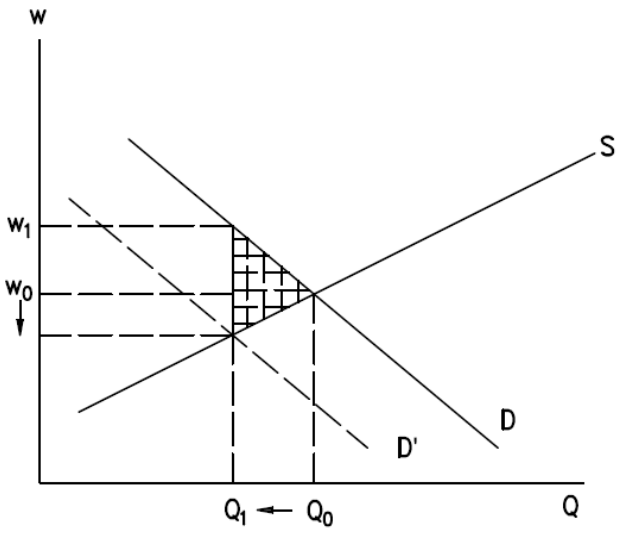
Source: J. E. Stiglitz, *Ekonomija javnog sektora*, 2008, p. 499

In Figure 6 labour demand is perfectly inelastic, and the complete burden of income taxation is borne by employers. There is no deadweight loss.

III. CASE

The third case covers the situation where tax is shared between employees and employers. It happens when there are no extreme situations, such as perfectly elastic or perfectly inelastic supply and demand (see Figure 7).

Figure 7. Tax Shared between Employees and Employers



Source: J. E. Stiglitz, *Ekonomija javnog sektora*, 2008, p. 502

It can be seen from Figure 7 that tax is shared between employers and employees. Before taxation, employees received w_0, which is exactly what employers paid. When tax is introduced, employers will pay w_1, but employees will receive less than w_0. Therefore, they share the burden.

In the paragraphs above, the partial equilibrium model was explained. Beside that partial equilibrium, there is another model called the general equilibrium model. The partial equilibrium model analyses the effects of taxes on one market. However, the general equilibrium model analyses the effects on various interrelated markets. The common statement for both of those equilibriums is that the statutory parties responsible for taxes are not those that really bear the burden.

1.1.6.2 Equitable and Efficient Taxation

It was shown in the previous section that higher rates create higher deadweight loss, meaning they reduce economic efficiency. One can say that a progressive system creates higher economic inefficiency, but a fairer distribution of income. Therefore, the government should find an appropriate trade-off between efficiency and equity.

Two types of models will be considered when making optimal income taxation: Edgeworth's Model and Modern Studies (Rosen & Gayer, 2008).

Edgeworth's Model

Edgeworth made a simple model based on the following assumptions:

1. He assigned utility to each individual and explained that the sum of utilities for each individual creates the social welfare that should be as high as possible:

   $$W = U_1 + U_2 + U_3 + ... + U_n, \quad (14)$$

   where W is social welfare, and the Us are individual utilities of each person, going from *first to n-th* individual in society.

2. Utilities of individuals depend on their income. This function has a diminishing[17] marginal utility of income.

3. The total income of all those individuals is fixed.

Edgeworth's model argues that the tax system should be designed in a manner to have equal distribution of after-tax income. Thus, Edgeworth's model advocates extreme progressivity in order to have complete equality.

However, the modern studies model relaxed a little bit those assumptions.

Modern Studies

The first criticism of Edgeworth's model concerns the third assumption listed above, i.e., the fixed income. Modern studies advocate that income cannot be fixed, because the introduction of tax draws decision and trade-off between work and leisure. Edgeworth's model seeks to allocate income to achieve complete equality, but does not consider the fact that individuals will not work as much as they did because they would rather enjoy leisure time than work and give a lot to government and lower-earning individuals (Rosen & Gayer, 2008).

Thus, the government needs to find the trade-off between efficiency and equity, as well as the trade-off between work and leisure.

According to Edgeworth's model, the excess burden does not exist, it is zero, and gaining equality does not impose any excess burden.

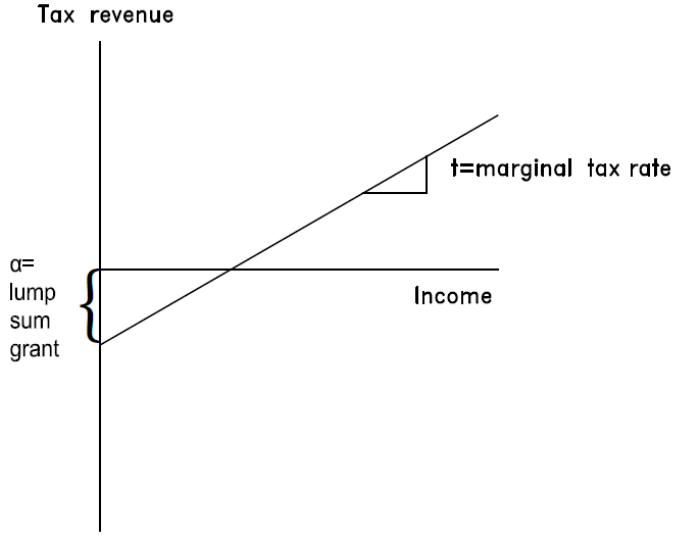
Stern (1987) studied Edgeworth's model and introduced work incentives into the model. He studied the equation

[17] As income increases it makes higher marginal utility, but at decreasing rate.

$$Revenues = -\alpha + t * Income, \quad (15)$$

where α is the work incentive, and t is a tax rate. This is shown in the Figure 8.

Figure 8. Stern and Work-Incentives



Source: H. S. Rosen and J. E. Gayer, *Public Finance*, 2008, p. 363

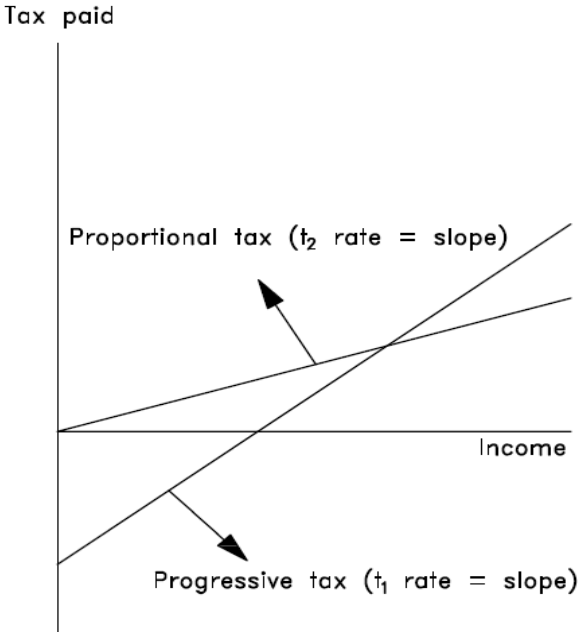
It can be noticed from Figure 8 that only at some level of income is the tax liability positive; otherwise it is negative or zero due to work incentive α. The straight line in the figure shows linear income tax that is proportional tax, called flat tax, and has the same marginal tax rate for all income levels. It is progressive in a way that work incentives give way to some progressivity, but how progressive it depends on α and t. As it has already been emphasized, higher values for t give higher progressivity, but create higher excess burden. Therefore, the government should find the optimal combination of α and t to maximize the social welfare and make the excess burden as small as possible.

Of course, the higher the elasticity of the labour supply curve, the higher the excess burden.

Stern (1987) gave valuable input, but he limited the analysis to a proportional tax system. Gruber and Saez (2002) analysed the model with four rates. They reached the conclusion that it is better for higher-earning individuals to have a lower marginal rate in order to change leisure for work and thus collect more tax revenues for government and help lower-earning individuals through social programs. Such model was applied in a canton of Switzerland (Rabushka, 2003).

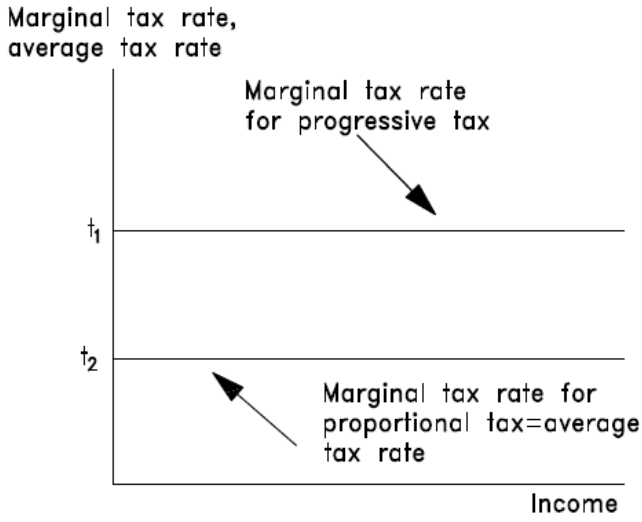
As opposed to Gruber and Saez (2002), Stiglitz (2008) also considered progressive taxation and its influence on excess burden. One should look at the Figures 9 and 10.

Figure 9. Proportional and Progressive Tax



Source: J. E. Stiglitz, *Ekonomija javnog sektora*, 2008, p. 564

Figure 10. Marginal and Average Tax Rates



Source: J. E. Stiglitz, *Ekonomija javnog sektora*, 2008, p. 564

In both Figures 9 and 10 it is referred to one rate. What makes the difference is whether there are allowances provided by government or not. If there are allowances, they make the way to progressivity even with one tax rate. In Figure 10, it can be seen that the average tax rate is the same as the marginal tax rate and constant in the case of proportional tax. However, in the case of progressive tax with one rate and allowances, marginal and average rates are different and the average rate asymptotically approaches the marginal rate as income increases. That is why this type of tax system is called progressive (Stiglitz, 2008).

It was shown earlier that those higher rates impose a higher excess burden, as does progressivity because it puts higher marginal rates in the system.

Ackert, Martinez-Vazquez, and Rider (2007) carried out a set of experiments to test how people's taste for fairness affects the preference for a particular tax structure. The test encompassed overall social preferences when voting for changes in the tax structure. The experiment showed that individuals showed concern about their own payoff and inequality aversion in deciding between different tax models. However, because with progressive taxation the deadweight loss increases, along with that the interest for inequality aversion decreases.

Fausto (2008) investigated the history of progressive taxation in Italy covering a period from the end of the nineteen century to the beginning of the twentieth century. The result of the survey indicated support for the idea of progressive taxation, not because of the theoretical background but because of political and social reasons. Similarly, according to Morgan (1994), the real key is the extent to which governments use taxes to raise revenues rather than progressivity. Moreover, people who face high effective tax rates have low financial incentive to work in order to increase their earned income (Beer, 2003).

1.1.7 Inequality Measures, Progressivity Measures, and Decomposition of Redistributive Effects

Lambert (2001, p. 24) says: *"...the income share of the top decile must exceed 10 per cent, so long as there is inequality in the distribution! Similarly, the income share of the bottom decile must be less than 10 per cent when there is inequality."*

In this chapter, the way of calculating inequality measures will be covered, such as the Gini/concentration coefficient, the Atkinson index, and the coefficient of squared variation, as well as the Kakwani index as a measure of progressivity, and decomposition of redistributive effects.

Measurement of inequality in distribution of income and wealth dates back to the year 1905 when M.O. Lorenz issued the publication "Methods of measuring the concentration of wealth" (Martić, 1986).

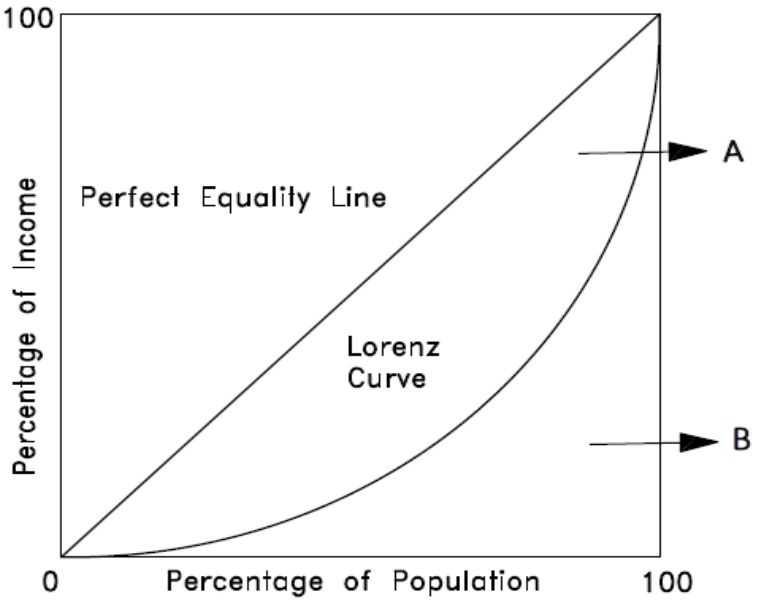
1.1.7.1 Gini Coefficient/Coefficient of Concentration

To explain the Gini/concentration coefficient, one should first look at Figure 11. The Lorenz curve (Lambert, 2001) can be seen, which explores the relation between the percentage of taxpayers and their respective income as a percentage of total income. It shows how income is distributed, and how high the concentration of income is. There is a 45-degree line (perfect equality line) that presents perfect distribution of income, meaning that everybody has the same income. One should measure how far the system is from equal distribution. That measure is the Gini coefficient, and it measures the area between the Lorenz curve and the perfect equality line as a portion of entire area (Lambert, 2001, p. 27):

$$G = \frac{A}{A + B} = 2A = 2\left(\frac{1}{2} - B\right) = 1 - 2B, \quad (16)$$

where *A* is the area between the Lorenz curve and the perfect equality line, and *B* is the area below the Lorenz curve.

Figure 11. Lorenz Curve



Source: P. J. Lambert, *The Distribution and Redistribution of Income*, 2001, p. 25

Values lie between 0 and 1, where 0 is completely equal distribution, and 1 is completely unequal distribution (all income belongs to one unit).

Therefore, put a simple way, the Gini coefficient shows the linkage between a certain share of the population making a certain share of income, where groups of the population are ordered according to the level of income.

However, sometimes one does not want to order groups of people by income, but by some other criterion (Lambert, 2001). For example, one might want to order groups of people by expenditures. Again there will be the diagram with same explanation of X-axis (percentage of population) and Y-axis (percentage of income), where the major difference is that such percentage of population is ordered based on expenditures. So, if it is taken 10% of the X-axis means that 10% of the population with the lowest expenditures has a respective percentage of income. The curve expressing such relationship is called the concentration curve for income with respect to expenditures.

The previous case can also be applied to taxes, and make the concentration curve for tax with respect to income. So, if it is taken again 10% of the X-axis, it means that 10% of population with the lowest share in income paid the respective percentage of tax. It can also

be made a concentration curve for after-tax income with respect to pre-tax income, and not the Lorenz curve because of rerankings of distributions.

Therefore, if it is plot both the Lorenz curve and the concentration curve to one diagram, "...every concentration curve lies on or above the corresponding Lorenz curve" (Lambert, 2001, p. 29).

As opposed to Lambert (2001), who strictly differentiates Lorenz curve and concentration curve, Martić (1986) defines the Lorenz curve as a special version of a concentration curve when distribution of income is in focus.

To describe the income distribution one can approach in two manners. One is to look at income as a discrete function, whereas the other is to treat income as a continuous function. The income should be ordered from lowest to highest, such as x_1, x_2, x_3, ..., x_N, where $x_1<x_2<x_3<...<x_N$, and X is total income (Lambert, 2001).

If it is treated as discrete function, the area below the Lorenz curve is calculated as the area of a triangle for the first quantile[18] group and the rest as the sum of areas of trapezes (Martić, 1986). Therefore, if the taxpayers are divided into decile groups, the area of a triangle and nine trapezes is calculated.

However, if there is a very large population with very detailed information, it all proceeds to an infinitesimal limit (Lambert, 2001). In this case, the income might be treated as continuously distributed. It also gives a smooth and elegant function. In that case, the frequency density function of income x will be defined as $f(x)$. This function presents the density proportion of income units-taxpayers in entire N number of income units-taxpayers at each income level x. Therefore, for any income level x and infinitesimal dx, $f(x)dx$ can be defined as the proportion of taxpayers who have income in the interval $[x, x + dx]$. When this is integrated, it is achieved the total proportion of all income units-taxpayers (Lambert, 2001):

$$1 = \int f(x)\, dx. \tag{17}$$

For a very large population, for each income level x there are $Nf(x)dx$ income units-taxpayers who have income belonging to interval $[x, x + dx]$. The total income of all these taxpayers is only infinitesimally different from $Nxf(x)dx$. If it is integrated again, the total income that is basically $N\mu$ is obtained, where μ is mean income:

$$N\mu = \int Nxf(x)\, dx. \tag{18}$$

When it is divided by N, it is obtained

[18] For example, the 4-quantiles are called quartiles; the 5-quantiles are called quintiles.

$$\mu = \int xf(x)\, dx. \tag{19}$$

To summarize, there are two major functions where x is a random variable and $f(x)$ is its probability density function (Lambert, 2001):

1. $\int f(x)\, dx$ is the proportion of all income units-taxpayers who have income in the interval $[x, x+dx]$.

2. $N\int xf(x)\, dx$ is the total income of the units, where it was shown that if the expression was divided by N the income of the group per capita of the overall population was obtained.

The variance as the measure of dispersion that is related to inequality and income distribution is defined as (Lambert, 2001):

$$Variance = \int (x - \mu)^2 f(x)\, dx. \tag{20}$$

Besides the inequality side, one can look from the point of view of social welfare, and assign a level of utility $U(x)$ to each level of income x, and evaluate the average utility in society (Lambert, 2001):

$$W = \int U(x)f(x)\, dx. \tag{21}$$

Equivalent to the frequency density function $f(x)$, $F(x)$ is the distribution function (Lambert, 2001):

$$F(x) = \int f(t)\, dt \tag{22}$$

and

$$f(x) = F'(x). \tag{23}$$

As known from statistical theory, there are a lot of probability distributions, but the simplest is lognormal, where logarithms of income are assumed to be normally distributed.

The frequency density function $f(x)$ is defined on the interval $[0, z]$, with positive density between a lower income $x_1 \geq 0$ and upper income $x_N \leq 0$. For each $p \in (0, 1)$, there is only one income level y with rank p. That income y lies between x_1 and x_N, and is defined as $p = F(y)$.

The income is defined as:

$$N\int_0^y \mathrm{xf(x)}\, \mathrm{dx} \tag{24}$$

and total income as:

$$N\int_0^z \mathrm{xf(x)\ dx} = N\mu. \tag{25}$$

Therefore, the Lorenz curve is defined as (Lambert, 2001):

$$p = F(y) \Longrightarrow L(p) = \int_0^y \frac{xf(x)\,dx}{\mu} \tag{26}$$

and the Gini coefficient in terms of the Lorenz curve as (Lambert, 2001):

$$G = 1 - 2\int_0^1 \mathrm{L(p)\ dp}. \tag{27}$$

In the further text, some of the above mentioned definitions are applied to taxes. It will be considered what it means when one says that progressive income tax is redistributive.

It is known that personal income tax liability is not determined only by income but also by some other factors, such as personal exemptions, dependent deductions, health insurance, interest rates, and so on.

Here are made some assumptions for mathematical convenience (Lambert, 2001):
- All taxpayers with income x have the same tax liability *t(x)*.
- *t(x)* is differentiable.
- *t'(x)* is a derivative that can measure the marginal tax rate, the rate that applies to a small increase *dx* in income.
- An increase in pre-tax income leads to increases in tax and after-tax income.

With those assumptions, function *t(x)* satisfies $0 \leq t(x) < x$ and $0 \leq t'(x) < 1$.

After setting the assumptions, here are some mathematical manipulations. *t(x)* is aggregated across *Nf(x)dx* taxpayers whose income gets in infinitesimal range *[x, x+dx]*, and total tax revenues collected are obtained:

$$T = N\int_0^z \mathrm{t(x)f(x)\ dx}. \tag{28}$$

The average tax rate is:

$$g = \frac{\mathrm{T}}{\mathrm{X}} = \int_0^z \frac{\mathrm{t(x)f(x)\ dx}}{\mu}. \tag{29}$$

From here it can be seen that $g\mu$ is the average tax liability, and $\mu(1-g)$ is the average after-tax income.

The Lorenz curve for pre-tax income is denoted as $L_X(p)$ (Lambert, 2001):

$$p = F(y) \Longrightarrow L_X(p) = \int_0^y \frac{xf(x)\,dx}{\mu}. \tag{30}$$

Besides the Lorenz curve for pre-tax income $L_X(p)$, it is also defined the concentration curve for after-tax income with respect to pre-tax income as L_{X-T} and the concentration curve for tax with respect to pre-tax income as L_T (Lambert, 2001):

$$p = F(y) \Longrightarrow L_{X-T}(p) = \int_0^y \frac{(x-t(x))f(x)\,dx}{\mu\,(1-g)} \tag{31}$$

and

$$p = F(y) \Longrightarrow L_T(p) = \int_0^y \frac{t(x)f(x)\,dx}{\mu g}. \tag{32}$$

$L_X = g\,L_T + (1\text{-}g)\,L_{X-T}$, so the Lorenz curve L_X is a weighted average of concentration curve for tax with respect to pre-tax income and concentration curve for after-tax income with respect to pre-tax income (Lambert, 2001).

Therefore, $L_{X-T} \geq L_X \Longleftrightarrow L_T \leq L_X$ (Lambert, 2001). From here one can see that L_{X-T} is closer to the perfect equality line than L_X is. This means that the area below L_{X-T} is larger than the area below L_X, and the Gini coefficient for L_X is higher than the concentration coefficient for L_{X-T}, proving that tax leads to better income distribution, i.e., it leads to income redistribution.

It is also valid that $L_T \leq L_X$. From here one can see that L_T is farther from the perfect equality line than L_X is. This means that the area below L_T is smaller than the area below L_X, and the Gini coefficient for L_X is lower than the concentration coefficient for L_T, proving that tax leads to better income distribution, i.e., it leads to income redistribution because of the higher concentration of tax than the concentration of pre-tax income.

Here it can be summarized (Lambert, 2001, p.39): "… incomes are less unequal after tax than before if and only if taxes are distributed more unequally than the incomes to which they apply."

From the mathematics above the elements of progressive taxation can be recognized, that is, if $t(x)/x$ is increasing with income then taxes are distributed more unequally than pre-tax income.

If the assumption that an increase in pre-tax income leads to increases in tax and after-tax income, $0 \leq t(x) < x$ and $0 \leq t'(x) < 1$, does not hold, then the concentration curve for after-tax income with respect to pre-tax income is not same as the Lorenz curve for after-tax income. The following might be examples:

- If the marginal tax rate is higher than 100% at certain income levels, it might be because of withdrawal of exemptions at the same time when applying taxes, where one can get into a "poverty trap" (Lambert, 2001, p.39), which happens when with an increase of pre-tax income the after-tax income decreases.
- There is no systematic pattern between income and taxes paid, e.g., a couple gets more than twice higher tax allowances than a single person.

If one takes into account non-income characteristics when calculating tax, it is quite possible that there are changes in ranking the income from pre-tax to after-tax ("reranking"; Lambert, 2001, p. 40). In that case the concentration curve for after-tax income with respect to pre-tax income $L_{X-T}(p)$ is different from the after-tax Lorenz curve $L^*(p)$. From previous definitions, $L_{X-T}(p) \geq L^*(p)$, for each p.

The redistributive effect is seen through transformation:
pre-tax Lorenz curve $L_X \rightarrow$ after-tax Lorenz curve L^*,

but is more precisely shown through

pre-tax Lorenz curve $L_X \rightarrow$ after-tax concentration curve L_{X-T}, and
after-tax concentration curve $L_{X-T} \rightarrow$ after-tax Lorenz curve L^*.

Similarly with the Gini coefficients for pre-tax (G_X) and after-tax income (G_{X-T}):

$$G_X = 1 - 2\int_0^1 L_X(p)dp \tag{33a}$$

$$G_{X-T} = 1 - 2\int_0^1 L^*(p)dp, \tag{33b}$$

concentration coefficients are calculated as:

$$C_{X-T} = 1 - 2\int_0^1 L_{X-T}(p)dp \tag{34a}$$

$$C_T = 1 - 2\int_0^1 L_T(p)dp. \tag{34b}$$

1.1.7.2 Atkinson Index

The Atkinson index is another measure of inequality. This index is named after the English econometrician Anthony Atkinson, who proposed the index in 1970 (Martić, 1986).

It is defined as (Martić, 1986):

$$A = \frac{X^* - X^{**}}{X^*}, \tag{35}$$

where X^* is average income, and X** is the equivalent level of equally distributed income, which is defined as:

$$X^{**} = \left(\frac{1}{N}\sum x_i^{1-\varepsilon}\right)^{1/(1-\varepsilon)},\ (\varepsilon \geq 0). \tag{36}$$

The equivalent level of equally distributed income is such level of individual income that would, if equally distributed, produce the same level of social welfare as actual distribution.

For:

$\varepsilon = 0,\ X^{**} = \frac{1}{N}\sum x_i = X^*;\ A=0$

$\varepsilon = 1,\ X^{**} = \left(\prod x_i\right)^{1/N} = G \rightarrow lnG = \frac{1}{N}\sum lnx_i;\ A = \frac{X^*-G}{X^*}$

$\varepsilon=2,\ X^{**} = \frac{N}{\sum\frac{1}{x_i}} = H;\ A = \frac{X^*-H}{X^*}$

$H \leq G \leq X^*$

ε is a measure of the degree of inequality aversion. The higher the ε, the higher the Atkinson.

If equation (36) is substituted into equation (35), a more general formula is obtained:

$$A = 1 - \left[\frac{1}{N}\sum\left(\frac{x_i}{X^*}\right)^{1-\varepsilon}\right]^{1/(1-\varepsilon)},\ \varepsilon \geq 0. \tag{37}$$

If one compares this new general formula (37) and equation (35), it can be realized that the first formula is easier for interpretation.

However, if one multiplies the numerator and the denominator of the new formula by N, one gets:

$$A = \frac{\sum x_i - NX^{**}}{\sum x_i}, \tag{38}$$

where $\sum x_i$ is total, generally unequally distributed income, and NX^{**} is total fictive equally distributed income.

For example, if A = 0.25, one can say, under assumption of equal distribution, that only 75% of actual national income is needed to achieve the same level of social welfare. In simple words, the same level of social welfare would be reached only with three quarters of actual national income, if income is equally distributed.

1.1.7.3 Generalized Entropy Measures

Besides the measure of inequality on the overall level, there is also the decomposition of inequalities by population subgroups and by income source (Čok, 2003).

Population Subgroups

Generalized entropy measures (E_θ) are suitable for decompositions by population subgroups (Cowell, 2000; Čok, 2003; Shorrock, 1984).

Two measures belong to the class of generalized entropy measures:
- the coefficient of squared variation *(I_2)*; $I_2 = 2 * E_{(2)}$;
- the mean logarithmic deviation *(I_0)*; $I_0 = E_{(0)}$.

The decomposition defines the extent to which inequality between population subgroups and within population subgroups is attributable to overall inequality. The class of generalized entropy measures E_θ is defined as:

$$E_\theta = \frac{1}{\theta_2 - \theta} * [\frac{1}{n}\sum [\frac{y_i}{\mu}]^\theta - 1], \quad (39)$$

where θ is a parameter that takes any value, y_i is the *ith* observation income, where *i* can take any value from *1* to *n*, and μ is the mean income of the total population.

The generalized entropy measure decomposes as:

$$I_{total} = I_{between} + I_{within}. \quad (40)$$

This generalized measure of total inequality consists of:

$I_{between}$, which is the inequality between the groups,

and

I_{within}, which is the inequality within the group.

Those can be shorten and written as:

I_b, which stands for $I_{between}$,

and

I_w, which stands for I_{within}.

I_b defines as:

$$I_b = \frac{1}{\theta_2 - \theta} * [\sum v_j [\hat{\lambda}_j]^{\theta} - 1], \quad (41)$$

where $v_j = n_j/n$, n_j is a population of sub-group j, j goes from 1 to k, n defines as total population, and $\hat{\lambda}_j = \mu_j/\mu$.

I_w defines as:

$$I_w = \sum (v_j \hat{\lambda}_j)^{\theta} (v_j)^{1-\theta} I_j, \quad (42)$$

where I_j is inequality in a sub-group j, where j goes from 1 to k.

Income Sources

As opposed to previously explained inequalities by income subgroups, there are also inequalities captured by different income sources (Shorrock, 1982). In this approach, the variance is used as a measure of inequality.

Y_i^k is the income of an individual (where i goes from 1 to n) from source k (where k goes from 1 to K), and $Y=(Y_1, Y_2, ..., Y_n) = \sum_k Y^k$ distribution of total income.

The variance of total income is:

$$\delta^2(Y) = \sum_k \delta^2(Y^k) + \sum_{j \neq k} \sum_k p_{jk} \delta(Y^j) \delta(Y^k), \quad (43)$$

where p_{jk} is the correlation coefficient between Y^j and Y^k.

If different sources of income are uncorrelated, then (43) becomes

$$\delta^2(Y) = \sum_k \delta^2(Y^k), \quad (44)$$

where $\delta^2(Y^k)$ is a contribution of factor k.

The contribution of factor k becomes:

$$S_k^* (\delta^2) = \delta^2(Y^k) + \sum_{j \neq k} p_{jk} \delta(Y^j) \delta(Y^k) = cov (Y_k, Y). \quad (45)$$

The sum of these contributions over K types of income gives the aggregate inequality value.

$s_k^*(I)$ is defined as a proportion of total inequality contributed by factor k, when the inequality measure is I

$$s_k^*(\delta^2) = \frac{S_k^*(\delta^2)}{\delta^2(Y)} = \frac{cov(Y_k,Y)}{\delta^2(Y)}, \quad (46)$$

and these sum to unity.

Variance is not usually used as a measure of inequality because it is not mean independent. However, I_2 (coefficient of squared variation) is commonly used, although that depends on the mean.

The coefficient of squared variation, where $p_{jk} = 0$ for all j,k, is:

$$I_2(Y) = \frac{\delta^2(Y)}{\mu^2} = \sum_k \frac{\delta^2(Y_k)}{\mu^2}, \quad (47)$$

where μ is the mean of Y.

Thus, $\frac{\delta^2(Y_k)}{\mu^2}$ is a contribution of factor k.

When different types of income are correlated,

$$S_k^*(I_2) = \frac{\mathrm{cov}(Y_k,Y)}{\mu^2(Y)}. \quad (48)$$

The proportion of total inequality contribution by factor k is now:

$$s_k^*(I_2) = \frac{S_k*(I_2)}{I_2(Y)} = \frac{cov(Y_k,Y)}{\delta^2(Y)}, \quad (49)$$

same as in (46).

There are two cases where contribution C_k of factor k might be:

1. Inequality that exists if the only source of inequality is component k.
2. Inequality of income source k is eliminated, and inequality falls.

The first case can be marked as C_k^A, the second case as C_k^B.

C_k^A is defined as:

$$C_k^A = \delta^2(Y^k). \quad (50)$$

C_k^B is defined as:

$C_k^B = \delta^2(Y^k) + 2cov(Y^k, Y\text{-}Y^k)$. (51)

Thus,

$S(Y^k, Y) = cov(Y^k, Y) = \frac{1}{2}(C_k^A + C_k^B)$. (52)

For inequality measure I_2:

$C_k^A = \frac{\delta^2(Y_k)}{\mu^2}$, (53)

$C_k^B = \frac{\delta^2(Y_k)+2cov(Y_k, Y-Y_k)}{\mu^2}$. (54)

1.1.7.4 Simple Measures of Progressivity

Here presented two simple measures are explained by Rosen and Gayer (2008, p. 308):

1. "…the greater the increase in average tax rates as income increases, the more progressive the system." Expressed mathematically:

   $v_1 = \frac{\frac{T_1}{I_1} - \frac{T_0}{I_0}}{I_1 - I_0}$, (55)

   where T_0 and T_1 are tax liabilities for income levels I_0 and I_1, and I_1 is a higher income level than I_0.

   The tax system with higher v_1 is considered more progressive.

2. "The higher the elasticity of tax revenues with respect to income, the more progressive the system."

   The same is expressed mathematically:

   $v_2 = \frac{\frac{T_1 - T_0}{T_0}}{\frac{I_1 - I_0}{I_0}}$. (56)

   Here is an example: "Everyone's tax liability is to be increased by 20 percent of the amount of tax he or she currently pays" (Rosen and Gayer, 2008, p. 308).

   $T_0 \rightarrow T_0 * 1.2$
   $T_1 \rightarrow T_1 * 1.2$

   If those are substituted in equation (55), there is:

$$v_1 = \frac{T_1 * \frac{1.2}{I_1} - T_0 * \frac{1.2}{I_0}}{I_1 - I_0}, \quad (57)$$

so v_1 rises by 20%. Thus, there is higher progressivity.

Substituting the same increased values for T_0 and T_1 into equation (56), it means that:

$$v_2 = \frac{\frac{T_1 * 1.2 - T_0 * 1.2}{T_0 * 1.2}}{\frac{I_1 - I_0}{I_0}} = \frac{\frac{1.2 * (T_1 - T_0)}{1.2 * T_0}}{\frac{I_1 - I_0}{I_0}}, \quad (58)$$

where *1.2* in the numerator and *1.2* in the denominator cancel out, and there is no change in v_2.

Thus, there are different conclusions based on different measures of progressivity. However, one needs to have in mind that measures do not depend only on tax liability, but also on level of income.

There are some similar measures of progressivity (R. A. Musgrave & P. B. Musgrave, 1993):

1. relation between change in effective rate and change in pre-tax income (or taxable income);
2. relation between relative change in tax liability and relative change in pre-tax income (or taxable income); and
3. relation between relative change in personal income after tax and relative change in pre-tax income (or taxable income).

1.1.7.5 Kakwani Index

Musgrave and Thin (1948) started to measure the tax progressivity. To measure, they used the Gini coefficient for pre-tax income and the Gini coefficient for after-tax income. However, Kakwani (1977) reacted that it was not the measure of progressivity, but the measure of redistributive effect:

$$RE = G_X - G_{X\text{-}T}, \quad (59)$$

where G_X is the Gini coefficient for pre-tax income, and $G_{X\text{-}T}$ is the Gini coefficient for after-tax income.

Kakwani (1977) presented a measure of progressivity. The Kakwani index measures twice the area between L_x (Lorenz curve for pre-tax income) and L_T (concentration curve for tax with respect to pre-tax income) (Kakwani, 1977; Lambert, 2001).

It is defined as the difference between C_t (concentration coefficient for tax) and Gx (Gini coefficient for pre-tax income), and is called the Kakwani index (P):

$$P = C_T - G_X. \quad (60)$$

If I recall from the sub-section *1.1.7.1 Gini Coefficient/Coefficient of Concentration*, the Gini coefficient for pre-tax income is

$$G_X = 1 - 2\int L_X(p)\, dp. \quad (61)$$

The concentration coefficient for tax is:

$$C_T = 1 - 2\int L_T(p)\, dp. \quad (62)$$

Therefore,

$$P = C_T - G_X = 1 - 2\int L_T(p)\, dp - 1 + 2\int L_X(p)\, dp = 2(\int L_X(p) - \int L_T(p))\, dp. \quad (63)$$

The limits (maximal regressivity and maximal progressivity) of the Kakwani index depend on the inequality distribution of pre-tax income (Lambert, 2001).

Therefore,

maximal regressivity calculates as $-(1 + Gx)$

and

maximal progressivity calculates as $(1 - Gx)$.

Kakwani (1977) derived the Kakwani index in the following way:

$T(x)$ is the tax of each individual having income x. The tax system can be proportional, progressive, or regressive:

- proportional – "elasticity of T with respect to x" = 1 $\forall x$
- progressive – "elasticity of T with respect to x" > 1 $\forall x$
- regressive – "elasticity of T with respect to x" < 1 $\forall x$.

Such definition is basically the same as the definition that says that the tax system is proportional, progressive, or regressive when:

- proportional – the marginal tax rate = the average tax rate
- progressive – the marginal tax rate > the average tax rate
- regressive – the marginal tax rate < the average tax rate.

A progressive tax system and reduction of income inequality are closely associated. The difference or ratio between the Gini for pre-tax income and the Gini for after-tax income represents a single measure of tax progressivity.

X that is an individual's income is a random variable which has the mean μ and probability distribution function *F(x)*. $F_1(x)$ is the share of units' income that is less than or equal to *x*. The Lorenz curve for income presents a relation between *F(x)* and $F_1(x)$. The Gini coefficient is determined as "one minus twice the area under the Lorenz curve" (Kakwani, 1977, p. 72). $F_1[T(x)]$ is the share of tax by individuals with income that is less than or equal to *x*. The concentration curve for tax presents the relation between *F(x)* and $F_1[T(x)]$. The concentration coefficient is determined as "one minus twice the area under the concentration curve" (Kakwani, 1977, p. 72). The distance between $F_1(x)$ and $F_1[T(x)]$ is dependent on tax elasticity (the greater the deviation of tax elasticity from one, the greater the distance).

Therefore, the suitable measure of progressivity can be derived through the Lorenz curve and concentration curve:

$$P = (C_T - G_X), \tag{64}$$

where C_T is the concentration coefficient for tax, and G_X is the Gini coefficient for pre-tax income.

P equals "twice the area between $F_1(x)$ and $F_1[T(x)]$" (Kakwani, 1977, p. 73).

P can take the following values:
- $P > 0$ – tax elasticity > 1 $\forall x$
- $P = 0$ – tax elasticity $= 0$ $\forall x$
- $P < 0$ – tax elasticity < 1 $\forall x$.

$$T(x) = T_1(x) + T_2(x) + \ldots + T_n(x), \tag{65}$$

$$C_T = \sum_{i=1}^{n} \frac{t_i}{t} * C_{Ti}, \tag{66}$$

where C_{Ti} is the concentration coefficient for i_{th} tax, and t_i is the average rate of i_{th} tax.

Respectively,

$$P = \sum_{i=1}^{n} \frac{t_i}{t} * P_i, \tag{67}$$

where P_i is the progressivity of i_{th} tax.

This means that the progressivity of all taxes is the weighted average of the individual taxes' progressivity. Weights are proportional to their average tax rates. This could be used for analysis of the percentage contribution of separate individual tax progressivity to overall tax progressivity.

A measure of tax progressivity shows the deviation of the tax system from proportionality.

1.1.7.6 Decomposition of Redistributive Effects

Decomposition of the redistibutive effect was offered by Kakwani (1984; 1986), presented above with the Gini coefficient (see equation (59)). Kakwani (1984; 1986) included horizontal and vertical equity, as follows:

$$R = H + V, \tag{68}$$

where H stands for the horizontal equity and V stands for the vertical equity. It decomposes as:

$$H = \frac{C_{X-T} - G_{X-T}}{G_X} \tag{69}$$

and

$$V = \frac{t * P}{(1-t) * G_X}, \tag{70}$$

where C_{X-T} is the concentration coefficient for after-tax income, G_{X-T} is the Gini coefficient for after-tax income, G_X is the Gini coefficient for pre-tax income, t is an average tax rate where $t = Q/m$, Q stands for total tax revenue and m stands for total pre-tax income, and P is the Kakwani index.

However, Atkinson (1980) and Plotnick (1981) took into account the income unit reranking and measured it as:

$$RAP^{19} = -(H), \tag{71}$$

meaning that:

$$RAP = G_{X-T} - C_{X-T}. \tag{72}$$

Therefore, decomposition of the redistributive effect includes the Kakwani vertical effect (VK) and the Atkinson-Plotnick index of reranking effect (RAP):

$$RE = VK^{20} - RAP, \tag{73}$$

where it can be seen that reranking reduces the redistributive effect.

[19] Reranking Atkinson-Plotnick.
[20] Kakwani vertical or progressivity effect.

VK calculates as $\frac{t*P}{(1-t)} = G_X - C_{X\text{-}T}$.

Atkinson-Plotnick-Kakwani decomposition has the deficiency presented through the lack of the horizontal inequity in its structure. It was overcome by inclusion of the horizontal inequity by Aronson, Johnson, and Lambert (1994). New decomposition states:

$$RE = VAJL^{21} - HAJL - RAJL, \quad (74)$$

where *VAJL* is consistent with *VK*, Kakwani vertical or progressivity effect, *HAJL* relies on the after-tax inequality, and *RAJL* is consistent with *RAP*.

The methodology explained in Aronson, Johnson, and Lambert (1994) entails same individuals' pre-tax income, which is something not achievable in regular world. To overcome that, individuals with similar income are clustered. As a consequence, there is an increase in reranking. Reranking within the group and reranking of entire group are not included. This kind of methodology is unsuccessful in regard with decomposition of redistributive effects (Urban & Lambert, 2008).

Urban and Lambert (2008) covered all effects and reranking (vertical, horizontal, reranking within the group, reranking of entire group, and *AJL*):

$$RE = V - H - RAP, \quad (75)$$

where *RAP* calculates as:

$$RAP = RWG + REG + RAJL, \quad (76)$$

where *RWG* is reranking within the group, *REG* is reranking of entire group, and *RAJL* is Aronson-Johnson-Lambert reranking.

Then from (75) and (76),

$$VAJL = V - REG \quad (77) \qquad \text{and} \qquad HAJL = H + RWG, \quad (78)$$

where:

$$V = VAJL + REG \quad (79) \qquad \text{and} \qquad H = HAJL - RWG. \quad (80)$$

As $V - H = RE + RAP$, based on (73) it means that:

[21] AJL – Aronson-Johnson-Lambert.

$$VK = V - H. \quad (81)$$

Therefore, I presented three decompositions of redistributive effects: the Atkinson-Plotnick-Kakwani, Aronson-Johnson-Lambert, and Urban-Lambert.

1.1.7.7 Summary of the Measures of Inequality and Progressivity

Here, I summarize the above mentioned measures of inequality and progressivity (see Table 10). Also, I put together the advantages and disadvantages of the measures of inequality (see Table 11).

