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How do top tax rate reductions in three post-soviet countries impact the pre-tax income share held by the upper end of the income distribution? A behavioral response assessment using the synthetic control method

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Abstract

The paper aims to measure the behavioral responsiveness of top income earners in three post-soviet countries to shed light on the drivers of growing income disparity in Central and Eastern European countries. Possible explanatory factors for the growth of the top income share are laid out, and top tax rate reductions are identified as an important driver of growing income disparity. I analyze top income shares before taxes to observe behavioral responses expressed through changes in the income shares. Therefore, the income shares are not affected by the tax alterations themselves. This is done empirically by investigating potential behavioral responses of comprehensive top tax rate-reducing reforms in Slovakia, Romania, and Ukraine. The effect of the reforms on top income shares is contrasted with the counterfactual situation of not experiencing comprehensive tax reforms by applying the synthetic control method. The estimated treatment effects are heterogeneous across countries. However, in all three cases, the income earners in the 95th percentile of the income distribution drive the responses. Moreover, tax avoidance responses, such as income-shifting and underreporting, seem to be responsible for the changes in the top income shares.

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1 Introduction

Growing income disparity has recently gained prominence as a major social issue all across the globe. Over the last years, the consensus of governments and policymakers on the urgency of tackling income inequality increased due to the rising salience of the adverse effects on society and economic growth (Blanchard and Rodrik, 2021). Higher inequality stands in contrast with the political ideal of equal opportunities (Arneson, 2018) and thus reduces intergenerational mobility (Corak, 2013). Long-term growth can be hampered in a state of high inequality through lower consumption, fewer public investments, and a lower level of education (Stiglitz, 2016). Furthermore, higher inequality is linked to lower institutional quality (Easterly, 2007) and lower socio-political stability (Alesina and Perotti, 1996). The literature provides many potential reasons for the growing income inequality, which has risen sharply since the 1980s (Cingano, 2014). Among the most cited reasons are technological progress, globalization, institutional structures, and fiscal policies (Nolan et al., 2019).

Alvaredo et al. (2013) and Piketty and Saez (2014), however, point out that potential contributors to income inequality such as technological progress and globalization are experienced by all advanced economies and can, therefore, not explain diverging income distribution patterns over the last decades in the respective advanced economies. They argue that differences in national tax policies are one of the most promising explanatory variables in explaining income disparity across countries.

Cingano (2014), in turn, states that the growing share of the total national income going to the top of the income distribution can explain a large part of the increased inequality in the last decades. Atkinson et al. (2011)'s work on the historical income distribution development in the US reveals how much of the overall income growth is captured by the top 1% of the income distribution. The authors calculated that between 1976 and 2007, 58% of the real economic growth went to the top one percent of the income distribution.

The attention devoted to the topic is primarily due to the sharp increase in income inequality in the US starting from the 1970s. The resurgence of income held by the top decile took off earlier in the US and was more pronounced compared with Europe (Piketty and Saez, 2014). In Europe, the increase in income going to the top of the income distribution was more distinct in Central and Eastern Europe (CEE) than in Western Europe. In the transition phase from a planned to a market-based economy, most CEE countries experienced a steep increase in the top income share (Milanovic, 1998). The top decile's income share in CEE increased from 27.84% in

1990 to 37.79% in 2007, compared with a smaller increase starting from 31.9% in 1990 to 35.48% in 2007 in Western Europe (WID, 2022).

Besides the common occurrence of economic transitioning, this time period coincides with many CEE countries implementing comprehensive tax reforms (Evans and Aligica, 2008). The countries implementing such a comprehensive tax reform often drastically decreased top tax rates.

The trend of reducing top tax rates is not restricted to CEE countries and has been widespread in the past decades, contributing to the increase in income inequality in many parts of the world (Alvaredo et al., 2013; Roine et al., 2009). Piketty et al. (2014)'s work on top tax rates and pre-tax income distribution indicates a negative relationship between changes in marginal tax rates and changes in the income share going to the top of the income distribution.

In order to observe indirect effects such as incentives and behavioral responses, income shares before taxes and transfers are examined. Consequently, a change in tax rate does not directly affect the share of pre-tax income. Rubolino and Waldenström (2020), among others, use the pre-tax income shares to analyze the effect of tax reforms on the highest income earners. Slemrod (2001) broadly categorizes two types of behavioral responses. Into real responses, such as labor supply responses and into tax avoidance responses.

The top of the income distribution is considered to react the strongest to marginal tax changes compared with middle and low-income earners (Saez et al., 2012). With the top incomes representing a large share of the tax revenue collection, it is crucial for governments to understand how this income cohort reacts to changes in the tax system when designing tax policies (Poterba, 2007). Moreover, understanding the behavioral responses of top income earners induced by tax reforms is essential to determining optimal top tax rates and understanding the driving forces of growing income disparity.

The contribution of this paper to the literature is twofold.
Firstly, it contributes to the cross-country tax reform studies based on the synthetic control method to analyze the dynamic effects on the income distribution across countries, similar to the study by Rubolino and Waldenström (2020). This paper contributes to this strand of analysis by first, putting the focus on substantial top tax rate reductions in transitioning economies rather than developed countries and second, by investigating the behavioral responses of the top income earner due to tax liability-reducing reforms. By analyzing different top income cohorts separately,

it will be possible to detect differences in responsiveness towards top tax rate reductions across income cohorts. The chosen design, however, has its limitations.

First, it will not allow for distinguishing the impact of different behavioral responses. Nonetheless, examining the responses of the different income cohorts provide suggestive evidence.

Second, I do not estimate an elasticity of taxable income for the respective countries. The validity of an elasticity estimate would be limited due to the various aspects of the reforms. Moreover, estimating the magnitude of the top income share changes does not provide external validity for the same reason. Nevertheless, conducting the three case studies provide insights into the behavioral responsiveness and the type of responses of the top income earners in the three analyzed countries.

The findings of my analysis indicate that tax avoidance responses are predominantly at work rather than real responses. Labor supply responses and changes in compensation bargaining are considered real responses. For example, Slovakia experienced a strong short-term elasticity prior to the implementation of the reform. This behavior is very likely attributable to income re-timing. The income share of the 95th percentile in Slovakia was around 15% lower than it would have been in the absence of the comprehensive tax reform. Overall, the income earners within the 95th percentile seem to be the driving force of the changes in income shares going to the top, with the highest income shares altering their behavior the most.

Behavioral responses, however, are heterogeneous across the three countries and do not provide a clear pattern.

The structure of the paper is organized as follows: Chapter 2 provides an overview of the top income share growth drivers and presents literature on the potential behavioral responses to top tax rate changes. In chapter 3, the optimal income tax theory is presented briefly. Chapter 4 introduces the analyzed tax reforms in the respective countries in more detail. Chapter 5 presents the empirical strategy, the data and its application. Subsequently, the results are presented, and the findings of the sensitivity and robustness tests are laid out. Moreover, the limitations of the empirical work are listed. Chapter 6 discusses the findings and thereafter concludes.

2 Literature Review

In the literature, several explanations for the growing income share held by the top of the income distribution have been brought forward. A first explanation approach refers to technological progress and globalization. According to Piketty and Saez (2014), technological progress leads to increased demand and remuneration of high-skilled labor. Technological progress is closely related to increased globalization. The openness of economies increases the demand for high-skilled workers, augments the mobility of production factors and facilitates the spread of technological advancements (Helpman, 2016). Milanovic (2005) considers the share of foreign direct investments and trade - measured as a percentage of GDP- as indicators of globalization. He analyzes survey data from 88 countries with the respective variables in two time periods. The findings suggest that for less developed countries, openness exerts a negative impact on income disparity, whereas, for medium and higher-income countries, openness reduces income disparity. The fixed-effect cross-country study by Jaumotte et al. (2013) displays a negative relationship between foreign direct investment and income equality, with the higher income earners benefiting from the inflow of money. The meta-analysis by Helpman (2016) sheds light on the vast literature addressing the link between globalization and income inequality. Even though globalization is found to increase the skill premium and thus income inequality, the author concludes that this development can only explain a small fraction of the overall growth in wage inequality.

A second stream of explanation refers to the periods of high economic growth and productivity growth, which seems to benefit the top of the income distribution disproportionately. In the economic growth period between 2002 and 2007, the 99th percentile of the US income distribution captured 65% of the income growth compared with 58% over a more extended period with lower average economic growth (Atkinson et al., 2011). One possible explanation provided by Roine et al. (2009) in this context is the close relationship between the income of the top earners and the actual economic performance. Roine et al. (2009) examine income shares of the 99th percentile, the remaining top decile (90th-99th percentile) and the share for the rest of the population for 16 countries over the entire 20th century. In order to detect the determinants of income inequality, various factors, such as economic growth, openness, financial development and top marginal tax rates, are regressed on the pre-tax income shares.

In periods with above-average growth, the top percentile's income share is found to be significantly positively related to growth. In contrast, the income share of the following nine percentiles depicts a significant negative relationship. The findings of

Dew-Becker and Gordon (2005), who consider the relationship between productivity growth and income shares based on micro-data, corroborate the presented findings. The income share growth at the top outperforms the productivity growth, and that relationship is inversed for the income shares below the top decile of the income distribution.

In addition, Roine et al. (2009) point out that financial development benefited the 99th percentile, had no effect on the highest decile excluding the 99th percentile and negatively affected the remaining population's income share.

Moreover, the decrease in union density is a further possible explanation for the growing income shares of the top income earners. Jaumotte and Osorio Buitron (2020) argue that less union coverage reduces workers' bargaining power and influence, thus enhancing the power and pay of top executives and shareholders. Their cross-country panel regression looking at advanced economies from 1980 to 2011 reveals a negative relationship between union density and top income shares before taxes. The results are corroborated by the study of Gomez and Tzioumis (2006), who find a negative relationship between union density and top executive pay.

