

DISCUSSION PAPER SERIES

IZA DP No. 15302

**Income Tax Policy in Europe between Two  
Crises: From the Great Recession to the  
COVID-19 Pandemic**

Michał Myck  
Kajetan Trzciński

MAY 2022

## DISCUSSION PAPER SERIES

IZA DP No. 15302

# Income Tax Policy in Europe between Two Crises: From the Great Recession to the COVID-19 Pandemic

**Michał Myck**

*Centre for Economic Analysis, University of Greifswald and IZA*

**Kajetan Trzciński**

*Centre for Economic Analysis and University of Greifswald*

MAY 2022

Any opinions expressed in this paper are those of the author(s) and not those of IZA. Research published in this series may include views on policy, but IZA takes no institutional policy positions. The IZA research network is committed to the IZA Guiding Principles of Research Integrity.

The IZA Institute of Labor Economics is an independent economic research institute that conducts research in labor economics and offers evidence-based policy advice on labor market issues. Supported by the Deutsche Post Foundation, IZA runs the world's largest network of economists, whose research aims to provide answers to the global labor market challenges of our time. Our key objective is to build bridges between academic research, policymakers and society.

IZA Discussion Papers often represent preliminary work and are circulated to encourage discussion. Citation of such a paper should account for its provisional character. A revised version may be available directly from the author.

ISSN: 2365-9793

**IZA – Institute of Labor Economics**

Schaumburg-Lippe-Straße 5–9  
53113 Bonn, Germany

Phone: +49-228-3894-0  
Email: [publications@iza.org](mailto:publications@iza.org)

[www.iza.org](http://www.iza.org)

## ABSTRACT

---

# Income Tax Policy in Europe between Two Crises: From the Great Recession to the COVID-19 Pandemic\*

We examine the revenue and redistributive effects of tax policy reforms in twelve European countries over the decade between the financial crisis and the outbreak of the COVID-19 pandemic, setting them against the implications of a hypothetical system reflecting the extent of fiscal drag resulting from nominal wage increases. We show that the combination of wage growth and progressivity of the tax system determined the fiscal leeway which governments could use to reduce income inequality. Despite significantly faster wage growth in the examined post-communist countries of Central and Eastern Europe, their much lower degree of progressivity implied limited additional scope for fiscal changes. While decisions taken in most of the examined countries in the CEE region led to increases in tax progressivity, their income tax systems continue to be far less redistributive in comparison with such countries as Ireland, the Netherlands, or Portugal. This not only has direct implications for income inequality but also translates into limitations of automatic fiscal drag effects on government revenues, which could offer additional resources, in particular at a time of high inflation.

**JEL Classification:** H24, D31

**Keywords:** income tax, tax reforms, fiscal drag

**Corresponding author:**

Michał Myck  
Centre for Economic Analysis CenEA  
Cyfrowa 2  
71-441 Szczecin  
Poland  
E-mail: [mmyck@cenea.org.pl](mailto:mmyck@cenea.org.pl)

---

\* This paper results from the ongoing involvement of the Centre for Economic Analysis in the development and update of the EUROMOD tax and benefit microsimulation model. EU-SILC data used for the project has been made available by EUROSTAT who are not responsible for any of the presented findings. The results are based on EUROMOD version i2.0+. Originally maintained, developed and managed by the Institute for Social and Economic Research (ISER), since 2021 EUROMOD is maintained, developed and managed by the Joint Research Centre (JRC) of the European Commission, in collaboration with EUROSTAT and national teams from the EU countries. We are indebted to the many people who have contributed to the development of EUROMOD. The results and their interpretation are the authors' responsibility.