Table 10. Summary of the Measures of Inequality and Progressivity

Inequality/Progressivity Measures	Way of Calculation	Legend
Gini Coefficient	$G_X = 1 - 2\int_0^1 L_X(p)dp$ (33a) $G_{X\text{-}T} = 1 - 2\int_0^1 L^*(p)dp$ (33b)	G_X – Gini coefficient for pre-tax income $G_{X\text{-}T}$ – Gini coefficient for after-tax income $L_X(p)$ - pre-tax Lorenz curve $L^*(p)$ - after-tax Lorenz curve
Concentration Coefficients	$C_{X\text{-}T} = 1 - 2\int_0^1 L_{X-T}(p)dp$ (34a) $C_T = 1 - 2\int_0^1 L_T(p)dp$ (34b)	$C_{X\text{-}T}$ - concentration coefficient for after-tax income with respect to pre-tax income C_T - concentration coefficient for tax with respect to pre-tax income $L_{X\text{-}T}(p)$ - concentration curve for after-tax income with respect to pre-tax income L_T - concentration curve for tax with respect to pre-tax income
Atkinson Index	$A = \frac{X^* - X^{**}}{X^*}$ (35) *or* $A = \frac{\sum x_i - NX^{**}}{\sum x_i}$ (38) $X^{**} = (\frac{1}{N}\sum x_i^{1-\mathcal{E}})^{1/(1-\mathcal{E})}, (\mathcal{E} \geq 0)$ (36) $\mathcal{E} = 0, X^{**} = \frac{1}{N}\sum x_i = X^*; A = 0$ $\mathcal{E} = 1, X^{**} = (\prod x_i)^{1/N} = G \rightarrow$ $\rightarrow lnG = \frac{1}{N}\sum lnx_i; A = \frac{X^* - G}{X^*}$ $\mathcal{E} = 2, X^{**} = \frac{N}{\sum \frac{1}{x_i}} = H; A = \frac{X^* - H}{X^*}$	A – Atkinson index X^* - average income X^{**} - equivalent level of equally distributed income $\mathcal{E}$ - measure of the degree of inequality aversion
Generalized Entropy Measures (I_θ): - coefficient of squared variation (I_2) - mean logarithmic deviation (I_0)	$I_2 = 2 * E_{(2)}$ $I_0 = E_{(0)}$ $E_\theta = \frac{1}{\theta_2 - \theta} * [\frac{1}{n}\sum [\frac{y_i}{\mu}]^\theta - 1]$ (39)	θ - parameter that takes any value y_i - income of the *ith* observation, where *i* can take any value from *1* to *n*

	Population subgroup: $I_{total} = I_b + I_w$ (40) $I_b = \frac{1}{\theta_2 - \theta} * [\sum v_j [\hat{\lambda}_j]^{\theta} - 1]$ (41) $I_w = \sum (v_j \hat{\lambda}_j)^{\theta} (v_j)^{1-\theta} I_j$ (42) Income sources: $C_k^A = \frac{\delta^2(Y_k)}{\mu^2}$ (53) $C_k^B = \frac{\delta^2(Y_k) + 2cov(Y_k, Y - Y_k)}{\mu^2}$ (54)	μ - mean income of the total population I_{total} – generalized measure of total inequality I_b – inequality between the groups I_w - inequality within the groups $v_j = n_j/n$, n_j is a population of sub-group j, j goes from *1* to k, n defines as total population $\hat{\lambda}_j = \mu_j/\mu$ I_j - inequality in a sub-group j, where j goes from *1* to k C_k^A - Inequality that exists if the only source of inequality is component k. C_k^B - Inequality of income source k is eliminated, and inequality falls.
Simple Measures of Progressivity	$v_1 = \frac{\frac{T_1}{I_1} - \frac{T_0}{I_0}}{I_1 - I_0}$ (55) $v_2 = \frac{\frac{T_1 - T_0}{T_0}}{\frac{I_1 - I_0}{I_0}}$ (56)	T_0 and T_1 - tax liabilities at income levels I_0 and I_1, respectively, and I_1 is a higher income level than I_0
Kakwani Index	$P = C_T - G_X =$ $= 1 - 2\int L_T(p)\,dp - 1 + 2\int L_X(p)\,dp =$ $= 2(\int L_X(p) - \int L_T(p))\,dp$ (63)	P – Kakwani index
Decomposition of Redistributive Effects	$RE = G_X - G_{X-T}$ (59) $R = H + V$ (68) $H = \frac{C_{X-T} - G_{X-T}}{G_X}$ (69) $V = \frac{t * P}{(1-t) * G_X}$ (70) $RAP = -(H)$ (71) $RAP = G_{X-T} - C_{X-T}$ (72)	RE, R – redistributive effects H – horizontal effect V, VK - vertical effect t - average tax rate calculated as Q/m, where Q is total tax revenue and m is total pre-tax income RAP – income unit reranking Atkinson-Plotnick

	$RE = VK - RAP$ (73) $RE = VAJL - HAJL - RAJL$ (74) $RE = V - H - RAP$ (75) $RAP = RWG + REG + RAJL$ (76)	(73) - Atkinson-Plotnick-Kakwani decomposition (74) - Aronson-Johnson-Lambert decomposition (75) – Urban – Lambert decomposition *RWG* – within group reranking *REG* – entire group reranking *RAJL* – AJL reranking

Source: own Table

Table 11. Advantages and Disadvantages of the Measures (Inequality and Progressivity)

Inequality/Progressivity Measures	Benefits	Drawbacks
Gini Coefficient	- well-known and popular measure in the literature, not only in economics, but also in other areas, like health sector (De Maio, 2007) - easy to compute, easy to interpret (Lambert, 2001) - measure of inequality, not the measure of average income (Inequality in Latin America, 2015) - measure of inequality used to compare inequality in different countries and sectors (Inequality in Latin America, 2015) - can be tracked over time (Inequality in Latin America, 2015)	- meeting the equality line is not achievable (Inequality in Latin America, 2015) - dependent on the data quality (Inequality in Latin America, 2015) - sensitivity to the middle class income, not to very high or very low income (De Maio, 2007; Ellison, 2002; Inequality in Latin America, 2015; Lambert, 2001) - relative measure, two countries may have the same Gini coefficient, but different level of wealth (UNDP, 2010) - two countries may have the same value of Gini coefficient, but in reality have very different income distribution (Bellu & Liberati, 2006) - different results when taking individuals and households in the same population (Deininger & Squire, 1996) - statistical measure with no sensitivity parameter - unable to differentiate various types of inequality

Atkinson Index	- includes judgments about the weights in income distribution, Ɛ (Martić, 1986; De Maio, 2007) - more nuanced than Gini coefficient (De Maio, 2007) - sensitive to other parts of income distribution (high and low income) (De Maio, 2007)	- no additive inequality decomposition (Martić, 1986)
Generalized Entropy Measures (I_θ)	- more nuanced than Gini coefficient (De Maio, 2007) - similar to Atkinson index, it has sensitivity to different level of income inequality, α (Cowell, 2000) - can be broken into population groups to measure inequality within group and inequality between different groups (Cowell, 2000; Čok, 2003; Shorrock, 1984)	- no specific drawbacks

Source: own Table

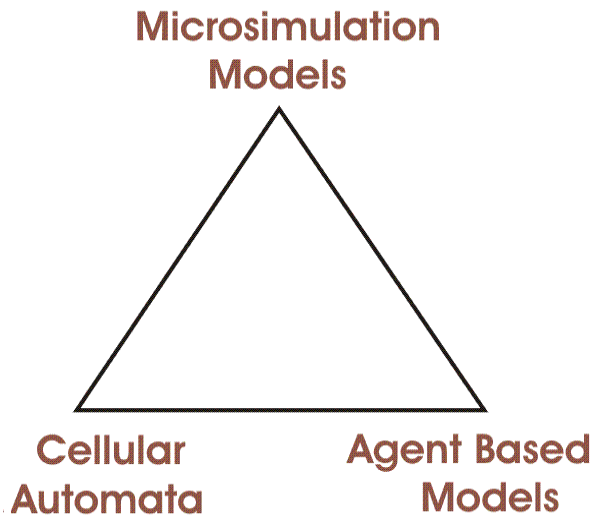
1.2 Microsimulation Model as a Tool for Reform

1.2.1 About Microsimulations

First concepts in microsimulations appear in 1950s (Michel & Lewis, 1990). Orcutt (1957) presented microsimulation models as a new concept of socioeconomic system. Microsimulation models are generally used to simulate different scenarios when making the reforms in taxation. Microsimulation models usually respond the questions related to revenue and redistributive effects (Buddelmeyer, Creedy, & Kalb, 2007). Therefore, the models are mostly used to estimate public revenue collection by income levels, and income distribution. They are also useful to convince the public to favour reform, because numbers are facts that tell a very important story. Microsimulation models are not used only for tax reform, but also for analysis of current systems (Mitton, Sutherland, & Weeks, 2000). Microsimulation models serve not only as practical policy advisors, but also as research and teaching tools (Merz, 1991). To build a microsimulation model, data are mandatory. When preparing data for a microsimulation model it is always a question of whether individual or household units should be used. Most of the models are based on administrative data that treat the fiscal unit set by law. So, this is based on tax forms filed by fiscal units-taxpayers (Decoster & Van Camp, 1998). On the other hand, when reviewing the studies explaining different microsimulation models (more in the *section 1.2.3 An Overview of Microsimulation Models*), I observed that most of the models are based on the survey household data, rather than administrative tax records.

Besides microsimulation models, there are two additional approaches: cellular automata (CA) and agent-based models (ABM) (International Microsimulation Association; see Figure 12).

Figure 12. MM, CA, and ABM



Source: International Microsimulation Association, 2009

These three modelling techniques could be observed as three angles of a triangle that treats individual-based modelling approaches (International Microsimulation Association, 2009; see Figure 12). According to CA, all entities are situated in a grid of a cell (spatial dimension) and have only one attribute whether they are alive or dead. Their behaviour depends on the neighbouring cells. According to ABM, entities interact with each other. The main attribute of each entity is its operating characteristic. This characteristic changes (evolves) over time depending on reception to realization or failure of interactions with other individuals. A microsimulation model does not contain either an evolutionary or a spatial dimension. The best approach would be a combination of these three approaches together. However, I will keep my attention to classical microsimulation models.

Traditionally, models are divided into two groups: static (accounting or arithmetic; deterministic, probability=1) and dynamic (probability<=1). A static model is one where the changes in tax regulations are simulated. Static models operate in time when underlying data were collected (Mitton et al., 2000). They can usually simulate the past, present, and near future. Dynamic models are used when changes in birth and age would be considered. Therefore, ageing is important for dynamic models, because each unit is older for a year every time one wants to upgrade or update the model (Mitton et al., 2000). Dynamic models can simulate the distant future.

Which model should be used basically depends on the policy question that is being addressed and the amount of time disposable to gain the answer. Static models are usually used when one cross-section is needed, i.e., modelling for changes in tax rates, whereas dynamic models need repeated cross-sections, e.g., pension reform or care system. A behavioural component can be included in both types of models. If one wants to see the first order of results with, for example, tax reform, there is no need for a behavioural component. However, if one wants to see changes in behaviour after introducing such reform, there is a need to include a behavioural component. For example, if one wants to see the effects on labour supply, a behavioural microsimulation model is used (Creedy & Kalb, 2006). Another very useful part of introducing behavioural components is the measurement of deadweight loss produced by changes in the tax system (Mitton et al., 2000).

The importance of microsimulation models in policy decision-making lies in their several qualities. The first and the most important quality is the possibility to fully exploit the information contained in datasets about heterogeneity of individuals, both pre- and after-reform. The second is the identification of winners and losers in a reform situation. The third is the characterization of income redistribution. Finally, the fourth is the estimation of aggregated costs/benefits of specific reforms (Spadaro, 2007).

Microsimulation models also have weaknesses. The main limitation of static tax-benefit models is their ignoring of changes in individual behaviour and macroeconomic effects. Behavioural model is necessary when a huge change in behaviour is expected. However, modelling human behaviour is difficult. There are too many factors that are interrelated and

not straightforward to include in the model. Besides, including such behavioural factors does not necessarily mean achieving higher reliability with the model. Usually behavioural components narrow transparency. The modelling full equilibrium effect requires data on the entire economy, which is not an easy task (Redmond, Sutherland, & Wilson, 1998).

Some other very important weaknesses of microsimulation models are the following: results depend on quality of data, they are time consuming, and building them might be costly (Verbist, Van den Bosch, & Cantillon, 2000). Microsimulation models require more technical knowledge than theoretical knowledge (Halpin, 1999). They are also relatively complex in practical terms, require significant data manipulation and calculation, are expensive to construct and update, and usually involve a team of experts to build those (Brown & Harding, 2002).

Microsimulation models could also be linked to macro-models, and in that way all direct and indirect influences can be seen (Mitton et al., 2000).

Overall, it can be said that the reliability of microsimulation models both with the researchers and users in a long run depends on the methods used for estimation, testing, and validation (Klevmarken, 2002).

Microsimulations started to be very popular with appearance of strong information technology packages that can deal with huge amounts of data. There are a few software programmes used for simulations. There is the standard software UMDBS (Universal Micro DataBase System) (Suauerbier, 2002). The software handles data and computation from the import of external data, over development of the microsimulation model through analysis of results. The modelling language it uses is MISTRAL. Some models were coded in program language C (e.g. EUROMOD; Dickert, Houser, & Scholz, 1994). However, for modelling in C one might have to know professional informatics programming. There are also some other software programmes that support the construction of microsimulation models, such as STATA, Matlab, and some others. The computer software I used for building the microsimulation model is STATA.

Microsimulation models have been constructed in all developed countries (Spielauer, 2007). Moreover, the International Microsimulation Association (www.microsimulation.org) was established in 2005 with the aim of easing the interchange of experiences between microsimulation practitioners. A lot of microsimulation models, both static and dynamic, as well as behavioural, have already been built. An overview of most of the worldwide models I give in the *section 1.2.3 An Overview of Microsimulation Models*.

EUROMOD goes one step in front of other national microsimulation models, because it simulates taxes and benefits for European Union countries (Sutherland & Figari, 2013). It gives comparative analysis across countries based on homogenized datasets and harmonized definitions of tax-benefit instruments, and transmission of tax-benefit policies from one to

another country (Bargain, 2006). EUROMOD relies on household budget surveys, not individual data (Lietz & Mantovani, 2007). Before EUROMOD, international comparison was very difficult because of different assumptions and elements in different models (Callan & Sutherland, 1997).

Almost all of the ten[22] member states that joined the European Union in 2004 have national microsimulation models (Lelkes, 2007). Most of these models are static and analyse only "day after effects". Such models usually simulate direct taxes, tax credits, state benefits, and social security benefits. All of them focus mainly on redistributive effects, i.e., analysis of winners and losers. Construction of the models was mostly financed by governmental institutions. Most of these models were financed as short-term projects, as opposed to Western European countries where such models are long-term projects run by ministries and statistical offices. The number of model users is estimated to be between 2 and 10, although constructors aim to create them in a user-friendly interface, put in training, and publish policy results. Most of them are rarely used, because they did not have the government support as government did not realize their usefulness (Lelkes, 2007).

Overall, it can be said that, through microsimulation models, one can compare the situation before and after some changes, both on the individual and the aggregate levels, as overall impact. Such models are usually tools to help in answering the question: what will happen if...?.

1.2.2 Validation: Methods and Findings

The usefulness of microsimulation models is validated mostly through the ability of the model to replicate the real world, to make simulations according to plan in tax reform, and its possibility to express current distribution of income and its changes. Checks on the model go through model inputs, model procedures, and model outputs (Redmond et al., 1998).

Checks on model inputs can use internal and external methods or sources. If an entire database of taxpayers is not available, but a family expenditure survey or a household budget survey, it can be used an internal method to make an assessment of degree of estimation (Kemsley, Redpath, & Holmes, 1980). Regarding external sources it can be a comparison of aggregates and distributions with official data (Atkinson & Micklewright, 1983; Kemsley et al., 1980).

Model procedure relates to the reliability of microsimulations, which can be a comparison of simulated results against legally correct outcomes (Lambert, Percival, Schofield, & Paul, 1994). It can also be validated through simulation of the same thing through two different models for the same country if two models exist at all.

[22] Czech Republic, Hungary, Estonia, Slovenia, Poland, Lithuania, Cyprus, Latvia, Slovakia, and Malta.

Model outputs can be validated again internally and externally. Internal validation is made directly through liability taken from microdata. External validation includes comparison of simulated revenue impacts of policy reforms with some other revenue models (Redmond et al., 1998), as was done by Hope (1988). Validation can also include "a study of the effects of sampling error on the reliability of outputs" (Redmond et al., 1998, p. 152). Such method was used by Pudney and Sutherland (1994).

1.2.3 An Overview of Microsimulation Models

In this section, I overview the microsimulation models in the countries of the EU, countries of former Yugoslavia which are not members of the EU, Canada, the United States of America, Latin America, Australia, Namibia, South Africa, and Russia. The reason I picked Namibia, South Africa and Russia lies in the fact that those models were built on the EUROMOD platform. Tabular overview of the models is given in the Appendix A while here I give the brief explanation. I covered around 120 relevant models that include static, dynamic, and behavioural models related to taxation, social security contributions and social benefits. The Table in the Appendix lists the country to which the model belongs, the name of the model, type of the model (static, dynamic, behavioural), the model's coverage, data source for the model, units in the data (individuals or households), and authors of the study related to respective microsimulation model. The models are listed in the alphabetical order of the country. Therefore, I start with Australia and finish with the United States of America.

Australian (NATSEM; Lambert, Percival, Schofield, & Paul, 1994) model is a tax-benefit static microsimulation model, named STINMOD (Static Incomes Model). STINMOD was created by NATSEM (National Centre for Social and Economic Modelling) at the University of Canberra. The model simulates direct and indirect taxes, and social benefits: PIT, goods and services tax, and benefits. The purpose of the model is to analyse the impact of tax changes on the budget as well as a distributional effect for families. The data, which the model uses, are from the Australian Bureau of Statistics. The data size is around 30,000 persons that can be also modelled at the level of households.

Austria has three models relevant for this study: AUSTROMOD (Fuchs[23] in Decoster et al., 2008), SORESI (Fuchs & Gasior, 2014), and IREA[24] (Hanappi, Hofer, Mullbacher, & Winter-Ebmer, 2012). Two of them are static (AUSTROMOD and SORESI) with EUROMOD platform. The third one (IREA) is dynamic. Static models simulate PIT, SSC and social benefits while the dynamic simulates pensions.

[23] Original paper, Fuchs, M. (2005), AUSTROMOD/EUROMOD: An Adaptation of the Tax/Benefit Microsimulation Model EUROMOD to Austria. Distributional Effects of Implemented and Hypothetical Tax/Benefit Policy Changes in Austria 1998-2005, is in German.

[24] **I**HS-MicroSimulation-Model-for-**RE**tirement-Behaviour-in-**A**ustria.

The data used for the static models are the survey data from the EU-SILC[25]. The data are on individuals (AUSTROMOD, SORESI, IREA) and households (AUSTROMOD and SORESI). The data used for the dynamic model is from the social security database and pension database. Data are on the individual level.

SORESI was developed by the researchers at the European Centre for Social Welfare Policy and Research Vienna, and funded by the Austrian government. AUSTROMOD was constructed upon request for the National Bank of Austria. IREA was built by personnel at the Institute for Advanced Studies Vienna, and funded by European Commission.

Belgium owns seven relevant models: MIMOSIS (Decoster et al., 2008), SIRe (Standaert & Valenduc[26] in Decoster et al., 2008), PICSOUS (Decoster et al., 2008), ASTER (Decoster, Delhaye, & Van Camp, 1996; Decoster et al., 2008; Decoster, Rober, & Van Dongen, 1994), MISIM (Decoster et al., 2008; Verbist, 2002; Verbist et al., 2000), MODETE (Joyeux[27] in Decoster et al., 2008), and STATION (Dekkers[28] in Dekkers & Belloni, 2009). Four models are static (SIRe, PICSOUS, MISIM, MODETE), two are behavioural (MIMOSIS, ASTER), and one is dynamic (STATION).

MISIM, SIRe and PICSOUS simulate PIT, while MODETE simulates PIT, SSC and social benefits. The dynamic model STATION simulates how pension benefits influence poverty and inequality among pensioners. The behavioural model ASTER simulates the indirect taxes and their effect on demand. MIMOSIS, a behavioural model, simulates PIT, SSC, and benefits, same as the above mentioned static model MODETE, but also measures the effect on the labour market.

ASTER (B[29]) uses survey data, while MIMOSIS (B) uses administrative data from various sources. MISIM (S) and MODETE (S) also use survey data, while PICSOUS (S) and SIRe (S) use administrative tax records data.

MIMOSIS (B) was constructed by the personnel of the University of Leuven, University of Liege, University of Antwerp, and Belgian Federal Public Service Social Security. ASTER (B) was constructed by the Center for Economic Studies in the Economics Department of the KU Leuven. MISIM (S) was constructed by the Herman Deleeck Centre for Social Policy. SIRe (S) was constructed by the Ministry of Finance. PICSOUS (S) was constructed by Universite de Namur. MODETE was constructed by the Universite Libre de Bruxelles (S).

[25] EU Statistics on income and living conditions.
[26] Original paper, Standaert & Valenduc (1996), Le modèle de micro-simulation de l'impôt des personnes physiques: SIRe, is in French.
[27] Original paper, Joyeux (1996), Modété: Un modèle de microsimulation pour la Belgique, is in French.
[28] Original paper, Dekkers (2000), L'évolution du pouvoir d'achat des retraités: Une application du modèle de micro simulation STATION, is in French.
[29] B – Behavioural, S – Static.

Belgium, Germany, and Italy have a joint dynamic microsimulation model, MIDAS (Dekkers & Belloni, 2009; Li & O'Donoghue, 2013). The model analyses the pension adequacy through investigating the poverty of pensioners, living standard of pensioners, ageing, and pension legislation changes in Belgium, Germany, and Italy. The model was developed by the Federal Planning Bureau of Belgium and CeRP (Center for Research on Pensions and Welfare Policies in Italy).

Bosnia and Herzegovina has different models for different entities. Through this dissertation, I developed the FBHMOD. First published results produced by this model are in the paper by Kramer, Čok, Cirman, and Verbič (in press). The work on the RS microsimulation model is in progress. Also, another model for Brčko District is planned to be done during next year. All three models (will) use administrative data. Also, there is a plan to develop another BiH model based on the EUROMOD platform. This model will use the Household Budget Survey/SILC data.

Canada is in possession of four models of the interest. Three of them are static and one is dynamic. Static models are: Mu.Sim (Zhou, 2013), SPSD/M (Decarie, Boissonneault, & Legare, 2011; Zhou, 2013), and one with unknown name simulating corporate income tax (Decarie et al., 2011). Besides, there is a dynamic model DYNACAN (Decarie et al., 2011) simulating pensions and pension contributions. Mu.Sim covers income and personal income taxation. SPSD/M is different from the Mu.Sim because it also covers the indirect taxes.

Croatia (Bezeredi, 2012; Urban, 2010) also has its static tax-benefit microsimulation model, which simulates PIT, SSC, and social benefits. The data used in the model are from the Household Budget Survey. The microsimulation model was first developed by Ivica Urban (staff of the Institute for Public Finance in Croatia) as a part of his doctoral dissertation. The model is now used in the Institute for Public Finance in Croatia.

Czech Republic has two models which simulate PIT and SSC (Immervol & Lelkes, 2009; Lelkes, 2007; Šatava, 2014). One of them was constructed by National Bank, and another one by CERGE-EI[30] for the Ministry of Finance. At the time of the publication (Šatava, 2014), the indirect tax has been in the process of incorporation into the model constructed by CERGE-EI. One constructed by the National Bank is behavioural while one constructed by the CERGE-EI is static. The data in the first one are about households collected from Microcensus while the data in another one are about individuals, taken from the SILC. Besides those two models, there are additional two models that simulate the pension system reform (Fialka, Krejd, & Bednarik, 2011; Li & O'Donoghue, 2013; Šatava, 2014). The former is constructed by Deloitte and the Ministry of Labour and Social Affairs, and the latter by CERGE-EI for research purposes.

[30] Center for Economic Research and Graduate Education – Economics Institute.

Cyprus has a static model (Immervol & Lelkes, 2009) with incorporated limited effects on the labour supply (Pashardes & Polycarpou, 2010). The model simulates PIT, SSC, and some benefits. It uses survey data. The creators of the model are Panos Pashardes and Alexandros Polycarpou, both from the University of Cyprus.

In ***Denmark***, there is a behavioural model LOVMODELLEN (Decoster et al., 2008; OECD, 2012; Stephensen, 2013). This model simulates PIT, SSC, and benefits, and their impact on the labour supply. The model uses administrative statistical data about individuals.

Estonia possesses two relevant models, ESTEEM (Immervol & Lelkes, 2009) and ALAN (Immervol & Lelkes, 2009; Vork, Paulus, & Poltimae[31] in Poltimae & Vork, 2009). Both models are recorded as static, although ESTEEM includes some behavioural impact and spatial analysis. Both models cover PIT, SSC, social benefits, and environmental taxes. ESTEEM uses administrative and survey data while ALAN uses survey data. ESTEEM was constructed by the Ministry of Environment while ALAN was constructed by Alari Paulus and Andres Vork, both from PRAXIS Center for Policy Studies.

European Union has a joint tax-benefit microsimulation model EUROMOD (Bargain, 2006; Callan & Sutherland, 1997; Immervoll, O'Donoghue, & Sutherland, 1999; Jara & Sutherland, 2013; Lietz & Mantovani, 2006; Sutherland, 2001; Sutherland & Figari, 2013; Sutherland et al., 2008). The model includes 28[32] EU countries. The model simulates PIT, SSC, and social benefits. The data are from EU-SILC and national SILCs. Leading institution for the development of the model is the University of Essex together with national expert teams.

Finland has a number of microsimulation models. Most of them are static, only one is dynamic. Static models are: TUJA (Decoster et al., 2008; Haataja, 2003), SOMA (Decoster et al., 2008; Haataja, 2003), SISU (Statistics Finland, 2013), JUTTA (Honkanen[33] in Zhou, 2013; Zhou, 2013), ASUMISTUEN MALLI (Honkanen[34] in Zhou, 2013), HVS (Honkanen[35] in Zhou, 2013), and UUSI MALLI (Honkanen[36] in Zhou, 2013). The dynamic model is ELSI (Gal, Horvath, Orban, & Dekkers, 2008; Tikanmaki, Sihvonen, & Salonen, 2014).

ELSI simulates pension system changes. HVS covers only PIT. TUJA, SOMA, SISU, JUTTA, and UUSI MALLI, besides PIT, also cover SSC and benefits. ASUMISTUEN

[31] Original paper, Vork, Paulus, & Poltimae (2008), Maksupoliitika mõju leibkondade maksukoormuse jaotusele. (Impact of taxation policy on distribution of household's tax burden), is in Estonian.
[32] Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain ,Sweden and the United Kingdom.
[33] Original paper, Honkanen (2010), JUTTA-kasikirja, is in Finnish.
[34] Unpublished document.
[35] Ibid.
[36] Ibid.

MALLI simulates only house benefits. Most of them use administrative registered data. TUJA was developed by the Ministry of Finance and VATT[37]. SOMA was developed by the Ministry of Social Affairs and Health (Honkanen[38] in Zhou, 2013). SISU was developed by the Statistics of Finland in cooperation with other relevant institutions[39], and is specific because it gives user-friendly interface. Another model developed by the Statistics of Finland is UUSI MALI. JUTTA and ASUMISTUEN MALLI was developed by KELA[40]. HVS was developed by the Tax Administration. ELSI was developed by the Finnish Center for Pensions.

France has four relevant models. The dynamic one is DESTINIE I/II (Blanchet & Chanut[41] in Bonnet & Mahieu, 2000; Bonnet & Mahieu, 2000), which is a predecessor of a newer model PENSIPP (Bonnet, Bozio, Landais, Rabate, & Tenand, 2013). The model was initially built by Blanchet (Blanchet & Chanut[42] in Bonnet & Mahieu, 2000). The model covers pensions, social security contributions, some social benefits, and some taxes, using data from the Financial Asset Survey, both on an individual and household level (Bonnet & Mahieu, 2000).

Another model is INES created by INSEE[43] (David, Lhommeau, & Starzec[44] in Murat, Roth, & Starzec, 2000), which is essentially static, but has the possibility of the introduction of behavioural elements as a reaction of the VAT changes. Therefore, the model, besides the VAT, also includes PIT, SSC, benefits, local taxes, and other indirect taxes. The data are the combination of tax records and employment survey, both on an individual and household level. INSEE also contributed to construction of DESTINIE I/II and PENSIPP (with IPP[45]).

The SYSIFF model (Bourguignon, Chiappori, & Sastre, 1998; Legendre, Lorgnet, & Thibault[46] in Decoster et al., 2008) is a static one, which simulates PIT and benefits. The data used in this model are from the Household Budget Survey. MYRIADE (Legendre, Lorgnet, & Thibault[47] in Decoster et al., 2008) is also a static model, which besides PIT and benefits also simulates SSC. The data used here are tax records (administrative data).

[37] Governmental Institute for Economic Research.
[38] Unpublished document.
[39] Research Department of the Social Insurance Institution of Finland, Ministry of Social Affairs and Health of Finance, National Institute for Health and Welfare, Government Institute for Economic Research.
[40] The Social Insurance Institution of Finland.
[41] Original paper, Blanchet and Chanut (1998), Les retraites individuelles a long terme: une projection par microsimulation, is in French.
[42] Original paper, Blanchet and Chanut (1998), Les retraites individuelles a long terme: une projection par microsimulation, is in French.
[43] National Institute of Statistics and Economic Studies.
[44] Original paper, David, Lhommeau, and Starzec (1999), Le modele de Microsimulation INSE: description et exemples d'utilisation, is in French.
[45] l'Institut des Politiques Publiques.
[46] Original paper, Legendre, Lorgnet, and Thibault (2001), MYRIADE: le modele de microsimulation de la CNAF, is in French.
[47] Ibid.

Germany has 14 relevant microsimulation models. Six of them are static while the four are static but with the possible link with behavioural models. Those static are: KiTs (Drabinski[48] in Wagenhals, 2004), SIMST (Gottfried & Schellhorn[49] in Wagenhals, 2004), MAITERTH (Maiterth[50] in Wagenhals, 2004), BMF (Wagenhals, 2004), Kiel (Boss[51] in Wagenhals, 2004; Boss & Elendner[52] in Wagenhals, 2004), and MIKMOD-est (Flory & Stowhase, 2012). Kiel (developed by Alfred Boss from the Institute for World Economics and University of Kiel) simulates only the wage tax, and the data it uses are administrative (wage statistics). SIMST (developed by the Institute for Applied Economics in Tubingen), MAITERHT (developed by Ralf Maiterht at the University of Berlin), BMF (used by the Ministry of Finance), and MIKMOD-Est (new model used by the Ministry of Finance) simulate personal income tax. All of them use the administrative data. KiTs (Kiel Static Tax-Benefit Microsimulation Model) simulates PIT, SSC, benefits, and part of indirect taxes using data on households from the Income and Consumption Survey. The model is developed at the University of Kiel.

Besides those, as I mentioned above, the following are the static models with a possible link to behavioural models: GMOD (Wagenhals, 2004) developed by Gerhard Wagenhals, STSM (Buslei & Steiner[53] in Wagenhals, 2004) developed by the Centre for European Economic Research and transferred to German Institute for Economic Research, SIMTRANS (Kaltenborn[54] in Wagenhals, 2004) developed by Kaltenborn in his dissertation, and POTSDAM (Bork[55] in Wagenhals, 2004) developed by Bork and the University of Potsdam. All four of them simulate PIT, SSC, and benefits, while POTSDAM also simulates the indirect taxes additionally. The data used in those models are mostly survey data.

Germany also possesses two dynamic models: MICSIM (Li & O'Donoghue, 2013; Merz, 1995; Merz, Stolze, & Zwick, 2002; Wagenhals, 2004) developed by Joachim Merz from the University of Luneburg and Sfb3 (Galler & Wagner[56] in Li & O'Donoghue, 2013; Hain

[48] Original paper, Drabinski (2001), Ein Mikrosimulationsmodell zur Besteuerung von Einkommen, is in German.
[49] Original paper, Gottfried and Schellhorn (2001), Das IAW- Einkommensteuerpanel und das Mikrosimulationsmodell SIMST, is in German.
[50] Original papers, Maiterht (2001), Karlsruher Entwurf zur Reform des Einkom-Mensteuergesetzes; and Maiterht (2003), Verteilungswirkungen alternativer Konzepte zur FamilienfÄorderung: Eine empirische Analyse auf Grundlage der Einkommensteuerstatistik des Statistischen Bundesamtes, are in German.
[51] Original paper, Boss (1986), Ein Modell zur Simulation des Lohnsteueraufkom-mens in der Bundesrepublik Deutschland - ein Beispiel fÄur die Nutzbarmachung sekundÄarstatistischer Daten, is in German.
[52] Original paper, Boss & Elendner (2004), VorschlÄage zur Steuerreform in Deutschland: Was bedeuten sie? Was "kosten" sie?, is in German.
[53] Original paper, Buslei & Steiner (1999), Beschaftigungseffekte von Lohnsubventionen im Niedriglohnbereich, is in German.
[54] Original paper, Kaltenborn (1998), SimTrans: Mikrosimulation des deutschen Steuer-Transfer-Systems und alternativer Reform-varianten, is in German.
[55] Original paper, Bork (2000), Steuern, Transfers und private Haushalte. Eine mikroanalytische Simulationsstudie der Aufkommens- und Ver-teilungswirkungen, is in German.
[56] Original paper, Galler & Wagner (1986), The Microsimulation Model of the Sfb3 for the Analysis of Economic and Social Policy, could not be found.

& Helberger[57] in Li & O'Donoghue, 2013). Both models simulate the pension reform. MICSIM also simulates the PIT reform using administrative data, while Sfb3 simulates shortening hours worked and education transfers effects, using different data sources.
Besides static and dynamic models, there are also two behavioural models: FiFoSiM (Decoster et al., 2008; Peichl, 2006; Peichl & Schaefer, 2009) that belong to the University of Cologne and IZAΨMOD (Peichl, Schneider, & Siegloch, 2010) that belong to the Institute for the Study of Labor. FiFoSiM simulates the PIT, SSC, and benefits, while catching the effects on the labour supply and the general economy. IZAΨMOD simulates PIT and benefits, and catches effects on the labour supply and demand.

To the best of my knowledge, ***Greece*** does not own a microsimulation model, besides its part in EUROMOD.

Hungary possesses two models. TARSZIM is the static one that covers limited changes in consumption (Benedek & Lelkes, 2005; Benedek, Scharle, & Szabo, 2007; Lelkes, 2007). The model is constructed by TARKI[58] and is also used by the Ministry of Finance. Another model is behavioural in nature (Benczur, Katay, & Kiss, 2012). TARSZIM simulates PIT, SSC, benefits, and indirect taxes. The data it uses are a combination of the survey and tax data. The behavioural model captures the changes in work hours, efforts, and participation in the labour force. The model was constructed at the Central European University. The model uses survey data from the Household Budget Survey.

Ireland has a static microsimulation model SWITCH (Callan, Keane, Walsh, & Lane, 2010; Callan, Nolan, Walsh, McBride, & Nestor, 2000; Decoster et al., 2008), and two dynamic/behavioural models, LIAM0 (Li & O'Donoghue, 2013; O'Donoghue, 2002) and LIAM1 (Li & O'Donoghue, 2013; O'Donoghue, Lennon, & Hynes, 2009). SWITCH simulates PIT, SSC, and benefits, using SILC data. LIAM0 captures redistributive effects of a tax-benefit system, while LIAM1 captures the pension reforms. LIAM0 and LIAM1 use the Household Survey Data.

Italy has nine relevant models. Five of them are static while two are dynamic, and two are dynamic/behavioural. Static models are: AWARETAX (Gastaldi & Liberati[59] in Decoster et al., 2008), ITAXMOD (Di Biase, Di Marco, Di Nicola, & Proto[60] in Russo, 2004 and Solera, 1998), MAPP98 (Baldini[61] in Decoster et al., 2008), TREMOD (Azzolini, Bazzoli, De Poli, Fiorio, & Poy, 2014), and another one with no specific name (Pellegrino, Piaceza, & Turati, 2011). AWARETAX, ITAXMOD, and MAPP98 simulate PIT, SSC, and benefits. TREMOD is based on a EUROMOD platform, and simulates the local taxes and benefits in the Province of Trento. One with no specific name simulates the housing taxation. All of

[57] Original paper, Hain & Helberger (1986), Longitudinal Simulation of Lifetime Income, could not be found.
[58] Social Reserach Institute in Budapest.
[59] Original paper, Gastaldi & Liberati (2000), Personal Income Tax and Child Allowances in Italy: a dificult interaction, could not be found.
[60] Original paper, Di Biase, Di Marco, Di Nicola, & Proto (1995), ITAXMOD, a microsimulation model of the Italian personal income tax and of social security contributions, could not be found.
[61] Original paper, Baldini (2001), Mapp98: un Modello di Analisi delle Politiche Pubbliche, is in Italian.

them, except TREMOD, use the Survey on Household Income and Wealth. TREMOD combines administrative data (tax records) and survey data.

Italy also owns two dynamic models: CAPP_DYN (Mazzaferro & Morciano, 2012) and DYNAMITE (Ando et al.[62] in Li & O'Donoghue, 2013). They simulate social security benefits and use survey data.

Dynamic/behavioural model MIND (Bianchi, Romanelli, & Vagliasindi, nd; 2001; Decoster et al., 2008) simulates pensions, PIT, and SSC including dynamic and behavioural effects. Tdymm is used to estimate the sustainability and adequacy of the pension system (Li & O'Donoghue, 2013; Tedeschi, 2011). MIND uses the Survey on Household Income and Wealth, while Tdymm uses a combination of administrative data and EU-SILC.

I covered five countries of ***Latin America (Brazil, Uruguay, Mexico, Guatemala, Chile)***. Only Guatemala has a static model (Castanon-Herrera & Romero, 2012), the others have behavioural models. Chilean model covers PIT, SSC, benefits, and indirect taxes, with effects on the labour supply (Cabezas & Acero, 2012; Larranaga, Encina, & Cabezas, 2012). Mexican model (Absalon & Urzua, 2012; Castanon-Herrera & Urzua, 2012) captures the effects on consumption. Uruguayan model does the same as the Mexican model (Amarante, Bucheli, Olivieri, & Perazzo, 2012; 2012a). Brazilian model covers the price variations (Bezzera Nogueira, & De Souza, 2012). All of them cover the static component of PIT, SSC, some indirect taxes, and benefits in most cases. They all use the survey data.

Latvia does not possess any microsimulation model (Silina & Veretjanovs, 2014), besides the participation that it takes in EUROMOD.

Lithuania has two static models. One of them (LITSIM) has the elements of dynamic population projection (Immervol & Lelkes, 2009; Lelkes, 2007). The purpose of the model is the measurement of redistributive effects, including indirect taxes. Another static model which does not have a specific name also covers redistributive effects, but this time including family benefits (Immervol & Lelkes, 2009). Both models use survey data. The first model was developed at a University in Lithuania, while another one was developed by the Dutch Universities.

Luxembourg has a model MIDLAS (Philippe, 2015) whose construction is in progress. The model is dynamic. It covers pensions and social transfers, i.e. their sustainability and adequacy.

In ***Macedonia***, there is a model named MAKMOD, based on the EUROMOD platform (Mojsoska-Blazevski, Petreski, & Petreska, 2013). It is a behavioural model. Besides

[62] Original paper, Ando et al. (2000), The Bank of Italy's DYNAMITE: Recent Developments, could not be found.

tracking the PIT, SSC, and benefits, the model also shows the effects on the labour supply. The data used are from the SILC.

According to my knowledge, ***Malta*** does not possess any microsimulation model, besides the participation in EUROMOD.

NAMOD, based on the EUROMOD platform, is a microsimulation model of ***Namibia*** (Wright, Noble, & Barnes, 2014). The model is static, and simulates PIT, SSC, benefits, and the value added tax. The data used in the model are from the Household Income and Expenditure Survey. It was created at the University of Oxford for the Government of Namibia.

The Netherlands has a number of models: NEDYMAS (Dekkers, Nelissen, & Verbon, 1993; Li & O'Donoghue, 2013; Nelissen, 1995), MIMOSI (Romijn, Goes, Dekker, Gielen, & Es[63] in Van Sonsbeek, nd), Micros (Hendrix[64] in Van Sonsbeek, nd), MIMIC (Van Sonsbeek, nd), WIA (Van Sonsbeek, nd; Van Sonsbeek & Alblas, 2011; Van Sonsbeek & Gradus, 2006), SADNAP (Van Sonsbeek, nd; Van Sonsbeek, 2009; Van Sonsbeek, 2010), and MICSIM (Jongen, Boer, & Dekker, 2014). Out of these seven models, two are static (MIMOSI and Micros), two are dynamic (WIA and SADNAP), one is dynamic/behavioural (NEDYMAS), and two are behavioural (MIMIC and MICSIM).

Both static models measure the distributive effects of the tax-benefit system. MIMOSI is developed and used by the Bureau of Economic Policy Analysis, while Micros is used by the Ministry of Social Affairs and Employment. Dynamic models cover disability benefits (WIA) and pensions (SADNAP). Both models (WIA and SADNAP) use administrative data. Both are developed by the Ministry of Social Affairs and Employment, same as the static model Micros. NEDYMAS is a dynamic model, but with behavioural elements such as limited computational general equilibrium model with effects on the labour supply and unemployment. It was developed at the Tilburg University. The model simulates pension reform and redistributive effects of social security schemes. It uses the census data. Behavioural model MIMIC covers tax and social security regimes with their influence on the labour supply. The data it uses are combined from an administrative panel household dataset and the labour market panel. Another behavioural model MICSIM estimates the effect on the labour supply as the tax-benefit system is changing. The static component is taken from the static MIMOSI model since the same institution developed it (Bureau of Economic Policy Analysis).

[63] Original paper, Romijn, Goes, Dekker, Gielen, & Es (2008), MIMOSI Microsimulatiemodel voor belastingen, sociale zekerheid, loonkosten en koopkracht, is in Dutch.
[64] Original paper, Hendrix (1993), Statische en dynamische microsimulatie, Toepassingen in de praktijk, is in Dutch.

There is a static ***OECD*** tax-benefit model (OECD, nd), which covers 32 OECD countries plus Southern Cyprus, Latvia, Lithuania, Malta, Bulgaria, and Romania. The model simulates PIT, SSC, and benefits.

Poland made it as SIMPL as possible, naming its model SIMPL (Bargain, Morawski, Myck, & Socha, 2007; Immervol & Lelkes, 2009; Lelkes, 2007). The model is behavioural. Besides covering PIT, SSC, and benefits, it also simulates the effects on the labour supply. The data it uses are from the Household Budget Survey. The model was constructed by the University of Warsaw for the Ministries of Finance, Social Affairs, and Labour, as well as for its own purposes.

Portugal is a country that owns a static tax-benefit microsimulation model (MicroSim_{PT}) based on the EUROMOD platform (Rodrigues, 2009). The model simulates PIT, SSC, and benefits. The model uses the EU-SILC data. Nicola (2014) expressed the need for a dynamic model in Portugal.

Romania possesses a static microsimulation model that covers the tax on cadastral income (Jitea, Dumitras, & Pocol, 2013). The model uses EU and Romanian Statistical Data.