Institutional quality and policy choices are mentioned in the literature as further potential drivers of income inequality besides globalization, technological change, and the unequal distribution of economic growth (Nolan et al., 2019).

A further explanation for growing income disparity highlights the reduction of top tax rates over the last decades (Alvaredo et al., 2013; Piketty and Saez, 2014; Roine et al., 2009; Rubolino and Waldenström, 2020).

Rubolino and Waldenström (2020) identify and analyze three distinct tax reforms which encompass substantial reductions in top tax rates. The authors apply a synthetic control method and estimate the effect of the tax reforms on the pre-tax income share going to the top of the income distribution. They find a large increase in the income share going to the highest percentile due to the tax reforms compared with the effect on the income share of the control group (the synthetic control unit). The effect is negligible for income earners below the 95th percentile of the income distribution. The work on the long-run determinants of income inequality by Roine et al. (2009) reveals a negative relationship between the top tax rates and the income share going to the highest decile of the income distribution.

Alterations in the top marginal tax rates are found to cause substantial changes in the market income share going to the top of the income distribution (Feenberg and Poterba, 1993; Feldstein, 1995; Rubolino and Waldenström, 2020; Saez, 2017; Saez et al., 2012; Slemrod, 1995). Feenberg and Poterba (1993) and Feldstein (1995)

analyze the effects of the tax reform in the United States on the behavior of top income earners based on tax return data. The Tax Reform Act of 1986 reduced the top tax rate drastically from 50% to 28%, increased the long-term capital gain tax from 20% to 28% and decreased the corporate income tax from 46% to 34%. The reform led to a substantial increase in the reported pre-tax income going to the top income earners. To foster Feenberg and Poterba (1993) rather descriptive observational study, Feldstein (1995) compares income tax return data for the same individuals before and after the reform. This panel data setup allows researchers to conduct a difference-in-difference approach as it contrasts the change in the marginal tax rate and the change in taxable income between pairs of marginal tax groups and to derive elasticities with respect to the net-of-tax rate. The elasticity measures the response of taxable income to changes in the net tax rate. The net tax rate is one minus the marginal top tax rate. The elasticity found is larger than one, increasing with the marginal tax rate. Hence, higher-income earners facing a higher marginal tax rate alter their behavior more than lower-income earners. In another study, Saez (2017) analyzes the top tax rate-increasing reforms of 1993 and 2013 in the United States. He likewise derives elasticities with respect to the net-of-tax rate by comparing the pre-tax income share going to the top one percent in the reform year with the income share prior to the reform, considering the growth path of incomes for the years following the financial crisis. In contrast to estimating the elasticity of taxable income, Rubolino and Waldenström (2020) estimate the magnitude of behavioral responses due to the tax reforms. The behavioral responses are reflected in the pre-tax income distribution.

The literature presented in the following part analyzes the effects of changes in the top tax rates on the market income share before taxes and transfers. This implies that behavioral responses drive the changes in the income shares rather than the tax rate alterations themselves. Consequently, the focus of the analysis in this paper will be on the behavioral responses of the top income earners due to top tax rate changes considering four possible behavioral reactions driving the changes in the income share going to the top as identified by Saez et al. (2012) and Piketty et al. (2014): income shifting, tax evasion or avoidance, labor supply responses and compensation bargaining. The first two concepts fall under Slemrod (2001)'s broader concept of tax avoidance. The third and fourth fall under the notion of real responses.

2.1 Income shifting

Income shifting is a form of tax avoidance. Taxpayers shift income to reduce the tax burden lawfully. This can be achieved either by channelling money through a tax base which is taxed at a lower rate, or by re-timing income in a way that income is realized in the year the lower tax rate applies (Slemrod, 1995). Feenberg and Poterba (1993) explain the increase in the income share going to the top of the income distribution by a reduced incentive for tax avoidance due to the lower top tax rates following the 1986 US tax reform.

Throughout this work, the concept of income shifting will be examined solely from the aspect of income re-timing responses, even though the reclassification of income from corporate income to personal income or vice versa can be at play. For instance, the move from C-corporations to S-corporations can explain a large part of the increased income share going to the top of the income distribution in the wake of the 1986 tax reform (Auerbach and Slemrod, 1997; Feldstein, 1995). Income for C-corporation shareholders is taxed as corporate income, whereas income for S-corporations is declared and taxed as personal income. Therefore, income was shifted from the corporate to the personal tax base.

Re-timing might occur when income can be realized in different years. While labor income is not easily shiftable, some types of capital income are. The timing of income realization can be influenced by capital gain realizations and the exercise of stock options (Goolsbee, 2000). Saez et al. (2012) and Saez (2017) report on the income timing effect of tax reforms in the United States. The tax reform by Clinton in 1993, entailing a rise in marginal tax rates, led to a higher reported income in 1992 and a lower reported income in the year the higher tax rate was applied. Saez et al. (2012) derive an elasticity estimate by running a two-stage least square regression. The share of total income reported by the top percentile serves as the dependent variable. 1992 is denoted as the pre-reform year, and 1993 as the post-reform year. The authors use the post-reform and treatment interaction as an instrument for the change in the marginal tax rate and add time trends for the treatment and the control group. The treatment group comprises the 99th percentile of the income distribution, whereas the control group consists of the following nine percentiles, which were not affected by the reform. The estimated elasticity of taxable income with respect to marginal tax rates is 0.47 and is statistically significant when comparing 1992 and 1993. The authors attribute the response around the reform to income re-timing. Moreover, Saez (2017) estimated that in anticipation of tax raises under Obama, the 99th percentile of the income distribution shifted around 10% of their 2013 incomes to be realized in 2012. This response implies a high short-term income shifting elasticity. The 99th percentile was the income cohort affected by

the tax rise. The author examines the income shares below the 99th percentile and does not find a change in reported income due to the reform. This finding supports the credibility of attributing the observed response of the 99th percentile to the tax reform.

When comparing the income shares of 2011 with 2015, the medium-term income shifting elasticity appears to be modest (Saez, 2017). Goolsbee (2000) estimates the short-term elasticity of taxable income in the US with respect to the net tax rate above one and a medium-run elasticity between zero and 0.4. For this analysis, the responsiveness of top executives in the United States is examined following top tax rate changes.

Overall, income shifting is found to be primarily limited to the top percentile or even the top 0.1% of the income distribution due to their higher share of capital income and ability to re-time income (Feenberg and Poterba, 1993; Goolsbee, 2000; Rubolino and Waldenström, 2020). The further up in the income distribution, the stronger the income re-timing responses. Rubolino and Waldenström (2020) find the strongest responses in the 99.9th percentile, fading out at the 95th percentile. In line with this finding, the top executives with the highest compensation and stock options are the ones reacting the strongest to top tax rate changes (Goolsbee, 2000).

2.2   Tax evasion

In contrast to tax avoidance, tax evasion is unlawful and considered a crime (Slemrod, 2007). Tax evasion activities lead to tax revenue losses and imply that the reported income inequality does not represent the true income inequality (Alstadsæter et al., 2019). However, it is challenging to obtain estimates on the tax evasion level (Slemrod, 2007). Many factors can determine the level of tax evasion, for example, the applied tax rate, tax enforcement and the perception towards taxes (Slemrod, 2007). Moreover, the country's development level and institutional quality determine the compliance with tax payments (Alm and Martinez-Vazquez, 2003). Developing countries and the countries transitioning from a planned economy to a market-based economy are facing high levels of unreported income (Gorodnichenko et al., 2009). Reducing the level of unreported income was one of the arguments for introducing comprehensive tax reforms with relatively low top tax rates in Central Eastern European countries (Evans and Aligica, 2008). Research by Gorodnichenko et al. (2009) indicates that higher marginal taxes at the top lead to higher levels of tax evasion. They find that the increase in tax revenue following the tax reform in Russia in 2001 originated predominantly from higher tax reporting compliance. The authors use the gap between reported consumption and reported income as a proxy for income evasion. The difference-in-difference and discontinuity approach reveals a

drop of about 10% in the consumption-income gap of the individuals facing a lower top tax rate as before, compared with the individuals with an unaltered tax burden. The micro-simulation by Duncan (2014) corroborates the results of Gorodnichenko et al. (2009). As with income shifting, the top of the income distribution is likely the cohort driving tax evasion. Alstadsæter et al. (2019) combined Swedish wealth and income data with leaks, revealing that especially the super-rich 0.01% of the income distribution are involved in large-scale off-shore tax evasion.

2.3   Labor supply response

A tax rate reduction can change the individuals' optimal leisure and work consumption bundle. It affects the individual's decision to work either by reducing the hours worked (income effect), which would decrease the pre-tax income or by working more (substitution effect), increasing the pre-tax income. Following a reduction in the tax burden, leisure becomes more expensive relative to work; therefore, the incentive to work increases (substitution effect). On the other side, a lower top tax rate implies a larger after-tax income. Individuals will consume more leisure if leisure is a normal good (income effect). In case the substitution effect dominates the income effect, output increases due to elevated work incentives. Moreover, the argument for lower top tax rates is to spur savings and investment (Feldstein, 1986). Consequently, according to supply-side economics, the positive labor, saving, and investment channel leads to a sustained increase in economic growth. Piketty and Saez (2014) examine that claim based on data for 18 OECD countries from 1960 to 2010 and do not find a correlation between the reduction in top tax rates and real GDP per capita growth. Moreover, their elasticity estimate suggests that the labor supply elasticity concerning marginal taxes is relatively low. Auerbach and Slemrod (1997) detect an increase in investment in the wake of the comprehensive tax rate-cutting reform of 1986 in the US. However, they find solely limited effects on saving and labor supply responses.

These findings align with the low labor supply elasticity estimates for prime income-earners and high-income earners (Bargain et al., 2011; Zidar, 2019).