## I. Introduction

In most European countries the 2008 financial crisis had dire consequences that permeated throughout the economy, from general economic contraction to downward pressure on wage growth in many industrial sectors (European Commission 2009). Core issues surrounding the inclusivity of the economic recovery and policy targeting towards inequality reduction were widely raised in the aftermath of the Great Recession, which in many countries amplified the intensity of calls for inequality-reducing policies (Dabla-Norris 2015). Concerns about distributional consequences and inequality have historically varied in their salience across European regions, with Western European countries coming up against this problem as far back as the early 1970s following the slowdown of post-war economic expansion (Ben-David and Papell 1998). In these countries questions of stagnating wage growth, growing income inequality and uneven profit sharing have been the subject of academic and policy debate for several decades (O.E.C.D. 2011) with a significant focus on the progressivity of the direct tax system as one of the primary tools governments hold to address these challenges (Meghir and Phillips 2010, Verbist and Figari 2014). On the other hand, post-communist countries, which prioritised macroeconomic stability and growth well into this century as a consequence of the turbulent transition to a market-oriented economy in the 1990s, began tackling these policy challenges much later (Rose and Viju 2014). Quasi-linear income tax designs were implemented in Lithuania (1994), Estonia (1994), and Latvia (1997) in the 1990s, and later in Slovakia (2004), the Czech Republic (2008) and Hungary (2011). While part of the justification behind linear tax reforms were attempts to limit the extent of the informal economy, it was clear that economic efficiency arguments in these countries, often inaccurately formulated, were taking precedence over equity (Evans and Aligica 2008).

The discussion concerning the role of tax system design in reducing inequality is likely to gain salience in the recovery from the economic crisis caused by the COVID-19 pandemic and at times of heightened economic uncertainty resulting from the Russian invasion of Ukraine. Tax systems will be a crucial component of this process and direct taxes in particular will play a key role in the allocation of support and the distribution of the burden of recovery initiatives. As inflation reaches levels unknown in some countries for several decades, rapid changes in nominal incomes generate additional government revenues and questions of adjustment of the tax systems to the resulting fiscal conditions will gain in importance.

In this paper we examine the role of the direct tax system in the 10-year window between the financial crisis and the pandemic across twelve European countries. We focus on the effect of policy interventions that the countries chose to implement in this period, on government revenues and on the redistributive effect of the income tax, and set them against the implications of a hypothetical system reflecting the extent of fiscal drag resulting from nominal wage increases.

Our simulations are conducted using the EUROMOD microsimulation model (H. Sutherland and Figari 2013) based on 2016 EU-SILC data for twelve countries (Czech Republic, Estonia, Hungary, France, Ireland, Latvia, Lithuania, the Netherlands, Poland, Portugal, Slovakia, Sweden). In nine out of the twelve countries - with the exception of Hungary, Sweden and the Netherlands - the direct tax system in 2019 contributed more to inequality reduction compared to the system from 2009. We demonstrate two channels through which this happened: on the one hand the specific tax policy interventions implemented by their respective governments, and on the other the lack of the system's indexation. The latter effect not only generates significant additional revenue which governments can use to bolster the public budget, but also has important distributional implications in periods of high nominal wage growth (Avram et al. 2013).

Our results suggest that, overall in nine of the twelve countries the scale of the implemented reforms was lower compared to a reference system which simply indexes the nominal parameters with nominal wage growth. In other words, the negative effects of fiscal drag – calculated with respect to wage dynamics – on households' disposable income were greater on average than the benefits of income tax policy reforms implemented by the government. Only in Sweden, Hungary and Estonia the governments reduced the overall tax burden by more than our reference system would have. The fiscal leeway offered by nominal wage growth reflects a combination of wage increases and the progressivity of the baseline system, with the highest total effect of fiscal drag in the Netherlands, Sweden and Hungary. It is also in these three countries that the implemented reforms resulted in a system that by the end of the analysed period was less redistributive compared to that in 2009. The reformed systems in the other countries either maintained or increased their redistributive effect. Still however, there remain significant disparities between older and younger free market economies with regard to the progressivity of the income tax. By the end of the 2010s all post-communist countries achieved lower redistribution through the income tax than any of the other countries examined.

The paper is organised as follows. To begin in Section 2 we present our methodology, in which we outline the application of a stripped-down tax function for isolating the effect of nominal wage growth on direct taxes, and consequently disposable income. This is followed by a review of the literature on fiscal drag and tax progressivity in Europe between 2009-19, as well as an outline of the underlying structural and macroeconomic conditions that drove the effect. In Section 4, we present our results, showing the tax revenue effects of income tax reforms as opposed to nominal indexation of the tax system, and examining their distributive implications. We draw conclusions in Section 5 and discuss the shifting policy priorities of PIT design across Europe and their consequences.