The tax-benefit microsimulation model in ***Russia*** was constructed on the EUROMOD platform (Popova, 2012). The model is named RUSMOD. The model is static and simulates PIT, SSC, and benefits with the data from the Longitudinal Monitoring Survey. The model was developed by the European University Institute.

Like Russia and some other countries, ***Serbia*** has a model constructed on the EUROMOD platform (Ranđelović, Vladisavljević, Vujić, & Žarković-Rakić, nd; Ranđelović & Žarković Rakić, 2012). The model is named as SRMOD. SRMOD is a behavioural model which simulates PIT, SSC, and benefits, and their impact on the labour supply. The data are from the Living Standards Measurement Survey.

Slovakia has built two models, and one is in progress. Two models are static. One of them is constructed on the basis of the EUROMOD platform (Siebertova, Svarda, & Valachyova, 2014). The model simulates PIT, SSC, and benefits. The model uses the data from the SK-SILC, which is a Slovakian version of EU-SILC. It was constructed by the Council for Budget Responsibility in Bratislava. Another static model simulates the PIT only, and uses administrative data that are the tax records (Trautman, 1999). The model was constructed by the US Treasury for the Ministry of Finance of Slovakia. Siebertova et al. (2014) explained that the construction of a dynamic/behavioural model is in progress by the Council for Budget Responsibility in Bratislava. The model is a tax-benefit model, and also covers the effects on the labour supply, and link to the macro model.

Slovenia possesses three models. The first one (STM) is a static tax-benefit model which simulates PIT, SSC, and benefits (Čok, 2002; Immervol & Lelkes, 2009; Kump, Majcen, & Čok, nd; Lelkes, 2007; Majcen, Verbič, Bayar, & Čok, 2009). Another model is DYPENSI (SIPEMM), which is a dynamic model (Li & O'Donoghue, 2013; Majcen, Čok, Sambt, &

Kump, 2011). The model simulates pension system reforms. The third one is a SLOMOD, which is a behavioural model (Bayar et al., 2011; Bayar et al., 2006; Čok et al., 2008; Čok, Sambt, Košak, Verbič, & Majcen, 2011; Majcen, Čok, Verbič, & Kump, 2007; Majcen et al., 2011). In this case, the computational general equilibrium model is linked to the microsimulation model mentioned above. The model is used for tax reforms, benefit reforms, government expenditures changes, financial flows between EU budgets and the Slovenian budget, macroeconomic and welfare aspects. All three models use administrative data. The constructors of the models are the University of Ljubljana and the Institute for Economics Research.

South Africa has a model constructed on the basis of EUROMOD platform, named SAMOD (Wilkinson, 2009). The model is a static tax-benefit model which simulates PIT, SSC, and benefits. It uses the data from the Income and Expenditure Survey. The model was developed at the Oxford University.

Spain has five models. One of them is static, one is dynamic, two are behavioural, and one is related to the property tax. The static model, ESPASIM, simulates PIT, SSC, benefits, VAT, and excise taxes (Horacin, Mercader-Prats, & Planas, 2000; Levy, 2003; Levy, Mercader-Prats, & Planas, 2001). This model is based on the survey data. It was developed at the Universitat Autonoma de Barcelona. The dynamic model, DyPes, simulates pension reforms (Fernandez-Diaz, Patxot, & Souto, 2013). It uses administrative data. SINDIEF (Sanz, Romero, Castaner, Prieto, & Fernandez[65] from Levy, 2003) and GLADHISPANIA (Oliver & Spadaro, 2007) are behavioural models. The first one covers indirect taxes and measures the effect on prices, while the other one covers PIT and SSC measuring the labour supply effect. SINDIEF was developed by the Institute for Fiscal Studies, while the GLADHISPANIA by the University of Balearic Islands. SIMCAT-P (Catalonia) covers the property tax, and its influence on progressivity and inequality (Arcarons & Calonge[66] in Levy, 2003). The model uses administrative data.

There are five relevant models in ***Sweden***. One is static, one is dynamic, two are dynamic/behavioural, and one is behavioural only. FASIT is a static model covering PIT, SSC, benefits, and indirect taxes (Decoster et al., 2008; Eklind, Nilstierna, & Schofield, 2008; Honkanen[67] in Zhou, 2013). The model is developed by the Bureau of Statistics, and uses both administrative and survey data. MIMESIS is a dynamic model, which simulates pensions and uses administrative data (Gal et al., 2008; Mikula, Elias, Holmgren, & Lundkvist[68] in Li & O'Donoghue, 2013). MICROHUS (Decoster et al., 2008; Klevmarken[69]

[65] Original paper, Sanz, Romero, Castaner, Prieto, & Fernandez (2003), Microsimulacion y Comportamiento Economico en el Analisis de Reformas de Imposicion Indirecta, is in Spanish.
[66] Original paper, Arcarons & Calonge (2003), El impuesto sobre el patrimonio: un modelo de microsimulacionpara el analisis se sus reformas, is in Spanish.
[67] Honkanen Pertti. Katsaus malleihin. Helsinki: Kela, unpublished document.
[68] Original paper, Mikula, Elias, Holmgren, & Lundkvist (2003), The Swedish Pension Model in context of the pension reform, could not be found.
[69] Original paper, Klevmarken (1991), A Microsimulation Model for the Swedish Household Sector. A progress report, could not be found.

in Li & O'Donoghue, 2013; Klevmarken & Olovsson[70] in Li & O'Donoghue, 2013) is a dynamic/behavioural model which covers PIT, SSC, and benefits, and how changes in the tax-benefit system influence the mobility of labour. The model uses survey data. SESIM is also a dynamic/behavioural model (Decoster et al., 2008). It is different from MICROHUS because of the usage of administrative data. SWEtaxben is a behavioural model which uses administrative data (Ericson, Flood, & Wahlberg, 2009). It encompasses the effects on the labour supply and social welfare, when the changes in the tax-benefit system appear.

The ***United Kingdom*** possesses a number of models. There are four static models: IGOTM (Decoster et al., 2008; Duncan, 2001), PSM (Decoster et al., 2008; Duncan, 2001), TAXBEN (Decoster et al., 2008; Duncan, 2001; Giles & McCrae, 1995; Honkanen[71] in Zhou, 2013), and POLIMOD (Decoster et al., 2008; Redmond et al., 1998; Honkanen[72] in Zhou, 2013). All four static models are tax-benefit models covering PIT, SSC, and benefits. IGOTM and PSM are the government models, while TAXBEN was developed by the Institute for Fiscal Studies. POLIMOD was developed at the University of Essex.

There are two pension dynamic models: PENSIM (Decoster et al., 2008; Li & O'Donoghue, 2013; Zaidi & Rake, 2001) and PENSIM2 (Decoster et al., 2008; Emmerson, Reed, & Shephard, 2004; Li & O'Donoghue, 2013). SAGE is a dynamic/behavioural model covering pensions (Li & O'Donoghue, 2013). There is another model, which is behavioural, SPAIN, developed by the Institute for Fiscal Studies (Decoster et al., 2008; Duncan, 2001). It uses the output from the static model TAXBEN and simulates its effects on the labour supply.

In the ***United States of America***, I covered four relevant models, three static and one dynamic. The static ones are: ITEP (itep, 2015; Honkanen[73] in Zhou, 2013), MATH SIPP+ (Smith & Wang, 2012; Honkanen[74] in Zhou, 2013) and TRIM3 (trim3, 2015; Zhou, 2013; Honkanen[75] in Zhou, 2013). ITEP covers PIT, the corporate income tax, indirect taxes, and the property tax. The other two, MATH SIPP+ and TRIM3 include the transfer income model. Besides those three static models, there is also a pension dynamic model PENSIM (Zhou, 2013; Honkanen[76] in Zhou, 2013).

1.3 The Case of Bosnia and Herzegovina

1.3.1 Bosnia and Herzegovina Environment

Bosnia and Herzegovina is one of six countries that formed Yugoslavia. In 1992, after the independence of Bosnia and Herzegovina from Yugoslavia was announced, a war that lasted

[70] Original paper, Klevmarken & Olovsson (1996), Direct and Behavioural Effects on Income Tax Changes-Simulation with the Swedish Model Microhus, could not be found.
[71] Honkanen Pertti. Katsaus malleihin. Helsinki: Kela, unpublished document.
[72] Ibid.
[73] Ibid.
[74] Ibid.
[75] Ibid.
[76] Ibid.

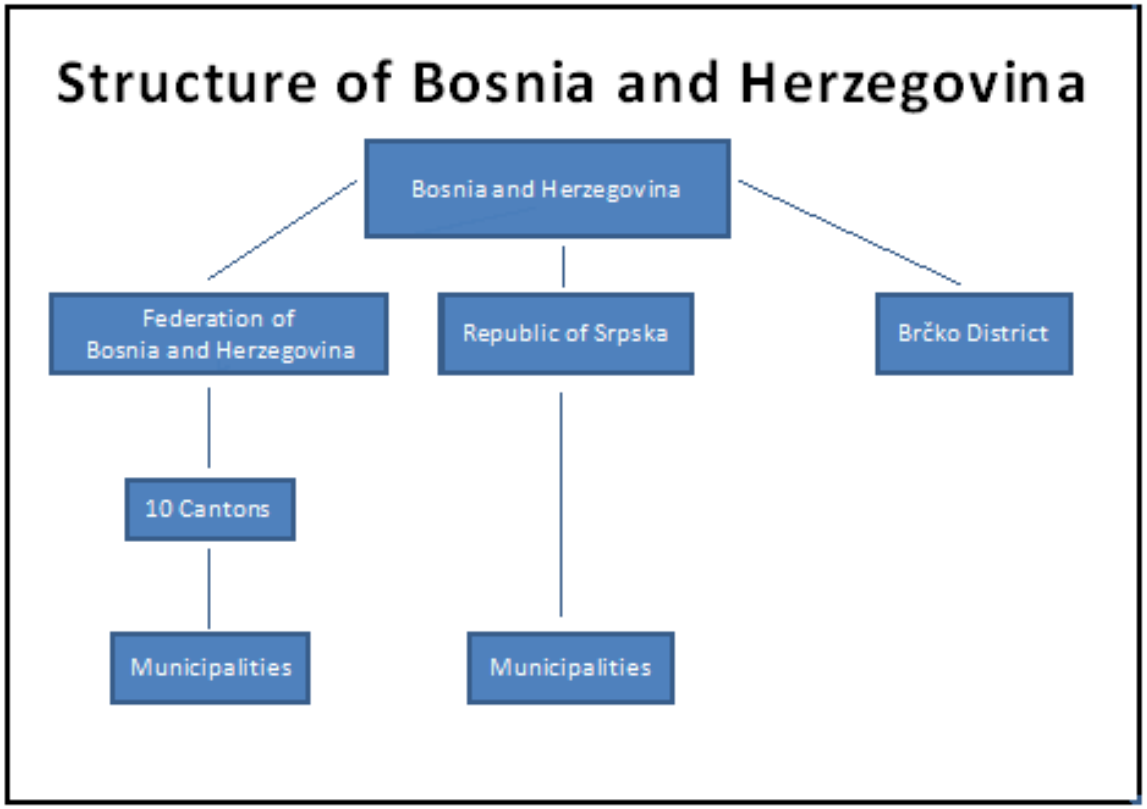
three and a half years started. The war ended with the Dayton Peace Accords (hereinafter: Accords), agreed upon in Dayton, Ohio, USA on 21 November, 1995 and signed in Paris, France on 14 December, 1995 (*Opći okvirni sporazum za mir u Bosni i Hercegovini* [General Framework Agreement for Peace in Bosnia and Herzegovina], 1995). Based on the Accords, Bosnia and Herzegovina loses the status of Republic and becomes a country consisting of two entities, namely, the Federation of Bosnia and Herzegovina (51% of territory) and the Republic of Srpska (49% of territory). Part of this Accords is the Constitution of Bosnia and Herzegovina. In the year of 2000, Brčko District becomes the separate part reducing the territory of other two entities (*Federalni zavod za statistiku* [Institute for Statistics of FB&H], 2013). The Figure 13 shows the territory of two entities and Brčko District.

Figure 13. Map of Bosnia and Herzegovina

Source*:* *https://upload.wikimedia.org/wikipedia/commons/2/2d/Map_Bih_entities.png*, 2015

The Federation of Bosnia and Herzegovina consists of 10 cantons, inside which are 79 municipalities (*Zakon o federalnim jedinicama* [Law on Federal Units], 1996). Each canton has its own government with own authorities (*Ustav Federacije Bosne i Hercegovine* [Constitution of the Federation of Bosnia and Herzegovina], 1994). The Republic of Srpska does not have cantons, only 62 municipalities (*Zakon o teritorijalnoj organizaciji Republike Srpske* [Law on Territorial Organization of Republic of Srpska], 2009) (see Figure 14).

Figure 14. Structure of Bosnia and Herzegovina



Source: *Opći okvirni sporazum za mir u Bosni i Hercegovini; Ustav Federacije Bosne i Hercegovine; Statut Brčko Distrikta; Zakon o federalnim jedinicama; Zakon o teritorijalnoj organizaciji Republike Srpske*; own Figure

Different government levels have authority over different taxes:

- *State level: Bosnia and Herzegovina*: Authority over indirect taxes belongs to the state of Bosnia and Herzegovina through transfer of authorities from the entities to the state level (Antić, 2012); authorized bodies are the Bosnia and Herzegovina Ministry of Finance and Treasury and the Indirect Tax Authority;
- *Entity and District level: Federation of Bosnia and Herzegovina, Republic of Srpska, Brčko District*: Authority over direct taxes belongs to the entities (FBH and RS; *Opći okvirni sporazum za mir u Bosni i Hercegovini* [General Framework Agreement for Peace in Bosnia and Herzegovina], 1995; *Ustav Federacije Bosne i Hercegovine* [Constitution of the Federation of Bosnia and Herzegovina], 1994), and Brčko District (*Konačna odluka Arbitražnog tribunala* [Final decision of the arbitral tribunal], 1999; *Statut Brčko Distrikta* [Statute of Brčko District]; *Opći okvirni sporazum za mir u Bosni i Hercegovini* [General Framework Agreement for Peace in Bosnia and Herzegovina], 1995); authorized bodies are the two entities' Ministries of Finance, the two entities' Tax Administrations, and District's Agency for Finance.

Basically, Bosnia and Herzegovina has four Tax Administrations (Indirect Tax Authority, Tax Administration of the Federation of Bosnia and Herzegovina, Tax Administration of Republic of Srpska, and Tax Administration of Brčko District). Because direct taxes are on

the entity and district levels, each of the entities and district function as a separate country in a direct tax sense. For example, if a person works in the Republic of Srpska or Brčko District, and lives in the FBH, i.e., is a resident of the FBH (spending more than 183 days in the FBH), that person needs to file an annual tax declaration in the FBH and use the tax credit for tax paid in the Republic of Srpska or Brčko District (*Zakon o porezu na dohodak u FBiH* [Law on Personal Income Tax in the FBH], 2008, Article 25). The same practice is observed with taxes paid in a foreign country. Therefore, the Federation of Bosnia and Herzegovina, the Republic of Srpska, and Brčko District sometimes function as separate countries. This is the major reason why I was not able to do the microsimulation model with the entire country, but with the FBH only.

1.3.2 Comparison of Personal Income Taxation in the Federation of Bosnia and Herzegovina and Region (Croatia and Slovenia)

1.3.2.1 The System of Personal Income Taxation in the Federation of Bosnia and Herzegovina

The process of reform in personal income taxation in the Federation of Bosnia and Herzegovina started in 2001, and first was led by the GIZ (Deutsche Gesellschaft für Internationale Zusammenarbeit – German International Assistance Corporation).

However, the USAID-funded Tax Modernization Project (TAMP) took over the reform process in 2004, and the Tax Reform Activity (TARA) continued the reform from 2006 to 2010. The Tax and Fiscal Project (TAF) provided support from 2010 to 2013 to the Ministries of Finance and Tax Administrations of the entities (Federation of Bosnia and Herzegovina and Republic of Srpska) and Brčko District. Now, there is a new USAID-funded Fiscal Sector Reform Activity (FAR), which continued to give support to the Ministries of Finance and Tax Administrations.

The Law on Personal Income Tax in the Federation of Bosnia and Herzegovina was adopted in 2008 and came into effect on January 1st, 2009.

Upon recommendation of the US Treasury and the USAID-funded project TARA, the Government founded the Board for Supervision of Implementation of the Law on Personal Income Tax in the Federation of Bosnia and Herzegovina (the Board). The Board justified its existence, as it took the leading position in identifying, facing, and resolving the problems with implementation.

It can be noticed that the system of personal income taxation after the reform in 2009 is much simpler than it used to be. Prior to the reform there was schedular system that treated different sources of income in different ways and applied different tax rates. There was the

wage tax, and there were around 60 different cantonal[77] taxes. Now, there is a single entity tax that treats all types of income in the same way. The Law on PIT substituted the wage tax law and cantonal citizen taxes (Sahinagic & Bosnic, 2005):

1. Tax on income from royalties, patents, and copyrights;
2. Tax on income from renting property and property rights;
3. Tax on profit of entrepreneurs;
4. Tax on agricultural activities;
5. Tax on high income-earning individuals;
6. Tax on income from contests and games of chance.

The Wage Tax Law was on the entity level. However, the tax base and the tax rates for all those taxes other than wage tax, listed above, were different from canton to canton. Therefore, each canton had authority over sources of income other than wage. Consequently, it meant that each canton had a separate law for each source of income other than wage. Thus, it resulted in around 60 different laws (around six laws per canton). Moreover, the Personal Income Tax Law simplified the income tax system by replacing 60 cantonal taxes with a single tax (Sahinagic & Bosnic, 2005).

Another important change was the **conversion** from a **net** system to a **gross** system, where the starting point for the calculation of social security contributions and taxes is gross wage, not net wage. This conversion was done according to the following formula (Article 49, *Zakon o porezu na dohodak u FBiH* [Law on PIT in the FBH], 2008):

$$\text{Gross wage} = \frac{\text{net wage} * 100/95}{(100 - \text{social security contributions rate borne by employee})/100}$$

Major Characteristics of Personal Income Tax in the Federation of Bosnia and Herzegovina

In the following paragraphs, I state the major characteristics of personal income taxation in the Federation of Bosnia and Herzegovina, such as **income**, **taxpayer**, **tax base (taxable income)**, **tax rate**, **tax period, exemptions**, **liability for those who make income only from dependent activity (employment income)**, and **determination of annual tax liability**.

[77] The Federation of Bosnia and Herzegovina consists of 10 cantons. Each canton consists of a number of municipalities.

Income

According to Article 4 of the Law on Personal Income Tax in the Federation of Bosnia and Herzegovina (*Zakon o porezu na dohodak u FBiH,* 2008*),* **income** consists of:

1. income from dependent (employment) activity (wages, compensations, and other income earned from dependent activity);
2. income from independent activity (income earned from entrepreneurial, agricultural, and forestry activities, temporary activities, and other independent activities);
3. income from property and property rights (income from renting out immovable property, sales of immovable property, renting out of equipment and other movable property, sales and transfer of intellectual rights, licenses, patents, franchises, etc.);
4. income from investment in capital (interests on loans and payment of voluntary life and pension insurance); and
5. income from contests and games of chance.

According to Article 5 of the Law on Personal Income Tax in the Federation of Bosnia and Herzegovina (*Zakon o porezu na dohodak u FBiH,* 2008*),* **income not considered** as taxable income consists of the following:

1. income on the basis of participation in the allocation of profit of companies (dividends or shares);
2. pensions of residents obtained abroad and in Bosnia and Herzegovina;
3. financial support and other reimbursement based on special regulation on rights of war invalids and civilian victims of the war, except salary;
4. welfare, donations received by citizens from physical and legal entities for health purposes (surgeries, medical treatments, purchase of medicines, orthopaedic support devices) that are not encompassed by elementary, additional, or private health insurance;
5. child benefits and money for equipment of a newborn baby;
6. inheritance and gifts on which tax is paid in accordance with some other Federation or cantonal regulations;
7. income from sales of property used for personal purposes;
8. damage compensation in natural disaster cases;
9. insurance or other damage compensation for property, in amount used for replacement or repair of damaged property;
10. rewards obtained in money, goods, and/or services for knowledge shown in quizzes and other similar competitions;
11. employee income on basis of compensations, assistance, and rewards paid by an employer for a tax period and not exceeding amount set by the Rulebook on Implementation of the Law on Personal Income Tax;
12. rewards for special achievements in the area of education, culture, science, etc., awarded by government institutions at celebration of special dates.

According to Article 6 of the Law on Personal Income Tax in the Federation of Bosnia and Herzegovina (*Zakon o porezu na dohodak u FBiH*, 2008*)*, **income exempt** from personal income taxation consists of the following:

1. income based on compensation for unemployment period and inability to work, when paid from extra-budgetary fund;
2. income of disabled persons employed in companies, institution, or workshop for working and professional enabling and rehabilitation of disabled persons;
3. income based on compensation for body damage and lowered working ability, and compensation for intangible damage suffered;
4. income based on compensation of damage for employees for the consequences of accident at work;
5. income based on rewards for members of the Academy of Sciences and Arts and rewards for technical innovations;
6. compensation for convicted individuals for period of serving penalty in corrective-educational, i.e., penal-corrective institutions;
7. monthly income on the basis of scholarships for pupils and students in the regular studying process, up to 75% of average monthly net salary published by the Federal Office of Statistics;
8. income realized by pupils and students earned through student associations, during one calendar year, up to four average monthly salaries in the Federation, according to the latest published information by Federal Office of Statistics;
9. awards won by pupils and students in competitions within the educational system and organized school and university competitions, up to two average monthly net salaries according to the latest information published by the Federal Office of Statistics;
10. salary remuneration paid to the persons during longer discontinuation of work not caused by the employee;
11. income based on interest on savings in banks, savings banks and saving-credit union, bank accounts (giro-accounts (transfer accounts), foreign currency accounts etc.), and interest on government-issued bonds;
12. income from penalty interests on salaries that should be paid out based on the Court Decisions;
13. income of citizens based on paid premiums of life insurance that has the character of savings, as well as voluntary pension insurance, if income is paid out by insurance companies with the place of permanent business in the territory of the Federation of Bosnia and Herzegovina, and if personal income tax and social security contributions have been paid on those premiums;
14. gains made by participating in prize games organized by companies for the purpose of promotion, which exclusively applies to product or package of products from own production line if the market value of such prize/profit does not exceed 1.000 KM[78];

[78] 1KM = 0.51129 EUR

Therefore, **personal income is** the total gross income received by the taxpayer in a tax period, except income not considered as taxable income and income exempt from personal income taxation, defined in Articles 5 and 6.

Taxpayer

A **taxpayer** (Article 2, par. 1, *Zakon o porezu na dohodak u FBiH* [Law on PIT in the FBH], 2008*)* of personal income tax in the Federation of Bosnia and Herzegovina is a resident of the Federation of Bosnia and Herzegovina regardless of whether the income is received in the Federation of Bosnia and Herzegovina or worldwide, and a non-resident who receives income in the Federation of Bosnia and Herzegovina.

A **resident** (Article 2, par 3., *Zakon o porezu na dohodak u FBiH* [Law on PIT in the FBH], 2008) of the Federation of Bosnia and Herzegovina is a physical person who (1) has residence within the territory of the Federation of Bosnia and Herzegovina, (2) spends 183 or more days with or without breaks, and (3) has residence in the Federation of Bosnia and Herzegovina, and receives income from dependent (employment) activity from the budget of the Federation of Bosnia and Herzegovina and /or Bosnia and Herzegovina, but works outside of the Federation of Bosnia and Herzegovina.

A **non-resident** (Article 2, par. 4, *Zakon o porezu na dohodak u FBiH* [Law on PIT in the FBH], 2008) is a physical person who spends less than 183 days in the territory of the Federation of Bosnia and Herzegovina.

Tax Base, Tax Rate, and Tax Period

The **tax base – taxable income** (Article 7, *Zakon o porezu na dohodak u FBiH* [Law on PIT in the FBH], 2008) is the difference between the total gross income received and deductibles (e.g., social security contributions, other costs, personal exemptions, dependent deductions, etc.) in one tax period.

The **tax** is calculated at the single (flat, proportional) **tax rate** of 10% *(*Article 9, *Zakon o porezu na dohodak u FBiH* [Law on PIT in the FBH], 2008*)* applied on the tax base.

The **tax period** (Article 8, *Zakon o porezu na dohodak u FBiH* [Law on PIT in the FBH], 2008) is a calendar year, except under some specific circumstances, such as follows:
- A resident becomes a non-resident;
- A resident becomes a taxpayer, or is not a taxpayer anymore.

Personal Exemption, Dependent Deductions, and Other Deductions

Usually, tax systems have tax allowances that lower the tax base (taxable income), and that is also the case in the Federation system *(*Article 24, *Zakon o porezu na dohodak u FBiH* [Law on PIT in the FBH], 2008*)*. Therefore, the system of taxation here is not completely flat, since these tax allowances give way to some degree of progressivity.

Tax Card

If a taxpayer desires to acquire the right to have his/her tax base (taxable income) lowered through personal exemption and dependent deductions, the taxpayer must apply for the tax card document at the Tax Administration Office. If a taxpayer earns income from employment, upon receipt of the tax card, the taxpayer should give it to his/her employer who will then use it when withholding tax from the employee's income. If the taxpayer stops working, he/she will take the tax card with him/her, and keep it at home until the next employment (Article 28, *Zakon o porezu na dohodak u FBiH* [Law on PIT in the FBH], 2008).

If a taxpayer does not have a tax card, then he/she does not have a right to claim personal exemption and dependent deductions.

Therefore, the tax card is not obligatory, but it brings tax reliefs.

Personal Exemption

The personal exemption amounts to 3,600 KM[79] annually, i.e., 300 KM monthly. Each resident of the Federation of Bosnia and Herzegovina can lower the income for mentioned amount if he/she has the tax card.

Dependent Deductions

The dependent deductions present the amount that can also, besides personal exemption, lower the tax base, if a taxpayer supports family members or has some disabilities himself or supported family members. The amount of dependent deductions is calculated by multiplying personal exemption (300 KM monthly) with the respective coefficient as shown in Table 12.

Table 12. Dependent Deductions

Basis for dependent deductions	Coefficient	Amount of monthly dependent deductions
Personal Exemption	1.0	300 x 1.0 = 300 KM
Dependent Spouse	0.5	300 x 0.5 = 150 KM
Dependent First Child	0.5	300 x 0.5 = 150 KM
Dependent Second Child	0.7	300 x 0.7 = 210 KM
Dependent Third and Following Children	0.9	300 x 0.9 = 270 KM
Other Dependent Immediate Family Member	0.3	300 x 0.3 = 90 KM
Own Disability and Disability of Dependent Family Member	0.3	300 x 0.3 = 90 KM

Source: *Zakon o porezu na dohodak u FBiH*, 2008; own Table

[79] 1KM = 0.51129 EUR

The total of personal exemption and dependent deductions is the sum of these two, based on information provided in the tax card.

Other Deductions

Other deductions are those that cannot be claimed with the tax card, but with the annual tax declaration.

These deductions are:

1. paid life insurance premiums and voluntary pension insurance up to 0.7 of personal exemption or real amount but not higher that 0.7[80];
2. costs of medical treatment and/or purchase of orthopaedic aiding devices for taxpayer and/or members of immediate family that he/she supports in accordance with documents, if these costs are not covered by mandatory and/or supplemental health insurance or donations; amount for deduction is unlimited (up to tax base);
3. interest paid on a housing loan that taxpayer took in order to buy or build an apartment that resolves his/her housing problem; amount for deduction is unlimited (up to tax base).

Determination of Tax Liability

During the tax period, taxpayers pay advance payments (withholding tax). In most cases, these payments do not constitute the final liability. The differences between those who receive income from wages only and the rest can be seen in the paragraphs below.

Determination of Liability for Those Who Make Income Only from Dependent Activity

The vast majority of taxpayers make income only from wages earned with one employer. Their employers calculate, withhold, and pay social security contributions and taxes, on the employees' behalf, out of the employees' gross income. If the employee has a tax card, the employer also applies the personal exemption and dependent deductions. However, if the employee wants to claim other deductions (medical expenses or interests for housing loans), the employee must file the annual tax declaration. If a taxpayer claims only those deductions assigned by the tax card, such taxpayer does not need to file the annual tax declaration. However, if a taxpayer wants to claim other deductions, such taxpayer can do so by filing the annual tax declaration. Moreover, if a taxpayer, beside wages, makes income from other sources, such taxpayer is obliged to file the annual tax declaration.

[80] This deduction has been eliminated in the recent amendments to the Law on Personal Income Tax. However, I keep it in the text because my data include this as well.

Determination of Annual Tax Liability

The **annual tax liability** can be determined in the way shown in Table 13.

Table 13. Annual Tax Liability

	GROSS INCOME		DEDUCTIBLES	INCOME
	GROUPS	SUBGROUPS		
	Gross Income from Dependent (Employment) Activity	- Gross Salary	- Social Security Contributions borne by Employee (31%)	- Income from Dependent (Employment) Activity
+	Gross Income from Independent Activity	- Entrepreneurial, Agricultural, and Forestry Gross Income	- Costs based on Book of Income lowered by Costs not Recognized for Tax Purposes	- Income from Independent Activity
		- Gross Income from Temporary Activities	- 20% standardized costs – Temporary Contracts (Service Contracts) - 30% or real standardized costs – Authors' Contracts (Royalties) - 4% – Health Contributions for Temporary (Service) and Authors' (Royalties) Contracts	- Income from Temporary Independent Activities
		- Gross Income from Other Independent Activities	- 4% - Health Contributions	- Income from Other Independent Activities

+	Gross Income from Property and Property Rights	- Gross Income from Renting Out Property	- 30% or real standardized costs	- Income from Property
		- Gross Income from Transfer of Rights with Limited Duration	- 20% standardized costs	- Income from Property Rights
TOTAL INCOME				
– loss from previous years – personal exemption (3,600KM), dependent and other deductions				
= TAX BASE				
TAX LIABILITY (TAX RATE 10%)				

Source: *Zakon o porezu na dohodak u FBiH*; *Zakon o doprinosima*; own Table

Income that is not included in the annual tax calculation, but which is subject to withholding tax at source that is treated as final liability, includes income from: (1) investment in capital: interests from given loans and payment of capital based on voluntary life and pension insurance; (2) contests and games of chance; (3) non-residents performing temporary independent activities; (4) real estate rented out to tourists that pay sojourn fee; (5) transfer of property rights; (6) sale of real estate/property rights; (7) independent activity for which the tax is paid in lump sum (e.g., taxi drivers); (8) work that does not last more than 10 days or 80 hours, and income earned from such work if is not higher than 250 KM. Table 14 summarizes these sources of income.

Table 14. Income Not Filed in Annual Tax Declaration

GROSS INCOME		DEDUCTIBLES	INCOME
GROUPS	SUBGROUPS		
Gross Income from Dependent (Employment) Activity	- Gross Income from work that lasts not more than 10 days or 80 hours, and income earned from such work if is not higher than 250 KM[81]	- Social Security Contributions borne by Employee (31%)	- Income from Dependent (Employment) Activity
Gross Income from Independent Activity	- Gross Income of Non-Residents Performing Temporary Independent Activities		- Income from Non-Residents Performing Temporary Independent Activities
	- Gross Income from independent activity for which the tax is paid in lump sum (e.g. taxi drivers)		- Income from Independent Activities
Gross Income from Property and Property Rights	- Gross Income from real estate rented out to tourists who pay sojourn fee	- 50% or real	- Income from Property
	- Gross Income from Sale of Real Estate/Property Rights	- Purchase value increased by rise of production prices of industrial products + costs in real amount	- Income from Property/Property Rights

[81] Tax withheld from this source of income can be treated as final liability. However, if a taxpayer wants to claim exemptions, one can do it by filing the annual tax declaration.

	- Gross Income from Transfer of Property Rights	- 20% standardized costs	- Income from Property Rights
Gross Income from Investment in Capital	- Interests from Given Loans		- Income from Investment in Capital
	- Payment of capital based on voluntary life and pension insurance		- Income from Investment in Capital
Gross Income from Contests and Games of Chance			- Income from Contests and Games of Chance

Source: *Zakon o porezu na dohodak u FBiH*; *Zakon o doprinosima*; own Table

After presenting the Federation PIT system in narrative and tabular way, here I show how to calculate the tax for different sources of income subject to personal income tax.

Examples:

1 Salaries (person supporting, e.g., two children):

Gross salary
– Social security contributions borne by employee (31%)
Income before tax
– Personal exemption and dependent deductions: (1 + 0.5 + 0.7)[82]* 3,600KM[83]
Tax base
Tax (advance payment): Tax base * 10%

2 Temporary (Service) Contracts:

Gross income
– Costs (20% of gross income)
Income
– Health contribution (4%)
Tax base
Tax (advance payment): Tax base * 10%

3 Authors' Contracts (Royalties):

Gross income
– Costs (real or 30% of gross income)
Income
– Health contribution (4%)
Tax base
Tax (advance payment): Tax base * 10%

4 Other Independent Activities:

Income
– Health contributions (4%)
Tax base
Tax (advance payment): Tax base * 10%

[82] See Table 12.
[83] 1KM = 0.51129 EUR.

5 Investment in Capital

Tax (final liability): Income * 10%

6 Gains from Contests and Games of Chance

Tax (final liability): Income * 10%

7 Non-residents: Temporary Independent Activity

Tax (final liability): Income * 10%

8 Real Estate Rented Out to Tourists that Pay Sojourn Fee

Gross income
– Costs (real or standardized costs 50% of gross income)
Tax base
Tax (final liability): Tax base * 10%

9 Transfer of Property Rights

Gross income
– Standardized costs (20% of gross income)
Tax base
Tax (final liability): Tax base * 10%

10 Sale of Real Estate/Property Rights

Gross income (market value)
– Costs (purchase value increased by rise in production costs of industrial products + maintenance costs in real amount)
Tax base
Tax (final liability): Tax base * 10%

11 Independent Activities: Entrepreneurial, Agricultural, and Forestry Activities

Gross income
– Costs (Book of Income and Costs)
+ Costs not recognized for tax purposes
Income

12 Renting Out Property

Gross income
- Costs (real amount or 30%)
Income

13 Transfer of Property Rights with Limited Duration

Gross income
– Costs (20% of gross income)
Income

So, taxpayers with income under cases 2, 3, 4, 11, 12, and 13 have to submit the annual tax declaration. A taxpayer with income under case 1 should submit such declaration only if he/she has other sources of income besides salary, or wants to claim other tax deductions, or did not claim deductions from the tax card during the year.

ANNUAL TAX DECLARATION

In order to file the annual tax declaration, a taxpayer needs to add income from all sources listed above except those where tax is considered as final liability. In equation (82) I added all sources of income.

Income: 1. + 2. + 3. + 4. + 11. + 12. + 13. – Loss from Previous Years =
= Income before tax from wages[84] *+ Tax base (2.) + Tax base (3.) + Tax base (4.) +*
Income (11.) + Income (12.) + Income (13.) – Loss from Previous Years (82)

Equation (83) sums up deductions:

Deductions = Personal Exemption + Dependent Deductions + Other Deductions (83)

The income should be lowered by deductions as shown in equation (84):

Tax Base = Income – Deductions (84)

Equation (85) calculates the tax:

*Tax = Tax base * 10%* (85)

Finally, equation (86) shows the difference between annual tax liability and tax liability already paid through advance payments.

[84] Pre-tax income (wage) = gross wage – social security contributions.

Difference = Tax – Previously Withheld Tax (advance payments) during Tax Period (86)

1.3.2.2 Comparison of the Federation Tax System with Region

After introducing the personal income tax system in the Federation of Bosnia and Herzegovina, in this sub-section I compare it with other systems in the region, i.e., those of Slovenia and Croatia. Table 15 shows a summary comparison (Kramer, Čok, Cirman, & Verbič, in press). All absolute values set by PIT and SSC laws (parameters in 2011) are presented as a percentage of national average gross annual wage (AGAW) in 2011. The year of 2011 is chosen because of the data availability, and this is prior to introduction of the "crisis tax" in Slovenia. The Table 15 consists of three parts: tax allowance, standardized costs as % of gross income, and PIT/SSC rates. In the part which relates to tax allowances, it is observed a basic tax allowance, tax allowance for children, for dependent spouse, for other dependent family members, for children with special needs, for disability (own + dependent family members), for work while student, for income of self-employed journalists and artists, for voluntary additional pension insurance, for life insurance premiums, for medical treatments, for interests for housing loans, for income from agriculture (cadastral income), and tax credit for pensions. If specific type of the tax allowance exists, it is expressed as a percentage of AGAW. For example, the basic tax allowance in the FBH is 3,600.00 KM, while the AGAW is 14,980.48 KM. Therefore, the basic tax allowance is 0.240313 AGAW (0.240313 = 3,600.00/14,980.48). Same logic applies to Slovenia and Croatia, just instead of the FBH values, Slovenian and Croatian values for the basic tax allowance and AGAW are taken. Same logic applies to all other tax allowances. In the part which relates to the standardized costs as a % of gross income, there are the percentages for the costs that are allowed to be deducted in order to reduce the tax base. For example, the standardized costs for contractual work are: 10% in Slovenia, 20% in the FBH, and 30% in Croatia. There are also the standardized costs for other income sources such as: royalties, work while student and income from property (rents). In the part which relates to the PIT/SSC rates, there are PIT rates, SSC rates borne by employer and employee, and SSC rates related to contractual work and royalties, as well as treatment of income from capital. For example, PIT rate in the FBH is 10%. In Slovenia and Croatia, there are three progressive rates. In Slovenia, the lowest rate is 16% up to threshold which is 0.41729AGAW. The same logic applies to other fields in this part of the Table 15. The characteristics of these three systems are summarized in the text below the Table 15.

Table 15. PIT/SSC parameters (2011) in Slovenia, FBH and Croatia (as share of AGAW in 2011)

Characteristics	Slovenia	FBH	Croatia[85]
Tax allowance			
Basic	0.17182 if gross income over 0.65399 0.229876 if gross income between 0.565314 and 0.65399 0.339188 if gross income below 0.565314	0.240313 for all taxpayers	0.230888 ...but there exists a different basic allowance for people living on "special state care areas"
Children	1st 0.126779 2nd 0.137824 3rd 0.229871 4th 0.321918 5th 0.413964 Additional 0.092046 for each subsequent child	1st 0.120157 2nd 0.168219 3rd and each subsequent child 0.216282	1st 0.115444 2nd 0.161621 3rd 0.230888 4th 0.323242 5th 0.438686 6th 0.577219 7th 0.738840 8th 0.923551 9th 1.131349 10th 1.362237 11th 1.616213 12th 1.893278
Dependent spouse	See "Other dependent family members"	0.120157	0.115444
Other dependent family members	0.126779	0.072094	0.141098
Children with special needs	1. 0.459374 + additional 0.092046 for each subsequent child	See "Disability (own + dependent family members)"	See "Disability (own + dependent family members)"
Disability (own + dependent family members)	0.918687 (own: 100% disability)	0.072094	0.230888 (100% disability) 0.069266 (<100% disability)

[85] With a kind support of dr. Ivica Urban.

Allowance for work while student	0.17182	Exempt up to 0.333333	0.437287
Income of self-employed journalists and artists	15% allowance for the first €25,000 (1.366443 AGAW) of income for self-employed journalists and artists	None	None
Voluntary additional pension insurance	Maximum 0.146661 AGAW or 5.844% of individual gross wage (whichever is higher)	Maximum 0.168219	None
Life insurance premiums	None	Maximum 0.168219	None
Medical treatments	None	All costs (unlimited)	None
Interest for housing loan	None	All costs (unlimited)	None
Income from agriculture (cadastral income)	If income from agriculture (cadastral income) is below €200 (0.054658 AGAW) it is not taxed	None	None
Tax credit for pension	PIT calculated from individual gross pension is reduced (tax credit) by 13.4% of the initial individual gross pension.	Pensions are exempt.	0.410467
Standardized costs as % of gross income			
Contractual work, royalties, work while student	10%	Contractual work: 20% Royalties: 30% or real	Contractual work: 30% Royalties: 30% All incomes mentioned above are taxed by withholding, using the flat rate of 25%, without obligation to submit the annual tax declaration.

Rents	Property: 40% Property rights: 10%	Property: 30% or real Real estate rented out to tourists: 50% or real Property rights: 20%	Property: 30% (and withholding using the flat rate of 15%) or real (and submitting the annual tax declaration) Real estate rented out to tourists: lump-sum amount Property rights: real (and withholding using the flat rate of 25%)
PIT/SSC rates			
PIT	Up to 0.417279 16% 0.417279−0.834556 27% Over 0.834556 41%	10%	Up to 0.461775 12% 0.461775−1.385326 25% Over 1.385326 40%
Employee SSC rate applied to gross wage	22.1%	31%	20% capped on six AGAW
Employer SSC rate applied to gross wage	16.1%	10.5%	17.2%
Income receiver SSC rate applied to contractual work and royalties	None	4% on gross reduced for standardized costs	20%
Income payer SSC and payroll tax rate applied to contractual work and royalties	Contractual work: 31% on gross income Royalties: none	6% on gross reduced for standardized costs	15%
Income from capital	20% schedular rate for all capital income. First 1,000 EUR (0.054658 AGAW) of interests from savings	Bank accounts, capital gains, and dividends are exempt.	Bank accounts and capital gains are exempt. Dividends are exempt up to 0.128271.

	bank accounts are exempt.	10% for interests from given loans and payment of capital based on voluntary life and pension insurance	Progressive rates for interests from given loans and payment of capital based on voluntary life and pension insurance

Source: Dž. Kramer, M. Čok, A. Cirman, and M. Verbič, *Switching Personal Income Tax and Social Security Contributions between Slovenia and the Federation of Bosnia and Herzegovina* (except for Croatia), in press

Summary of PIT and SSC systems in Slovenia, Federation of Bosnia and Herzegovina and Croatia

- Sources of income

In all three jurisdictions, there are the following sources of income that are subject to taxation (Kramer et al., in press): income from dependent (employment) activity; income from independent activity (entrepreneurial, temporary activities (contractual work) including royalties); 3) income from property and property rights; and 4) income from capital.

Definition of income from capital is different in Slovenia (Kramer et al., in press), the Federation of Bosnia and Herzegovina (Kramer et al., in press), and Croatia. FBH considers interest on loans and payment based on voluntary life and pension insurance as income from capital. In Croatia, income from payment of voluntary life and pension insurance is treated as a separate category called income from insurance, whereas income from capital includes interest on loans and dividends. Capital gains, dividends, and interestes on savings account are included in Slovenian system as income from capital. This is not taxed by the PIT Law in the FBH.

Slovenia (Kramer et al., in press) and Croatia also tax pensions, while the FBH (Kramer et al., in press) does not consider them as income subject to taxation. However, this only means that pensions are exempt, but not pensioners completely. They are taxpayers if they have some other taxable sources of income. The PIT Law in the Federation of Bosnia and Herzegovina also encompasses other sources of income such as income from contests and games of chance (Kramer et al., in press).