Zidar (2019) analyzes federal and state income tax shocks and finds larger labor supply responses at the extensive and intensive margin among lower-income earners and relatively little response among high-income earners.

This finding might not hold for subgroups such as married women (Eissa, 1995). The author analyzes the marginal tax cuts by the Tax Revenue Act in 1986 and its effects on married women's labor supply. The identifying variable is the husband's income distribution rank. At the 99th percentile, the household faced a substantial tax burden reduction, whereas at the 75th percentile, the tax burden was nearly

unaltered. The author, therefore, compares female labor supply responsiveness at the 99th percentile with females at the 75th percentile of the income distribution. The estimated labor supply elasticity with respect to the net wage is around 0.8, substantially higher than the estimated elasticity for (male) primary income earners.

2.4 Compensation bargaining

Piketty et al. (2014) outline a different possible channel: wage bargaining by high-income earners. In the case of a marginal tax rate reduction, high-income earners negotiate their compensation more aggressively. Bakija et al. (2012)'s analysis of tax return data and occupation and industry data reveals that individuals in manager positions, supervision and in the financial industry attract 70% of the growth of the national income experienced by the top 0.1% in the US between 1979 and 2005. This can be seen as evidence of aggressive compensation bargaining by top executives and alike. Furthermore, Piketty et al. (2014) demonstrate, based on panel data over a longer time horizon, the existence of a negative relationship between marginal top rates and compensation, controlling for the company's performance. This finding contrasts with the standard supply-side theory, in which the top rates should be uncorrelated with CEO pay when controlling for firm performance.

3 Optimal Income Tax Theory

This section provides a brief overview of the optimal personal income tax theory considering efficiency and equity arguments based on the Mirrlees (1971) framework and the literature building up on it (Diamond, 1998; Jacobs, 2022; Saez, 2001). The goal of the section is not to provide an all-encompassing overview of the optimal income tax theory but to introduce the conditions that determine the setting of non-linear top tax rates under the optimal tax theory.

3.1 Income taxation

In a first-best tax setting, the government would know the individuals' earning ability and tax them with an individualized lump-sum tax. However, the ability is private information, and the government has to resort to the second-best solution, taxing income. However, income does not perfectly represent the individual's earnings ability but approximates it.

Imposing taxes on income leads to changes in the optimal consumption bundle of the individual and distorts the labor supply decision. Therefore, taxation results in a deadweight loss. The stronger individuals react to tax changes, the larger the deadweight loss. This reaction can be captured by the taxable income elasticity (ETI) with respect to the marginal tax rate. The taxable income elasticity encompasses the behavioral responses presented above, the real responses such as labor supply as well as avoidance responses (Saez, 2001). A high elasticity leads to more considerable distortions and, thus, elevated efficiency costs. Likewise, if the tax base is large, more taxpayers are affected, and the distortions are more considerable compared with a narrower tax base. Therefore, high responsiveness and a broad tax base speak in favor of lower income tax rates.

A diminishing marginal utility of income is underlying the concept of income redistribution. An income earner higher up the income distribution facing a higher tax rate experiences a lower utility loss than a lower income earner experiencing the same income reduction. On the other side of the coin, the utility of additional income going to an individual with a low income is higher than the utility of the same additional income going to an individual higher up in the income distribution. Therefore, redistribution increases the social utility of income. However, the government attaches values along the income distribution and determines the level of the desired redistribution according to its inequality aversion. The values attached depend on the chosen social welfare function.

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In a nutshell, the responsiveness of the individuals to taxes, the income distribution/concentration and the welfare weights attached to the different income cohorts determine the optimal tax rate.

3.2   Optimal top tax rates

Contrary to the initial finding by Mirrlees (1971), the optimal top income tax rate is not zero. The finding was contradicted by Tuomala (1984), who showed that imputing a more realistic elasticity of substitution between consumption and leisure of 0.5 and underlying a different social welfare function changes the previous theoretical assumption. Moreover, the simulations conducted by Saez (2001) and Jacobs et al. (2017) refute the arguments for the theoretical findings of a top tax rate of zero. As outlined, the income concentration at the top matters in order to determine the optimal top tax rate. Atkinson et al. (2011) and Zoutman et al. (2013) demonstrate that the right tail of the income distribution resembles a Pareto distribution rather than a log-normal distribution. This is the reason why the optimal top tax rate is at a positive, constant level rather than zero. Leaving negative externality correcting features and the level of inequality aversion by the side, the optimal top tax rate depends on the income concentration at the top, and the elasticity of earned income with respect to the income tax rate (Jacobs, 2022). A higher income concentration at the top leads to higher distributional gains and a higher optimal top tax rate. A higher elasticity creates more distortions, and the optimal top tax rate is lower, accordingly.

3.3   Non-linear top tax rate versus linear (top) tax rate

In order to generate the same income redistribution within the income tax system, the linear income tax rate needs to be set higher than the average marginal non-linear income tax rate. The reason is that under a linear tax rate, the government needs to redistribute more to hold the same level of income inequality (Saez, 2001). In case the linear tax rate is not set higher, income inequality increases due to the less redistributive income tax system. Higher efficiency costs are incurred if the linear tax rate is set higher to keep the income inequality constant. Therefore, a linear tax rate inevitably worsens the trade-off between equity and efficiency compared with setting a non-linear top tax rate. Likewise, the inferiority of a proportional income tax rate is apparent when considering why the equity-efficiency trade-off exists in the first place. It exists due to the information asymmetry between individuals and the government. Income information can be used to infer the earning ability of the individuals, and in the proportional tax setting, this information is wasted (Jacobs et al., 2010).

4 Reforms of Interest

Within this work, three comprehensive tax reforms will be analyzed. The reforms substantially reduced the top-income tax rate in the respective countries. These tax reforms were labelled as 'flat income tax reforms' by the implementing countries and by Keen et al. (2006) and Adhikari and Alm (2016). Adhikari and Alm (2016) distinguish between a first and second wave of reforms. I focus on the second wave due to a longer observed pre-treatment period and a more considerable drop in top income tax rates. In the first wave, the reduction in top tax rates was relatively small, whereas, in the second wave, the top tax rate was reduced substantially (Keen et al., 2006). To focus on CEE countries is inspired by the paper of Adhikari and Alm (2016) and the substantial increase in pre-tax income inequality in the region (WID, 2022). The authors focus on the region due to the comprehensive tax reforms conducted and the shared characteristics of the countries, making it a good subject for empirical analysis. Moreover, the countries analyzed in this study are chosen according to their data availability and the reform year.

The countries of interest implemented a comprehensive tax reform in 2004 (Slovakia, Ukraine) and 2005 (Romania). The sample of potential control countries, the so-called donor pool, consists of other CEE countries not implementing comprehensive tax reform in the period of interest (Poland, Czech Republic, Bulgaria, Croatia, Hungary, Albania, and Slovenia).

Slovakia

Slovakia replaced their five income bracket tax system with a one-bracket system in 2004. The reform was adopted by the parliament in October 2003 and implemented in January 2004. Therefore, behavioral responses in anticipation of the tax reform are likely. The income tax rate ranged between 10% and 38% prior to the reform. With the introduction of the new tax schedule, a uniform tax rate of 19% applied to personal and corporate income (Hall and Rabushka, 2013). This means that the top tax rate was halved from 38% to 19%. The corporate income tax prior to 2004 stood at 25%. The tax exemptions were doubled to almost 60% of the average income at that time (Keen et al., 2006).

Romania

The country introduced a uniform tax of 16% on personal and corporate income in 2005. The newly elected government passed the comprehensive tax reform on the 28th of December 2004 to be effective in January 2005. Due to the very short period between passing and enacting the law, behavioral responses in anticipation

of the tax reform are unlikely. Prior to the reform, the tax schedule ranged from 18% to 40%, and a corporate income tax of 25% was in place. Hence, the top tax rate was more than halved from 40% to 16%. Moreover, the reform raised the basic allowance modestly (Keen et al., 2006).

Ukraine

The income tax reform legislation was passed in May 2003, effective on the first of January 2004. This delay in taking effect gives rise to possible anticipatory responses. As for Slovakia and Romania, the tax reform was passed by a government affiliated with the right-wing political spectrum (Beblavỳ, 2014). The uniform tax rate of 13% replaced the existing system, consisting of five tax brackets ranging from 10% to 40%. As a consequence, the top tax rate was cut from 40% to 13%. Moreover, the tax reform broadened the tax base by eliminating tax exemptions. The corporate income tax was reduced from 30% to 25%, and the basic allowance increased (Keen et al., 2006).

5 Empirical Part

This work aims to determine the effect of comprehensive tax reforms on the pre-tax national income share going to the top of the income distribution. The change in market income is deemed to reflect the behavioral adjustments of the top income earner due to the reforms in the three post-soviet countries described above. The chosen methodology resembles the set-up of Adhikari and Alm (2016) by focusing on CEE countries and their comprehensive tax reforms. The authors were primarily interested in the effect of the income tax reform in several CEE countries on GDP over time.

This paper shifts the focus from the impact on economic growth to the tax reform's impact on behavioral responses of the top income earners, similar to the work of Rubolino and Waldenström (2020). The authors identified comprehensive tax reforms in developed countries in the 1980s and 1990s and applied a synthetic control method to estimate the effect of tax reforms on top-income shares. Therefore, this paper combines the focus on transitioning economies in CEE of the work by Adhikari and Alm (2016) with the approach by Rubolino and Waldenström (2020) using the share of market income (pre-tax) of the highest decile, the 95th percentile, 99th percentile and top 0.1 percentile - as a percentage of national income – as the variables of interest.

5.1 Methodology

The synthetic control method resembles a difference-in-difference approach. However, the synthetic control method does not rely solely on one comparison unit but rather constructs a control unit based on several untreated comparison units. It is, therefore, well suited for comparative case studies and policy evaluation (Abadie et al., 2015). The synthetic control method creates a counterfactual to capture a dynamic treatment effect by comparing the outcome after the reform with the treated unit's counterfactual outcome in the absence of a treatment (Abadie et al., 2015).