## II. Methodology and Data

### 1. Adjustments to the tax function

We conduct the analysis with the use of a stripped-down tax function, as per Immervoll (2005). By simplifying the equation to calculate taxes ( $t$ ) as a function of pre-tax income ( $y$ ) with a few manageable parameters, namely gross income adjustments ( $a$ ), the tax schedule ( $s$ ) and tax credits ( $c$ ), we carry out a cross-country comparison where first-order effects can be systematically measured, while long-run effects are purposefully ignored. The comparison necessarily implies a number of assumptions. For one, we keep demographic and employment structures frozen at the level of the data year, in our case 2016, and we apply income indexation (by broad income categories) to the data to express incomes in the values of the final year of the period considered. The basic tax equation,  $t(y)_i = s_i(y - a(y)_i) - c(y)_i$ , allows us to ascertain the taxes paid by each household ( $i$ ), taking into account the system parameters which we are interested in adjusting. Other parts of the simulated tax-benefit system remain unchanged in the analysis.

The tax function from the beginning of the examined period, i.e. 2009, is compared to its actual parameters in the final year of the analysis, i.e. 2019, and to a hypothetical indexed scenario determined by the nominal dynamics of wages. Such an approach specifies nominal neutrality of the tax system in relation to the average wage growth, and thus with respect to wage changes identifies the fiscal drag. In the case of our analysis this is justified on the one hand, by the differentiated degree of fiscal leeway generated by different wage dynamics in the analysed counties, and on the other, by the arguments of Bargain and Callan (2010) who present average wage growth adjustments of nominal parameters as a distributionally neutral benchmark of the tax and benefit system over time as gross incomes evolve. Although in our exercise gross

incomes are fixed as we simulate different tax systems on a single year of data, the adopted approach to indexation provides a natural reference scenario from the point of view of our analysis. Average wage indexation is thus employed in devising the hypothetical ‘indexed system’. Functions  $s$ ,  $a$  and  $c$  from the baseline system (0) will be multiplied by  $(1 + \text{average wage growth})$  and the change in taxes  $(\Delta t(y)_I)$  resulting from indexation will be compared to the change in  $t(y)$  resulting from the actual real-world reforms  $(\Delta t(y)_R)$ .

Thus (dropping the ‘i’ subscript for clarity), we define the indexation effect as:

$$\Delta t(y)_I = [s_0(y - a(y))_0 - c(y)_0] * (1 + \text{average wage growth}) - [s_0(y - a(y))_0 - c(y)_0], \quad (1)$$

and the reform effect as:

$$\Delta t(y)_R = s_I(y - a(y))_I - c(y)_I - s_0(y - a(y))_0 - c(y)_0, \quad (2)$$

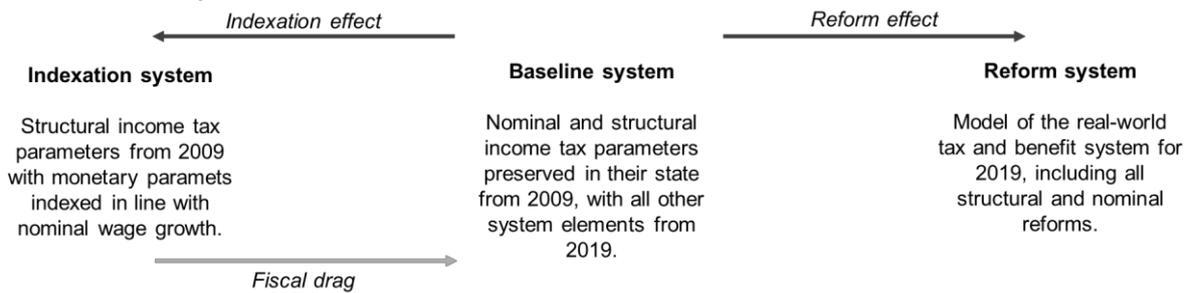
where we subtract taxes in the baseline system from 2009 (0) and the actual, reformed system from 2019 (1). For each household we measure the difference in the tax burden, as well as the resulting change in disposable income between the two systems.