- Tax allowances

Slovenia, Croatia, and FBH have a basic tax allowance for taxpayers. Unlike the Federation of Bosnia and Herzegovina and Croatian, there are three different levels of basic tax allowance in Slovenia (Kramer et al., in press). Those are dependent on the height of a taxpayer's gross income. The higher the income is, the lower basic tax allowance is for the taxpayers. Croatia also has an allowance for taxpayers living in "special state care areas", such as areas extremely affected by war.

Croatia and Slovenia (Kramer et al., in press) increase the child tax allowance for each subsequent child, while the FBH (Kramer et al., in press) increases the allowance for second and third child and each subsequent child is treated equally as the third child. There is no special treatment of children with special needs in Croatia and the FBH.

All three jurisdictions include a tax allowance for other dependent family members. Dependent spouses have different treatment compared to other dependent family members in Croatia and the FBH.

There are some differences regarding the disability tax allowance in those juristictions (Kramer et al., in press). Croatia and the FBiH entitle to an allowance not only those with 100% disability but also those with a lower level of disability, and not only for themselves, but also for dependent family members with a disability. Unlike Croatia and the FBH, Slovenia treats only those taxpayers with 100% disability. Croatia faces different parameters for 100% disability and less than 100% disability. The FBH provides the same parameters for those with 100% disability and less than 100%.

Slovenia and the FBH (Kramer et al., in press) give taxpayers the right to use an allowance for voluntary pension insurance if they pay for that[86]. The FBH also allows for life insurance premiums[87], medical treatments that are not covered by public health insurance, and interest on housing loans. Slovenia and Croatia provide a tax credit for pensions. As already mentioned above, pensions in the FBH are not subject to taxation.

- Standardized costs

Taxpayers, in all three systems, who receive income from temporary activities including royalties, and property and property rights are entitled to use standardized costs to lower the tax base.

- Tax schedule

Slovenia and Croatia have a progressive system of tax rates (Slovenia: 16%, 27%, and 41%; Croatia: 12%, 25%, and 40%), while the FBH faces a flat rate of 10%.

- Social Security Contributions

In all three jurisdictions there are two portions of SSC for dependent (employment) activity: borne by the employer and borne by the employee. Besides, SSC should also be paid for temporary activities including royalties. However, the FBH and Croatia have both portions (borne by the payer and receiver of income) of SSC for temporary activities including royalties, while Slovenia has only the portion of SSC borne by an income payer for temporary activities. The rates of SSC are different for income from employment, royalties, and temporary activities.

[86] This has been eliminated in the FBH in the recent amendments to the Law on Personal Income Tax.
[87] Ibid.

2 METHODOLOGY

2.1 About the Microsimulation Model of the Federation of Bosnia and Herzegovina (FBHMOD)

The Microsimulation Model of the Federation of Bosnia and Herzegovina (FBHMOD) is static. The model enables calculation and estimation, as well as distribution of income, personal income tax, social security contributions, and personal exemption and dependent deductions. It is all at the individual level, not at the level of household, the reason being administrative data received from the Tax Administration Office that keeps records based on individual taxpayers that file the tax declarations according to the Law on Personal Income Tax. The FBHMOD can estimate different scenarios of potential changes in tax policy and offer not only an aggregate fiscal effect, but also all kinds of distributions that might be necessary. As support in the decision on which scenario is best suited to the Federation of Bosnia and Herzegovina, I also calculated, through the model in STATA, inequality measures such as the Gini/concentration coefficient, Atkinson index, and coefficient of squared variation, as well as a progressivity measure in the Kakwani index.

The purpose of the FBHMOD is not only to analyse the current tax system and tax distribution, but also to evaluate the effects of tax changes. The Government of the Federation of Bosnia and Herzegovina does not possess any other microsimulation model, so the exercise is a very useful tool for them. None of the other governments in Bosnia and Herzegovina, whether the Republic of Srpska or Brčko District or Bosnia and Herzegovina, had such a model. This static model is thus a very good base for tax policy analysis and later can be improved by bringing behavioural effects and dynamics into it. Therefore, it can be linked with macro-models. Moreover, its current structure enables it to be broadened to a comprehensive tax-benefit model of the entire tax-benefit system. The issue that the government is interested in is the fiscal effect, the winners and the losers, as well as the redistribution effect. To construct the microsimulation model, one needs a representative taxpayers' database that captures the entire heterogeneity of underlying data. Thus, there is no need to work on a typical example of a taxpayer. I can do analysis both on the individual and the aggregate levels. It is important to emphasize the high quality of data because they come from an entire tax database with all characteristics of each individual.

Therefore, the purpose of this static microsimulation model that treats only taxes, not benefits, is to analyse the current system and estimate possible tax scenarios in favour of reform.

As stated in hypotheses 2 and 3 I want to reject or not to reject that the slice system of tax rate achieves better income distribution and reduces income inequality in the Federation of Bosnia and Herzegovina. Thus, progressivity would bring redistribution of income. Therefore, a more progressive system shifts the burden from lower-earning individuals to

higher-earning individuals, and disposable income from higher-earning individuals to lower-earning individuals.

I should compare not only different scenarios of proposed tax reforms, but also pre-tax and after-tax income.

2.2 Data

According to the Law on Personal Income Tax in the Federation of Bosnia and Herzegovina, the unit for taxation is an individual taxpayer. Therefore, the database I have is based on individuals, derived from tax declarations that are registered and kept by the Tax Administration Office.

The database I received from the Tax Administration of the Federation of Bosnia and Herzegovina is the entire database consisting of complete personal income tax records for all taxpayers in the Federation. The structure of taxpayers (tax declarations) can be seen in Table 16.

Table 16. Taxpayers (number of tax declarations) and Taxpayers' Share

Source of income	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	All
Taxpayers (number of tax declarations)	435,421	54,647	11,069	25,051	83	6,344	5,256	658	21	37	18,951	7,626	76	565,240
Taxpayers' share (%)	77.0	9.7	2.0	4.4	0.0	1.1	0.9	0.1	0.0	0.0	3.4	1.3	0.0	100

Source: *Taxpayers' Database (2009)*; own calculations

Note:

***I** - dependent (employment) activity – wages*

***II** - temporary independent activities - temporary (service) contracts*

***III** - temporary independent activities - authors contracts (royalties)*

***IV** - other independent activities - parliamentarians, members of governing and monitoring boards, bankruptcy administrators, and lay magistrates*

***V** - investment in capital - interests from given loans and payment of capital based on voluntary life and pension insurance*

***VI** – gains from contests and games of chance*

***VII** - non-residents – temporary independent activities*

***VIII** – real estate rented to tourists that pay sojourn fee*

***IX** - transfer of property rights*

***X** - sale of real estate/property rights*

***XI** - independent activities - entrepreneurial, agricultural, and forestry activities*

***XII** - renting out property*

***XIII** - income from transfer of rights with limited duration*

The database consists of 495,076 taxpayers for 2009 at the annual level. This means that 2009 is the year for which taxpayers filed tax declarations. These include the tax declarations filed for advance payments, tax declarations filed for withholding tax where tax is treated as final liability without filing annual tax declarations, and annual tax declarations filed in 2010 for 2009. Each of these records contains data on all sources of income, deductions, social security contribution, and taxes by each taxpayer. This database does not contain sources of income not subject to personal income taxation at the moment, such as pensions. Thus, I can model the tax reform only for those sources of income that are currently taxed through the Law on Personal Income Tax in the Federation of Bosnia and Herzegovina. Moreover, in the database there is no linkage between taxpayers, so I cannot make estimations on the household level, only individually.

Table 17 lists the variables I got the data for, based on the forms (tax declarations) set by the Rulebook on the Implementation of the Law on Personal Income Tax (*Pravilnik o primjeni Zakona o porezu na dohodak*, 2008).

Table 17. Variables

FORM: PK-1001 – Request for issuing the tax card	
Variables	***Description***
pk_poreskiobveznikid (pk_taxpayerid)	Taxpayer's identification number
pk_sifraopstine (pk_municipalitycode)	Municipality where a taxpayer resides
pk_zaposlen (pk_employed)	If a taxpayer is employed or not (yes/no)
pk_bracnidrugbroj (pk_spousenumber)	If a taxpayer has dependent spouse (yes/no)
pk_bracnidrugdohodak (pk_spouseincome)	Amount of income in KM[88] that dependent spouse makes/receives (from earnings, social transfers, etc.)
pk_bracnidrugudio (pk_spouseshare)	A taxpayer's % share in supporting dependent spouse
pk_bracnidrugkoef (pk_spousecoef)	Coefficient for supporting dependent spouse is 0.5 (see Table 12); if % share in supporting dependent spouse is less than 100%, then coefficient is less than 0.5; therefore, coefficient might take values ≥ 0 and ≤ 0.5
pk_djecabroj (pk_childrennumber)	Number of children that a taxpayer supports

[88] 1KM = 0.51129EUR

pk_djecadohodak (pk_childrenincome)	Amount of income in KM that dependent children make/receive (from earnings, scholarship, social transfer, etc.)
pk_djecaudio (pk_childrenshare)	A taxpayer's % share in supporting dependent children
pk_djecakoef (pk_childrencoef)	Coefficient for supporting dependent children goes from 0.5 for first child and increases for each subsequent child (see Table 12); this variable is a sum of coefficients for each dependent child; % share in supporting dependent children can be less than 100%, then coefficient for e.g. dependent one child is less than 0.5; therefore, coefficient for one dependent child might take values ≥0 and ≤0.5
pk_uzaporodicabroj (pk_closefamilynumber)	Number of close family members that a taxpayer supports
pk_uzaporodicadohodak (pk_closefamilyincome)	Amount of income in KM that dependent close family members make/receive (from earnings, scholarship, social transfer, etc.)
pk_uzaporodicaudio (pk_closefamilyshare)	A taxpayer's % share in supporting dependent close family member(s)
pk_uzaporodicakoef (pk_closefamilycoef)	Coefficient for supporting a close family member is 0.3 (see Table 12); if % share in supporting dependent close family member is less than 100%, then coefficient is less than 0.3; therefore, coefficient might take values ≥0 and ≤0.3
pk_alimentacijabroj (pk_alimonynumber)	Number of children and a spouse for which a taxpayer pays alimony
pk_alimentacijadohodak (pk_alimonyincome)	Annual amount of alimony paid for a spouse and/or children
pk_alimentacijakoef (pk_alimonycoef)	Coefficient for alimony paid is 0.5 for each child and a spouse
pk_invaliditetbroj (pk_invaliditynumber)	Number of dependents with disability and a taxpayer himself/herself with disability
pk_invaliditetdohodak (pk_invalidityincome)	Amount of income in KM that dependents with disability

	make/receive (from earnings, social transfers, etc.)
pk_invaliditetudio (pk_disabilityshare)	A taxpayer's % share in supporting dependents with disability and a taxpayer himself/herself
pk_invaliditetkoef (pk_disabilitycoef)	Coefficient for supporting dependents with disability and for a taxpayer's disability is 0.3 (see Table 12); if % share in supporting a dependent with disability is less than 100%, then coefficient is less than 0.3; therefore, coefficient might take values ≥0 and ≤0.3; coefficient for a taxpayer's invalidity is 0.3 and cannot be lower than that
pk_ukupankoef (pk_totalcoef)	Sum of: (pk_bracnidrugkoef + pk_djecakoef + pk_uzaporodicakoef + pk_alimentacijakoef + pk_invaliditetkoef) + 1; 1 is coefficient for personal exemption (see Table 12)
FORM: GIP-1022 – Annual report on total wages paid out and other personal earnings	
Variables	***Description***
gip_opstinaisplatioca (gip_employermunicipality)	Municipality of employer
gip_brutoplaca (gip_grosswage)	Gross wage including SSC borne by employee (31%), but not SSC borne by employer (10.5%)
gip_penzijsko (gip_pension)	SSC for pension insurance borne by employee (17%)
gip_zdravstvo (gip_health)	SSC for health insurance borne by employee (12.5%)
gip_nezaposlenost (gip_unemployment)	SSC for unemployment insurance borne by employee (1.5%)
gip_ukupnidoprinosi (gip_totalcontributions)	Total SSC (31%) = pension (17%) + health (12.5%) + unemployment (1.5%)
gip_placabezdoprinosa (gip_grosslesscontributions)	Wage before tax= gross wage less SSC
gip_iznoslicnogodbitka (gip_amountpersonaldeductions)	Personal deductions = total amount of personal exemption and dependent deductions (for spouse,

	children, other close family members, invalidity)
gip_osnovicaporeza (gip_taxbase)	Tax base = wage before tax less deductions
gip_iznosuplacenogporeza (gip_amounttaxpaid)	Tax = calculated as application of tax rate of 10% on tax base
gip_netoplaca (gip_netwage)	After-tax wage (take-home pay) = wage before tax less tax
FORM: AUG-1031 – Tax withheld for temporary independent activities	
Temporary Contracts	
Variables	***Description***
aug_opstinaisplatioca_u (aug_payermunicipality_c)	Municipality of payer (employer)
aug_iznosprihodaugovor (aug_grossincome_c)	Total gross income earned
aug_iznosrashodaugovor (aug_costs_c)	20% standardized costs for tax purposes
aug_iznosdohotka_u (aug_income_c)	Income = calculated as gross income reduced for standardized costs
aug_zdravstvenoosiguranje_u (aug_healthinsurance_c)	Health SSC = calculated as 4% on income (gross reduced for costs), borne by employee
aug_osnovica_u (aug_base_c)	Tax base = calculated as gross income reduced for standardized costs and health SSC
aug_porez_u (aug_tax_c)	Tax = calculated as 10% applied on tax base
Authors Contracts	
Variables	***Description***
aug_opstinaisplatioca_h (aug_payermunicipality_a)	Municipality of payer (employer)
aug_iznosprihodahonorari (aug_grossincome_a)	Total gross income earned
aug_iznosrashodahonorari (aug_costs_a)	Real costs or 30% standardized costs for tax purposes
aug_iznosdohotka_h (aug_income_a)	Income = calculated as gross income reduced for costs
aug_zdravstvenoosiguranje_h (aug_healthinsurance_a)	Health contribution = calculated as 4% on income (gross reduced for costs), borne by employee
aug_osnovica_h (aug_base_a)	Tax base = calculated as gross income reduced for costs and health SSC
aug_porez_h (aug_tax_a)	Tax = calculated as 10% applied on tax base
FORM: ASD-1032 – Tax withheld for other independent activities	

(parliamentarians, members of governing and monitoring boards, bankruptcy administrators, and lay magistrates)	
Variables	***Description***
asd_opstinaisplatioca (asd_payermunicipality)	Municipality of payer (employer)
asd_iznosdohotka (asd_income)	Total gross income earned
asd_zdravstvenoosiguranje (asd_healthinsurance)	Health SSC = calculated as 4% on gross income, borne by employee
asd_osnovica (asd_base)	Tax base = calculated as gross income reduced for health SSC
asd_porez (asd_tax)	Tax = calculated as 10% applied on tax base
FORM: PDN-1033 – Tax on income from investment in capital, gains from contests and games of chance, and income from non-residents earned through temporary independent activities	
Investment in capital	
Variables	***Description***
pdn_opstina_k (pdn_municipality_c)	Municipality of a payer of income to taxpayer
pdn_isplaceniiznoskapital (pdn_amountpaid_c)	Income from investment in capital (tax base)
pdn_iznosporezakapital (pdn_tax_c)	Tax = calculated as 10% applied on tax base
Gains from contests and games of chance	
Variables	***Description***
pdn_opstina_i (pdn_municipality_g)	Municipality of payer of gain
pdn_isplaceniiznosigre (pdn_amountpaid_g)	Gains from games (tax base)
pdn_iznosporezaigre (pdn_tax_g)	Tax = calculated as 10% applied on tax base
Non-residents	
Variables	***Description***
pdn_opstina_n (pdn_municipality_n)	Municipality of payer to non-resident
pdn_isplaceniznosnerez (pdn_amountpaid_n)	Income (tax base)
pdn_iznosporezanerez (pdn_tax_n)	Tax = calculated as 10% applied on tax base
FORM: PIP-1034 – Tax on income from property and property rights	
Property rented to tourists paying sojourn fee	
Variables	***Description***
pip_opstina_izn (pip_municipality_rent)	Municipality of taxpayer
pip_prihodiznajmljivanje (pip_income_rent)	Gross income
pip_rashodiiznajmljivanje (pip_costs_rent)	Real costs or 50% standardized costs for tax purposes

pip_osnovicaiznajmljivanje (pip_base_rent)	Tax base (gross income reduced for costs)
pip_poreziznajmljivanje (pip_tax_rent)	Tax = calculated as 10% applied on tax base
Income from transfer of property rights	
Variables	***Description***
pip_opstina_ust (pip_municipality_ces)	Municipality of a taxpayer
pip_prihodprava (pip_income_ces)	Gross income
pip_rashodiprava (pip_costs_ces)	20% standardized costs for tax purposes
pip_osnovicaprava (pip_base_ces)	Tax base (gross income reduced for costs)
pip_porezprava (pip_tax_ces)	Tax = calculated as 10% applied on tax base
Income from sales of real estate and/or property rights	
Variables	***Description***
pip_opstina_otu (pip_municipality_s)	Municipality of a taxpayer
pip_prihodotudjenje (pip_income_s)	Gross income
pip_rashodiotudjenje (pip_costs_s)	Costs for tax purposes calculated as purchase value increased by rise of production prices of industrial products + costs in real amount
pip_osnovicaotudjenje (pip_base_s)	Tax base (gross income reduced for costs)
pip_porezotudjenje (pip_tax_s)	Tax = calculated as 10% applied on tax base
FORM: SPR-1053 – Specification for determination of income from independent (entrepreneurial) activity (This form is filed along with GPD-1051 (Annual tax declaration) or along with GPZ-1052 (Annual declaration for income from joint independent activity)	
Variables	***Description***
spr_prihodiukupno (spr_totalincome)	Total income (gross) from independent activity
spr_rashodiukupno (spr_totalcosts)	Total costs from independent activity
spr_rashodinijemogodbiti (spr_costnotfortax)	Costs not recognized for tax purposes
spr_dohodakoddjelatnosti (spr_incomeactivity)	Total (gross) income reduced for total costs and increased for costs not recognized for tax purposes
FORM: GPD-1051 – Annual tax declaration of personal income tax	
Variables	***Description***
gpd_opstina (gpd_municipality)	Municipality where a taxpayer resides

gpd_gip_placabezdoprinosa (gpd_gip_ grosslesscontributions)	gip_placabezdoprinosa (from GIP-1022)
gpd_spr_dohodakoddjelatnosti (gpd_ spr_incomeactivity)	spr_dohodakoddjelatnosti (from SPR-1053)
gpd_prim_prihodi_troskovi (gpd_prim_income_costs)	Income from renting out property (calculated as gross income reduced for real or standardized cost of 30%)
gpd_vremograniceno	Income of timely limited transfer of property rights = calculated as gross income reduced for standardized costs of 20%
gpd_aug_asd_osnovicaporeza (gpd_aug_asd_taxbase)	Tax base including aug_osnovica_u + aug_osnovica_h + asd_osnovica (from AUG-1031 and ASD-1032)
gpd_gubitakranije (gpd_previousloss)	Loss from previous years
gpd_gubitak (gpd_loss)	Total loss
gpd_dobit (gpd_gain)	Total income
gpd_pk_ukupnilicniodbitak (gpd_pk_totalded)	Deductions, including personal exemption and dependent deductions
gpd_zivotnoodbitak (gpd_lifeded)	Deduction for life insurance and voluntary pension insurance[89]
gpd_zdravstvenoodbitak (gpd_healthded)	Deduction for health care not covered by obligatory health funds
gpd_kreditodbitak (gpd_loanded)	Deduction for interests paid on housing loans
FORM: GPD-1052 – Annual declaration of income from joint independent activity	
Variables	***Description***
gpz_opstina (gpz_municipality)	Municipality where activity is performed
gpz_ukupnadobit (gpz_totalprofit)	Total income = spr_dohodakoddjelatnosti (from SPR-1053)
gpz_ukupnigubitak (gpz_totalloss)	Total loss = spr_dohodakoddjelatnosti (from SPR-1053)
gpz_partneropstina (gpz_partnermunicipality)	Municipality where partners reside
gpz_udioprocenti (gpz_%share)	Partners' share in partnership
gpz_partnerovudio (gpz_partnershare)	Partners' share in profit/loss

Source*: Taxpayers' Database (2009), Pravilnik o primjeni Zakona o porezu na dohodak;* own Table

[89] This has been eliminated with the recent amendments to the Law on Personal Income Tax.

There is a need for a few remarks. I changed some of the original variable names, because I had already written the computer code with names I had chosen, so I matched the variable names to those. Moreover, there were mistakes in data derived from the form GPD-1051 (i.e., annual tax declaration). The annual tax declaration should be compiled from data presented in other tax declarations filed for tax advance payments. For example, if a taxpayer has income from independent activity filed in tax declaration SPR-1053, such income should be also presented in the annual tax declaration. However, sometimes it happens that income was presented in SPR-1053, but not in the annual tax declaration, which is obviously wrong. Due to such inconsistencies, I compiled annual tax declarations by myself.

Some of the variables listed above serve as control variables when the baseline scenario is created. The results provided by the baseline scenario should replicate the reality. It is the test on whether the model works. If such is the case, then I can start simulations and rely on the results.

However, some of the above listed variables are the starting point for building the baseline scenarios. One such variable is gross wage (gip_brutoplaca /gip_grosswage), from which I can calculate social security contributions, taxes, and take-home pay. I compare those results with control variables from the Tax Administration database. One needs to have in mind that the result might not be completely the same, although it should, because there also might be mistakes in the original database.

2.3 Steps in Construction of FBHMOD

The steps in creating the model are the following:

Step 1: Calculation of coefficients necessary to calculate the tax allowances (based on the Form PK-1001 – Request for issuing the tax card)

Coefficients necessary to calculate individual tax allowances, including personal exemption and dependent deductions (on the basis of dependent spouse, children, close family members, disability), are calculated for each taxpayer (see Table 18).

Table 18. Calculation of Coefficients for Tax Allowances

Variable	Database (D)/ Created (C)[90]	Way of Calculation in the Model	Coefficient
pk_ukupankoef	D (C as pk_ukupankoeff)		
pk_licnikoeff	C	1 (set by Law) if pk_ukupankoef >0; otherwise 0	1 or 0
pk_bracnidrugbroj	D		
pk_bracnidrugudio	D		
pk_bracnidrugkoeff	C (D as pk_bracnidrugkoef)	0.5 x pk_licnikoeff x pk_bracnidrugbroj x pk_bracnidrugudio	>=0 <=0.5
pk_djecabroj	D		
pk_djecaudio	D		
pk_1dijetekoeff	C	0.5 x pk_licnikoeff if pk_djecabroj>0; otherwise 0	0.5 or 0
pk_2dijetekoeff	C	0.7 x pk_licnikoeff if pk_djecabroj>1; otherwise 0	0.7 or 0
pk_3dijetekoeff	C	0.9 x pk_licnikoeff if pk_djecabroj>2; otherwise 0	0.9 or 0
pk_4dijetekoeff	C	0.9 x pk_licnikoeff if pk_djecabroj>3; otherwise 0; same logic applies for each subsequent child	0.9 or 0

[90] Database (D) means that the variable is observed in the database. Created (C) means that the variable is modelled. If the variable is both D and C, it means that the variable is observed in the database and used as a control variable for the modelled variable. Another way to recognize if the variable is observed or modelled is the last letter of the variable name. If at the end of the variable name there are two same letters (e.g. pk_ukupankoeff), it means that the variable is modelled. If there is no double letter at the end, it means it is observed (e.g. pk_ukupankoef). There is an exception, where there is one letter and *. It means that the variable is created from the variables observed in the database. Examples will appear in Steps 8 through 11.

pk_djecakoeff	C (D as pk_djecakoef)	(pk_1dijetekoeff + pk_2dijetekoeff + pk_3dijetekoeff + pk_4dijetekoeff + ...) x pk_djecaudio	>=0
pk_uzaporodicabroj	D		
pk_uzaporodicaudio	D		
pk_uzaporodicakoeff	C (D as pk_uzaporodicakoef)	0.3 x pk_licnikoeff x pk_uzaporodicabroj x pk_uzaporodicaudio	>=0
pk_invaliditetbroj	D		
pk_invaliditetudio	D		
pk_invaliditetkoeff	C (D as pk_invaliditetkoef)	0.3 x pk_licnikoeff x pk_invaliditetbroj x pk_invaliditetudio	>=0
pk_alimentacijakoef	D		>=0
pk_ukupankoeff	C (D as pk_ukupankoef)	pk_licnikoeff + pk_bracnidrugkoeff + pk_djecakoeff + pk_uzaporodicakoeff + pk_invaliditetkoeff + pk_alimentacijakoef	>=0
pk_brojmjesecii	C	gip_iznoslicnogodbitka/(pk_ukupankoef x 300)	
pk_licniodbitakk	C	300 (set by Law)	

Source*:* Own model

Step 2: Calculation of wage before tax, tax base from wages, and tax paid from wages as advance payment (based on the Form GIP-1022 – Annual report on total wages paid out and other personal earnings)

Wage before tax is calculated for each taxpayer, on the basis of gross wage and social security contributions. Tax base from wages is calculated on the basis of wage before tax and tax allowances for each taxpayer. Tax paid from wages as advance payment is calculated on the basis of tax base from wages for each taxpayer. All three segments are presented in the Table 19.

Table 19. Calculation of Wage before Tax, Tax Base from Wages, and Tax from Wages

Variable	Database/Created	Way of Calculation in the Model	Output
gip_brutoplaca	D		
gip_penzijskoo	C (D as gip_penzijsko)	gip_brutoplaca x 0.17	
gip_zdravstvoo	C (D as gip_zdravstvo)	gip_brutoplaca x 0.125	
gip_nezaposlenostt	C (D as gip_nezaposlenost)	gip_brutoplaca x 0.015	
gip_ukupnidoprinosii	C (D as gip_ukupnidoprinosi)	gip_penzijskoo + gip_zdravstvoo + gip_nezaposlenostt	
gip_placabezdoprinosaa	C (D as gip_placabezdoprinosa)	gip_brutoplaca - gip_ukupnidoprinosii	Wage before tax
gip_iznoslicnogodbitkaa	C (D as gip_iznoslicnogodbitka)	pk_ukupankoeff x pk_licniodbitakk x pk_brojmjesecii	
gip_osnovicaporezaa	C (D as gip_osnovicaporeza)	gip_placabezdoprinosaa - gip_iznoslicnogodbitkaa	Tax base from wages
poreznastopaa1	C	0.1	
gip_iznosuplacenogporezaa	C (D as gip_iznosuplacenogporeza)	gip_osnovicaporezaa x poreznastopaa1	Tax paid from wages as advanced payment

Source*:* Own model

Step 3: Calculation of tax paid from temporary independent activities as advance payment (based on the Form AUG-1031 –Tax withheld for temporary independent activities)

Tax on income from temporary and authors contracts is calculated for each taxpayer, on the basis of gross income, standardized costs, and social security contributions (see Table 20).

Table 20. Calculation of Tax from Temporary and Authors Contracts

Variable	Database/Created	Way of Calculation in the Model	Output
Temporary Contracts			
aug_iznosprihodaugovor	D		
aug_iznosrashodaugovorr	C (D as aug_iznosrashodaugovor)	aug_iznosprihodaugovor x 0.2	
aug_iznosdohotka_uu	C (D as aug_iznosdohotka)	aug_iznosprihodaugovor - aug_iznosrashodaugovorr	
aug_zdravstvenoosiguranje_uu	C (D as aug_zdravstvenoosiguranje_u)	aug_iznosdohotka_uu x 0.04	
aug_osnovica_uu	C (D as aug_osnovica_u)	aug_iznosdohotka_uu - aug_zdravstvenoosigranje_uu	
aug_porez_uu	C (D as aug_porez_u)	aug_osnovica_uu x poreznastopaa1	Tax paid as advance payment (Temp. Contracts)
Authors Contracts			
aug_iznosprihodahonorari	D		
aug_iznosrashodahonorari	D		
aug_iznosdohotka_hh	C (D as aug_iznosdohotka_h)	aug_iznosprihodahonorari - aug_iznosrashodahonorari	
aug_zdravstvenoosigranje_hh	C (D as aug_zdravstvenoosiguranje_h)	aug_iznosdohotka_hh x 0.04	
aug_osnovica_hh	C (D as aug_osnovica_h)	aug_iznosdohotka_hh - aug_zdravstvenoosigranje_hh	
aug_porez_hh	C (D as aug_porez_h)	aug_osnovica_hh x poreznastopaa1	Tax paid as advance payment (Authors Contracts)

Source*:* Own model

Step 4: Calculation of tax withheld for other independent activities: parlamentarians, members of governing and monitoring boards, bankruptcy administrators, and lay magistrates (based on the Form ASD-1032 –Tax withheld for other independent activities)

Tax on income from other independent activities is calculated for each taxpayer, on the basis of gross income and social security contributions (see Table 21).

Table 21. Calculation of Tax from Other Independent Activities

Variable	Database/Created	Way of Calculation in the Model	Output
asd_iznosdohotka	D		
asd_zdravstvenoosiguranjee	C (D as asd_zdravstvenoosiguranje)	asd_iznosdohotka x 0.04	
asd_osnovicaa	C (D as asd_osnovica)	asd_iznosdohotka - asd_zdravstvenoosiguranjee	
asd_porezz	C (D as asd_porez)	asd_osnovicaa x poreznastopaa1	Tax paid as advance payment

Source*:* Own model

Step 5: Calculation of tax on income from investment in capital, gains from contests and games of chance, and income from non-residents earned through temporary independent activities (based on the Form PDN-1033)

Tax on income from investment in capital, gains from contests and games of chance, and income from non-residents is calculated for each taxpayer, based on gross income and tax rate (see Table 22). Tax on those types of income is considered as final liability, not as advance payment.

Table 22. Calculation of Tax from Income from Capital, Contests and Game of Chance, and Non-Residents

Variable	Database/Created	Way of Calculation in the Model	Output
Investment in capital			
pdn_isplaceniiznoskapital	D		
pdn_iznosporezakapitall	C (D as pdn_iznosporezakapital)	pdn_isplaceniiznoskapital x poreznastopaa1	Tax withheld as final liability (capital)
Gains from contests and games of chance			
pdn_isplaceniiznosigre	D		
pdn_iznosporezaigree	C (D as pdn_iznosporezaigre)	pdn_isplaceniiznosigre x poreznastopaa1	Tax withheld as final liability (contests and games of chance)
Non-residents			
pdn_isplaceniznosnerez	D		
pdn_iznosporezanerezz	C (D as pdn_iznosporezanerez)	pdn_isplaceniznosnerez x poreznastopaa1	Tax withheld as final liability (non-residents)

Source*:* Own model

Step 6: Calculation of tax on income from property and property rights (based on the Form PIP-1034)

Tax on income from property rented to tourists, income from transfer of property rights, and income from sales of real estate and/or property rights, is calculated for each taxpayer, based on gross income, and standardized or real costs (see Table 23). Tax on those types of income is considered as final liability, not as advance payment.

Table 23. Calculation of Tax on Income from Property and Property Rights

Variable	Database/Created	Way of calculation in the Model	Output
Property rented to tourists paying sojourn fee			
pip_prihodiznajmljivanje	D		
pip_rashodiiznajmljivanje	D		
pip_osnovicaiznajmljivanjee	C (D as pip_osnovicaiznajmljivanje)	pip_prihodiznajmljivanje - pip_rashodiiznajmljivanje	
pip_poreziznajmljivanjee	C (D as pip_poreziznajmljivanje)	pip_osnovicaiznajmljivanjee x poreznastopaa1	Tax withheld as final liability (prop. rented to tourists)
Income from transfer of property rights			
pip_prihodprava	D		
pip_rashodipravaa	C (D as pip_rashodiprava)	pip_prihodprava x 0.2	
pip_osnovicapravaa	C (D as pip_osnovicaprava)	pip_prihodprava - pip_rashodipravaa	
pip_porezpravaa	C (D as pip_porezprava)	pip_osnovicapravaa x poreznastopaa1	Tax withheld as final liability (prop. rights)
Income from sales of real estate and/or property rights			
pip_prihodotudjenje	D		
pip_rashodiotudjenje	D		

pip_osnovicaotudjenjee	C (D as pip_osnovicaotudjenje)	pip_prihodotudjenje - pip_rashodiotudjenje	
pip_porezotudjenjee	C (D as pip_porezotudjenje)	pip_osnovicaotudjenjee x poreznastopaa1	Tax withheld as final liability (sales)

Source*:* Own model

Step 7: Calculation of income from independent (entrepreneurial) activity (based on the Form SPR-1053)

Income from independent (entrepreneurial) activity, is calculated for each taxpayer, based on the gross income and costs (see Table 24).

Table 24. Calculation of Income from Independent (Entrepreneurial Activity)

Variable	Database/Created	Way of calculation in the Model	Output
spr_prihodiukupno	D		
spr_rashodiukupno	D		
spr_rashodinijemogodbiti	D		
spr_dohodakoddjelatnostii	C (D as spr_dohodakoddjelatnosti)	spr_prihodiukupno - spr_rashodiukupno + spr_rashodinijemogodbiti	Income (entrepr. activity)

Source*:* Own model

Step 8: Calculation of income before dependent and other deductions from sources of income claimed in annual tax declaration, without those sources of income on which the tax is recognized as final liability (based on the Form GPD-1051)

Calculation of income before dependent and other deductions for sources of income that are claimed in the annual tax declaration (Form GPD_1051), is made on the basis of the income from the forms: GIP-1022, AUG-1031, ASD-1032, SPR-1053 (see Table 25).

Table 25. Calculation of Income before Deductions for Income Filed in the Annual Tax Declaration

Variable	Database/Created	Way of Calculation in the Model	Output
gpd_gubitak*/gpd_dobit*	C (created from the variables given in the database; I mark those variables with *; the variables gpd_gubitak and gpd_dobit exist in the database, but I calculate it on my own due to reason already explained above)	gip_placabezdoprinosa + spr_dohodakoddjelatnosti + gpd_prim_prihodi_troskovi + aug_osnovica_u + aug_osnovica_h + asd_osnovica + gpd_vremograniceno – gpd_gubitakranije; if ∑<0 then gpd_gubitak*, if ∑>0 then gpd_dobit*	Income before depend. and other deduc. in the Annual Tax Decl.(created from the variables given in the datab.)
gpd_gubitakk/gpd_dobitt	C	gip_placabezdoprinosaa + spr_dohodakoddjelatnostii + gpd_prim_prihodi_troskovi + aug_osnovica_uu + aug_osnovica_hh + asd_osnovicaa + gpd_vremograniceno – gpd_gubitakranije; if ∑<0 then gpd_gubitakk, if ∑>0 then gpd_dobitt	Income before depend. and other deduc. in the Annual Tax Decl. (created from the variabl. made for the baseline scenario + variabl. from the database that cannot be modelled)

Source*:* Own model

Step 9: Calculation of tax from sources of income claimed in the Annual Tax Declaration, without those on which the tax is recognized as final liability (based on the Form GPD-1051)

Calculation of tax from the sources of income claimed in the Annual Tax Declaration is made on the basis of total income before dependent and other deductions as set in the Step 8 above, and dependent and other deductions (see Table 26).

Table 26. Calculation of Tax for Income Filed in the Annual Tax Declaration

Variable	Database/Created	Way of Calculation in the Model	Output
gpd_pk_ukupnilicniodbitak*	C (created from the variables given in the database; the variable gpd_pk_ukupnilicniodbitak exists in the database, but I calculate it on my own due to reason already explained above)	Take gip_iznoslicnogodbitka, if no wage then gpd_pk_ukupnilicniodbitak from the database	
gpd_pk_ukupnilicniodbitakk	C	Take gip_iznoslicnogodbitkaa, if no wage then gpd_pk_ukupnilicniodbitak from the database	
gpd_zivotnoodbitak	D		
gpd_zdravstvenoodobitak	D		
gpd_kreditodbitak	D		
gpd_ukupanodbitak*	C (created from the variables given in the database)	gpd_pk_ukupnilicniodbitak* + gpd_zivotnoodbitak + gpd_zdravstvenoodobitak + gpd_kreditodbitak	
gpd_ukupanodbitakk	C	gpd_pk_ukupnilicniodbitakk + gpd_zivotnoodbitak + gpd_zdravstvenoodobitak + gpd_kreditodbitak	
gpd_osnovicaporeza*	C (created from the variables given in the database)	gpd_dobit* - gpd_ukupanodbitak*	
gpd_osnovicaporezaa	C	gpd_dobitt - gpd_ukupanodbitakk	

gpd_porez*	C (created from the variables given in the database)	gpd_osnovicaporeza* x poreznastopaa1	Tax in Annual Tax Decl. (real)
gpd_porezz	C	gpd_osnovicaporezaa x poreznastopaa1	Tax in Annual Tax Decl. (for the baseline scenario)

Source: Own model

Step 10: Calculation of income before dependent and other deductions from all sources of income including those on which the tax is recognized as final liability (based on the Form GPD-1051, PDN-1033, PIP-1034)

Calculation of income before dependent and other deductions for all sources of income is made on the basis of the income from the forms: GPD-1051, PDN-1033, PIP-1034 (see Table 27).

Table 27. Calculation of Income for all Sources of Income

Variable	Database/Created	Way of calculation in the Model	Output
Dohodakprijeodbitaka*	C (created from the variables given in the database)	gpd_dobit* + pdn_isplaceniiznoskapital + pdn_isplaceniiznosigre + pdn_isplaceniznosnerez + pip_osnovicaiznajmljivanje + pip_osnovicaprava + pip_osnovicaotudjenje	Income before dependent and other deductions for all sources of income (real)
dohodakprijeodbitakaa	C	gpd_dobitt + pdn_isplaceniiznoskapital + pdn_isplaceniiznosigre + pdn_isplaceniznosnerez + pip_osnovicaiznajmljivanjee + pip_osnovicapravaa + pip_osnovicaotudjenjee	Income before dependent and other deductions for all sources of income (baseline scenario)

Source*:* Own model

Step 11: Calculation of tax from all sources of income including those on which the tax is recognized as final liability (based on the Form GPD-1051, PDN-1033, PIP-1034)

Calculation of tax from all sources of income is made on the basis of the tax calculated based on the forms: GPD-1051, PDN-1033, PIP-1034 (see Table 28).

Table 28. Calculation of Tax for all Sources of Income

Variable	Database/Created	Way of calculation in the Model	Output
PIT*	C (created from the variables given in the database)	gpd_porez* + pdn_iznosporezakapital + pdn_iznosporezaigre + pdn_iznosporezanerez + pip_poreziznajmljivanje + pip_porezprava + pip_porezotudjenje	Tax for all sources of income (real)
PITT	C	gpd_porezz + pdn_iznosporezakapitall + pdn_iznosporezaigree + pdn_iznosporezanerezz + pip_poreziznajmljivanjee + pip_porezpravaa + pip_porezotudjenjee	Tax for all sources of income (baseline scenario)

Source: Own model

2.4 Accuracy of the Model

Model accuracy is tested by checking discrepancies between real data (control variables given in the database) and results from the baseline scenario. This is done for all sources of income separately, as well as for total income, and presented through distribution tables of revenues presented further in the text.

2.4.1 Discrepancy of the Model and Wage Data

Since wages are the most significant source of collected personal income tax, I first compare the baseline scenario of personal income tax from wages with real wage data. I can conclude that model works according to expectations if I compare the collected tax according to the Tax Administration data and baseline scenario created through the microsimulation model. The tax from wages estimated through the model is overestimated by 0.2% compared with real wage data (see Table 29). The actual tax collected through wages is based on advance payments withheld from the wages along with social security contributions borne by the employee.

Table 29 presents the tax from wages (gip_iznosuplacenogporeza (Database) and gip_iznosuplacenogporezaa (Created) through decile groups with respect to gross wage income (gip_brutoplaca (database)).

Table 29. Aggregated Tax Paid from Wages as Advance Payment

Decile group	Real in KM	% Share	Model in KM	% Share	Discrepancy in %
I	1,099,048	0.64	1,226,705	0.72	11.62
II	2,570,953	1.51	2,550,259	1.49	-0.80
III	2,948,706	1.73	2,973,620	1.74	0.85
IV	3,774,938	2.21	3,892,228	2.27	3.11
V	5,160,549	3.02	5,203,987	3.04	0.84
VI	8,482,174	4.97	8,526,680	4.98	0.49
VII	13,800,000	8.08	14,000,000	8.18	1.45
VIII	20,300,000	11.89	20,300,000	11.87	0.00
IX	31,900,000	18.68	31,900,000	18.65	0.00
X	80,700,000	47.27	80,500,000	47.06	-0.25
Total	170,736,368	100.00	171,073,479	100.00	0.20

Source: *Taxpayers' Database (2009);* own calculations

Note:
Decile group: Taxpayers are divided into 10 groups, from lowest gross wage to highest gross wage.
"Real in KM" is the sum of tax from wages paid as advance payment by decile groups; this is compiled from real data (control variables).
"% Share" (third column) is the % share of collected tax of each decile group in total collected tax from wages.
"Model in KM" is the sum of tax from wages estimated through the model by decile groups (baseline scenario).
"% Share" (fifth column) is the % share of estimated tax of each decile group in total estimated tax from wages through the model (baseline scenario).
"Discrepancy in %" is the % difference between tax estimated through the model (baseline scenario) and tax collected (control variables).

The lowest decile group shows relatively high percentage discrepancy (11.62%; see Table 29). However, if I see the KM difference it is only around 100,000 KM. If I compare 100,000 KM to 170.7 million KM that is total collected, I notice it is not significant (0.06%). Moreover, the difference in percentage share of the lowest decile group in the database and baseline scenario is only 0.08%. This discrepancy is explained below.

I will look now the wage income before tax (gross wage minus social security contributions; gip_placabezdoprinosa (Database) and gip_placabezdoprinosaa (Created)) through decile groups with respect to gross wage (gip_brutoplaca (Database)).