The following formula displays the construction of the synthetic control unit.

$$\hat{Y}_{1t}^{NR} = \sum_{j=2}^{J+1} W_j Y_{jt}$$

j=1 is the treated country, whereas j=2,...J+1 are the countries the donor pool is composed of; t represents the time in years. The pre-intervention period ranges from t=1 to t= T_0, the post-intervention period ranges from t= $T_0 + 1$ to t = T.
$\hat{Y}_{1t}^{NR}$ represents the counterfactual outcome (pre-tax income share going to the top

income earners) in the absence of the treatment. It is composed of W_j, which is a vector of country weights and Y_{jt}, which displays the outcome of the donor pool countries. The country weights indicate the percentage each donor pool country has assigned and sum up to 1 (100%). The index NR stands for no-reform.

The goal of the synthetic control unit is to resemble the treated unit as best as possible. In order to do so, a data-driven process determines the synthetic control unit's predictor weights and country weights. It is matched in the way that the weighted average of the synthetic control closely resembles the matching variables and outcome of the treated unit in the years prior to the treatment (Abadie, 2021). The following formula is minimized with this process.

$$\sum_{m=1}^{k} v_m (X_{1m} - X_{0m}W)^2$$

m represents the different matching variables. The matching variables are variables determining the outcome variable. v_m is the weight attributed to the matching variables. The weights indicate the predictive power of the variables in explaining the outcome.

X_1 represents a vector of pre-intervention variables of the treated unit. X_0 represents a vector of pre-intervention variables of the donor pool countries. $(X_1 - X_0W)$ represents the difference in pre-intervention characteristics between the treated and untreated unit. The root mean squared prediction error (RMSPE) determines an optimal weight to minimize the differences in order to obtain $X_1 \approx X_0W^*$. W* is the determined country weights to resemble the pre-intervention coefficients the best.

The described minimization is done to construct the synthetic control resembling the outcome of the treated unit the best. To obtain the estimated treatment effect the counterfactual's outcome has to be subtracted from the outcome of the treated country.

$$\hat{\tau}_{1t} = (Y_{1t}^{R} - \hat{Y}_{1t}^{NR})$$

Y_{1t}^{R} represents the observed outcome of the treated unit. The index R indicates the treated country.

$\hat{\tau}_{1t}$ is a credible estimate if the counterfactual outcome $(\hat{Y}_{1t}^{NR})$ matches well the trajectory of the treated countries outcome (Y_{1t}^{R}) prior to the reform. This assumption is crucial to attribute the change in the outcome to the reform. If the trajectory is well matched, it is credible that the treatment explains the differences between the treated and synthetic unit. Moreover, for the validity of the results, no interference between units should exist (Abadie et al., 2010). The treatment in one country

should not affect the outcome of the untreated country. Therefore, the comprehensive tax reform in one country should not affect the top income shares of another country, not enacting such a reform. In addition to that, the anticipation effects of the individuals can bias the results. Without considering anticipation effects, the treatment effect can be over- or underestimated. As in the work of Žúdel and Melioris (2016), the treatment year is assigned to the year anticipation effects are plausible.

5.2 Data

The dataset consists of top income share data, top tax rate data and control variable data. The extracted annual panel data spans the years 1990 through 2007, including 2007.

Income data

The income share data on several income cohorts is retrieved from the World Top Incomes Database (WTID), which is integrated into the World Inequality Database (WID). The WID data is based on the concept of Distributional National Accounts (DINA). DINA captures the national income of a country, which is calculated by subtracting capital depreciation of GDP and adding net income from abroad (Piketty et al., 2018). In order to construct a relatively homogenous top income share dataset over a longer time horizon, historical tax data and survey data is combined with data on national accounts (Alvaredo et al., 2020). The variable of interest indicates how much of the overall national pre-tax income goes to a particular income cohort. Individuals above the age of 20 are included in the data set. The population unit is "equal split" (i.e. the unit is the individual, but the household's income is split equally between its members). Income encompasses labor and capital income. Social transfers are not included. For example, the value for p99p100 specifies how much of the total income (p100) goes to the top 1% income earner (the difference between the national income up to the 99th percentile and the total national income). The advantage of this data is the data quality and comparability across countries (Atkinson et al., 2011). The top income data is most likely downward biased due to tax evasion or avoidance, which leads to lower reported income (Atkinson et al., 2011).

Most studies examining income inequality and income distribution rely on survey data, which is prone to bias and less comparable across countries. For survey data, the stated income can be lower or higher than the actual income.
A drawback of the data available for the purpose of this study is the indistinguishability of the income composition (i.e. the share of capital and labor income in the respective income cohorts). Moreover, not all data for the countries of interest are based on historical tax data. Some rely on survey data or a combination of both until a certain point in time (Bajard et al., 2021). Excluding all the countries relying partially on survey data would restrict the cross-country analysis severely.

Tax data

The top statutory personal income tax data is retrieved from the World Tax Indicators (WTI) of the Andrew Young School of Policy Studies. The data on the tax rates in each country is gathered by surveying hundreds of tax experts across the globe. Comprehensive data on European countries is available from 1990 or the subsequent years for some countries until 2005 (Peter et al., 2010). The short data availability does not cause problems because it is solely used for matching in the pre-treatment period. The reforms were implemented in 2004 and 2005, respectively. However, a more extended data availability would reveal that most donor countries reduced their top tax rates in the period around the analyzed tax reforms, even though to a lesser extent than the treated countries (Brys et al., 2011).

Control variables

Various control variables such as GDP per capita, annual GDP growth, trade (imports and exports taken together) as a percentage of GDP and Foreign Direct Investment (FDI) as a percentage of GDP are derived from the World Development Indicators (WDI) collected by the World Bank. The data is sourced from official data compiled by international institutions.

5.3 Constructing the Synthetic Controls

The data must be configured to meet a number of requirements in order to implement the synthetic control method. First, there needs to be a balanced panel of data, with the same number of years of data being available for each country, treated and untreated. Second, the outcome variable data needs to be available for the whole period of the study. Third, for each of the determinants, there must be at least one observation prior to the treatment.

The potential determinants of changes in the top income shares are chosen according to the findings of the empirical literature: It encompasses economic growth (Roine et al., 2009), measured as annual percentage GDP growth. GDP per capita as an approximation of productivity growth (Saez, 2017). Globalization as a measure of openness, measured by trade as a percentage of GDP (Milanovic, 2005; Roine et al., 2009). Financial globalization and technological advancements measured by FDI, as a percentage of GDP (Asteriou et al., 2014; Jaumotte et al., 2013), and top tax rates to take into account behavioral adjustments of top-income earners to top tax rate changes (Alvaredo et al., 2013; Roine et al., 2009; Rubolino and Waldenström, 2020; Saez, 2017).

Moreover, Abadie et al. (2010) highlight the importance of matching past values of the outcome variable to control for unobservables that potentially impact the outcome. The idea is that only units that are similar in the outcome variable's observed and unobserved determinants, as well as in the impact of those determinants on the outcome variable (top income shares), should result in similar outcome trajectories. Therefore, if an unobservable variable determines the income share, matching with previous income shares can control for it, assuming that the unobservable variable impacts the income share of the control unit in the same way. Furthermore, unobservables and variables possibly affecting the top income share, such as institutional quality and labor market characteristics, are assumed to be very similar in the treated countries and the donor pool countries due to their transitional state, regional closeness and similar background characteristics (Adhikari and Alm, 2016).

A pre-intervention period which resembles the treated share of income going to the top percentiles well over an extended period implies that besides the predictors, unobservables are exercising a similar influence on the outcome, reducing possible endogeneity concerns (Abadie et al., 2010).

The matching period starts in 1990 for the variables with data availability. Data on top income tax rates is available for different countries at different times (between 1990 and 1995) and is being matched according to the data availability. The post-reform period runs until 2007 (2006 for Ukraine) and enables me to determine the short- and medium-term effects (three to five years) of the tax reform on the pre-tax income share going to the top of the income distribution.

The choice of the countries in the donor pool resembles the choice and reasoning applied by Adhikari and Alm (2016). For example, to exclude Serbia due to the Kosovo conflict in 1998–1999.

The interpolation bias is reduced by restricting the sample to countries with close proximity (geographically, culturally and economically). A linear function of the predictors determines the outcome variable in the synthetic control method (Abadie, 2021). However, when this linearity is not given, biases can arise. Therefore, restricting the sample to countries with similar predictor variable outcomes reduces a possible interpolation bias. Therefore, the synthetic control sample consists of other CEE countries transitioning from planned to market-based economies. Comprehensive top tax rate cutting reforms were widespread in the region (Evans and Aligica, 2008). Therefore, the number of non-treated countries is limited. The post-reform period is restricted to 2007 in order to include the countries implementing comprehensive tax reform in 2008 in the donor pool (Albania, Bulgaria and Czech Republic). The 2007 restriction is to circumvent the small donor pool limitation partially.

Exemplifying the synthetic control method based on p90p100 Slovakia

The reform in Slovakia came into effect in January 2004. However, due to possible anticipation effects, the treatment year is set for 2003, the year the legislation was passed. The pretreatment period spans from 1990 to 2002, the year before the assigned treatment year. The data-driven process determines then the weights assigned to the donor pool countries. The synthetic control for Slovakia comprises Hungary and Slovenia, with Hungary accounting for 84.3% of the synthetic control unit, whereas Slovenia attributes 15.7%. Table 1 depicts the percentage share of each donor pool country.