## 2. Data and tax modelling

The study has been carried out with the use of the EUROMOD, the tax-benefit microsimulation model of the European Union. The EUROMOD is a tool designed for comparative cross-country fiscal policy analysis, covering all the countries of the European Union in an integrated platform. It is designed to reflect all major policy changes in each country on an annual basis (state of the system on June 1<sup>st</sup> of each year). The specificity with which simulated variables are designed allows for the analysis of household-level data that accounts for family structures, incomes, taxes, and benefits. Consequently, policy analysis can be conducted on various strata, from national aggregate statistics to income percentiles to specific family types. Furthermore, the output data is standardised according to uniform criteria across countries and years, which allows for multi-national studies over longer time periods with seamless maintenance of continuity.

The micro-data used for all countries was derived from the 2016 EU-SILC (European Survey of Incomes and Living Conditions) for the 2015 income year, uprated with income-type specific uprating factors to 2019. The EU-SILC data covers a broad range of household socio-demographic characteristics, employment status information as well as detailed incomes and assets. Basic sample size information for the examined countries is presented in Table A2 in the Appendix.

**FIGURE 1**  
**Simulated tax systems**



We used three tax benefit systems in our analysis; the first is the pre-existing standard model in the EUROMOD and represents the real-life tax-benefit system in each country in June, 2019. The other two are theoretical systems that were designed with the intention of isolating the effects of fiscal drag and the effect of the tax reforms that were implemented over the same period. In the case of tax policy reform modelling, the income tax structure and parameters were restored to their 2009 (nominal) state while maintaining the rest of the 2019 tax-benefit system. This hybrid system is the ‘*baseline system*’, from which the effect of PIT reforms and fiscal drag can be determined. The ‘*reform system*’ is a model of the real-life parameters and includes all PIT reforms that were implemented between 2009-19. The third system, or ‘*indexation system*’, allows for the determination of the measurement of the fiscal drag effect by indexing all the monetary parameters of the 2009 income tax system at the rate of nominal wage growth with all structural parameters – such as tax rates – unchanged.

There are two principal ways to address the implications of fiscal drag; the first takes price changes as the benchmark for the indexation of nominal parameters (Heinemann 2001), while the other is based on the nominal change in wages (Bargain and Callan 2010). Since our focus in this paper is on income tax policy in circumstances of differentiated nominal wage growth, it seems natural to take the Bargain and Callan (2010) approach as a reference point across the examined countries. As Bargain and Callan (2010) have demonstrated wage indexation has been shown to preserve the implications of the tax and benefit system for income inequality when applied in a decomposition of factors influencing its evolution. This makes it a valid reference scenario from the point of view of redistributive neutrality. In the analysis therefore we consider the implications of leaving the system frozen relative to the rate of nominal wage growth with four groups of countries differentiated by the rate of growth of nominal wages

between 2009 and 2019: from Portugal and Ireland with the most sluggish growth to the Baltic states where wage growth in this period was highest (see Table 1).

**TABLE 1**  
**Basic economic indicators across selected 12 European countries, 2009 -2019**

| Country     | GDP/capita<br>(2019) EUR | Price level<br>change per<br>cent (2009 =<br>100) | Unemployment<br>rate, per cent<br>of total labour<br>force (2019) | Real wage<br>growth<br>(2009 =<br>100) | Nominal<br>wage<br>growth<br>(2009 = 100) | Wage<br>growth<br>group |
|-------------|--------------------------|---|---|--|---|-------------------------|
| Portugal    | 20,780                   | 109   | 6.46  | 97                                     | 106                                       | Very low                |
| Ireland     | 72,158                   | 111   | 4.95  | 100                                    | 111                                       | Very low                |
| Netherlands | 46,714                   | 116   | 3.38  | 99                                     | 115                                       | Low                     |
| France      | 36,071                   | 111   | 8.44  | 108                                    | 119                                       | Low                     |
| Sweden      | 46,164                   | 116   | 6.83  | 113                                    | 129                                       | Low                     |
| Czechia     | 19,044                   | 115   | 2.01  | 129                                    | 144                                       | High                    |
| Slovakia    | 17,216                   | 122   | 5.75  | 123                                    | 145                                       | High                    |
| Hungary     | 14,951                   | 139   | 3.42  | 114                                    | 153                                       | High                    |
| Poland      | 14,013                   | 123   | 3.28  | 133                                    | 156                                       | High                    |
| Latvia      | 15,895                   | 129   | 6.31  | 142                                    | 171                                       | Very high               |
| Lithuania   | 17,468                   | 125   | 6.26  | 151                                    | 176                                       | Very high               |
| Estonia     | 21,187                   | 143   | 6.31  | 135                                    | 178                                       | Very high               |