Table 30. Aggregated Wage before Tax

Decile group	Real in KM	% Share	Model in KM	% Share	Discrepancy in %
I	45,800,000	1.27	44,400,000	1.24	-3.06
II	129,000,000	3.59	121,000,000	3.38	-0.06
III	182,000,000	5.07	181,000,000	5.05	-0.55
IV	213,000,000	5.93	213,000,000	5.95	0.00
V	241,000,000	6.71	241,000,000	6.73	0.00
VI	298,000,000	8.30	298,000,000	8.32	0.00
VII	379,000,000	10.55	379,000,000	10.58	0.00
VIII	458,000,000	12.75	458,000,000	12.79	0.00
IX	576,000,000	16.04	576,000,000	16.08	0.00
X	1,070,000,000	29.79	1,070,000,000	29.88	0.00
Total	3,591,800,000	100.00	3,581,400,000	100.00	-0.29

Source: *Taxpayers' Database (2009)*; own calculations

Note:
Decile group: Taxpayers are divided into 10 groups, from lowest gross wage to highest gross wage.
"Real in KM" is the sum of wage before tax by decile groups; this is compiled from real data (control variables).
"% Share" (third column) is the % share of wage before tax of each decile group in total wage before tax.
"Model in KM" is the sum of wage before tax estimated through the model by decile groups (baseline scenario).
"% Share" (fifth column) is the % share of estimated wage before tax of each decile group in total estimated wage before tax through the model (baseline scenario).
"Discrepancy in %" is the % difference between wage before tax estimated through the model (baseline scenario) and real wage before tax (control variables).

It can be seen from Table 30 that estimated wage income before tax in the first decile group is underestimated by 3% compared with actual data. So, this factor does not explain why I have the overestimated tax in the first decile group (see Table 29). Overall, wage income before tax is underestimated only by 0.29%. Such discrepancy of 0.29% might be caused by two reasons: special treatment in the area of social security contributions for some population groups, such as workers in the textile industry[91], and the quality of data (mistakes when entering the data – typos).

The wage income before tax cannot be the cause of overestimated tax because they move in different directions and should go in the same direction. If the tax is overestimated, also the wage income before tax should be overestimated, which is not the case here.

[91] The base for calculation of social security contributions for workers in coal mines, textiles, and the leather and shoe industry is multiplicand of average gross wage of the Federation of Bosnia and Herzegovina and coefficient of 0.25. Such special treatment is valid also for traditional craft. Some other self-employed also have special treatments, but with different coefficients. This is all regulated by the Law on Social Security Contributions of the Federation of Bosnia and Herzegovina. This is a kind of subsidy for workers in coal mines, textiles, and the leather and shoe industry.

Therefore, I further look at the tax base (gip_osnovicaporeza (Database) and gip_osnovicaporezaa (Created)) through decile groups with respect to gross income from wage (gip_brutoplaca (Database)).

Table 31. Tax Base from Wages

Decile group	Real in KM	Model in KM	Discrepancy in KM	Discrepancy in %
I	11,000,000	12,300,000	1,300,000	11.82
II	25,700,000	25,500,000	-200,000	-0.78
III	29,600,000	29,700,000	100,000	0.34
IV	37,500,000	38,900,000	1,400,000	3.73
V	51,500,000	52,000,000	500,000	0.97
VI	85,100,000	85,300,000	200,000	0.23
VII	139,000,000	140,000,000	1,000,000	0.72
VIII	204,000,000	203,000,000	-1,000,000	-0.49
IX	319,000,000	319,000,000	0	0.00
X	807,000,000	805,000,000	-2,000,000	-0.25
Total	1,709,400,000	1,710,700,000	1,300,000	0.08

Source: *Taxpayers' Database (2009)*; own calculations

Note:
Decile group: Taxpayers are divided in 10 groups, from lowest gross wage to highest gross wage.
"Real in KM" is the sum of tax base from wages by decile groups; this is compiled from real data (control variables).
"Model in KM" is the sum of tax base from wages estimated through the model by decile groups (baseline scenario).
"Discrepancy in KM" is the KM difference between the tax base from wages estimated through the model (baseline scenario) and real tax base from wages (control variables).
"Discrepancy in %" is the % difference between the tax base from wages estimated through the model (baseline scenario) and real tax base from wages (control variables).

It can be noticed that the discrepancy in tax (11.62%) in the first decile group (see Table 29) can be prescribed to discrepancy in the tax base (11.82%; see Table 31). Furthermore, the reason for that might be only a discrepancy in personal exemption and dependent deductions. Thus, I looked at the deductions in the respective decile group and found a discrepancy between real data and baseline scenario due to quality of data. Usually those are the typos influencing total deductions. There were 11 such cases. The discrepancy in tax base is small, so I decided to keep those cases in the database.

Overall, I can say that the model is an appropriate analytical tool, with a discrepancy only of 0.2% between the calculated tax from wages and actual wage data.

Discrepancy of sources of income other than wages is given below in the *section 2.4.2 Discrepancy of the Model and Sources of Income Other than Wages*.

2.4.2 Discrepancy of the Model and Sources of Income Other than Wages

Looking the overall results of all advance tax payments paid with respect to each gross income by each income source other than wages, I can say that model works perfectly, with a deviation of 0.00%. In Table 32 I summarize percentage discrepancies of the model compared with real data by decile groups (with respect to different types of gross income).

Table 32. Tax Discrepancies

Decile Group	Temporary (Service) Contracts (%)	Authors' (Royalties) Contracts (%)	Other Independent Activities (%)	Non-residents: Independent Activities (%)	Investment in Capital (%)	Gains from Games (%)	Renting to Tourists (%)	Transfer of Rights (%)	Sales of Real Estate (%)
I	-0.02	-0.01	-0.04	0.00	-	0.00	-	-	-
II	-0.01	0.00	0.00	0.00	-	0.00	-	-	-
III	0.00	0.00	0.00	0.00	-	0.00	-	-	-
IV	-0.01	0.00	0.00	0.00	-	0.00	-	-	-
V	0.00	0.00	0.00	0.00	-	0.00	-	-	-
VI	0.00	0.00	0.00	0.00	-	0.00	-	-	-
VII	0.00	0.00	0.00	0.00	-	0.00	-	-	-
VIII	0.00	0.00	0.00	0.00	-	0.00	-	-	-
IX	0.00	0.00	0.00	0.00	-	0.00	-	-	-
X	0.00	0.00	0.00	0.00	-	0.00	-	-	-
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Source: *Taxpayers' Database (2009)*; own calculations

It can be confirmed from Table 32 that tax estimated through the model does not differentiate from real data. There are two more sources: independent activities (agriculture, forestry, and other economic activities) and renting out property to people that are not tourists, for which I cannot check data on taxes because I do not have them. What I have is income from those sources, so I can calculate the tax myself.

After I presented the discrepancies of real data and baseline scenario for all different sources of income, I do the same for total income in the *section 2.4.3 Discrepancy of the Model and Total Income Data*.

2.4.3 Discrepancy of the Model and Total Income Data

The entire personal income tax from all sources of income estimated through the model is overestimated by 0.63% compared with real data (see Table 34). The discrepancy between the data and the baseline scenario is low. This indicates that the microsimulation model for the Federation is an appropriate analytical tool.

Since the Tax Administration Office does not provide data on aggregated total income, I calculated aggregated income before dependent and additional deductions (income before tax), adding up the data on different sources of income directly from the database. The discrepancy between such aggregated income in reality and aggregated income from baseline scenario is 0.2% (see Table 33). This means that income calculated through the model is underestimated by 0.2%. Such discrepancy in total income relates to the discrepancy in total wage income before tax where the discrepancy is also around 0.2% (see Table 30).

In Table 33 I show the discrepancy in total income before dependent and additional deductions (total income before tax; gpd_dobit and gpd_dobitt) by decile groups.

Table 33. Total Income before Dependent and Additional Deductions (total income before tax)

Decile Group	Real in KM	% Share	Model in KM	% Share	Discrepancy in %
I	23,500,000	0.59	23,400,000	0.59	-0.42
II	92,300,000	2.34	90,100,000	2.29	-2.38
III	174,000,000	4.40	169,000,000	4.29	-2.87
IV	224,000,000	5.67	224,000,000	5.69	0.00
V	259,000,000	6.56	259,000,000	6.57	0.00
VI	312,000,000	7.90	311,000,000	7.89	-0.32
VII	406,000,000	10.28	406,000,000	10.31	0.00
VIII	508,000,000	12.86	507,000,000	12.87	-0.20
IX	651,000,000	16.48	650,000,000	16.50	-0.15
X	1,300,000,000	32.91	1,300,000,000	33.00	0.00
Total	3,949,800,000	100.00	3,939,500,000	100.00	-0.20

Source: *Taxpayers' Database (2009)*; own calculations

Note:
Decile group: Taxpayers are divided in 10 groups, from lowest income before tax to highest income before tax.
"Real in KM" is the sum of income before tax by decile groups; this is compiled from real data (control variables).
"% Share" (third column) is the % share of income before tax of each decile group in total income before tax.
"Model in KM" is the sum of income before tax estimated through the model by decile groups (baseline scenario).
"% Share" (fifth column) is the % share of estimated income before tax of each decile group in total estimated income before tax through the model (baseline scenario).
"Discrepancy in %" is the % difference between income before tax estimated through the model (baseline scenario) and real income before tax (control variables).

The discrepancy of total income before tax, presented as difference between the actual data and the baseline scenario, is 10.3 million (see Table 33), which is almost the same as the discrepancy in wage income before tax (10.4 million; see Table 30). Therefore, the discrepancy might be caused almost completely by the discrepancy in wage income before tax.

Although the estimated total income before tax is lower by 0.2% (see Table 33), the estimated tax is higher by 0.63% (see Table 34). I further look the tax (PIT* (real) and PITT (baseline scenario) through the decile groups with respect to income before tax (dohodakprijeodbitaka (real) and dohodakprijeodbitakaa (baseline scenario)) (see Table 34).

Table 34. Real and Baseline Scenario Tax

Decile Group	Real in KM	% Share	Model in KM	% Share	Discrepancy in %
I	1,294,944	0.65	1,287,969	0.64	-0.54
II	3,268,406	1.64	3,289,160	1.64	0.63
III	3,848,613	1.93	4,434,600	2.21	15.23
IV	4,064,040	2.04	4,329,636	2.16	6.53
V	5,342,208	2.68	5,452,091	2.72	2.06
VI	8,630,466	4.33	8,920,115	4.45	3.36
VII	14,600,000	7.33	14,900,000	7.43	2.05
VIII	21,900,000	11.00	21,800,000	10.88	-0.46
IX	36,200,000	18.18	36,000,000	17.96	-0.55
X	100,000,000	50.21	100,000,000	49.90	0.00
Total	199,148,677	100.00	200,413,571	100.00	0.63

Source: *Taxpayers' Database (2009)*; own calculations

Note:
Decile group: Taxpayers are divided into 10 groups, from lowest income before tax to highest income before tax.
"Real in KM" is the sum of total tax paid by decile groups; this is compiled from real data (control variables).
"% Share" (third column) is the % share of collected tax of each decile group in total collected tax.
"Model in KM" is the sum of tax estimated through the model by decile groups (baseline scenario).
"% Share" (fifth column) is the % share of estimated tax of each decile group in total estimated tax through the model (baseline scenario).
"Discrepancy in %" is the % difference between tax estimated through the model (baseline scenario) and tax collected (control variables).

If I look at Table 34, I can notice that the III and IV decile groups face relatively high percentage discrepancy between the baseline scenario and real data, of 15.23% and 6.53%, respectively. The III decile group shows higher collection of tax in the baseline scenario than in reality, whereas income before dependent and additional deductions (income before tax) is lower than in the database. The IV decile group shows higher collection of tax in the baseline scenario although income is the same in both, the baseline scenario and real data. The only reason for such discrepancy might be the quality of data. As I already mentioned, there were typos when data were entered. Besides that, in a few cases, when I looked at the separate coefficients for dependent family members, and when I summed them up, I did not end up with same number as in the data.

Although the discrepancy of 15.23% seems high, it is only 0.29% of total collected tax in the database, as well as calculated through the baseline scenario. I do not have such problems in other sources of income, because the taxpayers are not allowed to claim deductions when paying advance payments. I face such problems when I enter all sources of income in the annual tax declaration. However, there is no indication of a serious problem, because the discrepancy in calculated tax and collected tax for entire income is 0.63% (see Table 34).

2.4.4 Accuracy of the Model Compared to the Models of Other Countries

A similar difference between the real data and the baseline scenario is in the MISIM-Belgium microsimulation model (Verbist et al., 2000). When baseline scenario based on the Social and Economic Panel database is compared with actual data, it shows a higher calculated tax by 0.69%. However, this difference is 24.11% when the baseline scenario is based on the Panel Study of Belgian Households' database. In Slovenia (STM-Slovenian Tax Model; Čok, 2002), if the baseline scenario based on the PIT database is compared with data already included in PIT database provided by the Ministry of Finance of the Republic of Slovenia, a higher calculated tax by 0.25% is shown. However, if the baseline scenario is based on the Household Budget Survey (HBS) database, the calculated tax is lower by 15.12% when compared with the PIT database. If I look at the validation result of ESPASIM (Spanish microsimulation model; Horacin et al., 2000), the tax simulated is 10% lower than the actual tax if simulation is based on the HBS database. When simulation is based on the Spanish sample of the European Community Household Panel database, the simulated tax is calculated correctly compared with real data. In SPSD/M in Canada in 2008, the discrepancy for income tax was approximately 3% (Statistics Canada, 2013). The difference in administrative and simulated totals is less than 2% in the US 2012 Baseline of the 2009 MATH SIPP+ Microsimulation Model and Database (Smith & Wang, 2012).

Therefore, when I compare the results of the model with validation results of some other microsimulation models, I find that all results differ from the actual data reported.

2.4.5 Analysis of the Current System

Before proceeding to the next part, which shows the results of microsimulations, I will first show the characteristics of the current system. Table 35 shows the basic characteristics of current system through distribution of income and taxes.

Table 35. Current System

Decile group	Income	%. Share	Tax	% Share	Effective tax rate (%)	Share difference
I	23,400,000	0.59	1,287,969	0.64	5.50	0.05
II	90,100,000	2.29	3,289,160	1.64	3.65	-0.65
III	169,000,000	4.29	4,434,600	2.21	2.62	-2.08
IV	224,000,000	5.69	4,329,636	2.16	1.93	-3.53
V	259,000,000	6.57	5,452,091	2.72	2.10	-3.85
VI	311,000,000	7.89	8,920,115	4.45	2.87	-3.44
VII	406,000,000	10.31	14,900,000	7.43	3.67	-2.88
VIII	507,000,000	12.87	21,800,000	10.88	4.30	-1.99
IX	650,000,000	16.50	36,000,000	17.96	5.54	1.46
X	1,300,000,000	33.00	100,000,000	49.90	7.69	16.9
Total	3,939,500,000	100.00	200,413,571	100.00	5.09	-

Source: *Taxpayers' Database (2009)*; own calculations

Note:
"Decile group" refers to decile groups with respect to income before tax (dohodakprijeodbitakaa).
"Income" refers to income before tax.
"% Share" (third column) refers to the % share of income before tax (of each decile group) in total income before tax.
"Tax" refers to tax (PITT) burden of each decile group.
"% Share" (fifth column) refers to the % share of tax (of each decile group) in total tax.
*"Effective Tax Rate (%)" calculates as tax/income before tax*100.*
"Share Difference" calculates as the % share in total tax minus % share in total income before tax.

If I look at the current system I can notice that the share of different income decile groups in total income goes from 0.59% in the lowest up to 33% in the highest (see Table 35). I can see that income is unequally distributed. However, I can also see that the share of tax in total collected tax by different decile groups goes from 0.64% in the lowest decile group to 49.9% in the highest decile group (see Table 35). So, I can see that top decile group of taxpayers pays 50% of total collected tax.

I will also look at the effective tax rates, the definition of which has already been mentioned. Through those rates I can conclude if the system is progressive. The overall effective tax rate is around 5% (see Table 35), as opposed to the statutory rate of 10%. Therefore, the tax expenditures are as high as the collected tax. If I look at the decile groups in more detail, I can see that top decile group's effective tax rate is 7.69%, whereas the lowest decile group has a rate of 5.5% (see Table 35). Although the system is progressive, I can also notice that the effective tax rate decreases in first four decile groups, and then rises in the fifth decile group. The ninth and first decile groups have almost the same effective rate. What I need here is a better redistribution of the tax burden and along with that a better redistribution of income. This might be achieved through slice step progressive rates.

However, the logical question is how the effective tax rates can decrease in the first four decile groups, since there are basically two rates, 0% through deductions and 10% as statutory rate. I can see three reasons for the decrease:

- As explained in the *sub-section 1.3.2.1 The System of Personal Income Taxation in the Federation of Bosnia and Herzegovina*, there are six sources of income where advance payment is treated as final liability without recognizing any deductions. That disturbs the principle of horizontal equity. The practice in some countries is to tax income from capital by one tax rate and treat it as final liability. However, only one source out of six is from capital and that one is not from dividends and capital gains. It is income from interests from given loans and payment of capital based on voluntary life and pension insurance.

- Taxpayers in three lowest decile groups do not necessarily claim at least personal exemption, because this type of exemption is not assigned automatically. Each taxpayer needs to have a tax card. By claiming personal exemption, taxpayers would be on average exempt completely in first two decile groups and partially in third decile group, except for the above mentioned six sources of income.

- It is the effect of a one-time relatively high income. This means that a taxpayer can earn a wage (wage before tax) of 900 KM in January and terminate his/her employment. However, that taxpayer gets into the lowest decile group sorted based on annual income. Such person has the right to claim a personal exemption of 300 KM per month, and pays tax of (900-300)*10% = 60 KM. However, a person who earned wage before tax of 900 KM spread over three months (300 KM + 300 KM + 300 KM) does not pay any tax because (300-300)*10% = 0 for each month. Therefore, both of them get into the lowest decile group, but the former pays tax, whereas the latter does not.

To determine which reason is in action, I look at the collected tax and income before tax, without those sources recognized as final liability, by decile groups determined by total income before tax.

Table 36. Current System – Income before Tax and Tax, in Annual Tax Return

Decile group	Income	Tax	Effective tax rate (%)
I	21,100,000	1,063,764	5.04
II	87,100,000	2,986,036	3.43
III	167,000,000	4,247,031	2.54
IV	223,000,000	4,209,144	1.89
V	258,000,000	5,366,912	2.08
VI	310,000,000	8,774,589	2.83
VII	404,000,000	14,700,000	3.64
VIII	506,000,000	21,700,000	4.29
IX	648,000,000	35,800,000	5.52
X	1,280,000,000	98,700,000	7.71
Total	3,904,200,000	197,547,376	5.06

Source: *Taxpayers' Database (2009)*; own calculations

Note:
"Decile group" refers to decile groups with respect to income before tax (gpd_dobitt).
"Income" refers to income before tax.
"Tax" refers to tax (gpd_porezz) burden of each decile group.
*"Effective tax rate (%)" calculates as tax/income before tax*100.*

It can be seen from Table 36 that the decrease in effective tax rate in the first four decile groups could practically be assigned to income that does not enter into the annual tax declaration. Mostly, however, it can be assigned to not using the personal exemption and the effect of a one-time relatively high income, already explained above. Here there might be two reasons why people do not claim deductions. One is that they are not informed properly about such deductions. The other is that they are lazy, but one cannot understand how people with such low income would be too lazy so as not to claim such deductions. Thus, this is very suspicious. The Tax Administration of the Federation of Bosnia and Herzegovina should pay more attention to these taxpayers, because they might lie in the area of grey economy.

3 RESULTS OF THE MICROSIMULATIONS

In the previous part, I explained the methodology of how I constructed the FBHMOD. Now I present results that the microsimulation model produced. I separated this part into four chapters. The first describes the scenarios simulated through the microsimulation model in the sense of the parameters used. The second presents the results of the simulated scenarios regarding of revenues and effective tax rates (percentage share of tax in income before tax). The third compares the results with theoretical foundations. The fourth covers the policy switching of the Slovenian and Croatian systems through the system of the FBiH.

3.1 Description of Scenarios (Parameters)

I simulated 16 scenarios with step progressive rates. These scenarios are in accordance with the systems of EU countries from the aspect of the number of marginal rates and their height. Rates in the EU are spread from 0% to over 50%. Some EU countries face a very high marginal rate in the top income bracket, but it was avoided because Bosnia and Herzegovina is not a developed country. In Table 37, I put all 16 scenarios with the different combination of rates, brackets, exemptions, and deductions. Income brackets are different combinations of an average net annual wage of the Federation of Bosnia and Herzegovina ranging from approximately one to approximately six.

More specifically, the scenarios were built in the following fashion. The Government of the Federation of Bosnia and Herzegovina considered those 16 scenarios as a part of personal income tax reform package. The intentions of the Government of the FBH were led by the principle of vertical equity and fairer tax system. Scenarios were listed in a manner as they were made up. In general, all listed scenarios were built on the basis of the average net annual wage in the FBH, and the average net annual wage in the public sector in the FBH.

Scenario S_1 introduces two rates. The lower rate is the current rate of 10% while the upper rate is 15%. Rate of 10% is applied on the tax base up to 9,600[92] KM which is approximately an average net annual wage in the FBH[93] (*Federalni zavod za statistiku* [Institute for Statistics of FB&H], 2012). The rate of 15% is arbitrarily chosen for the tax base higher than 9,600 KM.

It is important to note that approximately one-fourth of employed persons in the Federation of Bosnia and Herzegovina receives the income from the budget with the average net monthly wage of approximately 1,000 KM (*Federalni zavod za statistiku* [Institute for Statistics of FB&H], 2012). That was the rationale for creation of the Scenario S_2, which includes the current rate of 10% that is applied to the tax base up to 12,000 KM which is

[92] 800 KM monthly x 12 months

[93] 819.33 x 12 months = 9,832 KM precisely

approximately the average net annual wage of employees working in the public sector[94]. The 15% rate is used for the taxable income above 12,000 KM.

Scenario S_3 follows the rationale explained in the Scenario S_2, i.e. uses the average net wage of employees in the public sector. In this scenario, it was introduced one more rate of 20%. Therefore, this scenario has three rates: 10%, 15%, and 20%. The taxable income up to one average net annual wage (in the public sector) is taxed at the rate of 10% (up to 12,000 KM). The rate of 15% applies to the taxable income from one to two average net annual wages (from 12,000 to 24,000 KM), and rate of 20% applies to the taxable income higher than two average net annual wages (above 24,000 KM).

Scenario S_4 uses the combination of rationales used in the above scenarios, i.e. the basis is the combination of the average net annual wage in the FBH generally and the average net annual wage in the FBH public sector. The lowest bracket is set based on the average net annual wage in the FBH (9,600 KM) while the higher bracket is based on the average net annual wage in the FBH, but in the public sector (3 x 12,000 KM). Same as in the Scenario S_3, three rates have been used (10%, 15%, and 20%). The first income bracket is up to one average net annual wage (9,600 KM), the second bracket is from one average net annual wage in the FBH to three average net annual wages in the public sector (36,000 KM), which is almost four average net annual wages in the FBH (3.75 x 9,600 KM = 36,000 KM).

In the fifth Scenario S_5, the same rates are kept as in Scenarios S_3 and S_4, but the second income bracket goes from one to four average net annual wages in the public sector (4 x 12,000 KM; in Scenario S_4 – one to three average net annual wages in the public sector – 3 x 12,000 KM), which is five average net annual wages in the FBH (9,600 KM x 5 = 48,000 KM).

Scenario S_6 introduces the fourth rate of 25%, at the same time keeping other three rates the same (10%, 15%, and 20%). As opposed to Scenarios S_4 and S_5, the Scenario S_6 in the second income bracket places two and a half average net annual wages in the public sector (2.5 x 12,000 KM = 30,000 KM) as the upper limit (the rate of 15%) which is approximately three average net annual wages in the FBH (3.125 x 9,600 KM = 30,000 KM). The third income bracket goes from two and a half to five average net annual wages (30,000 KM – 60,000 KM) in the public sector (the rate of 20%), which is approximately six average net annual wages in the FBH (6.25 x 9,600 = 60,000 KM).

Scenario S_7 is different from Scenario S_6 in a way that instead of the top rate of 25%, it implies the rate of 30%.

[94] 11,940 KM precisely

The difference between S_8 and S_7 lies in the fact that the first income bracket upper limit is not an average net annual wage in the FBH (9,600 KM), but an average net annual wage in the public sector (12,000 KM).

Scenario S_9 increases the upper limit of the first income bracket up to one and a half average net annual wage in the public sector (18,000 KM) compared to Scenario S_8 and lowers the top rate from 30% to 25% (a scenario similar to S_6).

S_{10} is very similar to S_8 with the only difference in the lowest income bracket. The upper limit in the lowest income bracket is one and a half average net annual wage in the public sector (18,000 KM) while in Scenario S_8 it is one average net annual wage in the public sector (12,000 KM).

Scenario S_{11} uses the same parameters as Scenario S_{10}, but the rates are not marginal, and one rate is applied to entire tax base belonging to specific income bracket. Such fashion of applying tax rates is not known in practice.

Scenario S_{12} is derived from Scenario S_{10} with an addition of the rate of 5% for the taxable income up to one average net annual wage in the FBH.

Scenario S_{13} is very similar to Scenario S_{12}, only instead of the top rate of 30% it uses the top rate of 25%.

Scenario S_{14} merges second and third income bracket from Scenarios S_{12} and S_{13}, and assigns parameters to the second income bracket. The limits of the second income bracket are from 9,600 KM to 30,000 KM, with the rate of 10%. Earlier in Scenarios S_{12} and S_{13}, the second income bracket was from 9,600 KM to 18,000 with the rate of 10%, while the third income bracket was from 18,000 KM to 30,000 KM with the rate of 15%. In this scenario, after merging the second and third income bracket of Scenarios S_{12} and S_{13}, tax rate of 15% was eliminated. Therefore, the rates of 5%, 10%, 20% and 25% make Scenario S_{14}.

Scenario S_{15} is the same as Scenario S_4 regarding rates and brackets, with the only difference in personal exemption and dependent deductions. In Scenario S_{15}, exemption and deductions are increased. This means that the annual personal exemption increases from 3,600 KM to 4,200 KM (17% increase). Accordingly, dependent and other deductions also increase.

Similarly, Scenario S_{16} is similar to Scenario S_5, with difference same as between Scenarios S_{15} and S_4.

Overall, I can set these scenarios in three general groups. The first one is where the income brackets are formed based solely on the average net annual wage in the Federation of Bosnia and Herzegovina. The second group consists of scenarios that are formed based solely on the average net annual wage of employees in the public sector in the FBH. Finally, the third

group is formed based on scenarios that income brackets are the combination of both, average net annual wage in the FBH and average net annual wage in the public sector.

Only Scenario S_1 (income bracket – 1 ANAW[95]) belongs to the first group.

The following scenarios belong to the second group: Scenario S_2 (income bracket – 1ANAWPS[96]), S_3 (income bracket I - 1ANAWPS; income bracket II – 2ANAWPS), S_8 (income bracket I - 1ANAWPS; income bracket II – 2.5ANAWPS; income bracket III – 5ANAWPS), S_9 (income bracket I – 1.5ANAWPS; income bracket II – 2.5ANAWPS; income bracket III – 5ANAWPS), S_{10} (same as S_9), and S_{11} (same as S_9 and S_{10}).

The third group is formed of the rest of scenarios, which are S_4 (income bracket I – 1ANAW; income bracket II – 3ANAWPS), S_5 (income bracket I – 1ANAW; income bracket II – 4ANAWPS), S_6 (income bracket I – 1ANAW; income bracket II – 2.5ANAWPS; income bracket III – 5ANAWPS), S_7 (same as S_6), S_{12} (income bracket I – 1ANAW; income bracket II – 1.5ANAWPS; income bracket III – 2.5ANAWPS; income bracket IV – 5ANAWPS), S_{13} (same as S_{12}), S_{14} (income bracket I – 1ANAW; income bracket II – 2.5ANAWPS; income bracket III – 5ANAWPS), S_{15} (income bracket I – 1ANAW; income bracket II – 3ANAWPS) and S_{16} (income bracket I – 1ANAW; income bracket II – 4ANAWPS).

In the first group, Scenario S_1 starts with two rates (10% and 15%). The bottom rate is the same as the current PIT rate.

In the second group, Scenario S_2 continues with the above mentioned two rates (different income brackets than in Scenario S_1). Scenario S_3 introduces an additional rate of 20%. Scenarios S_8, S_9, S_{10}, and S_{11}, introduce one more rate of 25% (S_9) or 30% (S_8, S_{10} and S_{11}).

In the third group, Scenarios S_4, S_5, S_{15}, and S_{16} introduce three rates (10%, 15% and 20%). As it has already been mentioned above, Scenarios S_4 and S_{15}, as well as S_5 and S_{16} are with same parameters except for the personal exemption and the dependent and other deductions. Scenario S_6 introduces one more rate of 25% having all together four rates (10%, 15%, 20% and 25%) while S_7 introduces a top rate of 30% (four rates: 10%, 15%, 20% and 30%). Scenario S_{12} introduces again one more rate of 5%, achieving altogether five rates (5%, 10%, 15%, 20% and 30%). Another two scenarios S_{13} and S_{14} are also with the lowest rate of 5% (S_{13} – 5%, 10%, 15%, 20% and 25%; S_{14} – 5%, 10%, 20% and 25%).

I can also create additional two groups of scenarios. In the first group are those with the same personal exemption and dependent deductions as in the current system. In the second group are those with changes in the personal exemption and dependent deductions. Scenarios S_{15}

[95] Average Net Annual Wage (ANAW)
[96] Average Net Annual Wage in the Public Sector (ANAWPS)

and S_{16} are those with the changes in the tax allowances, as already mentioned above. All other scenarios keep the same tax allowances.

I can also create the groups according to the number of rates: two rates (S_1, S_2), three rates (S_3, S_4, S_5, S_{15}, S_{16}), four rates (S_6, S_7, S_8, S_9, S_{10}, S_{11}, S_{14}), and five rates (S_{12}, S_{13}).

Moreover, Table 37 includes the parameters of scenarios, for example, S_1 is Scenario 1 with two marginal tax rates, 10% and 15%, whereas the 10% rate is applied on a tax base up to 9,600 KM, whereas the 15% rate is applied on a tax base higher than 9,600 KM. The annual personal exemption for each taxpayer owning a tax card is 3,600 KM. The annual tax allowance for a dependent spouse is 1,800 KM. For the first dependent child, the annual tax allowance is also 1,800 KM; it is 2,520 KM for the second dependent child and 3,240 KM for the third and each subsequent dependent child. For other close family members, the tax allowance is 1,080 KM annually, and for disabled dependent family members/taxpayer himself/herself it is also 1,080 KM annually.

If I look at Table 37, overall, I can notice that rates range from 5% to 30%. Social security contribution rates are the same and not changed compared with the baseline scenario, which are 31% for wages and 4% for other sources of income, as already mentioned in previous chapters. Personal exemption stays unchanged as in the current system in scenarios 1 to 14, but it rises from 3,600 KM to 4,200 KM annually in Scenarios 15 and 16. Dependent deductions also rise in Scenarios 15 and 16.

Table 37. Scenarios

Scenarios	Tax schedule						Tax allowances						
	5%	10%	15%	20%	25%	30%	PE (in KM)	Spouse (in KM)	1st Child (in KM)	2nd Child (in KM)	3rd Child (in KM)	OCFM (in KM)	Disability (in KM)
(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)	(IX)	(X)	(XI)	(XII)	(XIII)	(XIV)
CS	-	tax base	-	-	-	-	3,600	1,800	1,800	2,520	3,240	1,080	1,080
S_1	-	≤ 9,600	> 9,600	-	-	-	3,600	1,800	1,800	2,520	3,240	1,080	1,080
S_2	-	≤ 12,000	> 12,000	-	-	-	3,600	1,800	1,800	2,520	3,240	1,080	1,080
S_3	-	≤ 12,000	> 12,000 ≤ 24,000	> 24,000	-	-	3,600	1,800	1,800	2,520	3,240	1,080	1,080
S_4	-	≤ 9,600	> 9,600 ≤ 36,000	>36,000	-	-	3,600	1,800	1,800	2,520	3,240	1,080	1,080
S_5	-	≤ 9,600	> 9,600 ≤ 48,000	>48,000	-	-	3,600	1,800	1,800	2,520	3,240	1,080	1,080
S_6	-	≤ 9,600	> 9,600 ≤ 30,000	> 30,000 ≤ 60,000	> 60,000	-	3,600	1,800	1,800	2,520	3,240	1,080	1,080
S_7	-	≤ 9,600	> 9,600 ≤ 30,000	> 30,000 ≤ 60,000	-	> 60,000	3,600	1,800	1,800	2,520	3,240	1,080	1,080
S_8	-	≤ 12,000	> 12,000 ≤ 30,000	> 30,000 ≤ 60,000	-	> 60,000	3,600	1,800	1,800	2,520	3,240	1,080	1,080

S_9	-	≤ 18,000	> 18,000 ≤ 30,000	> 30,000 ≤ 60,000	> 60,000	-	3,600	1,800	1,800	2,520	3,240	1,080	1,080
S_{10}	-	≤ 18,000	> 18,000 ≤ 30,000	> 30,000 ≤ 60,000	-	> 60,000	3,600	1,800	1,800	2,520	3,240	1,080	1,080
S_{11}[97]	-	≤ 18,000	≤ 30,000	≤ 60,000	-	> 60,000	3,600	1,800	1,800	2,520	3,240	1,080	1,080
S_{12}	≤ 9,600	> 9,600 ≤ 18,000	> 18,000 ≤ 30,000	> 30,000 ≤ 60,000	-	> 60,000	3,600	1,800	1,800	2,520	3,240	1,080	1,080
S_{13}	≤ 9,600	> 9,600 ≤ 18,000	> 18,000 ≤ 30,000	> 30,000 ≤ 60,000	> 60,000	-	3,600	1,800	1,800	2,520	3,240	1,080	1,080
S_{14}	≤ 9,600	> 9,600 ≤ 30,000	-	> 30,000 ≤ 60,000	> 60,000	-	3,600	1,800	1,800	2,520	3,240	1,080	1,080
S_{15}	-	≤ 9,600	> 9,600 ≤ 36,000	>36,000	-	-	**4,200**	**2,100**	**2,100**	**2,940**	**3,780**	**1,260**	**1,260**
S_{16}	-	≤ 9,600	> 9,600 ≤ 48,000	>48,000	-	-	**4,200**	**2,100**	**2,100**	**2,940**	**3,780**	**1,260**	**1,260**

Source: own Table

Note:

Column I: abbreviations for current system and 16 scenarios, i.e., CS stands for Current System, S_1 for Scenario 1, S_2 for Scenario 2, and so on.

Column II: income bracket on which a marginal tax rate of 5% is applied for each scenario.

Column III: income bracket on which a marginal tax rate of 10% is applied for each scenario.

Column IV: income bracket on which a marginal tax rate of 15% is applied for each scenario.

Column V: income bracket on which a marginal tax rate of 20% is applied for each scenario.

Column VI: income bracket on which a marginal tax rate of 25% is applied for each scenario.

Column VII: income bracket on which a marginal tax rate of 30% is applied for each scenario.

[97] Not marginal rates, but one rate applied to entire income. Not known in practice of personal income tax.

Column VIII: abbreviation PE stands for annual personal exemption, i.e., presents basic tax allowance for each taxpayer who possesses the tax card, as already explained in previous chapters.
Column IX: "Spouse" stands for the annual tax allowance for the dependent spouse.
Column X: "1st child" stands for the annual tax allowance for the first dependent child.
Column XI: "2nd child" stands for the annual tax allowance for the second dependent child.
Column XII: "3rd child" stands for the annual tax allowance for the third and each subsequent dependent child.
Column XIII: abbreviation OCFM stands for the annual tax allowance for the other close family member.
Column XIV: "Disability" stands for the annual tax allowance for the dependent family members with a disability and a taxpayer with a disability himself/herself.

3.2 Results

I can divide the analysis into two parts. First, I analyse scenarios when I encompass all sources of income. This means that I cover income filed in the Annual Tax Declaration, and income for which the tax is withheld at the source without the right for tax allowances and also not filed in the annual tax declaration (see Tables 38 and 39). Second, I analyse the scenarios when I cover income filed in the Annual Tax Declaration (see Tables 40 and 41). I use Tables 39 and 40 as auxiliary tables for calculation of effective tax rates in the Tables 38 and 41.

Sources of income filed in the Annual Tax Declaration and other sources of income

In the first part of the analysis, based on the parameters presented in Table 37, I calculated possible revenue collection and effective tax rates for all of them (see Tables 38 and 39).

Table 38 shows the current system and 16 scenarios regarding total collected revenues and effective tax rates when also taking into account sources of income that are not filed in the annual tax declaration besides those filed in the annual tax declaration. In the current system, collected revenues were around 200 million KM. The effective tax rate is around 5%. Since the statutory rate is 10%, it means that tax expenditures are also around 200 million KM. Effective rates from the first to the tenth decile group have the strange pattern, as already noticed in the *section 2.4.5 Analysis of the Current System*. The effective rate in the first decile group starts with 5.5%, then decreases in the second decile group, further in the third and fourth decile groups, and starts to increase in the fifth decile group (see Table 38). The reasons for such pattern may lie in a fact that sources of income that are not filed in the annual tax declaration are taxed with the top marginal tax rate in each scenario. Also, there is an effect of one-time relatively high income, explained in the *section 2.4.5 Analysis of the Current System*. There is also a possibility that taxpayers do not claim the tax allowances due to reasons already mentioned in the *section 2.4.5 Analysis of the Current System*. The top marginal rate applied to the sources of income that are not filed in the annual tax declaration gives me the reason I have the second part of the analysis that includes only those sources of income that are filed in the annual tax declaration.

In Scenario S_1, which has two rates, 10% and 15%, all decile groups face higher effective tax rate compared to the current system (see Table 38). However, those changes are minor, except in the tenth decile groups (CS – 7.69%; S_1 – 9.85%). The reason for higher effective tax rates in all decile groups compared to the current system lies in a fact that the highest marginal tax rate applies to the sources of income for which the tax is withheld at the source and treated as the final tax liability. Also, with those types of income, the taxpayers do not have the right to claim the tax allowances. Regarding Scenario S_1, it means that the top rate of 15% would be applied to those sources of income withheld at the source and treated as the final tax liability. If I put this in the context of Bosnia and Herzegovina, it means that all

taxpayers in all decile groups would be on average worse off. However, increases in the effective tax rates are small (seen on the first or second decimal place), and only relatively bigger increase (around 2%) is in the top decile group (see Table 38). Applying the rates from Scenario S_1, none of the taxpayers would be better off, and the government would collect approximately 15% more for the budget based on this source of fiscal revenue (see Table 38).

In Scenario S_2, also all decile groups are on average worse off than in the current system (see Table 38). Scenario S_2 is different from the Scenario S_1 because the income bracket for application of the top rate is moved to the higher level (from 9,600 KM to 12,000 KM). In our case, it means that the effective tax rates in the ninth and tenth decile groups are slightly lower than in Scenario S_1. Accordingly, estimated collected budget revenues from this source of income are higher by 12% as opposed to S_1, which shows an increase of 15%, compared to the current system in the FBH (see Table 38).

Scenarios S_3, S_4, and S_5, apply three rates (10%, 15%, 20%), and all three scenarios produce the results showing that almost all decile groups are on average worse off than in the current system, and in Scenarios S_1 and S_2 (see Table 38). Again, the top rate (in this case 20%), applies to the sources of income not filed in the annual tax declaration. As explained before, the difference between those three scenarios (S_3, S_4, and S_5) are income brackets to which these rates apply. All three scenarios produce the same effect from the first to the eighth decile groups, while S_4 and S_5 show different effect only in the tenth decile group compared to each other. Again, none of the taxpayers are better off compared to the current system. The revenues in the budget are estimated to increase by 17% for scenarios S_3 and S_5, and 18% for Scenario S_4, compared to the current system (see Table 38). Scenario S_4 is the same as Scenario S_3 regarding rates. The difference is the income bracket, where the lowest income bracket is moved from 12,000 KM to 9,600 KM, and the top income bracket is moved from 24,000 KM to 36,000 KM (see Table 37). Therefore, I can see an increase in the effective rates in the top two decile groups in S_4 compared to S_3. The difference between S_4 and S_5 is in the top bracket which is moved to the higher level (lowest income bracket 9,600 KM; top income bracket 48,000 KM), which results in the same effective tax rate in the tenth decile group as in S_3 (lowest income bracket 12,000 KM; top income bracket 24,000 KM). Overall effective tax rates for Scenarios S_3 and S_5 are almost the same.

Scenarios S_6 and S_9 again achieve higher effective tax rates than in the current system, while those two scenarios at the same time achieve same results in the first seven decile groups (see Table 38). Those scenarios are the same regarding rates (10%, 15%, 20% and 25%). Their first income bracket is different (9,600 KM in S_6 and 18,000 KM in S_9). Therefore, Scenario S_6 gains higher effective tax rates in the eighth, ninth, and tenth decile groups.

Scenarios S_7, S_8, S_{10}, and S_{11} again achieve higher effective tax rates than in the current system (see Table 38). Those three scenarios are the same in the sense of rates (10%, 15%, 20%, 30%). Scenarios S_7, S_8, S_{10}, have different first income bracket (9,600 KM in S_7;

12,000 KM in S_8; 18,000 KM in S_{10}). Scenario S_{11} is the same as S_{10} regarding rates and brackets, but it applies a respective marginal tax rate to entire income that belongs to specific income bracket. All four scenarios have the same effective tax rates up to the eighth decile group.

Scenario S_{12} is not similar to any other scenario in sense of rates (5%, 10%, 15%, 20%, 30%). Since this is a scenario that has a 5% rate in its structure, it can be combined with other two scenarios with a 5% rate, S_{13} and S_{14} (5%, 10%, 15%, 20%, 25%). In the so far analysis, scenario S_{12} is the first in the wide range of scenarios which achieves the effective tax rate lower than in the current system in all decile groups, except in the tenth decile group, where the effective tax rate is higher as in the other mentioned scenarios (see Table 38). The overall effective tax rate is lower by 14% (5.09% in the current system; 4.40% in S_{12}). Also, Scenario S_{13} faces lower effective tax rates in all decile groups except the tenth compared to the current system (see Table 38). This is a similar result also achieved by Scenario S_{12}. Scenario S_{14} faces even lower effective tax rate in the tenth decile group compared to the current system (decrease by 4%; 7.69% in the current system; 7.37% in S_{14}; see Table 38). The issue with all these three scenarios is insufficient expected budget revenues compared to the current system. Scenarios S_{12}, S_{13}, and S_{14}, achieve a decrease in revenues by 13%, 16%, and 25% respectively (see Table 38).

Scenarios S_{15} and S_{16} are the same in a sense of rates (10%, 15%, 20%), but with different second income bracket (36,000 KM in S_{15}; 48,000 KM in S_{16}). The joint characteristic of both scenarios is increased personal exemption and dependent deductions. Otherwise, those scenarios are the same as Scenarios S_4 and S_5 respectively, with the only difference in tax allowances. Scenarios S_{15} and S_{16} have the same results regarding effective tax rates in nine decile groups (see Table 38). Those two scenarios produce higher effective tax rate in the first decile group compared to the current system (increase by 13%; 5.5% in the current system; 6.24% in S_{15} and S_{16}). From the second to the ninth decile group, the effective tax rates are lower than in the current system. However, the overall effective tax rates are higher by 6% in S_{15} (5.09% in the current system; 5.42% in S_{15}) and 5% in S_{16} (5.09% in the current system; 5.37% in S_{16}), compared to the current system. At the same time, the expected collected revenues are higher by 7% in S_{15} and 6% in S_{16} (see Table 38).