Table 1: W* in synthetic Slovakia

Country	Weight
AL	0
BG	0
CZ	0
HR	0
HU	.843
PL	0
SI	.157

The predictor balance in Table 2 indicates how well the predictor variables are matched prior to the treatment. The predictors are averaged over the whole pretreatment period if not specified otherwise. Column (1) presents X_1, which is the observed average in the treated country, Slovakia, in this case. The second column displays $X_0 W^*$, the average of the predictor variables of synthetic Slovakia. Overall the income share, the top tax rate and GDP per capita are well matched. Deviations between the average of larger magnitude are observable in FDI, GDP per capita and trade.

The weight attributed to the matching variables (v_m) is chosen in such a way that it minimizes the RMSPE of the synthetic control. The RMSPE for synthetic Slovakia amounts to 0.0156.

Table 2: Income share predictor means

	Treated	Synthetic
p90p100	.2588	.2734
toprate	42.1	44.16
fdi	3.3	5.58
gdpgrowth	3.94	2.47
gdppercapita	8182.08	9297.41
trade	106.69	91.86

5.4 Results

In order to obtain a better understanding of the different behavioral reactions, four income cohorts are assessed for each of the countries of interest; the income share of the 90th percentile (p90p100), 95th percentile (p95p100), 99th percentile (p99p100) and 99.9th percentile (p99.9p100) of the income distribution. Important to note is that all the income shares presented are expressed for the whole population. For instance, the 99th percentile of the income distribution's income share is included in the 90th percentile. The behavioral responsiveness of the different income cohorts can be detected by examining the difference in the magnitude of the effect. This can be done by comparing the absolute change in the income share across the different top percentiles in the wake of the reform.

Figure 1: Top income share Slovakia

(a) (b) (c) (d)

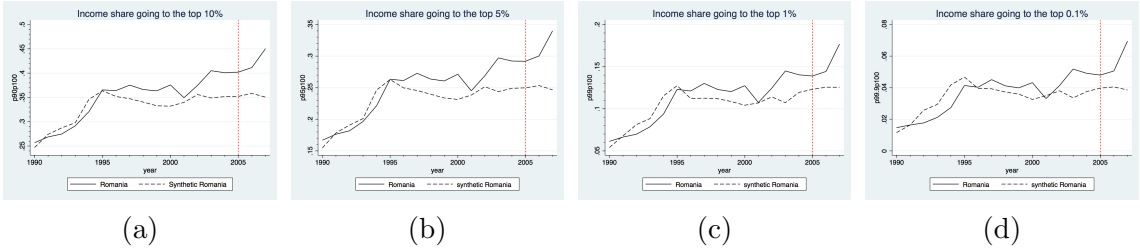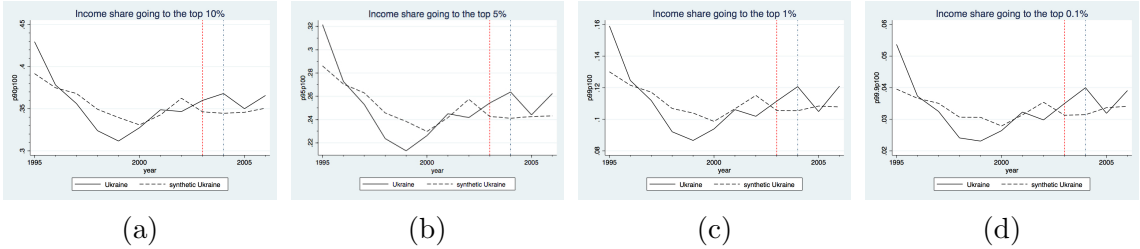Figure 2: Top income share Romania

(a) (b) (c) (d)

Figure 3: Top income share Ukraine

(a) (b) (c) (d)

Figures 1, 2 and 3 present the trajectory of the top income shares before taxes and transfers in the three analyzed countries over the investigated period. The pre-treatment period starts in 1990 for Slovakia and Romania. It begins in 1995 for Ukraine due to data scarcity prior to that year. The post-treatment period goes until 2007 for Slovakia and Romania and 2006 for Ukraine due to possible anticipation

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effects of the synthetic control unit in 2007. The straight black lines demonstrate the observed outcomes, whereas the black dotted lines indicate the trajectory of the synthetic control's outcome. The red dotted line is the year the treatment was assigned, considering possible anticipatory effects. The dashed blue line indicates the year the tax reform came into force.

The results of the synthetic control method are presented in the upcoming section. The estimated treatment effect $\hat{\tau}_{1t}$ is presented graphically as "gap figures" (i.e. the gap between the observed outcome and the synthetic control's outcome over time).

Slovakia

For Slovakia, a substantial behavioral response of the top income earners is evident by examining the income share gap graph in Figure 4 and as well as by examining Figure 1, which depicts the top income share of Slovakia and synthetic Slovakia. The legislation passed in 2003, and in anticipation of the lower tax rates in 2004, the income share going to the top in 2003 dropped strongly compared with 2002. In absolute values, from 30.9% to 28.34% for the 90th percentile of the income distribution. From 21.58% to 18.86% for the 95th percentile. From 10.06% to 8.05% for the 99th percentile and from 3.67% to 2.72% for the 99.9th percentile (see Appendix B, Table 4).

In relative terms, the income share going to the 95th percentile drops by 12.6% while it increases by 2.83% for synthetic Slovakia between 2002 and 2003. Therefore, the income share of the 95th percentile is more than 15% lower in 2003 than it would have been in the absence of the tax reform in 2004. For the 99th percentile, the income share in 2003 is roughly 22% lower than it would have been in the absence of the reform. For the 99.9th percentile, this number amounts to roughly 26%.

The income share reduction prior to the top tax rate reduction hints at income-retiming responses of the top income earners. In order to fully attribute the response to income-retiming, I would need to assume that individuals do not adjust their labor supply, tax evasion response or compensation bargaining before the actual implementation of the reform.

Under income shifting, it would be expected that the income shares going to the top rebound strongly in 2004. The 2004 income share would then consists of the regular labor and capital income plus the income shifted from 2003 to 2004. However, the top income share in 2004 is not higher than the 2002 level, implying an overall lower

income share going to the top of the income distribution as it would have been in the absence of the reform. This finding becomes evident when comparing it with the income share of synthetic Slovakia, which does not depict a decrease and is flat between 2003 and 2004 (except for p90p100, which decreases slightly between 2003 and 2004).

When considering which income cohort is driving the behavioral responses, the strength of the absolute income share reduction between 2002 and 2003 can be examined. The drop in the top decile's income share amounts to 2.37, for the 95th percentile to 2.32, for the 99th percentile the income share reduction amounts to 1.76, and for the 99.9th percentile to 0.95. This indicates that the 95th percentile captures all behavioral responses, and within the 95th percentile, most is driven by the 99th percentile of the income distribution.

Prior to the reform, the income share gap increased strongly. In 2002 a tax reform reduced the top tax rate from 42% to 38%. The higher responsiveness of the 95th percentile's income share - and above - compared with the 90th percentile's suggests that it could be driven by the top income earners in response to the tax reform. Therefore, if the behavioral response is attributable to income re-timing, income shifting from 2001 to 2002 is likely to increase the top income shares in 2002. Consequently, the described behavioral response derived from comparing the income shares in 2003 with 2002 is likely to be overestimated and presents an upper bound estimate. Even though the top tax rate reduction in 2002 could explain the pre-treatment trajectory partially, it cannot explain the steep increase in the income share going to the top in 2001.

In the subsequent year of the implemented tax reform, the top income shares for synthetic Slovakia increased in contrast to the actual development of the top income shares in Slovakia, which are stable for p90p100 and p95p100. At the same time, the top income share is decreasing for p99p100 and p99.9p100. This movement has three possible explanations. The highest income earners (99th and 99.9th percentile) reduced their labor supply (income effect dominates substitution effect). Secondly, these income cohorts declared less income than before, even though a lower top tax rate applies. A third possible avenue is a substantial increase in the labor supply by the income earners below the top percentiles, which increases their income share and, thus, consequently reduces the income share of the highest income earners.

Figure 4: Income share gap Slovakia
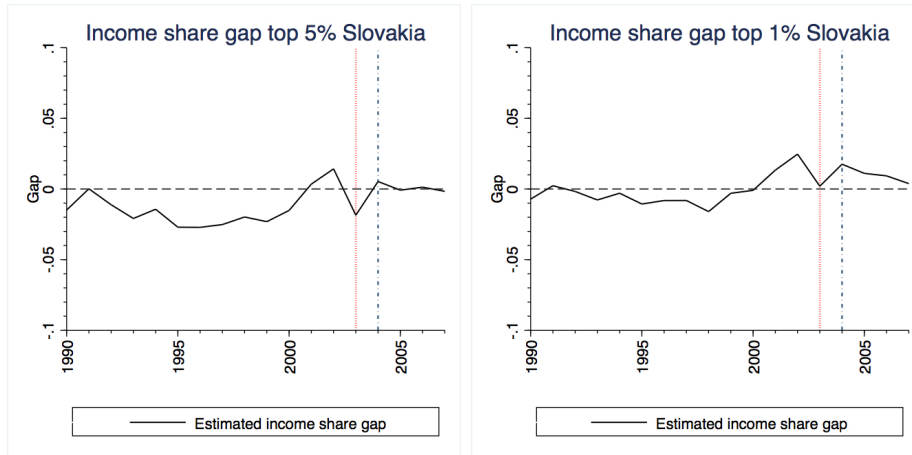
Romania

The timing of the implementation of the reform provides few opportunities for anticipation effects. Figure 2 and 5 corroborate that intuition. The income share in synthetic Romania and Romania around the reform does not change much. However, in the two subsequent years (predominantly in the third year), the income going to the top of the income distribution increases strongly. For the 90th percentile, the income share increases by 4.84 between 2005 and 2007, by 4.83 for the 95th percentile, 3.8 for the 99th percentile and 2.15 for the 99.9th percentile. For synthetic Romania, the income shares increases in 2006. However, to a lesser extent and decreases in 2007 below the 2005 level, except for the 99th and 99.9th percentile. The income share decreases between 2005 and 2007 by 0.39 for the 90th percentile and 0.66 for the 95th percentile. It increases by 0.23 for the 99th percentile and 0.75 for the 99.9th percentile between 2005 and 2007 (see Appendix B, Table 5). Therefore, the estimated treatment effect in 2007 represents an income share increase of 5.23 for the 90th percentile, 5.49 for the 95th percentile, 3.57 for the 99th percentile and 1.4 for the 99.9th percentile. The observed treatment effect almost entirely occurs between 2006 and 2007. The estimated treatment effect between 2005 and 2006 is close to zero.