*Source: OECD; World Bank Data.*

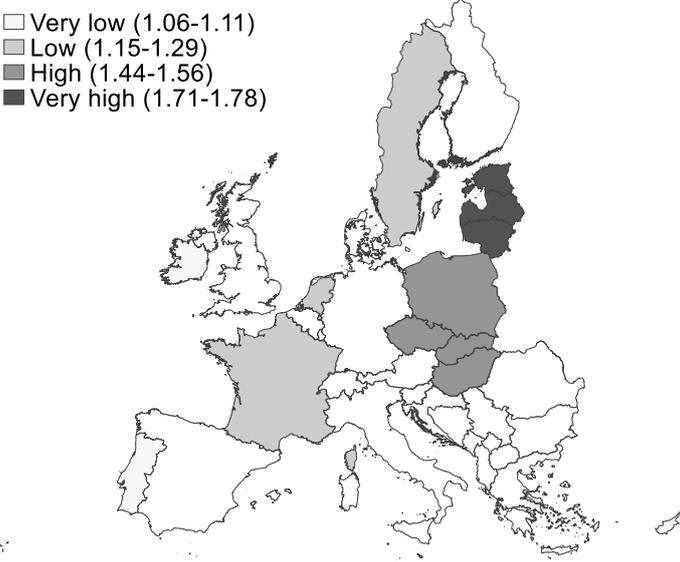
### III. Wage growth and fiscal drag in Europe

Fiscal drag is an inherent element of any progressive income tax system when the nominal value of wages change. It occurs as a result of the increase in the nominal cost of labour (Altig and Carlstrom 1993 , Immervoll 2005, Saez 2003) and is a side effect of progressive tax brackets, the relative value of which falls with respect to the growing wages. As nominal wages rise, so does the effective tax rate for many workers since an increasing proportion of income is taxed at a higher rate. This phenomenon pertains not only to tax thresholds but to all commonly observed nominal elements of the income tax system, such as family credits or the tax-free allowance. It is important to note that while fiscal drag is often inequality reducing, it can still be a significant burden for poorer households (Paulus and Tasseva 2019; Sutherland et al. 2008). When the universal basic allowance parameter is nominally frozen, the rate of change in the effective tax rate can be greater for low-income households than for high earners, even if

the proportional and absolute increases are greater for the latter group. Encompassed by this conceptualisation of bracket creep is a core issue of tax efficiency in times of rapid price changes with the negative implications of the burden of increasing effective tax rates at the micro and macro levels (Heer and Süßmuth 2013).

These consequences of fiscal drag in times of poor economic performance have led many countries, notably Belgium, Britain, Canada, the Netherlands, Switzerland and the USA, to enshrine automatic tax parameter indexation in line with rising prices into law. In the countries we have analysed such inflation driven form of system indexation is found in Portugal, Ireland and the Netherlands.

**FIGURE 2**  
**Nominal wage growth in selected 12 European countries, 2009-19**



*Source: see Table 1.*

For the purpose of our analysis, we have grouped the twelve analysed countries according to the rate of nominal wage growth, allowing for an inter-group comparison of the impact of indexation, as well as an intra-group analysis of dissimilarities in policy approaches with similar underlying conditions and the variations in the effect of fiscal drag. This categorisation is mapped in Figure 2. The three Baltic countries (Estonia, Latvia and Lithuania) experienced the highest rate of nominal wage growth between 2009 and 2019, while wages in Portugal and Ireland grew most slowly – by 6 and 11 percent respectively (see Table 1). Real wage growth was also highest in the Baltic states, and was negative or stagnant in Portugal, Ireland and the Netherlands (Table 1).

All twelve countries implemented income tax reforms of various magnitude and scope between 2009 and 2019, ranging from the introduction or withdrawal of a linear income tax system to small adjustments in tax allowance criteria (European Commission 2009b). Table A1 in the Appendix outlines the state of the income tax system in each country in 2009 and summarises the most important reforms that were implemented during the following decade. As the transition from central planning to a market economy allowed greater flexibility in policy design compared to established fiscal systems, introduction of a flat income tax has been widespread in the countries of Central and Eastern Europe over the past 30 years (Bernardi, Chandler, and Gandullia 2005). Even though none of the studied countries have attempted the implementation of a pure flat tax (i.e. a system without any credits or allowances), these overhauls have had dramatic impacts on the redistributive nature of the entire tax benefit system of these countries.