However, to choose a specific scenario, I set criteria. The first criterion I set is "revenue neutrality". It means that, to consider a specific scenario, an estimated revenues should be at least what they are now. Keeping that criterion, I do not want to disturb budget stability. Revenues collected based on data from 2009 are around 200 million KM. If I compare the estimated revenues based on possible scenarios (S_n, where *n* goes from 0 to 16) to revenues currently collected, only scenarios S_{12}, S_{13}, and S_{14} do not face revenue neutrality. Others provide more revenues with percentage increases ranging from 6% in S_{16} to 32% in S_{11} (see Table 38). The effective tax rate for entire income in the current system is 5.09%. In all other scenarios, the effective tax rate is higher except in scenarios S_{12}, S_{13}, and S_{14}. The same applies to the effective tax rate in the first decile group. The effective tax rate in the second

decile group is slightly lower in scenarios S_{15} and S_{16} (besides scenarios S_{12}, S_{13}, and S_{14}) than in the current system. The same applies to other decile groups from the third decile group to the ninth decile group. In the tenth decile group, all scenarios except Scenario S_{14} show a higher effective tax rate than in the current system. Therefore, only scenarios S_{15} and S_{16} show lower effective tax rates in decile groups from II to IX, while at the same time gain slightly more revenues (or revenue neutrality) than now. In the first decile group, only scenarios S_1 and S_2 show lower (although higher than in the current system) effective tax rates than scenarios S_{15} and $S_{16.}$ However, scenarios S_1 and S_2 show all other effective tax rates higher than scenarios S_{15} and S_{16} (see Table 38).

Sources of income filed in the Annual Tax Declaration

In the second part of the analysis, I interpret numbers shown in Table 41. This table shows that the effective tax rate is around 5% in the current system. Since the statutory rate is 10%, it means that tax expenditures are as high as the collected tax (the government effectively collects around 200 million KM and it could collect an additional 200 million KM if the tax allowances were not in effect). Effective rates from the first to the tenth decile group have the same patterns as in the first part of the analysis when I also included the sources of income not filed in the annual tax declaration. The effective rate in the first decile group starts with 5.04%, then decreases in the second decile group, further in the third and fourth decile groups, and starts to increase in the fifth decile group. The possible reason for such behaviour is that taxpayers do not use the tax allowances. Another reason might be that taxpayers earned income for example once in a year and had right to claim tax allowances only once, as already mentioned above. For example, there are two taxpayers. Both of them had an annual income before tax 3,600 KM. A taxpayer A earned an income during one month while a taxpayer B earned 3,600 through 12 months. Both of them have a right to claim a tax allowance of 300 KM per month. Taxpayer A had to pay a tax in the amount of (3,600 – 300) x 10%, which is 330 KM while taxpayer B had to pay a zero tax (3,600 – 12 x 300).

Scenario S_1 produces the same effective tax rates in the decile groups from the first to the eighth, compared to the current system. Since the income bracket is 9,600 KM, which is the average net annual wage in the Federation of Bosnia and Herzegovina, it is clear that around 80% of the entire taxpayer population has the taxable income up to annual net average wage. From the first to the eighth decile group, scenarios S_1 to S_{11} keep the same effective tax rates as in the current system. Scenario S_1 faces the effective tax rate of 5.65% in the ninth decile group (5.52% in the current system; 2% increase), and 9.77% in the tenth decile group (7.71% in the CS; 27% increase).

In the Scenario S_2, the effective tax rate in the ninth decile group is 5.54% (5.52% in the current system; 0.4% increase), and in the tenth decile group is 9.38% (7.71% in the current system; 22% increase).

Scenario S_3 faces the same increase in the ninth decile group as Scenario S_2 (0.4% increase), and an increase of 31% (effective tax rate 10.08% in S_3) in the tenth decile group compared to the current system.

In Scenario S_4, the change in the effective tax rate appears in the tenth decile group where I note an increase of 32% (effective tax rate 10.16% in S_4) compared to the current system.

Scenario S_5, just as Scenario S_4, records the difference from the current system only in the tenth decile group. The difference is 31% (effective tax rate 10.08% in S_5), which is the same as in S_3.

Scenario S_6 faces the same increase in the ninth decile group as the Scenario S_1, that is 2% (effective tax rate 5.65% in S_6) while an increase in the tenth decile group is 37% (effective tax rate 10.55% in S_6) compared to the current system.

Scenario S_7 produces the same result for the ninth decile group as S_1 and S_6 while in the tenth decile group it achieves an increase of 40% (effective tax rate 10.78% in S_7) compared to the current system.

Scenario S_8 shows the same increase in the ninth decile group as scenarios S_2 and S_3 (0.3% increase). An increase in the tenth decile group for Scenario S_8 is 35% (effective tax rate 10.39% in S_8) compared to the current system.

Scenarios S_9, S_{10}, and S_{11}, have no changes in the ninth decile group compared to the current system, just as scenarios S_4 and S_5. Increases in the tenth decile group for those three scenarios are respectively 23% (S_9), 26% (S_{10}), and 58% (S_{11}) compared to the current system.

Summarizing these eleven scenarios, based on their results, I can consider them via two groups. One group is the scenarios which have changes only in the tenth decile group (S_4, S_5, S_9, S_{10}, S_{11}) and the second group are those that have changes in the ninth and tenth decile group (S_1, S_2, S_3, S_6, S_7, S_8) as compared to the current system.

Considering the first group, I place them in an order from the lowest to the highest percentage effective tax rate increase compared to the current system (23% - S_9, 26% - S_{10}, 31% - S_5, 32% - S_4, 58% - S_{11}). This means that those five scenarios put higher tax burden only on the highest income decile group and gain additional revenues for the budget.

In the same way I will organize the results in the next group. First, I place the scenarios in an order according to the ninth decile group, from the lowest to the highest percentage increase in the effective tax rate as compared to the current system (0.3% - S_8, 0.4% - S_2, 0.4% - S_3, 2% - S_1, 2% - S_6, 2% - S_7). According to the tenth decile group, the scenarios are as follows: 22% - S_2, 27% - S_1, 31% - S_3, 35% - S_8, 37% - S_6, 40% - S_7.

In the first group, the revenue increase ranges from 11% to 16% (excluding Scenario S_{11} which not applicable in practice), while in the second group it ranges from 11% to 20% (see Table 40). The revenue increase is on average similar in those two groups. Furthermore, the

revenue increase is the only characteristic that these scenarios achieve by placing a higher burden on higher earning individuals. Moreover, it would be less harmful to focus on the first group where the burden is placed only on the top income bracket. The increases in the effective tax rate for the tenth decile group in the first group range from 23% to 32% (excluding Scenario S_{11}), while in the second group they range from 22% to 40%. If I consider the four scenarios S_4, S_5, S_9, and S_{10} from the first group, I apply an additional criterion that is simplicity, and I prefer three rather than four rates (all four scenarios have either three or four rates). Therefore, in the group of the eleven scenarios, I prefer either S_4 or S_5, which have three rates.

Scenarios S_{12}, S_{13}, S_{14}, are scenarios with the lowest tax rate of 5%. This is different from the scenarios explained above, whereby those three scenarios (S_{12}, S_{13}, S14) introduce the rate that is lower than the current rate of 10%. This is optimal from the point of income and tax burden redistribution. However, looking at the results of those three scenarios regarding the estimated revenue collection, it would harm the budget stability. Estimated collected revenues are not revenue neutral (they are even less than revenue neutral). Nevertheless, I will analyse those scenarios from the point of income distribution and income redistribution. In all three scenarios (S_{12}, S_{13}, S_{14}) and in decile groups one to eight (contrast the 11 above mentioned scenarios that kept the same effective tax rates as in the current system) the effective tax rates are cut in half compared to the current system (see Table 41). Therefore, the tax burden of those taxpayers is reduced. Also, the tax burden of the taxpayers in the ninth decile group is also reduced, but slightly less than half. Likewise, in Scenario S_{14}, the tax burden has been reduced slightly even in the tenth decile group. Therefore, Scenario S_{14} produces less tax burden for everyone. At the same time, the tax burden of the tenth decile group in Scenarios S_{12} and S_{13} is increased, measured by the effective tax rates. In Scenario S_{12}, the effective tax rate increases by 14% in the tenth decile group (from 7.71% to 8.83%), while in Scenario S_{13}, the effective tax rate increases by 11% in the tenth decile group (from 7.71% to 8.59%). Therefore, scenarios S_{12} and S_{13} would be interesting from the point of income redistribution, where only the taxpayers in the tenth decile group would face a higher tax burden, while all others would face a lower tax burden. However, the overall effective tax rates are lower by 17% in S_{12} (5.06% in the current system; 4.18% in S_{12}) and 19% in S_{13} (4.1% in S_{13}) compared to the current system. This indicates that the estimated revenue collection based on those two scenarios is lower than the current revenue collection that impacts budget stability.

Scenarios S_{15} and S_{16} regarding rates and income brackets are the same as S_4 and S_5, which were our preference in the first group of scenarios that kept the same tax burden in nine decile groups, with the exception of the tenth decile group. The difference between Scenarios S_4 and S_5, and S_{15} and S_{16} are the tax allowances. In scenarios S_{15} and S_{16}, the tax allowances are increased. The personal exemption is increased by 17% (from 3,600 KM to 4,200 KM), and all other deductions follow suit (derived from the personal exemption). In both scenarios, S_{15} and S_{16}, taxpayers in nine decile groups face the same impact, which is a decrease of effective tax rates as compared to the current system. The only increase in tax burden is for

taxpayers in the tenth decile group by 26% (from 7.71% to 9.69%) in S_{15} and 24% (from 7.71% to 9.53%) in S_{16}. From the point of income redistribution, those two scenarios reduce the tax burden for taxpayers in nine decile groups, and increase tax burden for taxpayers in the tenth decile group. As opposed to scenarios S_{12} and S_{13} which make a similar effect to income distribution (decrease of the tax burden for nine decile groups and an increase of the tax burden in the tenth decile group), scenarios S_{15} and S_{16} gain enough revenues for the budget, meaning that the stability of the budget has not been disturbed. The overall effective tax rate increases by 5% for S_{15} (5.06% in the current system; 5.31% in S_{15}), and 4% for S_{16} (5.06% in the current system; 5.26% in S_{16}).

Looking at the revenues collected only from those sources of income filed in the annual tax declaration (see Table 40), I notice the same as when observing all sources of income (explained above), i.e., scenarios S_{12}, S_{13}, and S_{14} do not provide revenue neutrality. The current system (without tax considered as the final liability) collects around 197 million KM based on data from 2009. The percentage increase in revenues ranges from 4% in S_{16} to 29% in S_{11}.

The effective tax rate in the current system for this group of income sources is 5.06%. The effective tax rate is higher than in the current system in all scenarios that estimate revenue neutrality (some are even higher than revenue neutral). Effective tax rates in eight decile groups (I–VIII), for scenarios obtaining revenue neutrality (or higher), are the same as in the current system except for S_{15} and S_{16}, where they are lower. In the ninth decile group, considering only scenarios with revenue neutrality (or higher), scenarios S_4, S_5, S_9, S_{10}, and S_{11} show the same effective rate as the current system. Scenarios S_1, S_2, S_3, S_6, S_7, and S_8, show higher effective tax rates, whereas S_{15} and S_{16} show such rates to be lower than the current ones. In the tenth decile group, all scenarios obtaining revenue neutrality (or higher) show a higher effective tax rate. Therefore, only scenarios S_{15} and S_{16} show lower effective tax rates than the current system in decile groups from I to IX and at the same time achieve at neutrality or higher (see Table 41).

Overall, when evaluating the different scenarios, as I said earlier, I eliminated those that do not gain at least as much revenue as collected currently. However, if I look at scenarios S_1 to S_{11}, I cannot see any winners, but only losers. The only winner is the state. Therefore, such scenarios would place a heavier burden on higher-earning individuals without redistributing the burden from higher-earning individuals to lower-earning individuals. Scenarios S_{12}, S_{13}, and S_{14}, show a reduction in effective tax rates for lower-earning individuals, but do not provide revenue neutrality. Scenarios S_{15} and S_{16} reduce the effective tax rates for lower-earning individuals and raise the effective rate for the highest decile group. At the same time, the overall effective tax rate for those two scenarios has a slight increase, and estimated revenues increase as well, compared to the current system. From the current point of view, when taking into account revenues collected, and redistribution of income and the tax burden, only scenarios S_{15} and S_{16} satisfy those principles.

Table 38. Effective Tax Rates: Current System and All Scenarios

Decile group (I)	CS (II)	S_1 (III)	S_2 (IV)	S_3 (V)	S_4 (VI)	S_5 (VII)	S_6 (VIII)	S_7 (IX)	S_8 (X)	S_9 (XI)	S_{10} (XII)	S_{11} (XIII)	S_{12} (XIV)	S_{13} (XV)	S_{14} (XVI)	S_{15} (XVII)	S_{16} (XVIII)
I	5.50	5.98	5.98	6.46	6.46	6.46	6.94	7.42	7.42	6.94	7.42	7.42	5.15	4.67	4.67	6.24	6.24
II	3.65	3.82	3.82	3.99	3.99	3.99	4.16	4.32	4.32	4.16	4.32	4.32	2.67	2.50	2.50	3.63	3.63
III	2.62	2.68	2.68	2.74	2.74	2.74	2.79	2.85	2.85	2.79	2.85	2.85	1.59	1.53	1.53	2.25	2.25
IV	1.93	1.96	1.96	1.99	1.99	1.99	2.01	2.04	2.04	2.01	2.04	2.04	1.10	1.07	1.07	1.47	1.47
V	2.10	2.12	2.12	2.14	2.14	2.14	2.15	2.17	2.17	2.15	2.17	2.17	1.13	1.12	1.12	1.59	1.59
VI	2.87	2.89	2.89	2.91	2.91	2.91	2.94	2.96	2.96	2.94	2.96	2.96	1.55	1.53	1.53	2.33	2.33
VII	3.67	3.69	3.69	3.72	3.72	3.72	3.74	3.77	3.77	3.74	3.77	3.77	1.96	1.94	1.94	3.08	3.08
VIII	4.30	4.32	4.32	4.34	4.34	4.34	4.36	4.36	4.36	4.34	4.36	4.36	2.23	2.21	2.21	3.63	3.63
IX	5.54	5.69	5.58	5.60	5.71	5.71	5.72	5.75	5.63	5.60	5.62	5.62	3.00	2.97	2.97	5.00	5.00
X	7.69	9.85	9.46	10.15	10.23	10.15	10.69	10.92	10.54	9.62	9.92	12.38	9.08	8.77	7.37	9.77	9.62
Total	5.09	5.84	5.70	5.95	5.99	5.96	6.16	6.26	6.11	5.79	5.91	6.72	4.40	4.27	3.81	5.42	5.37
Total tax revenues	200.4	230.1 (15%)	224.4 (12%)	234.3 (17%)	236.0 (18%)	235.0 (17%)	242.8 (21%)	246.6 (23%)	240.8 (20%)	227.9 (14%)	232.7 (16%)	264.7 (32%)	173.3 (-13%)	168.3 (-16%)	150.1 (-25%)	213.6 (7%)	211.6 (6%)

Source: *Taxpayers' Database (2009)*; own calculations

Note:

"Decile group" refers to decile groups with respect to income before tax.

Columns II to XVIII: abbreviations for current system and the 16 scenarios, i.e., CS stands for Current System, S_1 for Scenario 1, S_2 for Scenario 2, and so on.

Rows II to XII: effective tax rates by decile groups and total effective tax rate for the current system and the 16 scenarios.

Row XIII (Total tax revenues): revenues collected through the current system and estimated revenues for 16 scenarios in million KM.

Table 39. Current and Possible Systems – Total Income before Tax and Tax

Decile group (I)	Income (II)	CS (III)	S_1 (IV)	S_2 (V)	S_3 (VI)	S_4 (VII)	S_5 (VIII)	S_6 (IX)	S_7 (X)
I	23,400,000	1,287,969	1,400,072	1,400,072	1,512,174	1,512,174	1,512,174	1,624,277	1,736,379
II	90,100,000	3,289,160	3,440,722	3,440,722	3,592,285	3,592,285	3,592,285	3,743,847	3,895,409
III	169,000,000	4,434,600	4,528,385	4,528,385	4,622,170	4,622,170	4,622,170	4,715,954	4,809,739
IV	224,000,000	4,329,636	4,389,882	4,389,882	4,450,128	4,450,128	4,450,128	4,510,374	4,570,621
V	259,000,000	5,452,091	5,494,681	5,494,681	5,537,271	5,537,271	5,537,271	5,579,860	5,622,450
VI	311,000,000	8,920,115	8,992,878	8,992,878	9,065,641	9,065,641	9,065,641	9,138,403	9,211,166
VII	406,000,000	14,900,000	15,000,000	15,000,000	15,100,000	15,100,000	15,100,000	15,200,000	15,300,000
VIII	507,000,000	21,800,000	21,900,000	21,900,000	22,000,000	22,000,000	22,100,000	22,100,000	22,100,000
IX	650,000,000	36,000,000	37,000,000	36,300,000	36,400,000	37,100,000	37,100,000	37,200,000	37,400,000
X	1,300,000,000	100,000,000	128,000,000	123,000,000	132,000,000	133,000,000	132,000,000	139,000,000	142,000,000
Total	3,939,500,000	200,413,571	230,146,620	224,446,620	234,279,669	235,979,669	234,979,669	242,812,715	246,645,764

Source: *Taxpayers' Database (2009)*; own calculations

Note:

Column I (Decile group): refers to decile groups with respect to income before tax.

Column II (Income): refers to income before tax in KM by decile groups.

Columns III to X: abbreviations for current system and seven scenarios, i.e., CS stands for Current System, S_1 for Scenario 1, S_2 for Scenario 2, and so on; each column shows estimated tax in KM by decile groups through CS and scenarios.

Table 39. Current and Possible Systems – Total Income before Tax and Tax (continued)

Decile group (I)	Income (II)	CS (III)	S_8 (IV)	S_9 (V)	S_{10} (VI)	S_{11} (VII)	S_{12} (VIII)	S_{13} (IX)	S_{14} (X)
I	23,400,000	1,287,969	1,736,379	1,624,277	1,736,379	1,736,379	1,204,497	1,092,395	1,092,395
II	90,100,000	3,289,160	3,895,409	3,743,847	3,895,409	3,895,409	2,402,391	2,250,829	2,250,829
III	169,000,000	4,434,600	4,809,739	4,715,954	4,809,739	4,809,739	2,686,224	2,592,439	2,592,439
IV	224,000,000	4,329,636	4,570,621	4,510,374	4,570,621	4,570,621	2,466,049	2,405,803	2,405,803
V	259,000,000	5,452,091	5,622,450	5,579,860	5,622,450	5,622,450	2,938,994	2,896,404	2,896,404
VI	311,000,000	8,920,115	9,211,166	9,138,403	9,211,166	9,211,166	4,823,872	4,751,109	4,751,109
VII	406,000,000	14,900,000	15,300,000	15,200,000	15,300,000	15,300,000	7,962,511	7,858,573	7,858,573
VIII	507,000,000	21,800,000	22,100,000	22,000,000	22,100,000	22,100,000	11,300,000	11,200,000	11,200,000
IX	650,000,000	36,000,000	36,600,000	36,400,000	36,500,000	36,500,000	19,500,000	19,300,000	19,300,000
X	1,300,000,000	100,000,000	137,000,000	125,000,000	129,000,000	161,000,000	118,000,000	114,000,000	95,800,000
Total	3,939,500,000	200,413,571	240,845,764	227,912,715	232,745,764	264,745,764	173,286,538	168,347,552	150,147,552

Source: *Taxpayers' Database (2009)*; own calculations

Note:

Column I (Decile group): refers to decile groups with respect to income before tax.

Column II (Income): refers to income before tax in KM by decile groups.

Columns III to X: abbreviations for current system and seven scenarios, i.e., CS stands for Current System, S_8 for Scenario 8, S_9 for Scenario 9, and so on; each column shows estimated tax in KM by decile groups through CS and scenarios.

Table 39. Current and Possible Systems – Total Income before Tax and Tax (continued)

Decile group (I)	Income (II)	CS (III)	S_{15} (IV)	S_{16} (V)
I	23,400,000	1,287,969	1,460,144	1,460,144
II	90,100,000	3,289,160	3,271,147	3,271,147
III	169,000,000	4,434,600	3,805,115	3,805,115
IV	224,000,000	4,329,636	3,293,923	3,293,923
V	259,000,000	5,452,091	4,127,711	4,127,711
VI	311,000,000	8,920,115	7,234,136	7,234,136
VII	406,000,000	14,900,000	12,500,000	12,500,000
VIII	507,000,000	21,800,000	18,400,000	18,400,000
IX	650,000,000	36,000,000	32,500,000	32,500,000
X	1,300,000,000	100,000,000	127,000,000	125,000,000
Total	3,939,500,000	200,413,571	213,592,176	211,592,176

Source: *Taxpayers' Database (2009)*; own calculations

Note:

Column I (Decile group): refers to decile groups with respect to income before tax.

Column II (Income): refers to income before tax in KM by decile groups.

Columns III to V: abbreviations for current system and two scenarios, i.e., CS stands for Current System, S_{15} for Scenario 15, S_{16} Scenario 16; each column shows estimated tax in KM by decile groups through CS and scenarios.

Table 40. Current and Possible Systems – Income before Tax and Tax, Filed in Annual Tax Return

Decile group (I)	Income (II)	CS (III)	S_1 (IV)	S_2 (V)	S_3 (VI)	S_4 (VII)	S_5 (VIII)	S_6 (IX)	S_7 (X)
I	21,100,000	1,063,764	1,063,764	1,063,764	1,063,764	1,063,764	1,063,764	1,063,764	1,063,764
II	87,100,000	2,986,036	2,986,036	2,986,036	2,986,036	2,986,036	2,986,036	2,986,036	2,986,036
III	167,000,000	4,247,031	4,247,031	4,247,031	4,247,031	4,247,031	4,247,031	4,247,031	4,247,031
IV	223,000,000	4,209,144	4,209,144	4,209,144	4,209,144	4,209,144	4,209,144	4,209,144	4,209,144
V	258,000,000	5,366,912	5,366,912	5,366,912	5,366,912	5,366,912	5,366,912	5,366,912	5,366,912
VI	310,000,000	8,774,589	8,774,589	8,774,589	8,774,589	8,774,589	8,774,589	8,774,589	8,774,589
VII	404,000,000	14,700,000	14,700,000	14,700,000	14,700,000	14,700,000	14,700,000	14,700,000	14,700,000
VIII	506,000,000	21,700,000	21,700,000	21,700,000	21,700,000	21,700,000	21,700,000	21,700,000	21,700,000
IX	648,000,000	35,800,000	36,600,000	35,900,000	35,900,000	36,600,000	36,600,000	36,600,000	36,600,000
X	1,280,000,000	98,700,000	125,000,000	120,000,000	129,000,000	130,000,000	129,000,000	138,000,000	138,000,000
Total	3,904,200,000	197,547,376	224,647,476	218,947,476	227,947,476	229,647,376	228,647,376	237,647,476	237,647,476
% Change	-	-	14	11	15	16	16	19	20

Source: *Taxpayers' Database (2009)*; own calculations

Note:

Column I (Decile group): refers to decile groups with respect to income before tax filed in the annual tax declaration.

Column II (Income): refers to income before tax filed in the annual tax declaration in KM by decile groups.

Columns III to X: abbreviations for current system and seven scenarios, i.e., CS stands for Current System, S_1 for Scenario 1, S_2 for Scenario 2, and so on; each column shows estimated tax in KM by decile groups through CS and scenarios.

Last row (% Change): percentage difference of estimated tax by different scenarios compared with the current system.

Table 40. Current and Possible Systems – Income before Tax and Tax, Filed in Annual Tax Return (continued)

Decile group (I)	Income (II)	CS (III)	S_8 (IV)	S_9 (V)	S_{10} (VI)	S_{11} (VII)	S_{12} (VIII)	S_{13} (IX)	S_{14} (X)
I	21,100,000	1,063,764	1,063,764	1,063,764	1,063,764	1,063,764	531,882	531,882	531,882
II	87,100,000	2,986,036	2,986,036	2,986,036	2,986,036	2,986,036	1,493,018	1,493,018	1,493,018
III	167,000,000	4,247,031	4,247,031	4,247,031	4,247,031	4,247,031	2,123,515	2,123,515	2,123,515
IV	223,000,000	4,209,144	4,209,144	4,209,144	4,209,144	4,209,144	2,104,572	2,104,572	2,104,572
V	258,000,000	5,366,912	5,366,912	5,366,912	5,366,912	5,366,912	2,683,456	2,683,456	2,683,456
VI	310,000,000	8,774,589	8,774,589	8,774,589	8,774,589	8,774,589	4,387,295	4,387,295	4,387,295
VII	404,000,000	14,700,000	14,700,000	14,700,000	14,700,000	14,700,000	7,338,883	7,338,883	7,338,883
VIII	506,000,000	21,700,000	21,700,000	21,700,000	21,700,000	21,700,000	10,900,000	10,900,000	10,900,000
IX	648,000,000	35,800,000	35,900,000	35,800,000	35,800,000	35,800,000	18,700,000	18,700,000	18,700,000
X	1,280,000,000	98,700,000	133,000,000	121,000,000	124,000,000	156,000,000	113,000,000	110,000,000	91,900,000
Total	3,904,200,000	197,547,376	231,947,476	219,847,476	222,847,476	254,847,476	163,262,621	160,262,621	142,162,621
% Change	-	-	17	11	13	29	-17	-19	-28

Source: *Taxpayers' Database (2009)*; own calculations

Note:

Column I (Decile group): refers to decile groups with respect to income before tax filed in the annual tax declaration.

Column II (Income): refers to income before tax filed in the annual tax declaration in KM by decile groups.

Columns III to X: abbreviations for current system and seven scenarios, i.e., CS stands for Current System, S_8 for Scenario 8, S_9 for Scenario 9, and so on; each column shows estimated tax in KM by decile groups through CS and scenarios.

Last row (% Change): percentage difference of estimated tax by different scenarios compared with the current system.

Table 40. Current and Possible Systems – Income before Tax and Tax, Filed in Annual Tax Return (continued)

Decile group (I)	Income (II)	CS (III)	S_{15} (IV)	S_{16} (V)
I	21,100,000	1,063,764	1,011,734	1,011,734
II	87,100,000	2,986,036	2,664,898	2,664,898
III	167,000,000	4,247,031	3,429,976	3,429,976
IV	223,000,000	4,209,144	3,052,938	3,052,938
V	258,000,000	5,366,912	3,957,353	3,957,353
VI	310,000,000	8,774,589	6,943,084	6,943,084
VII	404,000,000	14,700,000	12,100,000	12,100,000
VIII	506,000,000	21,700,000	18,200,000	18,200,000
IX	648,000,000	35,800,000	32,000,000	32,000,000
X	1,280,000,000	98,700,000	124,000,000	122,000,000
Total	3,904,200,000	197,547,376	207,359,983	205,359,983
% Change	-	-	5	4

Source: *Taxpayers' Database (2009)*; own calculations

Note:

Column I (Decile group): refers to decile groups with respect to income before tax filed in the annual tax declaration.

Column II (Income): refers to income before tax filed in the annual tax declaration in KM by decile groups.

Columns III to V: abbreviations for current system and two scenarios, i.e., CS stands for Current System, S_{15} for Scenario 15, and S_{16} for Scenario 16; each column shows estimated tax in KM by decile groups through CS and scenarios.

Last row (% Change): percentage difference of estimated tax by different scenarios compared with the current system.

Table 41. Effective Tax Rates: Current System and All Scenarios for the Income before Tax, Filed in Annual Tax Declaration

Decile group (I)	CS (II)	S_1 (III)	S_2 (IV)	S_3 (V)	S_4 (VI)	S_5 (VII)	S_6 (VIII)	S_7 (IX)	S_8 (X)	S_9 (XI)	S_{10} (XII)	S_{11} (XIII)	S_{12} (XIV)	S_{13} (XV)	S_{14} (XVI)	S_{15} (XVII)	S_{16} (XVIII)
I	5.04	5.04	5.04	5.04	5.04	5.04	5.04	5.04	5.04	5.04	5.04	5.04	2.53	2.53	2.53	4.79	4.79
II	3.43	3.43	3.43	3.43	3.43	3.43	3.43	3.43	3.43	3.43	3.43	3.43	1.71	1.71	1.71	3.06	3.06
III	2.54	2.54	2.54	2.54	2.54	2.54	2.54	2.54	2.54	2.54	2.54	2.54	1.27	1.27	1.27	2.05	2.05
IV	1.89	1.89	1.89	1.89	1.89	1.89	1.89	1.89	1.89	1.89	1.89	1.89	0.94	0.94	0.94	1.20	1.20
V	2.08	2.08	2.08	2.08	2.08	2.08	2.08	2.08	2.08	2.08	2.08	2.08	1.04	1.04	1.04	1.53	1.53
VI	2.83	2.83	2.83	2.83	2.83	2.83	2.83	2.83	2.83	2.83	2.83	2.83	1.42	1.42	1.42	2.24	2.24
VII	3.64	3.64	3.64	3.64	3.64	3.64	3.64	3.64	3.64	3.64	3.64	3.64	1.82	1.82	1.82	3.00	3.00
VIII	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	4.29	2.15	2.15	2.15	3.60	3.60
IX	5.52	5.65	5.54	5.54	5.52	5.52	5.65	5.65	5.54	5.52	5.52	5.52	2.89	2.89	2.89	4.94	4.94
X	7.71	9.77	9.38	10.08	10.16	10.08	10.55	10.78	10.39	9.45	9.69	12.19	8.83	8.59	7.18	9.69	9.53
Total	5.06	5.75	5.61	5.84	5.88	5.86	6.01	6.09	5.94	5.63	5.71	6.53	4.18	4.1	3.64	5.31	5.26

Source: *Taxpayers' Database (2009)*; own calculations

Note:

Decile group: refers to decile groups with respect to income before tax filed in the annual tax declaration.

Columns II to XVIII: abbreviations for current system and 16 scenarios, i.e., CS stands for Current System, S_1 for Scenario 1, S_2 for Scenario 2, and so on.

Rows II to XII: effective tax rates by decile groups and total effective tax rate for the current system and 16 scenarios.

3.3 Comparison of Results with Theoretical Foundations

In this chapter I compare the findings with theoretical tax effects and with inequality and progressivity measures.

3.3.1 Comparison with Tax Effects

In the previous chapters I covered the tax effects. Now, I compare my findings with the theoretical background.

As already mentioned in previous chapters, the tax effects I should consider when evaluating a specific personal income tax system are:

1) revenues;
2) deadweight loss;
3) income re(distribution);
4) vertical and horizontal equity;
5) costs;
6) simplicity;
7) utility and development goals.

I evaluate the current system and the possible scenarios in the above listed context.

Current vs. Possible Scenarios

Each reform should gain at least as much *revenues* as the current system does. Scenarios S_{12}, S_{13}, and S_{14} do not collect a sufficient amount of revenues that would create at least revenue neutrality, so I can ignore them.

Moreover, each tax causes distortions and along with that might reduce efficiency and produce *deadweight loss*. The area of a triangle that represents the deadweight loss depends on the height of taxes and the elasticity of labour supply and demand. As the tax rate increases the loss might increase. Therefore, progressive taxation might increase the deadweight loss. Thus, the current system might produce higher efficiency than the system with slice progressive tax rates.

However, government should make a trade-off between deadweight loss and *redistribution* of income. The system can have higher inefficiency if makes improvements in the area of income redistribution between higher- and lower-earning individuals. As I covered before, the purpose of progressivity is income redistribution. That means that each new system should make winners and losers of reforms. A higher income distribution than the current distribution can be achieved in three ways:

- the lowest tax rate must be lower than 10%, and higher tax rate(s) must be higher than 10%, or
- personal exemption and dependent and other deductions must increase, or
- the lowest rate can stay at 10%, but higher collected governmental revenues should make utility to taxpayers. This can happen either by making investments or giving social transfers that would redistribute income.

However, one needs to have in mind that redistributive programmes reduce incentives to work, accordingly producing efficiency costs. Redistribution, for example, one euro from higher-earning individuals to lower-earning individuals, may lead the government to place the welfare cost that is greater than one euro on higher-earning individuals (Immervoll, Kleven, Kreiner, & Saez, 2007).

When I look at scenarios S_1 to S_{11}, deductions stay at the same level and the lowest tax rate also stays at 10%. In that way income redistribution can be achieved only through social transfers. For those cases the income redistribution cannot be achieved through transfer of burden from lower-earning individuals to higher-earning individuals. If the government does not have a specific aim for development goals or social transfers out of more revenues collected, the only winner is government with more revenues in the budget for expenditures. Therefore, it might happen that at the end of the day there are higher tax rates, higher deadweight loss, and no income redistribution. If that might happen, the current system would be more suitable.

Scenarios S_{12}, S_{13}, and S_{14} produce income redistribution, but do not gain enough revenues for government (i.e., they are not revenue neutral). It seems that scenarios S_{15} and S_{16} might give higher deadweight loss due to the increase in tax rates, but make income redistribution through an increase of deductions and progressive rates (if I consider sources of income that are filed in the annual tax declaration without those creating horizontal inequity). As presented in the chapter "Results", scenarios S_{15} and S_{16} showed the best performance in terms of income distribution through effective rates. Therefore, S_{15} and S_{16} produce at least revenue neutrality and income redistribution, although these two scenarios might increase the deadweight loss compared with the current system.

When I consider *vertical equity*, a slice progressive system would be more acceptable than the current system because people with a higher ability to pay should pay higher taxes. When I think about *horizontal equity*, it is already diminished by treating the previously mentioned six sources of income in a way that deductions are not applicable to them. The same would stay with all different possible scenarios. Such source of income would be taxed with the highest progressive rate. The government should reconsider such legal solutions, because such a system causes effective rates to go higher in first decile group of income and then decrease going further.

The current system is simpler than the alternative system with more than one rate. Since the Law on Personal Income Tax has been in effect since 2009, taxpayers are already used to this taxation of personal income. Therefore, the switch to more rates should not be a problem for taxpayers, because they are already familiar with the concept of personal income tax.
Based on a conversation with the Tax Administration of the Federation of Bosnia and Herzegovina, the *costs* to implement a system with progressive rates should not be high since they already have a system that they will modify accordingly.

I can consider scenarios with a significant increase in revenues without making any redistribution of income, only if those revenues serve *development goals* and in such way that give *utility* to taxpayers. Therefore, if the rates for higher-earning individuals are increased, more money is collected that should be invested in development goals so that taxpayers can achieve utility of paying taxes.

In Table 42 I summarize the effects of different scenarios compared with the current one.

Table 42. Evaluation

Effects	S_1	S_2	S_3	S_4	S_5	S_6	S_7	S_8	S_9	S_{10}	S_{11}	S_{12}	S_{13}	S_{14}	S_{15}	S_{16}
Revenues	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↓	↓	↓	↑	↑
Possible change in deadweight loss	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
Redistribution from higher-earning individuals to lower-earning individuals	0	0	0	0	0	0	0	0	0	0	0	+	+	+	+	+
Winners	no	no	no	no	no	no	no	no	no	no	no	yes	yes	yes	yes	yes
Losers	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Vertical equity	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
Horizontal equity	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Simplicity	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
Costs	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑

Source: own Table

Table 42 summarizes the tax effects for evaluation of all scenarios compared with the current system. There are types of signs/words used in the table: "↑" means that the specific tax effect goes up compared with the current system; "↓" means that the specific tax effect goes down compared with the current system; "0" means no improvements compared with the current system; "+" means improvements compared with the current system; "yes" means the effect exists; and "no" means the effect does not exist. Table 29 reads in the following way: Scenario 1 (S_1) collects more revenues than the current system (revenues "↑"), deadweight loss might increase compared with current system although I am not able to measure it (deadweight loss "↑"), there is no redistribution from higher-earning individuals to lower-earning individuals (redistribution "0"), there are no winners from reform (winner "no"), there are losers from reform (losers "yes"), vertical equity increases compared with the current system (vertical equity "↑"), there are no improvements in horizontal equity (horizontal equity "0"), simplicity decreases compared with the current system (simplicity "↓"), and costs increase due to the introduction of a slice progressive system (costs "↑").

The assumption that I state is that there is no specific aim of the government for reasonable social transfers or development goals.

All those scenarios have six out of nine effects in common, with same conclusions on tax effects:

(1) Deadweight loss might increase due to step progressive taxation; I am not able to measure that, but I should be aware of it as theoretical concept.
(2) Losers exist in all scenarios.
(3) Vertical equity increases for all scenarios because of step progressive taxation.
(4) Horizontal equity stays the same because of the earlier mentioned six sources of income.
(5) Simplicity goes down because a step progressive system is more complex than a flat rate system.
(6) Costs go up because of the introduction of a new system.

What makes them different from each other are the following:

(1) revenues;
(2) redistribution of income from higher-earning individuals to lower-earning individuals;
(3) winners from reform.

Because all of them, except scenarios S_{12}, S_{13}, and S_{14}, produce more than revenue neutrality, I proceed to the next two effects (redistribution and winners from reform). Only in scenarios S_{15} and S_{16} can I notice redistribution from higher-earning individuals to lower-earning individuals and winners from reform, while at the same time achieving at least as much revenues as in the current system. I showed the same in the previous *chapter 3.2 Results*.

3.3.2 Inequality and Progressivity Measures for Personal Income and Personal Income Tax in the Federation of Bosnia and Herzegovina

In this section I compare previous findings (under the *chapter 3.2 Results* and under *section 3.3.1 Comparison with Tax Effects*) with calculated measures of inequality and progressivity.

3.3.2.1 Gini Coefficient, Atkinson Index, and Coefficient of Squared Variation (I_2)

I first calculated the Gini coefficient for pre-tax income. Next, I calculated the Gini for after-tax income, not only for the current system but also for all other possible scenarios of personal income tax in the Federation of Bosnia and Herzegovina, as well as the Atkinson index and the coefficient of squared variation. I calculated those different coefficients/indices because they all have benefits and drawbacks. Therefore, I want to check what they mean in my dataset and the scenarios. Since, they have sensitivity to different levels of income, they might produce different results.

Table 43. Gini coefficient, Atkinson index, and coefficient of squared variation (I_2)

(I)	CS: Pre-tax income (II)	CS: After-tax income (III)	S_1 (IV)	S_2 (V)	S_3 (VI)	S_4 (VII)	S_5 (VIII)	S_6 (IX)	S_7 (X)	S_8 (XI)	S_9 (XII)	S_{10} (XIII)	S_{11} (XIV)	S_{12} (XV)	S_{13} (XVI)
Gini coefficient	0.46011	0.45075	0.44712	0.44778	0.44650	0.44640	0.44662	0.44580	0.44543	0.44610	0.44757	0.44720	0.44263	0.44684	0.44721
Atkinson index (eps=1)	0.38666	0.38007	0.37707	0.37765	0.37678	0.37672	0.37694	0.37654	0.37662	0.37721	0.37811	0.37819	0.37396	0.37680	0.37671
Coefficient of squared variation (I_2)	10.18061	9.17262	8.33514	8.31301	7.44590	7.45544	7.45259	6.62442	5.84069	5.82605	5.68367	5.80581	5.86162	3.09807	3.64805

	S_{14} (XVII)	S_{15} (XVIII)	S_{16} (XIX)
Gini coefficient	0.44981	0.44657	0.44678
Atkinson index (eps=1)	0.37937	0.37715	0.37736
Coefficient of squared variation (I_2)	6.33774	7.36844	7.36588

Source: *Taxpayers' Database (2009)*; own calculations

Note:
Columns II to XIX: abbreviations for current system and 16 scenarios, i.e., CS stands for Current System, S_1 for Scenario 1, S_2 for Scenario 2, and so on. All scenarios S_1 to S_{16} relate to after-tax income.

Based on three measures calculated in Table 43 (Gini coefficient, Atkinson index, and coefficient of squared variation), I can draw the following conclusions:

Pre-tax income

- The Gini coefficient for pre-tax income is 0.46011.
- The coefficient of squared variation is 10.18061 for pre-tax income; however, this coefficient is very sensible to very low or very high income.
- The value of Atkinson index for pre-tax income is 0.38666.

Current after-tax income

- The current system corrects the Gini coefficient to 0.45075, which is 2% lower than the Gini coefficient for pre-tax income.
- The Atkinson index is lower by 1.7%, and I_2 by 9.9% compared with the values for pre-tax income.

Results of Inequality Measures for Scenarios of Step-Progressive Personal Income Taxation

- The Gini coefficient has been reduced for all scenarios.
- The best result in improvement of the Gini coefficient is for scenario S_{11}, which takes into account four rates (10%, 15%, 20%, and 30%), which is around 1.8% less than in the current system. Scenario S_{11} achieves the highest reduction of income inequality, because the marginal rates are applied to entire income that belongs to respective income bracket. It means that a taxpayer who belongs to the income bracket which is above 60,000 KM will pay the tax at the rate of 30%, meaning almost one third of entire taxable income, which contributes to reduction of income inequality.
- The Atkinson index has been reduced for all scenarios; the highest reduction is for Scenario S_{11} due to same reason explained as for the Gini coefficient.
- Scenario S_{12} improves I_2 the most and reduces it by 66%. The result is expected as the coefficient of squared variation is very sensitive to very high and very low income. Since this is the only scenario which has five rates with lowest rate of 5% and the highest rate of 30%, sensitivity is expected.

Table 44 presents the percentage differences for all scenarios compared to the current system.

Table 44. Gini coefficient, Atkinson index, and coefficient of squared variation (I_2); sorted

	Gini		Atkinson		I_2
	(% change)		(% change)		(% change)
S_{14}	-0.2	S_{14}	-0.2	S_1	-9.1
S_2	-0.7	S_{10}	-0.5	S_2	-9.4
S_9	-0.7	S_9	-0.5	S_4	-18.7
S_{13}	-0.8	S_2	-0.6	S_5	-18.8
S_{10}	-0.8	**S_{16}**	**-0.7**	S_3	-18.8
S_1	-0.8	S_8	-0.8	**S_{15}**	**-19.7**
S_{12}	-0.9	**S_{15}**	**-0.8**	**S_{16}**	**-19.7**
S_{16}	**-0.9**	S_1	-0.8	S_6	-27.8
S_5	-0.9	S_5	-0.8	S_{14}	-30.9
S_{15}	**-0.9**	S_{12}	-0.9	S_{11}	-36.1
S_3	-0.9	S_3	-0.9	S_7	-36.3
S_4	-1.0	S_{13}	-0.9	S_8	-36.5
S_8	-1.0	S_4	-0.9	S_{10}	-36.7
S_6	-1.1	S_6	-0.9	S_9	-38.0
S_7	-1.2	S_7	-0.9	S_{13}	-60.2
S_{11}	-1.8	S_{11}	-1.6	S_{12}	-66.2

Source: *Taxpayers' Database (2009)*; own calculations

Table 44 shows that each scenario with step progressive rates decreases inequality of income. Percentage changes of the Gini coefficient and the Atkinson index are not higher than 1.8%. Taking into account other aspects, such as effective tax rates, distribution of income, distribution of tax burden, and other tax effects analysed in earlier sections, I would suggest that I keep my attention again at scenarios S_{15} and S_{16}. They are not at the top when looking at those coefficients, but somewhere in the middle. These scenarios reduce the Gini coefficient by 0.9%, the Atkinson index by 0.8% and 0.7% respectively, and I_2 by 19.7%.