The estimated treatment effect in 2007 is likely to be overestimated. Bulgaria is a contributor to synthetic Romania, and the income share in 2007 is likely lower than it would have been in the absence of the possible anticipation effects to the comprehensive tax reform in 2008 in Bulgaria. The reform could explain the minor decrease in the synthetic income shares in 2007. However, despite the possible downward correction, the increase in the income share going to the top is substantial.

As for Slovakia, the absolute increase in the income share going to the 95th percentile has roughly the same magnitude as for the 90th percentile. Therefore, the behavioral responses of the 95th percentile drive the income share up. The income earners below the 95th percentile do not seem to react to the top tax rate changes. The income earners in the 99th percentile react the strongest. Either compensation bargaining or increased tax compliance could drive the substantial increase in p99p100 and p99.9p100. The delay in the response could speak in favor of increased compensation bargaining, assuming it takes time to re-negotiate the salary package. The graphs 2 and 5 indicate that the pre-treatment period around the 2000s is not well matched. Therefore, synthetic Romania cannot entirely explain Romania's income share variation.

Figure 5: Income share gap Romania
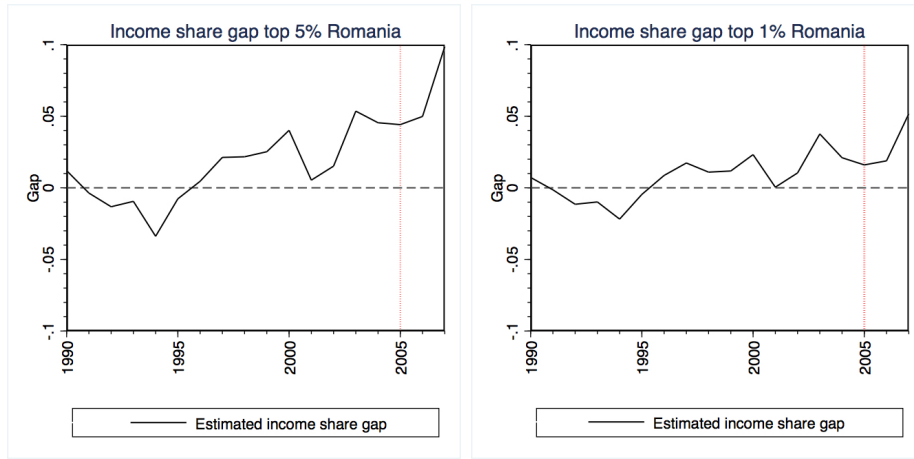
Ukraine

Due to possible anticipation effects, the treatment is assigned to 2003, the year the tax reform passed. Contrary to Slovakia, where the highest income shares dropped in the year prior to the tax rate cutting reform, the income shares increased, as it can be seen in Figure 3 and Figure 6. This effect is the opposite of what would be expected if income re-timing is at play. If Ukraine had followed the same unvarying path as synthetic Ukraine, a temporary reduction in 2003 would occur if income was shifted from 2003 to 2004. Therefore, income shifting presumably played no or solely a minor role.

Overall, the income shares of Ukraine vary much more in the post-reform period than the income shares of synthetic Ukraine. The income shares of the synthetic control are mostly flat in the post-treatment period. Whereas the income shares of Ukraine increased in 2003 and 2004, decreased in 2005 and rebounded in 2006 (see Appendix B, Table 6 and in Figure 6).

The estimated treatment effect between 2003 and 2004 is 0.95 for p90p100, 1.14 for p95p100, 1.02 for p99p100 and 0.51 for p99.9p100. The surge in 2004, the year of the implementation, could be due to the increased tax compliance of top-income earners. However, in the year following the reform, the income share going to the top decreased substantially. The estimated treatment effect between 2004 and 2005 is -1.88 for p90p100, -2.23 for p95p100, -1.67 for p99p100 and -0.91 for p99.9p100. This could indicate that the increase in tax compliance is a one-time effect. A further possible explanation is a strong labor response, in which high-income earners reduce their labor supply due to the lower tax burden. Following the substantial decrease in income going to the top income earners, the income shares rebound in 2006. The estimated treatment effect between 2005 and 2006 is 1.09 for p90p100, 1,74 for p95p100, 1.67 for p99p100 and 0.67 for p99.9p100.
Income shifting could be an explanation for the increase in the income share in 2006, which was followed by a decrease in 2007, as the behavioral response to a higher tax rate suggests. Figure 9 demonstrates this decrease in top income shares in 2007. These movements coincide with an increase in the uniform tax rate from 13% to 15% in 2007.

As for Slovakia and Romania, the behavioral responses of the 95th percentile and the cohorts above are the income share drivers. In this case, they are predominantly driven by the behavioral responses of the income earners in the 99th percentile of the income distribution. In contrast to the other countries of interest, the absolute

change in the income share is more considerable for the 95th percentile than for the 90th percentile. This is true for all income cohorts in all years. On the one hand, this could be due to more intense compensation bargaining at the expense of the lower income earner, including the p90p95. However, this effect might solely be able to explain the lower magnitude on the p90p100 compared with p95p100 if a positive estimated treatment effect prevails. A further explanation might be labor supply responses of the p90p95 in which the income effect dominates the substitution effect. Therefore, the labor supply goes down, and less income goes to this income cohort.

The behavioral responses of the top income earners are less clear-cut and sometimes contrary to what would have been expected based on the literature review. Overall, the top income shares of Ukraine compared with synthetic Ukraine are more volatile, especially in the pre-treatment period from 1995 to 1999. Moreover, the increase in the income share going to the top between 2002 and 2003 does not have a plausible explanation. In addition, the potential responses for the substantial decrease in income shares in 2005 compared with 2004 are not very compelling. The results for Ukraine have to be evaluated with caution due to the survey-based data on the top earners' income shares.

Figure 6: Income share gap Ukraine
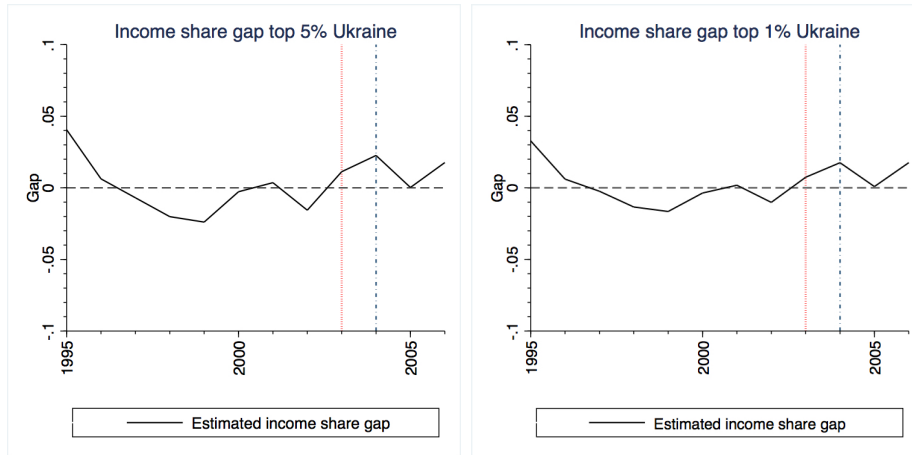
5.5 Sensitivity Test

The synthetic control method enables researchers to conduct falsification exercises to test the chosen method's sensitivity and robustness.

"In-space" placebo tests are used to test the internal validity of the results (Abadie et al., 2015). Thus, the "in-space" placebo test is conducted to check the statistical significance of the results.

The treatment is artificially assigned to each donor country in the sample. In this way, a synthetic control is constructed for each donor pool country. The outcome of that test can be shown graphically by a distribution of placebo effects. Figure 7 depicts this distribution of placebo effects of the 95th percentile for each country. The figures are gap figures indicating the gap between the outcome of the treated and the synthetic unit. The bold line presents the actual treated unit, whereas each faint line presents the synthetic control method applied to one of the donor pool countries. Therefore, their respective gaps depict the difference between the observed outcome and the outcome of its synthetic control. The results can be deemed significant if the actual treatment estimate is reasonably larger compared with the placebo effect distribution (Abadie et al., 2015). A way to formalize this is by creating p-values which estimate in-space placebo effects by calculating the percentage of effects that are larger than or equal to the effect reported for the treated country (Abadie et al., 2015). Therefore, the p-values in Table 3 represent the probability that this effect would occur by chance in the selected sample of countries.