Other scenarios offer some lower coefficients, but their inequality is reduced not through income redistribution, but by putting a higher burden on higher-earning individuals. One must be aware that the difference between those coefficients are very low, and anything serious in terms of income redistribution cannot be achieved because there are a lot of people with very low earnings, but this is a least step forward. I must also stress that Tax Administration must work harder to reduce the informal economy and push those who file very low wages to file real wages. This is the only way to make a better redistribution of income and raise more revenues without putting an extremely high burden on higher-earning individuals.

3.3.2.2 Kakwani Index

I have also looked at the Kakwani index as a measure of tax progressivity. The Kakwani index calculates as $C_t - G_x$, as explained in the *sub-section 1.1.7.5 Kakwani Index*. There, it is also stated that the limits (maximal regressivity and maximal progressivity) of the Kakwani index depend on pre-tax income inequality. The upper limit calculates as $(1 - G_x)$, the lower limit as $(-(1 + G_x))$, where the upper limit is maximal progressivity and the lower limit is maximal regressivity.

Based on statements mentioned in *sub-section 1.1.7.5 Kakwani Index* and the previous paragraph, the maximal progressivity of the system based on the Kakwani index is 0.53989, whereas the maximal regressivity is -1.46011.

Table 45 presents the Kakwani index for the current after-tax system and the possible 16 scenarios.

Table 45. Kakwani index

Rows	Scenarios	C_t	Kakwani index
I	CS	0.63851	0.17840
II	S_1	0.67382	0.21371
III	S_2	0.66841	0.20830
IV	S_3	0.67897	0.21886
V	S_4	0.67984	0.21973
VI	S_5	0.67067	0.21056
VII	S_6	0.66845	0.20834
VIII	**S_7**	**0.75264**	**0.29253**
IX	S_8	0.75182	0.29171
X	S_9	0.72304	0.26293
XI	S_{10}	0.68461	0.22450
XII	S_{11}	0.68278	0.22267
XIII	S_{12}	0.70716	0.24705
XIV	S_{13}	0.67899	0.21888
XV	S_{14}	0.67694	0.21683
XVI	**S_{15}**	**0.70109**	**0.24098**
XVII	**S_{16}**	**0.69908**	**0.23897**

Source: *Taxpayers' Database (2009)*; own calculations

Note:
Rows I to XVII: abbreviations for current system and 16 scenarios, i.e., CS stands for Current System, S_1 for Scenario 1, S_2 for Scenario 2, and so on. All scenarios S_1 to S_{16} relate to the Kakwani index of after-tax income.

It can be seen from Table 45 that the highest Kakwani index belongs to Scenario S_7. Looking at the Table 37 with different scenario parameters, I expect the highest progressivity with

scenarios which have the highest top marginal rate. Scenario 7 has four tax rates (10%, 15%, 20%, 30%). There are also other scenarios with the same rates (S_8, S_{10}, S_{11}), but they gain lower Kakwani index. The difference between Scenario S_7 and other scenarios lies in a fact that they have different lowest income bracket. Scenario S_7 fixes the lowest income bracket at 9,600 KM, while Scenario S_8 puts the lowest income bracket at 12,000 KM. Scenario S_{10} puts the lowest income bracket at 18,000 KM. Scenario S_{11} does not have step progressive rates, and uses the same income brackets as S_{10}. Scenario S_{11} reduces inequality, but does not contribute to progressivity as much as it contributes to reduction of inequality. The effective tax rates in this scenario are almost the same as statutory rates. Scenario S_7 has the highest spread of income brackets, meaning that the lowest rate is applied to income up to 9,600 KM, as opposed to other three scenarios where the rate is applied to 12,000 KM or 18,000 KM. However, there is another scenario which has also the top rate of 30%, and it is Scenario S_{12} which shows best results with the coefficient of squared variation as seen above. Moreover, when looking Scenario S_{12} in terms of Kakwani, although it is in the top 25% scenarios in the terms of increase in Kakwani index compared to the current system (see Table 46), it is not with the greatest increase of Kakwani index. The reason for that may lie in a fact that the taxable income up to 9,600 KM to which the rate of 5% is applied, contributes relatively small to overall revenue collection. So, it means that the higher earning individuals influence the progressivity. The effective tax rate in this scenario is lower than in the current system. Therefore, as expected, Scenario S_7 has the highest Kakwani index.

I look at Table 46 to check where each scenario stands compared with the current system. As I have already stated, Scenario S_7 shows the highest percentage increase in progressivity. Scenarios S_{15} and S_{16} show a relatively high percentage increase.

Table 46. Kakwani index; sorted (scenarios listed from the lowest to highest % change in Kakwani index)

	Kakwani index (% change)
S_2	16.8
S_6	16.8
S_5	18.0
S_1	19.8
S_{14}	21.5
S_{13}	22.7
S_3	22.8
S_4	23.2
S_{11}	24.8
S_{10}	25.8
S_{16}	**33.9**
S_{15}	**35.1**
S_{12}	38.5
S_9	47.0
S_8	63.0
S_7	64.0

Source: *Taxpayers' Database (2009)*; own calculations

3.4 Policy Switching

This chapter is related to the *article Switching Personal Income Tax and Social Security Contributions between Slovenia and the Federation of Bosnia and Herzegovina (Kramer et al., in press)*. This chapter brings Slovenia, Croatia, and the Federation of Bosnia and Herzegovina together through "policy switching". It means that Slovenian and Croatian parameters (determined by the Law on Personal Income Tax and the Law on Social Security Contributions) are applied to FBH data. The Slovenian and Croatian PIT systems are step progressive ones, whereas the Federation has a flat rate. One part of this exercise has been presented in the article by Kramer et al. (in press), related to Slovenian parameters and FBH data.

The aim is to study the effects on PIT/SSC revenues, distribution of net income by decile groups, income inequality, and tax progressivity in the FBH by using Slovenian and Croatian PIT/SSC parameters. In order to answer the question, I use the Gini coefficient, concentration indices for after-tax income and taxes, the Kakwani index, and decomposition of redistributive effects, as was done by Kramer et al. (in press).

However, all parameters from Table 15 could not be applied to my set of data, same as in Kramer et al. (in press). Therefore, in Table 47 it is summarized what was excluded from the analysis and the way the parameters were applied (parameters that were not possible to apply straightforwardly).

Table 47. PIT/SSC excluded and adjusted parameters

FBH	
Tax allowance	
Dependent spouse and other dependent family members	Applied parameter for "other dependent family members"
Children with special needs	Excluded
Disability (own + dependent family members)	Excluded
Allowance for work while student	Excluded
Income of self-employed journalists and artists	Excluded
Voluntary additional pension insurance	Excluded
Life insurance premiums	Excluded
Medical treatments	Excluded
Interest for housing loan	Excluded
Standardized costs as % of gross income	
Rents	Real estate rented to tourists: 30% instead of 50%
Excluded income from capital, pensions, income from contests and games of chance, and income from sale of real estate/property rights	

Source: Dž. Kramer, M. Čok, A. Cirman, and M. Verbič, *Switching Personal Income Tax and Social Security Contributions between Slovenia and the Federation of Bosnia and Herzegovina*, in press

Some sources of income are eliminated from analysis (pensions, capital, gains from contests and games of chance; Kramer et al., in press). The reason for this is because the FBH does not have data on pensions in its database, as they are not a taxable source of income. As mentioned earlier, income from capital such as dividends, capital gains, and interest from saving accounts is not taxed in the Federation at all, so these were omitted from the analysis. Therefore, the FBH database has no data on potential taxpayers that might pay tax on income from pensions and capital in the future. There were excluded those sources of income that

are not taxed at all or are not taxed through the PIT law in all three jurisdictions. In the area of tax allowances, for example, there were excluded allowances for any type of disability because of no ability to apply those parameters. As can been seen in Table 47, there were excluded some other allowances as well.

When applying standardized costs for income from property, there was also an adjustment. For example, the FBH treats income from property rented to tourists and non-tourists differently. Because Slovenian law does not differentiate property rented to tourists and non-tourists, all of them were treated as non-tourists.

In this section I present the findings of "policy switching" of the Slovenian and Croatian systems through the Federation of Bosnia and Herzegovina.

There are three types of results: 1) actual results for the Federation (Kramer et al., in press), 2) scenario results with Slovenian parameters and FBH data (Kramer et al., in press), and 3) scenario results with Croatian parameters and FBH data (see Tables 48, 49, and 50).

All of the results have two scenarios. In the first scenario, taxes (TT) are compounded as the sum of PIT and SSC (borne by the employer, i.e., the income payer, and the employee, i.e., the income receiver). In the second scenario, only PIT without SSC (T) is included.

Results

This subsection shows the results of policy switching applying Slovenia and Croatian parameters to FBH data. Here, implications on revenues, distribution of net income, inequality measures, progressivity measures, and redistributive effect are considered. As a starting point for all of the calculations, I use "grossA" which includes both types of SSC, PIT, and net income (see equation (87)), same as in Kramer et al. (in press). That represents the total cost to the employer (income payer). It is stated mathematically as follows:

$$\begin{aligned} & \text{grossA} \\ & - \text{SSC employer}^{98} \\ & = \text{grossB} \\ \hline & - \text{SSC employee}^{99} \\ & = \text{income before tax} \\ \hline & - \text{PIT} \\ & = \text{net income} \end{aligned} \tag{87}$$

[98] This also refers to the payer of royalties and income from contractual work.
[99] This also refers to the receiver of royalties and income from contractual work.

In equation (87), “net income” is “take-home” pay, “PIT” is personal income tax, “SSC employer” is SSC borne by the employer, and “SSC employee” is SSC borne by the employee.

Therefore, the difference between “grossA” and “grossB” is that the former includes SSC borne by the employer and employee, whereas the latter includes only SSC borne by the employee.

Table 49 shows FBH gross income (GROSS_A), SSC borne by the employer (income payer; SSCER) and SSC borne by employee (income receiver; SSCEE), overall collection of SSC (both borne by employer and borne by employee; TOTSSC), PIT, overall collection of taxes (both PIT and SSC; TOTTAX) and net income (NET), and figures showing what would happen if the Federation applied Slovenian (Kramer et al., in press) and Croatian PIT/SSC systems. Those figures are presented in units of AGAW (average gross annual wage). Applying Slovenian (Croatian) parameters to FBH data, the revenues from SSC would reduce by 11%, from 153,681 AGAW to 136,449 AGAW (13% - Croatian parameters; from 153,681 AGAW to 133,412 AGAW). Applying Slovenian (Croatian) progressive rates, it would increase revenues from PIT by 214%, from 14,408 AGAW to 45,271 AGAW (209% - Croatian parameters; 14,408 AGAW to 44,565 AGAW). Total taxes (SSC + PIT) would rise by 10%, from 168,089 AGAW to 181,720 AGAW applying Slovenian parameters (6% - Croatian parameters, from 168,089 AGAW to 177,977 AGAW). The net pay would decrease by 5%, from 264,139 AGAW to 250,508 AGAW (4% - Croatian parameters; from 264,139 AGAW to 254,251 AGAW).

In Table 48, the distribution of average net income through decile groups can be observed. Again, all figures are presented in units of AGAW. In the Federation, the first and top four decile groups would face a reduction in net income when Slovenian parameters (Kramer et al, in press) are applied (first decile group: from 0.0337AGAW to 0.0320 AGAW; seventh decile group: from 0.5311 AGAW to 0.5193 AGAW; eighth decile group: from 0.6567 AGAW to 0.6208 AGAW; ninth decile group: from 0.8317 AGAW to 0.7786 AGAW; tenth decile group: from 1.6276 AGAW to 1.3902 AGAW). However, a major difference in net income would be faced in the top decile group. When Croatian parameters are applied, four decile groups (the first and top three) would experience a decrease in net income (first decile group: from 0.0337 AGAW to 0.0314 AGAW; eighth decile group: 0.6567 AGAW to 0.6222 AGAW; ninth decile group: from 0.8317 AGAW to 0.7393 AGAW; tenth decile group: from 1.6276 AGAW to 1.4570 AGAW); the major difference would be faced in the top two decile groups.

The Gini coefficient for after-tax income (G_{X-T}) is 0.4478 in the FBH (Kramer et al., in press). When Slovenian (Croatian) parameters are applied, the Gini coefficient for after-tax income is 0.4121 (0.4197 - Croatian parameters), which is 8% (7% - Croatian parameters) lower compared with what the Federation has now. Therefore, applying Slovenian (Croatian) parameters, the FBH would experience lower inequality (see Tables 49 and 50).

For the Federation of Bosnia and Herzegovina, the concentration of net income C_{X-T} (both scenarios: TT = SSC + PIT and T = PIT) reduces by 8% (TT = SSC + PIT) and 7% (T = PIT) when Slovenian parameters (Kramer et al., in press) are applied (from 0.4460 to 0.4097 when TT = SSC + PIT; from 0.4476 to 0.4096 when T = PIT), and 7% when Croatian parameters are applied (to 0.4140 for TT; to 0.4137 for T), whereas the concentration of taxes (C_T) rises by 10% (from 0.4768 to 0.5245 for TT) and 13% (from 0.6373 to 0.7186 for T) when Slovenian parameters are applied, and 9% (to 0.5208 for TT) and 11% (to 0.7076 for T) when Croatian parameters are applied (see Tables 49 and 50).

Looking at the decomposition of redistributive effects, I observe the following. When Slovenian (Croatian) parameters are applied, the redistributive effect (RE) increased by 353%, from 0.0101 to 0.0458 (increased by 278% (Kramer et al., in press), from 0.0101 to 0.0382; Croatian parameters) when it is taken into account the Gini coefficient for income before SSC and PIT. It increases by 365% (Kramer et al., in press; from 0.0096 to 0.0447) if the Gini coefficient for income before PIT is taken into account (increases by 294%, from 0.0096 to 0.0378; Croatian parameters).

The Kakwani index (P) increases by 254% when Slovenian parameters (Kramer et al., in press) are applied, from 0.0188 to 0.0666, when TT = SSC + PIT (increases by 234%, from 0.0188 to 0.0629; Croatian parameters) and by 46%, from 0.1799 to 0.2617, when T = PIT (increases by 39%, from 0.1799 to 0.2501; Croatian parameters). The decrease in income inequality in the Federation when switching to Slovenian and Croatian systems is caused by an increase in average tax rates (t) and the Kakwani index.

The ratio between the vertical effect (VK) and redistributive effect (RE) shows that the loss of redistribution would increase from 2.1% to 5.8% when Slovenian parameters (Kramer et al., in press) are applied and from 2.1% to 15.9% when Croatian parameters are applied, when T = PIT. When TT = SSC + PIT, the loss of redistribution decreases from 18% to 5.4% when Slovenian parameters are applied and from 18% to 14.9% when Croatian parameters are applied (see Tables 49 and 50). Redistributive loss happens because of different treatment of different taxpayers in the Laws on PIT and SSC in all three jurisdictions.

Table 48. Average Net Income by Decile Groups

	Average net income (Units of AGAW)		
Decile groups	FBH	SLO – FBH	CRO – FBH
I	0.0337	0.0320	0.0314
II	0.1269	0.1282	0.1280
III	0.2303	0.2400	0.2407
IV	0.2997	0.3179	0.3182
V	0.3436	0.3671	0.3662
VI	0.4116	0.4294	0.4351
VII	0.5311	0.5193	0.5588
VIII	0.6567	0.6208	0.6222
IX	0.8317	0.7786	0.7393
X	1.6276	1.3902	1.4570
Total	0.5093	0.4824	0.4897

Source: Dž. Kramer, M. Čok, A. Cirman, and M. Verbič, *Switching Personal Income Tax and Social Security Contributions between Slovenia and the Federation of Bosnia and Herzegovina*, in press; *Taxpayers' Database (2009)*; own calculations for CRO-FBH

Note (Kramer et al., in press):

***SLO – FBH**: SLO parameters and FBH data; **CRO – FBH**: CRO parameters and FBH data*

Table 49. Inequality/Progressivity Measures and Redistributive Effects; TT = SSC + PIT

	FBH		SLO – FBH		CRO – FBH	
		% RE		% RE		% RE
GROSS_A	432,228		432,228		432,228	
SSCER	39,268		59,467		61,727	
SSCEE	114,413		76,982		71,685	
TOTSSC	153,681		136,449		133,412	
PIT	14,408		45,271		44,565	
TOTTAX	168,089		181,720		177,977	
NET	264,139		250,508		254,251	
G_X	0.4579		0.4579		0.4579	
G_{X-T}	0.4478		0.4121		0.4197	
RE	0.0101		0.0458		0.0382	
RE/G_X	0.0221		0.0100		0.0834	
C_{X-T}	0.4460		0.4097		0.4140	
C_T	0.4768		0.5245		0.5208	
P	0.0188		0.0666		0.0629	
t	0.3881		0.4204		0.4116	
VK	0.0199	117.98	0.0483	105.42	0.0439	114.92
RAP	0.0018	17.98	0.0025	5.42	0.0057	14.92

Source: Dž. Kramer, M. Čok, A. Cirman, and M. Verbič, *Switching Personal Income Tax and Social Security Contributions between Slovenia and the Federation of Bosnia and* Herzegovina, in press; *Taxpayers' Database (2009)*; own calculations for CRO-FBH

Note (Kramer et al., in press):

***FBH** = FBH data and FBH parameters; **SLO – FBH** = Slovenian parameters and FBH data; **CRO – FBH** = Croatian parameters and FBH data; **GROSS_A** (in units of AGAW) = net income + PIT + SSC borne by employee (income receiver) + SSC borne by employer (income payer); **SSCER** (in units of AGAW) = SSC borne by employer (income payer); **SSCEE** (in units of AGAW) = SSC borne by employee (income receiver); **TOTSSC** (in units of AGAW) = SSCER + SSCEE; **TOTTAX** (in units of AGAW) = TOTSSC + PIT; **NET** (in units of AGAW) = GROSS_A – TOTSSC – PIT; $\boldsymbol{G_X}$ = Gini coefficient before taxation; $\boldsymbol{G_{X-T}}$ = Gini coefficient after taxation; **RE** (redistributive effect) = $G_X - G_{X-T}$; $\boldsymbol{RE/G_X}$ = share of RE in GX; $\boldsymbol{C_{X-T}}$ = concentration coefficient for after-tax income; $\boldsymbol{C_T}$ = concentration coefficient for taxes; **P** = Kakwani index of progressivity; **t** = average tax rate; **VK** = vertical effect; **RAP** = reranking effect; **VK(%RE)** = V as percentage share in RE; **RAP(%RE)** = RAP as percentage share in RE*

Table 50. Inequality/Progressivity Measures and Redistributive Effects; T = PIT

	FBH		SLO – FBH		CRO - FBH	
		% RE		% RE		% RE
G_X	0.4574		0.4569		0.4575	
G_{X-T}	0.4478		0.4121		0.4197	
RE	0.0096		0.0447		0.0378	
RE/G_X	0.0210		0.0979		0.0826	
C_{X-T}	0.4476		0.4096		0.4137	
C_T	0.6373		0.7186		0.7076	
P	0.1799		0.2617		0.2501	
t	0.0517		0.1530		0.1490	
VK	0.0098	102.10	0.0473	105.76	0.0438	115.87
RAP	0.0002	2.10	0.0026	5.76	0.0060	15.87

Source: Dž. Kramer, M. Čok, A. Cirman, and M. Verbič, *Switching Personal Income Tax and Social Security Contributions between Slovenia and the Federation of Bosnia and* Herzegovina, in press; *Taxpayers' Database (2009)*; own calculations for CRO-FBH

CONCLUDING REMARKS AND IMPLICATIONS

1 Research Implications

The major research question that this dissertation tried to answer is if the flat or the alternative system of personal income taxation is more suitable in the Federation of Bosnia and Herzegovina.

First, I reviewed the theoretical part through the literature review. I covered definitions of income as the first step in the determination of the tax liability. The troubles arose when defining income for tax purposes. There are different approaches to the subject. The first is the Haig-Simons approach (Rosen & Gayer, 2008) which defines total income as the base for taxation. Another approach has consumption as a base for taxation as opposed to income (Kaldor, 1955; Meade, 1978). However, Mirrlees (2010) changed the course of discussion from the dilemma whether to take income or consumption as the base for taxation to the trend of capital income taxation, i.e. as a part of total income or separately. The next step in the tax liability determination are the tax allowances, and standardized costs which are recognized in the most countries' tax systems. Finally, the tax rates are the third part in the tax liability determination, where I covered five types of rates: statutory, average, effective, marginal, and basic. Average and effective rates are important for analytical purposes.

As the major contribution to science, I find the tax microsimulation model that is a valuable tool to answer the above mentioned research question. Since the research question is related to types of taxation, I reviewed three types of taxation: progressive, proportional, and regressive. I learned that most countries in the world face the step progressive rates in the system of personal income taxation, with no difference if the countries are developed or not developed. The only exception to this finding I can locate in the countries of South Eastern Europe (regardless if they belong to the European Union or not). The possible reason for such behaviour is that those countries were former communist countries with no comprehensive personal income tax previously. Therefore, it was easier to implement the flat tax than the complex step progressive personal income tax. Mencinger (2006) considers that the flat tax is common to the former communist countries because everyone was treated equal and this heritage has its influence even today 25 years after the collapse of communism. Another reason for the flat tax reform in the South-Eastern Europe is the reduction of the shadow economy through a reduction of tax evasion (Ivanova et al., 2005; Paulus & Peichl, 2008).

An important segment when evaluating a respective tax system is to put it in the context of principles of a good taxation system. The literature shows seven principles of a good tax system: sufficient public revenues in the budget, horizontal equity, vertical equity, efficiency, costs of compliance, simplicity, and fiscal policy as a tool for stabilization and development goals. I paid special attention to the permanent issue of equity vs. efficiency.

On the other hand, I investigated the measures of income inequality and tax progressivity. I found that those measures have their benefits and drawbacks. I also researched the details of the current flat system of personal income taxation through the Law on Personal Income Tax and the Law on Social Security Contributions in the Federation of Bosnia and Herzegovina. I compared FBH solutions with the solutions in the region, i.e. Slovenia and Croatia which have a step progressive system of personal income taxation.

Since, the microsimulation model is a necessary tool to make any meaningful tax reform, in the area of literature review, I investigated a number of relevant microsimulation models worldwide. I found out that certain countries, for example, Germany, has circa 15 different models. Some of the worldwide models are static, or dynamic, or behavioural. Several of them cover only tax, some of them are tax-benefit models, some also include indirect taxes, some produce behavioural effects on the labour supply or goods demand while some of them are used for pension reform and those are dynamic models. I built the tax microsimulation model that is the most significant part of this dissertation. This is the first microsimulation model in Bosnia and Herzegovina.

The *first hypothesis* states that the system of personal income taxation in the Federation of Bosnia and Herzegovina has different effects regarding personal income tax progressivity and influence on income inequality measures than the personal income tax systems in Slovenia and Croatia.

To reject or not to reject this hypothesis, I followed the results of the policy switching, showed in the *Chapter 3.4 Policy Switching*. The parameters of Croatian and Slovenian personal income tax and social security contributions systems were applied on the FBH dataset. Using the microsimulation model, as presented by Kramer et al. (in press) and here, the Gini coefficient for after-tax income is 8% (7%) lower when applying the Slovenian (Croatian) system. Moreover, the concentration of after-tax income in both scenarios, when total tax equals SSC plus PIT (TT = SSC + PIT; first scenario), and total tax equals PIT (T = PIT; second scenario), decreases by the same percentages as the Gini coefficient. The concentration of taxes increases in both scenarios applying both systems. Therefore, with the Slovenian and Croatian parameters, the Federation of Bosnia and Herzegovina would face lower inequality.

The Kakwani index increases by 254% (234%) with Slovenian (Croatian) parameters in the first scenario, whereas in the second scenario it increases by 46% (39%; Croatian parameters). This means that the Federation of Bosnia and Herzegovina would face much higher tax progressivity as compared with the current system.

Overall, the evidence shows that Croatia and Slovenia have lower income inequality and higher tax progressivity than the Federation of Bosnia and Herzegovina.

Shown from the empirical evidence, I *cannot reject* the *first hypothesis* stating that the personal income taxation in the Federation of Bosnia and Herzegovina has different effects regarding personal income tax progressivity and influence on income inequality measures than the personal income tax systems in Slovenia and Croatia.

The *second hypothesis* states that the flat tax system in the Federation of Bosnia and Herzegovina creates a higher after-tax income inequality than the slice system of tax rate. Again, I used the microsimulation model to reject or not to reject the stated hypothesis. I analysed the key findings provided by the microsimulation model. I analysed 16 different scenarios. Those scenarios have at least two rates and at most five rates. Rates are in the range of 5% to 30%. When analysing the current system, I can conclude that the current system has moderate progressivity due to the 0% bracket that is formed through personal exemption and dependent deductions. Although the statutory rate is 10%, the effective rate is 5%. I can also conclude that pre-tax and after-tax income is unequally distributed. The share of the top decile group in total income before tax is 33%, but the share of that decile group in total collected tax is 50% as shown in the *section 2.4.5 Analysis of the Current System*.

The evidence from all 16 simulated scenarios shows a reduction of income inequality measured through the Gini Coefficient, Atkinson Index, and coefficient of squared variation. The results are shown in the *section 3.3.2 Inequality and Progressivity Measures for Personal Income and Personal Income Tax in the Federation of Bosnia and Herzegovina*.

Based on the evidence, I *cannot reject* the *second hypothesis* stating that the flat tax system in the Federation of Bosnia and Herzegovina creates a higher after-tax income inequality than the slice system of tax rate.

The *third hypothesis* states that regarding income distribution in the Federation of Bosnia and Herzegovina, the step progressive system would be more suitable from the point of view of reducing inequality. To evaluate this hypothesis, I used the results of simulation of those above mentioned 16 scenarios. I again recall the results for the Gini coefficient, Atkinson index, and coefficient of squared variation, which show a reduction of inequality for all 16 scenarios. Besides that, I can divide those 16 scenarios in two groups: those producing only losers without winners (eleven scenarios), and those producing both losers and winners (five scenarios). Those eleven scenarios that produce only losers, have the bottom income bracket marginal tax rate of 10%, keeping the tax allowances and social security contributions at the same level as in the current system. Regarding scenarios that produce both winners and losers, three of them have the lowest income bracket marginal tax rate of 5% while two of them (Scenarios 15 and 16) keep the lowest marginal tax rate at the level of 10%, but at the same time raising the tax allowances. I put all scenarios in the context of a theoretical perspective related to the principles of a good taxation system, as presented in the *section 3.3.1 Comparison with Tax Effects*.

All 16 scenarios reduce inequality and influence tax distribution whereas the share of higher earning individuals in total tax collection increases, while the share of the lower earning individuals decreases. However, I put one more criterion and that is income redistribution, which means redistributing income from the higher earning individuals to the lower earning individuals. That happens only in scenarios that belong to a group of those producing both losers and winners of reform (five scenarios mentioned above). However, three scenarios with the bottom marginal tax rate of 5% do not produce enough revenues for the budget that is the first principle of a good tax system. Other two scenarios (Scenarios 15 and 16) are of special interest. Those two scenarios propose three rates (10%, 15%, 20%), and raise the personal exemption and dependent deductions. Through that, they contribute to income redistribution. These two scenarios put a heavier burden on higher-earning individuals and a lighter burden on lower-earning individuals while at the same time gaining enough revenues for the budget. Besides that, those two scenarios might increase the deadweight loss compared to the current system, but they improve income redistribution, have both winners and losers as each reform entails, and improve vertical equity. They keep the horizontal equity at the same level as the flat system. The bad side of those scenarios is a decrease of simplicity of the tax system that is basically gained only through the flat system. It is also expected that cost of compliance would increase because it would be a new system both to taxpayers and Tax Administration of the Federation of Bosnia and Herzegovina.

If I look at the Gini coefficient, it decreases by 0.9% for those two scenarios (Scenarios 15 and 16) compared to the current system (from 0.45075 to 0.44657 (Scenario 15) and 0.44678 (Scenario 16)). The Atkinson index decreases by 0.8% and 0.7%, respectively (from 0.38007 to 0.37715 (Scenario 15) and 0.37736 (Scenario 16)), whereas the coefficient of squared variation (I_2) decreases by 19.7% (from 9.17262 to 7.36844 (Scenario 15) and 7.36588 (Scenario 16)). Therefore, income inequality decreases, as shown in the *section 3.3.2 Inequality and Progressivity Measures for Personal Income and Personal Income Tax in the Federation of Bosnia and Herzegovina*.

Scenarios 15 and 16 increase progressivity by 35.1% and 33.9%, respectively (from 0.17840 to 0.24098 (Scenario 15) and 0.23897 (Scenario 16)), measured by the Kakwani index.

Therefore, the evidence from the study suggests that I *cannot reject* the *third hypothesis* which states that regarding income distribution in the Federation of Bosnia and Herzegovina, the step progressive system would be more suitable from the point of view of reducing inequality.

Overall, the results of this dissertation indicate that the government cannot simply introduce higher rates without having in mind income redistribution, deadweight loss, and the utility of such a burden. Also, the government received the microsimulation model and should be able to use it, update it, and create its models upon finalization of education.

When taking all those elements into account, I might recommend a movement of the personal income tax system of the Federation of Bosnia and Herzegovina to step progressive rates. This dissertation drew significant conclusions and created the microsimulation model that produces numbers telling an important story. The microsimulation model is a valuable tool and the major contribution, both for the government to do tax reforms and for scientists. Besides the achievements, the study also has at least three important limitations that need to be considered. The most important limitation lies in the fact that the database used is only the tax database without social benefits, property, and other important factors. Therefore, the model built is only a tax model, not a tax-benefit model. Another limitation is that tax data covered only taxpayers currently actively paying taxes, without those who could be potential taxpayers such as pensioners who are exempt according to current Law on Personal Income Tax in the Federation of Bosnia and Herzegovina. Also, since the data are on the individual level, the analysis on the basis of households in not feasible. The third limitation is the fact that microsimulation model is static.

As I stated, I am aware of limitations of the study. However, the limitations give room for further research. Regarding the database, it can be expanded by survey data to cover sources of income not covered by available administrative database, and to enable analysis not only on the individual level, but on the level of households. Further improvement related to the model is updating the tax model with benefits and creating a tax-benefit model, which is currently in the process. Another movement could be the introduction of dynamic elements into the current microsimulation model, and linkage with macro-models in order to include behavioural element in analysis. Also, a comprehensive tax-benefit model can be created that would encompass the entire tax-benefit system.

2 Final Recommendations to the Government of the Federation of Bosnia and Herzegovina

The findings suggest several courses of action for the Government of the Federation of Bosnia and Herzegovina:

1. The Federation Ministry of Finance should consider education on the microsimulation model seriously and update the model every year with new data and new changes in the Law on Personal Income Tax in the Federation of Bosnia and Herzegovina.

2. As I explained, I can propose either Scenario 15 or Scenario 16 because they are in accordance with principles of a good tax system, reduction of income inequality, and increase of progressivity of the tax system. These scenarios are also in line with international practice where rates are mostly progressive.

3. The government should consider the problem of horizontal inequity caused by six sources of income that are taxed at the source and where tax paid is considered as the final tax liability without a right to claim exemption and deductions, as well as applying the highest marginal rate on the entire income.

4. The government should also consider the cases of not claiming personal exemptions because such cases might be in the area of the grey economy with underreported income.

5. There is also a need for the Federation Ministry of Finance to consider the idea of establishing a Fiscal Analysis Unit and setting up a team to work on such models and analyses.

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APPENDICES

LIST OF APPENDICES

Appendix A: Microsimulation Models

	Country	Model name	Model type	Coverage	Data source	Data (individuals/households)	Authors of the studies
1	**Australia**	**STINMOD**	Static	Personal income tax Benefits Goods and services tax	Australian Bureau of Statistics (survey data)	Individuals	NATSEM (2015) University of Canberra Lambert, Percival, Schofield, and Paul (1994)
2	**Austria**	**AUSTROMOD**	Static (EUROMOD platform)	Personal income tax Social security contributions Benefits	EU-SILC	Individuals; households	Fuchs (2005) (in Decoster et al., 2008)
		SORESI	Static (EUROMOD platform)	Personal income tax Social security contributions Benefits	EU-SILC	Individuals; households	Fuchs and Gasior (2014)
		IREA	Dynamic	Pensions	Social security database + pension database	Individuals	Hanappi, Hofer, Mullbacher, and Winter-Ebmer (2012)
3	**Belgium**	**MIMOSIS**	Behavioural (labour market)	Personal income tax Social security contributions Benefits Pension benefits	Administrative data; various sources	Individuals; households	Decoster et al. (2008)
		SIRe	Static	Personal income tax	Administrative data (tax records)	Fiscal unit	Standaert and Valenduc (1996) (in Decoster et al., 2008)
		PICSOUS	Static	Personal income tax	Administrative data (tax records)	Fiscal unit	Decoster et al. (2008)
		ASTER	Behavioural (effect on demand)	Indirect taxes	Household Budget Survey	Individuals; households	Decoster, Delhaye, and Van Camp (1996) Decoster, Rober, and Van Dongen (1994) Decoster et al. (2008)

	Country	Model name	Model type	Coverage	Data source	Data (individuals/households)	Authors of the studies
		MISIM	Static	Personal income tax	EU-SILC	Individuals; households	Decoster et al. (2008) Verbist (2002) Verbist et al. (2000)
		MODETE	Static	Personal income tax Social security contributions Benefits	Panel Study of Belgian Households	Individuals; households	Joyeux (1998) (in Decoster et al., 2008)
		STATION	Dynamic (pension model)	Pension benefits Inequality among pensioners			Dekkers (2000) (in Dekkers and Belloni, 2009
4	**Belgium** **Germany** **Italy**	**MIDAS**	Dynamic	Adequacy of pensions: poverty of pensioners, living standard of pensioners, ageing, pension legislation			Dekkers and Belloni (2009) Li and O'Donoghue (2013)
5	**Bosnia and Herzegovina**	**FBHMOD** (Federation of Bosnia and Herzegovina) Republic of Srpska (in progress)	Static	Personal income tax	Administrative data (tax records)	Individuals	Kramer, Čok, and Cirman (in press)
6	**Canada**	**Mu.Sim**	Static	Personal income tax Social security contributions Benefits	Survey data		Zhou (2013)
		SPSD/M	Static	Personal income tax Social security contributions Benefits Indirect taxes	Survey of Labour and Income Dynamics + Administrative data (tax records)	Individuals; households	Decarie, Boissinneault, and Legare (2011) Zhou (2013)

	Country	Model name	Model type	Coverage	Data source	Data (individuals/households)	Authors of the studies
		-	Static	Corporate income tax			Decarie, Boissinneault, and Legare (2011)
		DYNACAN	Dynamic	Pensions and pension contributions			Decarie, Boissinneault, and Legare (2011)
7	**Croatia**	-	Static	Personal income tax Social security contributions Benefits	Household Budget Survey	Individuals	Bezeredi (2012) Urban (2010)
8	**Czech Republic**	-	Behavioural (Constructor: National Bank)	Personal income tax Social security contributions Benefits	Microcensus	Households	Immervol and Lelkes (2009) Lelkes (2007)
		-	Static (Constructor: CERGE-EI)	Personal income tax Social security contributions Benefits Indirect taxes in process of incorporating	SILC	Individuals	Šatava (2014)
		-	Dynamic (pensions; Constructor: Deloitte and Ministry of Labour and Social Affairs)	Pension system reform	Multiple data sources		Fialka, Krejd, and Bednarik (2011) Li and O'Donoghue (2013)
		-	Static (with population projection elements; pensions; Constructor: CERGE-EI)	Pension system reform	SILC		Šatava (2014)
9	**Cyprus**	-	Static (with limited effects on labour supply)	Personal income tax Part of benefits Social security contributions	EU-SILC	Individuals	Immervol and Lelkes (2009) Pashardes and Polycarpou (2010)
10	**Denmark**	**LOVMODELLEN (The Law Model)**	Behavioural (labour supply)	Personal income tax Social security contributions Benefits	Administrative data - statistical information		Decoster et al. (2008) OECD (2012) Stephensen (2013)

	Country	Model name	Model type	Coverage	Data source	Data (individuals/households)	Authors of the studies
11	**Estonia**	**ESTEEM** (including behavioural impact and spatial analysis)	Static	Personal income tax	Administrative data + Household Budget Survey	Households	Immervol and Lelkes (2009)
				Social security contributions			
				Benefits			
				Indirect taxes			
				Environmental taxes			
		ALAN	Static	Personal income tax	Household Budget Survey	Households	Immervol and Lelkes (2009) Vork, Paulus, and Poltimae (2008) (in Poltimae and Vork, 2009)
				Social security contributions			
				Benefits			
				Indirect taxes			
				Environmental taxes			
12	**European Union**	**EUROMOD**	Static	Personal income tax	EU-SILC + National-SILCs		Bargain (2006) Callan and Sutherland (1997) Immervoll, O'Donoghue, and Sutherland (1999) Jara and Sutherland (2013) Lietz and Mantovani (2006) Sutherland (2001) Sutherland and Figari (2013) Sutherland et al. (2008)
				Social security contributions			
				Benefits			
13	**Finland**	**TUJA (similar to MIMOSIS)**	Static	Personal income tax	Administrative data (Income Distribution Survey)	Individuals; households	Decoster et al. (2008) Haataja (2005)
				Social security contributions			
				Benefits			
		SOMA	Static	Personal income tax		Individuals; households	Decoster et al. (2008)

	Country	Model name	Model type	Coverage	Data source	Data (individuals/households)	Authors of the studies
				Social security contributions	Administrative data (Income Distribution Survey)		Haataja (2005)
				Benefits			
		ELSI	Dynamic	Pensions	Register of pensions and residential data of Finnish citizens + earning register	Individuals	Gal et al. (2008) Tikanmaki, Sihvonen, and Salonen (2014)
		SISU	Static	Personal income tax	Administrative data	Individuals; households	Statistics Finland (2013)
				Social security contributions			
				Benefits			
		JUTTA	Static	Personal income tax	Administrative data	Individuals; households	Honkanen (2010) (in Zhou, 2013)
				Social security contributions			
				Benefits			
		ASUMISTUEN MALLI	Static	House benefits	Administrative data	Households	Honkanen (unpublished) (in Zhou, 2013)
		HVS	Static	Personal income tax		Households	Honkanen (unpublished) (in Zhou, 2013)
		UUSI MALLI	Static	Personal income tax			Honkanen (unpublished) (in Zhou, 2013)
				Social security contributions			
				Benefits			
14	**France**	**DESTINIE I/II PENSIPP**	Dynamic	Pensions	Financial Asset Survey	Individuals; households	Blanchet and Chanut (1998) (in Bonnet and Mahieu, 2000) Bonnet, Bozio, Landais, Rabate, and Tenand (2013) Bonnet and Mahieu (2000)
				Social security contributions			
				Some social benefits			
				Some taxes			
		INES		Personal income tax		Individuals; households	

	Country	Model name	Model type	Coverage	Data source	Data (individuals/households)	Authors of the studies
			Static (with possibility of introduction of behavioural elements as reaction of VAT changes)	Social security contributions	Administrative data (tax records) + Employment Survey		David, Lhommeau, and Starzec (1999) (in Murat, Roth, and Starzec, 2000)
				Benefits			
				Local taxes			
				VAT and other indirect taxes			
		MYRIADE	Static	Personal income tax	Administrative data (tax records)		Legendre, Lorgnet, and Thibault (2001) (in Decoster et al., 2008)
				Social security contributions			
				Benefits			
		SYSIFF	Static	Personal income tax	Household Budget Survey	Individuals; households	Bourguignon, Chiappori, and Sastre (1998)
				Benefits			Legendre, Lorgnet, and Thibault (2001) (in Decoster et al., 2008)
15	**Germany**	**FiFoSiM**	Behavioural (tax-benefit microsimulation model and computational general equilibrium model)	Personal income tax	Administrative data + Socio-Economic Panel (survey)	Individuals; households	Decoster et al. (2008)
				Social security contributions			Peichl (2006)
				Benefits			Peichl and Schaefer (2009)
				Labour supply effect			
				General economic effect			
		GMOD	Static (with possible link to behavioural model)	Personal income tax	Socio-Economic Panel Study (survey)	Individuals; households	Wagenhals (2004)
				Social security contributions			
				Benefits			
		STSM	Static (with possible link to behavioural model)	Personal income tax	Socio-Economic Panel Study (survey)		Buslei and Steiner (2004) (in Wagenhals, 2004)
				Social security contributions			
				Benefits			
		SIMTRANS	Static (with possible link to behavioural model)	Personal income tax	Socio-Economic Panel Study (survey)	Households	Kaltenborn (1998) (in Wagenhals, 2004)
				Social security contributions			
				Benefits			
		KiTs	Static	Personal income tax		Households	Drabinski (2001)

	Country	Model name	Model type	Coverage	Data source	Data (individuals/households)	Authors of the studies
				Social security contributions	Income and Consumption Survey		(in Wagenhals, 2004)
				Benefits			
				Part of indirect taxes			
		POTSDAM	Static (with possible link to behavioural model)	Personal income tax	Socio-Economic Panel Study + Income and Consumption Survey + administrative data (tax records)	Individuals	Bork (2000) (in Wagenhals, 2004)
				Social security contributions			
				Benefits			
				Indirect taxes			
		SIMST	Static	Personal income tax	Administrative data	Individuals	Gottfried and Schellhorn (2001) (in Wagenhals, 2004)
		MICSIM	Dynamic	Personal income tax	Administrative data (wage and income statistics)	Individuals	Li and O'Donoghue (2013) Merz (1995) Merz, Stolz, and Zwick (2002) Wagenhals (2004)
				Pension			
		MAITERTH	Static	Personal income tax	Administrative data (wage and income statistics)		Maiterht (2001; 2003) (in Wagenhals, 2004)
		BMF	Static	Personal income tax	Administrative data (wage and income statistics)		Wagenhals (2004)
		Kiel	Static	Wage tax	Administrative data (wage statistics)		Boss (1986) (in Wagenhals, 2004) Boss and Elendner (2004) (in Wagenhals, 2004)
		Sfb3	Dynamic	Pension reform	Different sources	Individuals; households	Galler and Wagner (1986)