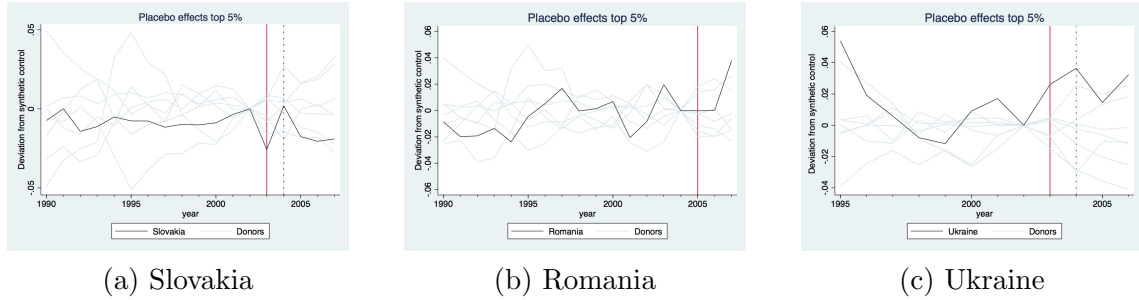Figure 7: Distribution of placebo effects p95p100

(a) Slovakia   (b) Romania   (c) Ukraine

Table 3: P-values placebo effects

		2003	2004	2005	2006	2007
Slovakia	p90p100	<0.01	1	<0.01	<0.01	0.1429
	p95p100	<0.01	1	<0.01	<0.01	0.5714
	p99p100	<0.01	1	0.2857	0.2857	0.4286
	p99.9p100	<0.01	0.2857	0.4286	0.8571	0.8571
Romania	p90p100			0.7143	1	<0.01
	p95p100			1	1	<0.01
	p99p100			0.8571	0.7143	<0.01
	p99.9p100			0.1429	0.1429	1
Ukraine	p90p100	<0.01	<0.01	0.2857	0.2857	
	p95p100	<0.01	<0.01	0.5714	0.1429	
	p99p100	<0.01	<0.01	0.7143	0.2857	
	p99.9p100	<0.01	0.2857	1	0.7143	

Slovakia

The estimated drop in 2003 for Slovakia's treatment effect is more extensive than any other placebo donor treatment effect (Figure 7a). Therefore, Slovakia's treatment estimate is reasonably larger compared with the placebo effect distribution and can be deemed significant.

The placebo p-values in Table 3 formalize the graphical presentation and demonstrate a significant behavioral response to the Slovakian tax reform on the income share in 2003 for all Slovakian income cohorts of interest. The estimated response is not distinguishable from the donor placebo effects in the following year. For 2005 and 2006, the estimated responses place p95p100 and p90p100 at the bottom of the placebo effect distribution, indicating a significant negative medium-term effect of the tax reform on these income shares. An explanation might be that the income earners below the 99th percentile reduced their labor supply, resulting in a lower income share going to these income cohorts. This does not hold true for the income cohorts at the 99th percentile and above.

Romania

Figure 7b and the p-values in Table 3 demonstrate that the reform does not cause substantial changes in the income shares, except in the third year after the reform. For 2007, the treatment estimate is reasonably larger compared with the placebo effect distribution. This does hold true for all income cohorts of interest except for the 99.9th percentile of the income distribution. In the year of the reform and the following year, the estimated effects of the 99.9th percentile display a low probability of occurring by chance. Therefore, some effect is visible for p99.9p100 in 2005 and 2006 and a substantial estimated response in 2007 for the other income cohorts. The

faster responsiveness of the highest income earners could be explained by their higher responsiveness to top tax rate changes. Therefore, this income cohort changed their behavior more quickly than the income earners below the 99.9th percentile.

Ukraine

Figure 7c and the p-values in Table 3 indicate a significant estimated short-term treatment effect due to the comprehensive tax reform in Ukraine for all top income cohorts. No later than 2005, the effect seems to vanish. However, for 2006 the probability that the estimated effect is solely due to chance decreases again, mainly for p95p100 and, to a lesser extent, p90p100 and p99p100. The findings support the potential explanation of a one-time increase in tax compliance in 2004. The lower p-values in 2006 compared with 2005 could indicate a behavioral response which might be attributable to the uniform tax increase in 2007. However, the estimated effect for the 99.9th percentile, the otherwise most responsive income cohort, does not exhibit a difference from the donor placebo effects.

5.6 Robustness Check

To test the robustness of the findings, I will conduct "in-time" placebo tests as specified by Abadie et al. (2015). The year of the tax reform is assigned to a different year than the actual reform year for the in-time placebo test. The estimated effects occurring in the actual treatment period should not be observable in untreated periods. In case of finding similar estimates, the credibility of the synthetic control estimate reflecting the impact of the treatment would be put into question (Abadie et al., 2015).

As for the sensitivity test, a distribution of placebo effects is generated. However, in contrast to the sensitivity test, the treatment year is pre-dated six years prior to the assigned treatment year. The red vertical line represents the pre-dated treatment date, whereas the dotted blue line indicates the actual assigned treatment year, taking into account possible anticipation effects.
The 95th percentile of the income distribution is used to present the "in-time" placebo test graphically.

Figure 8: Distribution of "in- time" placebo effects p95p100

(a) Slovakia   (b) Romania   (c) Ukraine
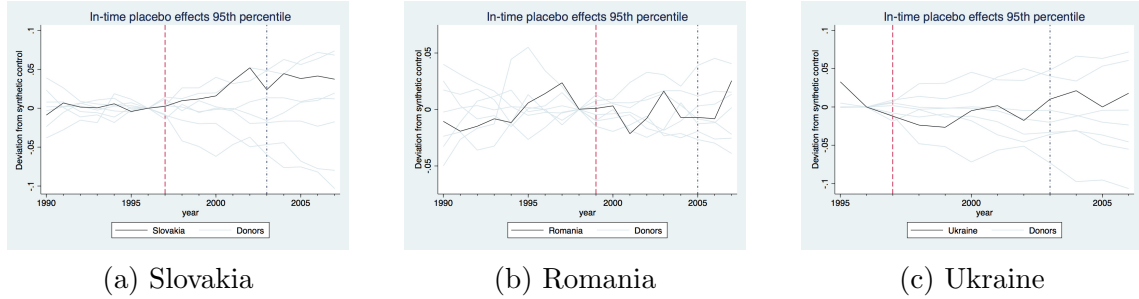
As visible in Figure 8, the pre-dated reform does not generate a treatment estimate that is reasonably larger than the placebo effect distribution in any of the countries, considering the 95th percentiles. Neither are similar estimates found for the pre-dated and the actual reform. Looking at the placebo p-values in Appendix B, Table 7 up to three years after the "reform" ($T_0 + 1$, $T_0 + 2$ and $T_0 + 3$), no significant treatment value is estimated, except for the 99th percentile in Ukraine. As outlined in the result section, Ukraine's data is very volatile in the pre-treatment years, and the findings are contradictory. Therefore, it can be concluded that the results are robust to the in-time placebo test for Slovakia and Romania but not for Ukraine.

5.7   Limitations

Although the sensitivity analysis and robustness check do not weaken the credibility of the analysis, some caveats remain.

First, not all the observed movements of the income shares can be explained. For example, it is unclear why strong behavioral responses in anticipation of the tax reform occur in Slovakia but not in Ukraine. Moreover, the increase in the income shares going to the top prior to the reform in Romania, Ukraine and Slovakia can not be fully explained.

In addition, there are possible offsetting behavioral responses which can not be distinguished and detected. The labor supply in the top percentile could, for instance, decrease but be offset by increased compensation bargaining.

Moreover, the behavioral responses can not be disentangled, and the potential driving forces are suggestive and cannot be identified with certainty.

The external validity of the results is not given due to the many confounding factors of the comprehensive reforms. In addition, the reforms are not solely restricted to reforming the tax system. For example, social security contributions were part of the comprehensive reforms (Keen et al., 2006).

This has, among other things, implications for the labor supply channel. Not only does the income tax impact the labor supply decision, but social security contributions are also a determining factor. However, social security contributions are not considered in this analysis.

A further caveat is that it is impossible to analyze the income shifting between the personal and corporate income tax base with the available data. This effect can be sizeable if tax rates on corporate and personal income diverge, as the Tax Reform Act of 1986 demonstrates. Slovakia and Romania unified the tax rates on both types of income, reducing the likelihood of extensive income tax shifting between tax bases.

Lastly, the income shares are composed of tax record data and complemented with survey data, decreasing the advantageousness of assessing the income shares of top income cohorts and comparing them across countries. The data on Ukraine is entirely survey-based. The potential poor data quality could explain the contradictive findings of the reform on top income shares. Therefore, the inference of Ukraine's findings is limited.

6 Discussion and Conclusion

6.1 Discussion

In order to attribute the observed changes in the outcome to the tax reform, no interference between the outcome of the treated unit and the control unit shall exist. Furthermore, the trajectory of the outcome variable has to depict a similar outcome variable trend in the treated country and the synthetic control.
The interference between the treated country's income shares and the income shares of non-treated countries is likely to be low. Solely migration from a donor pool country with a high top tax rate to a low top tax rate country could present a possible channel of interference.

Most of the time, a similar pre-trend between the treated and the synthetic country is given. However, not all the movements in the income shares are depicted by the income shares of the synthetic control. These partial mismatches in the income share trajectory reduce the credibility of assigning the change in the outcome variable to the reform. However, the sensitivity analysis and robustness checks indicate that the substantial top tax rate reducing reforms cause the observed movements, either in anticipation or following the reform, at least for Slovakia and Romania.

In accordance with the literature, the top income cohorts respond the strongest to tax rate changes. The income earners of the 95th percentile in the three countries analyzed are the most responsive cohort. Therefore, all the changes in behavior in response to the tax reform are driven by this income cohort. This conclusion is in line with the findings of Rubolino and Waldenström (2020). In most cases, the behavioral responses seem to be predominantly driven by the 99th percentile of the income distribution. Demonstrating that the highest-income earners are the most responsive ones. Even though the responsiveness of the income cohorts demonstrates similarities across the countries, the behavioral responses are heterogeneous and depend on the country-specific case.

Increased tax compliance could play a role in Romania and Ukraine in the year the uniform tax rate was applied first. However, for Romania, the stark increase in the top income share occurred in the third year of the reform, and such a delayed improvement in tax compliance seems rather implausible. For Ukraine, higher compliance would elevate the top income shares over a longer period. However, the top income shares are not sustained at a higher level. In Slovakia, the income shares going to the top decreased after the reform, speaking against an increase in the declaration of unreported income by the top income earners.