	Country	Model name	Model type	Coverage	Data source	Data (individuals/households)	Authors of the studies
				Shortening hours worked			(in Li and O'Donoghue, 2013) Hain and Helberger (1986) (in Li and O'Donoghue, 2013)
				Education transfers effects			
		IZAΨMOD	Behavioural	Personal income tax	Socio-Economic Panel Study + linked employer-employee dataset	Households	Peichl, Schneider, and Siegloch (2010)
				Social security contributions			
				Benefits			
				Labour supply			
				Labour demand			
		MIKMOD-ESt	Static	Personal income tax	Administrative data (Statistical Office; tax records)		Flory and Stowhase (2012)
16	**Greece**	**None**					
17	**Hungary**	**TARSZIM**	Static (including limited changes in consumption)	Personal income tax	Household Budget Survey + Income Survey (TARKI[1] Monitor) + tax records	Individuals; households	Benedek and Lelkes (2005) Benedek, Scharle, and Szabo, 2007 Lelkes (2007)
				Social security contributions			
				Benefits			
				Indirect taxes			
		-	Behavioural (including labour supply response; general equilibrium microsimulation model)	Change in work hours, effort	Household Budget Survey	Individuals; households	Benczur, Katay, and Kiss (2012)
				Participation in labour force			
18	**Ireland**	**SWITCH**	Static	Personal income tax	SILC	Individuals	Callan, Keane, Walsh, and Lane (2010) Callan, Nolan, Walsh, McBride, and Nestor (2000) Decoster et al. (2008)
				Social security contributions			
				Benefits			

	Country	Model name	Model type	Coverage	Data source	Data (individuals/households)	Authors of the studies
		LIAM0	Dynamic/Behavioural	Redistributive effects of tax-benefit system	Household Survey Data	Households	Li and O'Donoghue (2013) O'Donoghue (2002)
		LIAM1	Dynamic/Behavioural	Pension reform	Household Survey Data	Individual	Li and O'Donoghue (2013) O'Donoghue, Lennon, and Hynes (2009)
19	**Italy**	**AWARETAX**	Static	Personal income tax Social security contributions Benefits	Survey on Household Income and Wealth	Individuals	Gastaldi and Liberati (2000) (in Decoster et al., 2008)
		ITAXMOD	Static	Personal income tax Social security contributions Part of benefits	Survey on Household Income and Wealth	Individuals; households	Di Biase, Di Marco, Di Nicola, and Proto (1995) (in Russo, 2004 and Solera, 1998)
		MAPP98	Static	Personal income tax Social security contributions Benefits	Survey on Household Income and Wealth	Individuals	Baldini (2001) (in Decoster et al., 2008)
		MIND	Dynamic/Behavioural	Personal income tax Social security contributions Pensions	Survey on Household Income and Wealth	Individuals	Bianchi, Romanelli, and Vagliasindi (nd; 2001) Decoster et al. (2008)
		CAPP_DYN	Dynamic	Social security benefits	Survey on Household Income and Wealth	Individuals; households	Mazzaferro and Morciano (2012)
		DYNAMITE	Dynamic	Social security benefits Retirement decisions	Survey on Household Income and Wealth	Households	Ando et al. (2000) (in Li & O'Donoghue, 2013)
		Tdymm	Dynamic/Behavioural	Pension system	Administrative data + EU-SILC		Li and O'Donoghue, 2013 Tedeschi (2011)
		-	Static	Housing taxation	Survey on Household Income and Wealth	Individuals; households	Pellegrino, Piaceza, and Turati (2011)
				Local taxes		Individuals	

	Country	Model name	Model type	Coverage	Data source	Data (individuals/households)	Authors of the studies
		TREMOD (Province of Trento)	Static (EUROMOD platform)	Local benefits	Administrative data (tax records) + Survey data		Azzolini, Bazzoli, De Poli, Fiorio, and Poy (2014)
20	**Latin America**						
	Brazil	-	Behavioural (price variations)	Personal income tax Social security contributions Benefits Indirect taxes (taxes on consumption)	Household Survey	Households	Bezzera Nogueira, and De Souza (2012)
	Uruguay	-	Static + Behavioural (indirect taxes; demand)	Personal income tax Social security contributions Indirect taxes	Household Survey and Expenditure Survey		Amarante, Bucheli, Olivieri, and Perazzo (2012; 2012a)
	Mexico	-	Static + Behavioural (indirect taxes; demand)	Personal income tax Social security contributions Indirect taxes	Household Survey and Expenditure Survey	Households	Absalon and Urzua (2012) Castanon- Herrera and Urzua (2012)
	Guatemala	-	Static	Personal income tax Social security contributions Benefits Value added tax	Income and Expenditure Survey	Individuals; households	Castanon-Herrera and Romero (2012)
	Chile	-	Static + Behavioural (labour supply)	Personal income tax Social security contributions Benefits Indirect taxes (taxes on consumption)	Socio-economic characterisation Survey and Family Budget Survey	Individuals; households	Cabezas and Acero (2012) Larranaga, Encina, and Cabezas (2012)
21	**Latvia**						Silina and Veretjanovs (2014)
22	**Lithuania**	**LITSIM**	Static (with element of dynamic projection of population)	Redistributive effects (with indirect taxes)	Household Budget Survey	Households	Immervol and Lelkes (2009) Lelkes (2007)

	Country	Model name	Model type	Coverage	Data source	Data (individuals/households)	Authors of the studies
		-	Static	Redistributive effects (with family benefits)	EU-SILC	Households	Immervol and Lelkes (2009)
23	**Luxembourg**	**MiDLAS (in progress)**	Dynamic	Pensions Social transfers			Philippe (2015)
24	**Macedonia**	**MAKMOD (EUROMOD platform)**	Behavioural	Personal income tax Social security contributions Benefits Labour supply	SILC	Individuals; households	Mojsoska-Blazevski, Petreski, and Petreska (2013)
25	**Malta**						
26	**Namibia**	**NAMOD (EUROMOD platform)**	Static	Personal income tax Social security contributions Benefits Value added tax	Household Income and Expenditure Survey	Households	Wright, Noble, and Barnes (2014)
27	**Netherlands**	**NEDYMAS**	Dynamic/Behavioural (limited computational general equilibrium model)	Pension reform Redistributive effects of social security system	Census	Individuals	Dekkers, Nelissen, and Verbon (1993) Li and O'Donoghue (2013) Nelissen (1995)
		MIMOSI	Static	Distributive effects of tax-benefit system			Romijn, Goes, Dekker, Gielen, and Es (2008) (in Van Sonsbeek, nd)
		Micros	Static	Distributive effects of tax-benefit system			Hendrix (1993) (in Van Sonsbeek, nd)
		MIMIC	Behavioural	Labour supply Personal income tax Social security system	Administrative Panel Household dataset + Labour Market Panel		Van Sonsbeek (nd)
		MICSIM	Behavioural (using static component of MIMOSI)	Labour supply as result of tax-benefit changes	Administrative Household dataset		Jongen, Boer, and Dekker (2014)

	Country	Model name	Model type	Coverage	Data source	Data (individuals/households)	Authors of the studies
		WIA	Dynamic	Disability benefits	Administrative data		Van Sonsbeek (nd) Van Sonsbeek and Alblas (2011) Van Sonsbeek and Gradus (2006)
		SADNAP	Dynamic	Pensions	Administrative data		Van Sonsbeek (nd) Van Sonsbeek (2009) Van Sonsbeek (2010)
28	**OECD (38 countries: 32 OECD+Southern Cyprus, Latvia, Lithuania, Malta, Bulgaria, Romania)**	-	Static	Personal income tax Social security contributions Benefits			OECD (nd)
29	**Poland**	**SIMPL**	Behavioural (including labour supply response)	Personal income tax Social security contributions Benefits Labour supply	Household Budget Survey (Badania Budżetow Gospodarstw Domowych - BBGD)	Individuals; households	Bargain, Morawski, Myck, and Socha (2007) Immervol and Lelkes (2009) Lelkes (2007)
30	**Portugal**	**MicroSimPT (EUROMOD platform)**	Static Need for Dynamic	Personal income tax Social security contributions Benefits	EU-SILC	Individuals; households	Rodrigues (2009) Nicola (2014)
31	**Romania**		Static	Tax on cadastrale income	EU and Romanian statistical data		Jitea, Dumitras, and Pocol (2013)
32	**Russia**	**RUSMOD (EUROMOD platform)**	Static	Personal income tax Social security contributions Benefits	Longitudinal Monitoring Survey	Individuals; households	Popova (2012)
33	**Serbia**		Behavioural	Personal income tax		Individuals; households	

	Country	Model name	Model type	Coverage	Data source	Data (individuals/households)	Authors of the studies
		SRMOD (EUROMOD platform)		Social security contributions Benefits Labour supply	Living Standards Measurement Survey		Ranđelović, Vladisavljević, Vujić, and Žarković-Rakić (nd) Ranđelović and Žarković Rakić (2012)
34	**Slovakia**	**(EUROMOD platform)**	Static	Personal income tax Social security contributions Benefits	SK-SILC (Slovakian version of EU-SILC)	Individuals; households	Siebertova, Švarda, and Valachyova (2014)
		-	Behavioural/ Dynamic (in progress)	Tax-benefit system Labour supply Macro model			Siebertova, Švarda, and Valachyova (2014)
		-	Static	Personal income tax	Administrative data (tax records)	Individuals	Trautman (1999)
35	**Slovenia**	**STM**	Static	Personal income tax Social security contributions Benefits	Administrative data	Individuals; households	Čok (2002) Immervol and Lelkes (2009) Kump, Majcen, and Čok (nd) Lelkes (2007) Majcen, Verbič, Bayar, and Čok (2009)
		DYPENSI (SIPEMM)	Dynamic	Pension system reform	Administrative data	Individuals; households	Li and O'Donoghue (2013) Majcen, Čok, Sambt, and Kump (2011)
		SLOMOD	Behavioural (computational general equilibrium	Tax reform Benefits reform	Administrative data	Individuals; households	Bayar et al. (2011) Bayar et al. (2006)

	Country	Model name	Model type	Coverage	Data source	Data (individuals/households)	Authors of the studies
			model linked to microsimulation model)	Government expenditures changes			Čok, Majcen, Verbič, and Košak (2008)
				Financial flows between EU and Slovenian budgets			Čok, Sambt, Košak, Verbič, and Majcen (2011)
				Macroecon. aspects			Majcen, Verbič, Bayar, and Čok (2011)
				Welfare aspects			Majcen, Čok, Verbič, and Kump (2007)
36	**South Africa**	**SAMOD (EUROMOD platform)**	Static	Personal income tax	Income and Expenditure Survey	Households	Wilkinson (2009)
				Social security contributions			
				Benefits			
37	**Spain**	**ESPASIM**	Static	Personal income tax	Household Budget Survey + Spanish part of EC Household Panel	Individuals; households	Horacin, Mercader-Prats, and Planas (2000) Levy (2003) Levy, Mercader-Prats, and Planas (2001)
				Social security contributions			
				Benefits			
				VAT			
				Excise taxes			
		SINDIEF	Behavioural	Indirect taxes	Household Budget Survey		Sanz, Romero, Castaner, Prieto, and Fernandez (2003) (in Levy, 2003)
		GLADHISPANIA	Behavioural	Personal income tax	Spanish part of EC Household Panel	Households	Oliver and Spadaro (2007)
				Social security contributions			
				Labour supply effect			
		DyPeS	Dynamic	Pension reform	Administrative data (Social Security Administration)		Fernandez-Diaz, Patxot, and Souto (2013)
		SIMCAT-P (Catalonia)	-	Property tax	Administrative data		Arcarons and Calonge (2003) (in Levy, 2003)
				Progressivity effects			
				Redistributive effects			
38	**Sweden**	**FASIT**	Static	Personal income tax		Individuals; households	Decoster et al. (2008)

	Country	Model name	Model type	Coverage	Data source	Data (individuals/households)	Authors of the studies
				Social security contributions	Survey + administrative data (tax records)		Eklind, Nilstierna, and Schofield (2008)
				Benefits			Honkanen (unpublished) (in Zhou, 2013)
		MICROHUS	Dynamic/Behavioural	Personal income tax	Income distribution database (Household Panel Survey)	Individuals; households	Decoster et al. (2008)
				Social security contributions			Klevmarken (1991) (in Li and O'Donoghue, 2013)
				Benefits			Klevmarken and Olovsson (1996) (in Li and O'Donoghue, 2013)
				Labour supply effects			
		SESIM	Dynamic/Behavioural	Personal income tax	Administrative data (Longitudinal individual data for Sweden)	Individuals; households	Decoster et al. (2008)
				Social security contributions			
				Benefits			
				Labour supply effects			
		MIMESIS	Dynamic	Pensions	Administrative data (social insurance data)	Individuals	Gal et al. (2008)
							Mikula, Elias, Holmgren, and Lundkvist (2003) (in Li and O'Donoghue, 2013)
		SWEtaxben	Behavioural	Changes in tax-benefit system	Administrative data (Longitudinal individual data for Sweden)	Individuals	Ericson, Flood, and Wahlberg (2009)
				Labour supply and social welfare			
				Fiscal effects			
39	**United Kingdom**	**IGOTM**	Static	Personal income tax	Family Resources Survey	Individuals; households	Decoster et al. (2008)
				Social security contributions			Duncan (2001)
				Benefits			
		PSM	Static	Personal income tax	Family Resources Survey	Individuals; households	Decoster et al. (2008)
				Social security contributions			Duncan (2001)

	Country	Model name	Model type	Coverage	Data source	Data (individuals/households)	Authors of the studies
				Benefits			
		TAXBEN	Static	Personal income tax	Family Expenditure Survey + Family Resources Survey + Labour Force Survey	Individuals; households	Decoster et al. (2008) Duncan (2001) Giles and McCrae (1995) Honkanen (unpublished) (in Zhou, 2013)
				Social security contributions			
				Benefits			
		SPAIN	Behavioural	Personal income tax	Output from TAXBEN	Individuals; households	Decoster et al. (2008) Duncan (2001)
				Labour supply			
		POLIMOD	Static	Personal income tax	Family Expenditure Survey + Family Resources Survey	Individuals; households	Decoster et al. (2008) Honkanen (unpublished) (in Zhou, 2013) Redmond, Sutherland, and Wilson (1998)
				Social security contributions			
				Benefits			
		PENSIM	Dynamic	Pensions	Survey of Retirement and Retirement Plans + Family Expenditure Survey + Social Change and Economic Life Initiative	Individuals; households	Decoster et al. (2008) Li and O'Donoghue (2013) Zaidi and Rake (2001)
		PENSIM2	Dynamic	Pensions	Lifetime Labour Market Database + Family Resources Survey + British Household Panel Study	Individuals; households	Decoster et al. (2008) Emmerson, Reed, and Shephard (2004) Li and O'Donoghue (2013)
		SAGE	Dynamic/Behavioural	Pensions	Survey data	Individuals	Li and O'Donoghue (2013)
40	**United States of America**	**ITEP**	Static	Personal income tax	Survey and administrative data (tax records)	Individuals	Honkanen (unpublished) (in Zhou, 2013) Itep (2015) Institute of Taxation and Economic Policy
				Corporate income tax			
				Indirect taxes			
				Property taxes			

	Country	Model name	Model type	Coverage	Data source	Data (individuals/households)	Authors of the studies
		MATH SIPP+	Static	Transfer income model	Survey data	Individuals; households	Honkanen (unpublished) (in Zhou, 2013) Smith and Wang (2012)
		TRIM3	Static	Transfer income model		Individuals; households	Honkanen (unpublished) (in Zhou, 2013) Trim3 (2015) Urban Institute Zhou (2013)
		PENSIM	Dynamic	Pensions	Survey data	Individuals	Honkanen (unpublished) (in Zhou, 2013) Zhou (2013)

Appendix B: Summary in Slovenian language/Daljši povzetek disertacije v slovenskem jeziku

REFORMA DOHODNINE V FEDERACIJI BOSNE IN HERCEGOVINE

Razmere v Bosni in Hercegovini

Bosna in Hercegovina je ena izmed šestih držav nekdanje Socialistične federativne republike Jugoslavije. Potem ko je leta 1992 razglasila neodvisnost, se je začela vojna, ki je trajala tri leta in pol. Vojna se je končala z daytonskim mirovnim sporazumom, sklenjenim 21. novembra 1995 v mestu Dayton v ameriški zvezni državi Ohio in podpisanim 14. decembra 1995 v Parizu (*Opći okvirni sporazum za mir u Bosni i Hercegovini* [Splošni okvirni sporazum za mir v Bosni in Herzegovini], 1995). S tem sporazumom, ki je bil hkrati podlaga za oblikovanje ustave, je Bosna in Hercegovina izgubila status republike nekdanje države in postala država, sestavljena iz dveh entitet, Federacije Bosne in Hercegovine (51 % ozemlja) ter Republike Srbske (49 % ozemlja). V letu 2000 se Okrožje Brčko loči in tako zmanjša ozemlje drugih dveh entitet (*Federalni zavod za statistiku* [Statistični urad Federacije BiH], 2013).

Federacijo Bosne in Hercegovine (v nadaljevanju: Federacija BIH) sestavlja 10 kantonov, ki so razdeljeni na 79 občin (*Zakon o federalnim jedinicama* [Zakon o zveznih enotah], 1996). Vsak kanton ima svojo upravo (*Ustav Federacije Bosne i Hercegovine* [Ustav Federacije Bosne in Hercegovine], 1994). Republika Srbska nima kantonov, ampak je razdeljena na 62 občin (*Zakon o teritorijalnoj organizaciji Republike Srpske* [Zakon o teritorialni organizaciji Republike Srbske], 2009).

Različne vladne ravni so pristojne za različne davke:

- *državna raven: Bosna in Hercegovina*: pristojnost za posredne davke ima država Bosna in Hercegovina (Antić, 2012); pooblaščena organa odločanja sta Ministrstvo za finance in zakladništvo Bosne in Hercegovine ter Uprava za posredne davke;
- *raven posameznih entitet in okrožja: Federacija BIH, Republika Srbska in Okrožje Brčko:* pristojnost za neposredne davke imata entiteti (*Opći okvirni sporazum za mir u Bosni i Hercegovini* [Splošni okvirni sporazum za mir v Bosni in Hercegovini], 1995; *Ustav Federacije Bosne i Hercegovine* [Ustav Federacije Bosne in Hercegovine], 1994) in Okrožje Brčko (*Konačna odluka Arbitražnog tribunala* [Končna odločitev Arbitražnega sodišča], 1999; *Statut Brčko Distrikta* [Statut Okrožja Brčko], 2010; *Opći okvirni sporazum za mir u Bosni i Hercegovini* [Splošni okvirni sporazum za mir v Bosni in Hercegovini], 1995);

pooblaščeni organi odločanja so ministrstvi za finance obeh entitet, davčni upravi obeh entitet in Agencija za finance Okrožja Brčko (ki jo sestavljata Uprava za zakladništvo in Davčna uprava).

Bosna in Hercegovina ima dejansko štiri davčne uprave: Upravo za posredne davke, Davčno upravo Federacije Bosne in Hercegovine, Davčno upravo Republike Srbske in Davčno upravo Okrožja Brčko. Ker se neposredni davki sprejemajo na ravni entitet in okrožja, v davčnem smislu obe entiteti in okrožje delujejo kot ločene države. Na primer, če določena oseba dela v Republiki Srbski ali Okrožju Brčko in živi v Federaciji BIH (je torej rezident Federacije BIH), mora letno davčno napoved vložiti v Federaciji BIH in pri tem odbiti davek, ki ga plača v Republiki Srbski ali Okrožju Brčko (*Zakon o porezu na dohodak u FBiH* [Zakon o dohodnin v Federaciji BiH], 2008). Enaka praksa se uporablja za davke, plačane v tujini. Zaradi tega Federacija BIH, Republika Srbska in Okrožje Brčko včasih delujejo kot ločene države. To je glavni razlog, zakaj nisem mogla uporabiti mikrosimulacijskega modela za celotno državo, ampak samo za Federacijo BIH.

Predmet analize

V disertaciji obravnavam možne posledice uvedbe drugačnih dohodninskih sistemov. Predmet analize in glavno raziskovalno vprašanje je, ali bi bilo pri obdavčitvi osebnih dohodkov v Federaciji BIH bolje vpeljati dohodnino z eno samo davčno stopnjo ali progresivno dohodnino z več davčnimi stopnjami. Raziskava vključuje tudi oblikovanje mikrosimulacijskega modela kot zelo uporabnega orodja za vpeljavo davčnih reform. Rezultate tega modela analiziramin primerjam s teoretičnimi osnovami.

Cilji analize

Cilj raziskave je oceniti določene vidike različnih davčnih sistemov, med drugim pobiranje prihodkov, preprostost sistema, posledice dohodkovne neenakosti in porazdelitev davčne obremenitve. Na podlagi te ocene lahko z uporabo sodobnega orodja, kot je mikrosimulacijski model, izberemo najprimernejši dohodninski sistem.

Cilje analize lahko razdelim v tri dele:

(1) oblikovanje mikrosimulacijskega modela:

eden glavnih ciljev je oblikovanje mikrosimulacijskega modela, ki v državi do zdaj še ni bil uporabljen. Gre za koristno orodje, s katerim lahko pridemo do številčnih vrednosti, ki so osnova za različne analize, na podlagi katerih lahko izluščimo končne ugotovitve. Ministrstvo za finance v Federaciji BIH je že prepoznalo uporabnost tovrstnega modela in v postopkih odločanja že uporablja izsledke različnih možnih scenarijev;

(2) preučevanje teoretičnih osnov:

mikrosimulacijski modeli dajejo določene informacije v obliki številk. Te številke so dejstva, ki pripovedujejo zelo pomembno zgodbo, vendar pa se lahko izkažejo za neuporabne, če jih ne znamo razložiti. Zato poleg rezultatov mikrosimulacijskih modelov potrebujemo tudi dobro teoretično znanje, ki nam pomaga pojasniti te številke. Tovrstna raziskava ponuja osnovo za poglobljeno analizo dohodnine ter daje celovito sliko, ki obsega empirične dokaze in tudi teoretične osnove. Lahko rečem, da gre za prvo resno analizo dohodninskega sistema v Bosni in Hercegovini, ki temelji na številkah, mednarodni primerjavi in teoretičnih dokazih;

(3) izobraževanje:

usposabljanje kadrov na ministrstvih za finance v Federaciji BIH in Republiki Srbski, ki jim omogoča, da sami izdelajo tovrstne modele in opravljajo tovrstne analize. Čeprav je bil mikrosimulacijski model oblikovan za Federacijo BIH, je njegovo uporabnost prepoznalo tudi Ministrstvo za finance Republike Srbske, ki je sodelovalo v izobraževalnem procesu, ki ga je Agencija Združenih držav za mednarodni razvoj (USAID) financirala v okviru Davčnega in fiskalnega projekta (TAF) v Bosni in Hercegovini. V okviru projekta USAID so kupili tudi programsko opremo STATA za obe vladi.

Poleg svoje praktične vrednosti analiza prispeva tudi k razvoju znanosti, saj je predstavljeni model prvi mikrosimulacijski model v Bosni in Hercegovini.

Hipoteze

Glavno raziskovalno vprašanje se glasi: Bi bilo pri obdavčitvi osebnih dohodkov v Federaciji BIH bolje vpeljati dohodnino z eno samo davčno stopnjo ali progresivno dohodnino z več davčnimi stopnjami? Na vprašanje bom odgovorila oziroma ga preučila tako, da bom potrdila oziroma ovrgla naslednje tri hipoteze:

(1) dohodninski sistem v Federaciji BIH drugače vpliva na progresivnost dohodnine in dohodkovno neenakosti kot dohodninska sistema v Sloveniji in na Hrvaškem;
(2) sistem obdavčitve v Federaciji BIH z eno samo davčno stopnjo povzroča večjo neenakost dohodka po obdavčitvi kot sistem progresivne obdavčitve z več davčnimi stopnjami;
(3) glede na porazdelitev dohodka v Federaciji BIH bi bil sistem progresivne obdavčitve z več davčnimi stopnjami primernejši, saj bi zmanjšal neenakost.

Metodologija (mikrosimulacije in podatki)

Navadno se mikrosimulacijski modeli (za oblikovanje scenarijev in mikroanalitske simulacije) uporabljajo za simulacijo različnih možnosti spreminjanja obdavčitve, v tem primeru obdavčitve osebnih dohodkov. Koncept mikrosimulacijskega modeliranja je bil razvit v petdesetih letih 20. stoletja (Orcutt, 1957). Vprašanja davčne politike se lahko nanašajo na posebne probleme, kot so vplivi na dohodke, učinki prerazporeditve in transferji, ki bi jih morali reševati z uporabo mikrosimulacijskih modelov (Buddelmeyer, Creedy in Kalb, 2007). Zato se ti modeli večinoma uporabljajo za ocenjevanje zbranih davkov in porazdelitve dohodka. Prav tako so koristni za prepričevanje javnosti, naj podpre reformo, saj so številke dejstva, ki pripovedujejo zelo pomembno zgodbo. Mikrosimulacijski modeli se ne uporabljajo samo za vpeljavo davčnih reform, ampak tudi za analizo obstoječih sistemov (Mitton, Sutherland in Weeks, 2000). Ne ponujajo samo praktičnih nasvetov v zvezi z davčno politiko, ampak so tudi raziskovalna in učna orodja (Merz, 1991). Za izdelavo mikrosimulacijskega modela so nujno potrebni podatki. Pri pripravi podatkov za mikrosimulacijski model se vedno zastavi vprašanje, ali bi bilo za osnovno enoto bolje uporabiti posameznika ali gospodinjstvo. Večina modelov temelji na administrativnih podatkih za davčno enoto, ki je določena z zakonom. To pomeni, da temeljijo na obrazcih za davčno napoved, ki jih oddajo davčne enote oziroma davkoplačevalci (Decoster in Van Camp, 1998).

Navadno tovrstne modele delimo na dve skupini: statične (računovodske ali aritmetične; deterministične, z verjetnostjo $p = 1$) in dinamične (verjetnost $p <= 1$). S statičnimi modeli simuliramo spremembe davčnih predpisov v časovnem obdobju, v katerem so bili zbrani osnovni podatki (Mitton et al., 2000). Z njimi lahko navadno simuliramo preteklost, sedanjost in bližnjo prihodnost. Dinamične modele uporabljamo, ko želimo upoštevati spremembe v številu rojstev in starostni sestavi prebivalstva. Staranje prebivalstva je zato pri dinamičnih modelih zelo pomembno, saj je vsako leto, za katerega želimo posodobiti model, vsaka enota za leto starejša (Mitton et al., 2000). Z dinamičnimi modeli lahko simuliramo daljno prihodnost.

Izbira modela je odvisna od vprašanja, ki ga obravnavamo, in časa, ki ga imamo na voljo za njegovo rešitev. Statične modele navadno uporabljamo, ko potrebujemo le en prečni prerez stanja (npr. modeliranje sprememb davčne stopnje), dinamične pa, ko potrebujemo ponavljajoče se prečne prereze (npr. pokojninska reforma ali reforma zdravstvenega sistema). Pri obeh modelih lahko vključimo tudi vedenjsko komponento. Če na primer želimo za davčno reformo dobiti rezultate prvega reda, za to ne potrebujemo vedenjske komponente. Če pa želimo videti spremembe v vedenju po vpeljavi reforme, moramo vključiti tudi vedenjsko komponento. Denimo, če želimo ugotoviti vplive ponudbe delovne sile, moramo uporabiti vedenjski mikrosimulacijski model (Creedy in Kalb, 2006). Drugi zelo uporaben vidik uporabe vedenjskih komponent je merjenje nepotrebnih izgub, ki jih povzročajo spremembe davčnega sistema (Mitton et al., 2000).

V disertaciji je odločanje podprto z rezultati mikrosimulacijskega modela, ki je bil izdelan v programu STATA na podlagi podatkov Davčne uprave Federacije BIH za leto 2009, pridobljene aprila 2011.

Mikrosimulacijski model Federacije BIH (FBHMOD) je statični model ter omogoča izračun in oceno dohodkov, dohodnine, prispevkov za socialno varnost, osebnih olajšav in olajšav za vzdrževane družinske člane. Vse poteka na ravni posameznika in ne gospodinjstva, saj so bili podatki pridobljeni od davčne uprave, ki vodi evidenco o posameznih davkoplačevalcih, ki oddajo napoved za odmero dohodnine v skladu z zakonom o dohodnini. Po tem zakonu je davkoplačevalec vsak posameznik. Poročen par ne more oddati skupne napovedi.

FBHMOD lahko oceni različne scenarije morebitnih sprememb davčne politike ter da informacijo tako o učinku skupne obdavčitve kot o posameznih komponentah, ki so lahko različno določene.

V pomoč pri odločanju o tem, kateri scenarij bi bil najprimernejši za Federacijo BIH, sem z modelom, izdelanim s programom STATA, izračunala tudi mere neenakosti, kot so Ginijev količnik koncentracije, Atkinsonov indeks in kvadrat koeficienta variacije, ter mero progresivnosti, ki se določa s Kakvanijevim indeksom.

Namen modela torej ni le analizirati obstoječi davčni sistem in porazdelitev davkov, ampak oceniti tudi učinke davčnih sprememb. Vlada Federacije BIH nima nobenega drugega mikrosimulacijskega modela, zato je predstavljeni model zelo uporabno orodje. Tudi nobena druga vlada v Bosni in Hercegovini (v Republiki Srbski ali Okrožju Brčko) ne uporablja tovrstnega modela. Ta statični model je torej dobra osnova za analizo davčne politike ter ga lahko pozneje izboljšamo tako, da mu dodamo še vedenjske učinke in dinamiko. Zaradi tega ga lahko povežemo z makromodeli, njegova trenutna zgradba pa omogoča, da ga razširimo tudi v celovit model, ki bi vključeval celoten sistem davkov in socialnih prejemkov.

Za izdelavo mikrosimulacijskega modela je potrebna reprezentativna zbirka podatkov o davkoplačevalcih, ki odraža celotno heterogenost osnovnih podatkov. Zato ni treba preučevati tipičnega primera davkoplačevalca.

Podatkovna zbirka, prejeta od Davčne uprave Federacije BIH, obsega celotne podatke o dohodnini vseh davkoplačevalcev v Federaciji BIH.V njej je za leto 2009 na letni ravni vpisanih 495.076 davkoplačevalcev, kar pomeni, da so ti davkoplačevalci svojo davčno napoved vložili za leto 2009. Napovedi obsegajo napovedi za odmero akontacij dohodnine, obračun davčnih odtegljajev (ki štejejo za dokončni davek, kar pomeni, da dohodkov, za katere je bil ta davek plačan, ni treba prijaviti v letni napovedi) in letne napovedi za odmero dohodnine, oddane leta 2010 za leto 2009. Podatkovna zbirka obsega podatke o vseh virih dohodkov, olajšavah, prispevkih za socialno varnost in davkih vsakega davkoplačevalca, ne obsega pa virov dohodkov, ki trenutno ne spadajo v dohodnino (npr. pokojnine). Davčno reformo lahko zato modeliram samo za tiste dohodkovne vire, ki so trenutno obdavčeni po

zakonu o dohodnini v Federaciji BIH. Podatkovna zbirka poleg tega ne omogoča povezovanja posameznih davkoplačevalcev, zaradi česar ni mogoče pripraviti ocene za celotno gospodinjstvo, ampak samo za posameznike. Treba je poudariti visoko kakovost podatkov, saj davčna podatkovna zbirka obsega vse značilnosti vsakega posameznika.

FBHMOD sem izdelala v naslednjih korakih:

- *izračun prispevkov za socialno varnost in standardiziranih stroškov;*
- *izračun obdavčljivega dohodka pred olajšavami (pred obdavčitvijo);*
- *izračun olajšav;*
- *izračun letne dohodnine;*
- *razdelitev davkoplačevalcev v decile;*
- *testiranje natančnosti modela;*
- *določanje odstopanja med modelom in podatki o plačah;*
- *določanje odstopanja med modelom in viri dohodkov, ki niso plače;*
- *določanje odstopanja med modelom in podatki o skupnem dohodku;*
- *primerjava natančnosti modela z natančnostjo modelov, ki se uporabljajo v drugih državah;*
- *analiza obstoječega sistema.*

Mikrosimulacijski model je bil nato poslali vladi, ki bi ga morala znati uporabljati, posodabljati in prilagoditi svojim potrebam.

Zgradba disertacije

Najprej je predložen pregled literature s področja obdavčitve osebnih dohodkov (dohodnine). Sledi opis teoretičnega ozadja mikrosimulacij ter razlaga mikrosimulacijskega modela FBHMOD. Pri tem so analizirani obstoječi sistem in mogoči scenariji dohodninskega sistema. Na koncu so predstavljena priporočila za vlado.

Natančnost modela

Ugotovila sem, da je celotna dohodnina za vse vire dohodkov, ocenjena z modelom, za 0,63 % višja od dejanskih podatkov. To pomeni, da gre za majhno odstopanje ter da je mikrosimulacijski model za primerno analitično orodje.

Davčna uprava ne zagotavlja podatkov o skupnem dohodku, zato sem ga izračunala pred olajšavami za vzdrževane člane in dodatnimi olajšavami (dohodek pred obdavčitvijo), in sicer tako da sem seštela podatke o različnih virih dohodka, ki sem jih vzela neposredno iz podatkovne zbirke. Razlika med dejanskim skupnim dohodkom in skupnim dohodkom

izhodiščnega scenarija znaša 0,2 %, kar pomeni, da je dohodek, izračunan z modelom, za 0,2 % nižji od dejanskega.

Simulacije in rezultati

Simulirala sem 16 scenarijev dohodnine, ki sem jih oblikovala na podlagi sistemov v drugih državah EU. Davčne stopnje v EU se gibljejo med 0 in celo več kot 50 %. Za nekatere države EU je značilna zelo visoka mejna stopnja v najvišjem dohodkovnem razredu. Scenariji se med seboj razlikujejo glede na različno kombinacijo stopenj, razredov, oprostitev in olajšav ter imajo vsaj dve in največ pet davčnih stopenj, ki se gibljejo od 5 do 30 %.

Pri analizi obstoječega sistema lahko ugotovim, da je zanj značilna zmerna progresivnost, in sicer zaradi davčnega razreda z ničto davčno stopnjo (0 %), ki temelji na osebni olajšavi in olajšavi za vzdrževane družinske člane. Čeprav siceršnja zakonska davčna stopnja znaša 10 %, znaša efektivna davčna stopnja le 5 %.

Prav tako lahko ugotovim, da je dohodek pred obdavčitvijo in po njej neenako razporejen. Delež najvišjega decilnega razreda v skupnem dohodku pred obdavčitvijo je 33 %, delež tega razreda v skupno pobranem davku pa je 50 %.

Na podlagi analize sem izločila tiste scenarije, pri katerih bi bili vsi na slabšem, in tiste, ki v državno blagajno ne bi prinesli dovolj prihodkov. Pri scenarijih, pri katerih so vsi na slabšem, je edini zmagovalec država. Močneje bi obremenili posameznike z višjimi dohodki, ne da bi davčno breme prerazporedili od posameznikov z nižjimi k tistim z višjimi dohodki.

Ustrezala pa bi morda lahko scenarija 15 in 16, v skladu s katerima bi uvedli tri davčne stopnje (10, 15 in 20-odstotno) ter dvignili osebno olajšavo in olajšavo za vzdrževane družinske člane. S tem bi ustrezno prerazporedili dohodke. Po teh dveh scenarijih so bolj obremenjeni posamezniki z višjimi dohodki, hkrati pa v primerjavi z obstoječim sistemom, ki se uporablja v Federaciji BIH, zagotavljata večji priliv prihodkov v državno blagajno.

Ugotovila sem, da bi s tovrstnima scenarijema sicer zbrali dovolj prihodkov, vendar bi hkrati dobili tudi zmagovalce in poražence (kar bi moralo veljati za vsako reformo) ter povečali vertikalno enakost.

Če pogledamo Ginijev količnik, se pri scenarijih 15 in 16 zmanjša za samo 0,9 % v primerjavi z obstoječim sistemom (z 0,45075 na 0,44657 (Scenarij15) in 0,44678 (Scenarij 16)). Atkinsonov indeks se zmanjša za 0,8 % in 0,7 % (z 0,38007 na 0,37715 (Scenarij 15) in 0,37736 (Scenarij 16)), medtem ko se kvadrat koeficienta variacije (I_2) zmanjša za 19,7 % (z 9,17262 na 7,36844 (Scenarij 15) in 7,36588 (Scenarij 16)). Dohodkovna neenakost se s tem zmanjša.

Scenarija 15 in 16 povečata progresivnost za 35,1 % in 33,9 % (z 0,17840 na 0,24098 (Scenarij 15) in 0,23897 (Scenarij 16)). Zato z njima zmanjšamo dohodkovno neenakost, kar potrjujejo tudi vrednosti Ginijevega količnika, Atkinsovega indeksa in kvadrata koeficienta variacije. Navedena scenarija močno izboljšata tudi progresivnost, ki se meri s Kakvanijevim indeksom.

Poleg tega sem pri oblikovanju scenarijev za Federacijo BIH uporabila tudi parametre slovenskega in hrvaškega sistema. Pri tem sem dobila tri vrste rezultatov: 1) dejanske rezultate za Federacijo BIH, 2) rezultate scenarija s slovenskimi parametri in podatki Federacije BIH ter 3) rezultate scenarija s hrvaškimi parametri in podatki Federacije BIH. Na podlagi dobljenih rezultatov lahko oblikujem dva scenarija. Pri prvem davke oblikujem kot vsoto dohodnine in prispevkov za socialno varnost (ki jih krijeta delodajalec oziroma plačnik dohodka in zaposleni oziroma prejemnik dohodka). Pri drugem scenariju vključim samo dohodnino brez prispevkov za socialno varnost.

Ko sem slovenske in hrvaške parametre uporabila na podatkih Federacije BIH, sem ugotovila, da je Ginijev količnik za dohodek po obdavčitvi za 8 % (slovenski parametri; 7 % - hrvaški parametri) nižji od tistega v obstoječem sistemu. Poleg tega se koncentracija dohodka po obdavčitvi v obeh scenarijih zmanjša za enaka odstotka (8 % - slovenski parametri; 7% - hrvaški parametri), kot znašata Ginijeva količnika. Koncentracija davkov se poveča v obeh scenarijih, v katerih sem uporabila oba sistema. Iz tega sledi, da bi se z uporabo slovenskih in hrvaških parametrov neenakost dohodka po obdavčitvi v Federaciji BIH zmanjšala.

Pri prvem scenariju se Kakwanijev indeks z uporabo slovenskih (hrvaških) parametrov poveča za 254 % (234 %), pri drugem pa za 46 % oziroma 39 %.

Na splošno sem z uporabo slovenskih in hrvaških parametrov na podatkih Federacije BIH ugotovila, da bi se tako neenakost dohodka po obdavčitvi v Federaciji BIH zmanjšala, progresivnost pa bi se močno povečala.

Na podlagi opravljene raziskave ugotovljam, da ne moremo zavreči nobene hipoteze.

Rezultati raziskave kažejo, da vlada ne more preprosto vpeljati višjih davčnih stopenj, ne da bi upoštevala prerazporeditev dohodka, nepotrebne izgube in koristi tovrstnih bremen.

Omejitve

Čeprav sem z raziskavo prišla do nekaj pomembnih ugotovitev in oblikovala mikrosimulacijski model, ki bi ga lahko vlada uporabila kot koristno orodje pri uvedbi davčnih reform, se je izkazalo, da ima vsaj tri pomembne omejitve, ki jih je treba upoštevati.

Najpomembnejša omejitev je dejstvo, da uporabljena podatkovna zbirka vsebuje samo podatke o davkih, ne pa tudi o socialnih prejemkih, nepremičninah in drugih pomembnih dejavnikih. Zato je izdelani model le model davkov, ne pa tudi model davkov in socialnih prejemkov.

Naslednja omejitev je ta, da davčni podatki obsegajo samo davkoplačevalce, ki trenutno dejavno plačujejo davke, brez potencialnih davkoplačevalcev, kot so upokojenci, ki so po veljavnem davku o dohodnini v Federaciji BIH oproščeni plačila dohodnine za pokojnine. Ravno tako, ker so podatki na ravni posameznikov, ne mogoče izpeljati analize za gospodinjstva.

Tretja omejitev je, da je izdelani mikrosimulacijski model statičen.

Priporočila

Ob upoštevanju vsega opisanega bi bilo priporočljivo dohodninski sistem Federacije BIH spremeniti v sistem s progresivno dohodnino z več davčnimi stopnjami. V ta namen predlagam uporabo enega izmed dveh predstavljenih scenarijev s tremi davčnimi stopnjami (10, 15 in 20 %), saj sledita načelom dobrega davčnega sistema, manjše dohodkovne neenakosti in večje progresivnosti. Poleg tega sta scenarija v skladu z mednarodno prakso, pri kateri prevladujejo progresivne dohodnine z več davčnimi stopnjami.

Ugotovitve prav tako kažejo, da bi morala vlada Federacije BIH sprejeti dodatne ukrepe:

- ministrstvo za finance bi moralo resno razmisliti o uporabi izobraževanja v mikrosimulacijskem modelu ter model vsako leto posodobiti z novimi podatki in spremembami zakona o dohodnini;

- preučiti bi morala problem horizontalne neenakosti, ki jo povzroča šest dohodkovnih virov, obdavčenih pri viru, pri čemer se ta davek šteje za dokončnega ter se zanj ne morejo uveljavljati oprostitve in olajšave, obenem je ta dohodek obdavčen po najvišji mejni davčni stopnji;

- ministrstvo za finance bi moralo razmisliti tudi o ustanovitvi enote za fiskalne analize in ekipe, ki bi delala s takimi modeli in analizami.

Izzivi za nadaljnje raziskovalno delo

Kot že omenjeno, se zavedam, da je imela opravljena raziskava določene omejitve. Hkrati te omejitve ponujajo priložnost za nadaljnje raziskave, pri katerih bi lahko na primer davčni model razširili na socialne prejemke ter tako oblikovali model davkov in socialnih

prejemkov. Samo bazo podatkov bi bilo možno razširiti s podatki iz anket glede dohodkov, ki niso zajeti v obstoječi podatkovni bazi ter tako omogočiti analizo, ne le na ravni posameznikov, pač pa na ravni celotnih gospodinjstev. Prav tako bi v model lahko vključili še druge davke, na primer davek od dohodkov pravnih oseb ali davek na dodano vrednost. Poleg tega bi lahko v obstoječi mikrosimulacijski model vključili še dinamične elemente in ga povezali z makromodeli ter tako v analize vključili vedenjski element.

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