Contrary to the arguments used by the respective governments in favor of the comprehensive tax reforms at that time, the reductions in top tax rates do not seem to reduce distortions and thus do not seem to improve efficiency substantially. A period with sustained higher reported income in the subsequent years would indicate higher tax compliance and improved efficiency of the tax system. However, higher tax compliance does not seem to play a prominent role in the medium term. Consequently, according to the optimal income tax theory, a low elasticity of taxable income (ETI) leads to small efficiency gains when the tax rates are reduced.

The labor supply response is difficult to disentangle. Nevertheless, it seems that the hypothesis regarding the small labor supply response of the top-income earners holds. It is likely that the uniform tax rate and increase in basic allowance induced income earners below the 95th percentile of the income distribution to increase their labor supply and, thus, their share of the overall income. This seems to be especially the case for Slovakia and, to a smaller extent, for Ukraine. The decreasing income share of the top earners could indicate a sizeable positive labor supply channel for the incomes below. However, that possible increase in labor supply is likely to be rather attributable to other factors of the reform, such as an increase in the basic tax allowance, than the reduction in top tax rates.

Compensation bargaining is a promising explanation for the growth in income shares going to the top for Romania. However, in general, it does not seem to hold that fierce compensation bargaining is always a byproduct of lower top tax rates. The decrease in the income shares in Slovakia and the decrease in Ukraine in 2005 speak against this possible channel.

Overall, the findings are inconclusive concerning the development of income inequality. The market income shares going to the top do not seem to increase substantially over a longer period of time. Note to worth is that the subject of the analysis is the top income shares before taxes and transfers. Due to the inferiority of an income tax system with a tax rate closer to a linear tax rate compared with a non-linear tax rate system, the redistributive power of the governments decreases, ceteris paribus.In order to keep the income inequality level constant, the linear tax rate would need to be set higher than the previous average tax rate. This is not the case for the analyzed reforms.

6.2   Conclusion

This paper analyses comprehensive tax reforms in three Central and Eastern European countries, substantially reducing top tax rates. The motivation for this work was to shed light on the driving forces of income disparity. The overall reduction in top tax rates in CEE countries likely contributed to the increase of the pre-tax income shares of the top income earners. However, the substantial top tax rate reductions analyzed do not seem to fuel the short- or medium-term pre-tax income disparity inevitably.

The overall findings regarding the behavioral responses of the analyzed reforms are heterogeneous across countries and seem to depend on the country-specific case. Moreover, the responsiveness of the individuals within the top decile of the income distribution is found to be highly heterogeneous.

Common characteristics across the three countries are that the highest income earners are the driving force of the income shares. In addition, the absolute change in income shares is entirely driven by the income earners in the 95th percentile. The income earners below do not seem to respond to top tax rate changes, or at least not in the same way as income earners surpassing them in terms of income. They may even alter their behavior in a different direction than the income earners in the income distribution above them. Moreover, the observed changes in the income shares lead to the conclusion that the behavioral responses fall in the tax avoidance category rather than the real responses category.

Differences across the countries are observable in the magnitude of the effects and the direction of the effects. Whereas in Romania, the income shares increase in the subsequent years after the reform, and the income shares fall in Slovakia. Slovakia experiences a substantial behavioral response in anticipation of reduced top tax rates. Ukraine does not depict such anticipatory effects.

With regard to the efficiency and equity considerations of the optimal top-income tax rate theory, the efficiency gains seem to be limited. No sustained increase in tax compliance is observable. Moreover, top-income earners' labour supply response is deemed to be low. These two findings, taken together, imply a rather low elasticity of taxable income. Therefore, the efficiency gains of a lower top tax rate seem to be limited. On the downside, a significant response in anticipation of the tax reform in Slovakia implies a large negative effect on tax revenue in the year prior to the tax reform. Therefore, a substantial short-term response with respect to the new top

tax rate can be observed. However, the response increased the distortions rather than decreased them.

Concerning the equity aspect of the optimal tax theory, the top tax rate cutting reforms do not seem to lead to an overall increase in pre-tax income inequality. The governments enacting these comprehensive reforms are affiliated with the right political spectrum, which could hint at a lower inequality aversion. Although even if the government accepts a higher level of income inequality, the reforms did not seem to increase the income tax system's efficiency and are associated with tax revenue losses and, most likely, a less redistributive income tax system.

The described findings of introducing a uniform tax rate which substantially reduced top tax rates, give rise to valuable policy implications. Firstly, it is important to consider behavioral responses when designing a change in the top tax rates, having in mind the tax avoidance behavior of the income cohort surpassing the 95th percentile of the income distribution. Secondly, income-shifting responses can lead to substantial fluctuations in tax revenue. Therefore, it can be deemed important to incorporate the possible tax revenue losses in the tax planning in the years around the reform. Overall, the heterogeneous responses and magnitude of the effects on top income shares require a case-by-case analysis. When reducing top rates, policymakers should thus consider the behavioral responses and design the policy according to the expected particularities of the reform and the country.

An avenue for further research could be the analysis of tax reforms which solely reduced the top tax rate and compare it with the developments in pre-tax income shares in countries similar to the treated country but not reforming their tax system over a longer period of time. Such a setup might, however, be challenging to encounter in real life.

In addition to this avenue, looking at the changes in the income share of each percentile separately in response to a top tax reform might shed further light on the heterogeneous responses within the top decile.

Finally, to better understand the different behavioral responses and their magnitude, microdata on labor supply and income reporting could offer further insights. Moreover, personal and corporate income data on an individual level would provide valuable insights into the potential income shifting between tax bases.

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A   Graphs

Figure 9: Income share 95th percentile Ukraine
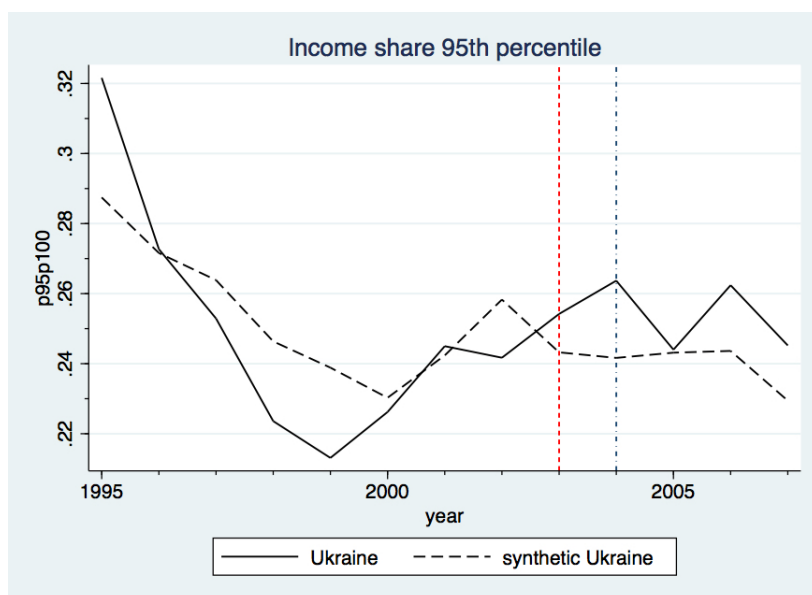
B Tables

Table 4: Income share Slovakia and synthetic Slovakia

Year Income share	2002	2003	2004	2005	2006	2007
p90p100	.3090	.2834	.3071	.3043	.3088	.3061
synth p90p100	.3143	.3167	.3116	.3257	.3327	.3345
p95p100	.2158	.1886	.2118	.2091	.2136	.2107
synth p95p100	.2015	.2072	.2065	.2099	.2123	.2124
p99p100	.1006	.0805	.0981	.0942	.0961	.093
synth p99p100	.0840	.0859	.0860	.0879	.0925	.091
p99.9p100	.0367	.0272	.0367	.0331	.0329	.0307
synth p99.9p100	.0255	.0257	.0262	.0285	.0322	.0285

Table 5: Income share Romania and synthetic Romania

Year Income share	2004	2005	2006	2007
p90p100	.4008	.4020	.4115	.4504
synth p90p100	.3493	.3501	.3557	.3462
p95p100	.2922	.2919	.3002	.3399
synth p95p100	.2468	.2478	.2503	.2412
p99p100	.1403	.1389	.1443	.1769
synth p99p100	.1193	.1229	.1255	.1252
p99.9p100	.0491	.048	.0506	.0695
synth p99.9p100	.0365	.0371	.0358	.0318

Table 6: Income share Ukraine and synthetic Ukraine

Year Income share	2002	2003	2004	2005	2006
p90p100	.3467	.3599	.3681	.3501	.3658
synth p90p100	.3614	.3457	.3440	.3451	.35
p95p100	.2417	.2542	.2637	.244	.2624
synth p95p100	.2574	.2427	.2411	.2426	.2431
p99p100	.1019	.1115	.1207	.1049	.121
synth p99p100	.1121	.1041	.1031	.1040	.1034
p99.9p100	.0298	.035	.04	.0319	.0391
synth p99.9p100	.0343	.0308	.0307	.0318	.0323

Table 7: P-values "in-time" placebo test

		T_0+1	T_0+2	T_0+3
Slovakia	p90p100	0.7143	0.2857	0.5714
	p95p100	1	0.5714	0.5714
	p99p100	1	0.5714	.07143
	p99.9p100	0.7143	0.1429	0.4286
Romania	p90p100	1	1	0.2857
	p95p100	1	0.8571	0.2857
	p99p100	1	0.4286	0.2857
	p99.9p100	0.8571	0.1429	0.8571
Ukraine	p90p100	0.4286	0.1429	0.1429
	p95p100	0.2857	0.2857	0.2857
	p99p100	<0.01	<0.01	0.5714
	p99.9p100	0.1429	0.1429	<0.01