The design of the direct tax system in many Central and Eastern European (CEE) countries has for a long time been driven primarily by efficiency and much less by equity concerns, with the objective to attract high skilled workers, encourage entrepreneurship and intensive labour supply, and to limit incentives for tax evasion in conditions when tax enforcement has been highly imperfect (Hall and Rabushka 2007). The result of this was the implementation of linear or quasi-linear tax systems in many European transition countries. While of the countries studied here by 2019 Slovakia, the Czech Republic, Lithuania, and Latvia reverted from the flat tax to progressive taxation (respectively in 2013, 2013 and 2017), Estonia kept a quasi-linear system in place, and Hungary in turn instituted a flat tax in 2011. Although Poland's system was never fully linear, since 2009 most tax-payers have faced only two tax rates, and the self-employed have operated under a linear PIT since 2004. Another major development in the examined transition countries over the analysed period have been increases in financial support for families through the tax system. This can be in part attributed to the increasing demographic challenges resulting from population ageing, a development accelerated in part by stubbornly low fertility rates (Sobotka 2016).

The five older free market countries included in our sample had significantly more redistributive and progressive systems in the 2009 baseline. These characteristics are manifested by, on average, a larger number of tax brackets, targeted credits and income dependent allowances compared to the transition countries. There are also many national specificities that are well ingrained into the system, such as the division of income tax collection between the central and local government in Sweden, which can act as a limitation on the range

of potential tax system reforms under consideration, as opposed to the ‘blank slate’ with which post-communist countries entered the 1990s. All five countries had numerous tax brackets in 2009, while Portugal had the highest number with an eight-tier progressive income tax system. Ireland and Sweden technically had two tax brackets, but in practice the Additional Income Levy in the former and the Municipal Tax in the latter signify a larger number of increasing tax rates for higher earners. Since systems with a higher number of tax brackets can be more effective in lowering income inequality and shifting the tax burden towards top earners (Andrienko, Apps, and Rees 2014), these five countries were already better prepared for counterbalancing increasing income inequality in 2009, and moreover, had many elements that could be easily adjusted if needed.

France and Portugal had the highest number of differentiated tax brackets in 2009, and also implemented the most changes to their systems over the following decade. By 2013 France had increased the tax rate for the 5<sup>th</sup> income bracket and added a 6<sup>th</sup> bracket, implementing a new top marginal tax rate of 45 per cent. Starting in 2017, low-income earners also benefited from the introduction of an additional tax reduction of 20 per cent. In Portugal the number of tax brackets was increased in 2010, reduced in 2013, and restored back to seven in 2018. However, by 2019 all seven rates had increased, with the top marginal rate of 48 per cent replacing a rate of 42 per cent from 2009. Portugal, Ireland and France either implemented or reformed some form of additional tax levy for high income earners to fund the social protection system, which essentially functions as an increase in tax rates for some households. It is worth to note that of the transition countries, Poland also implemented a similar scheme in 2019. In the Netherlands tax rates were subject to minimal adjustments on an annual basis, but these usually amounted to fractions of a percent in one direction or the other. The government also increased the progressivity of tax credits and allowances between 2014 and 2017 by raising the value for low earners and implementing a tapered withdrawal for higher earners. In 2018 the Netherlands reduced their number of tax brackets from four to three, but the top rate remained nearly unchanged from its state in 2009. The Swedish system underwent the fewest major structural changes, but the income tax parameters were subject to significant nominal adjustments of bracket thresholds and allowances. While the scale of reforms varied, what can be observed is a variety of easily accessible options that multiple tax brackets provide in adjusting the progressivity of the system without the need for an implementation of new mechanisms which may be more complicated to design.

Thus the examined countries adopted very different approaches with respect to the adjustment of their tax systems, and these changes in turn cannot be separated from the background of strongly differentiated overall economic dynamics of the post crisis recovery and the related growth of individual incomes. The varying pace of economic growth over the analysed decade combined with very different distributional nature of different tax systems provides interesting conditions for a closer examination of reform decisions undertaken by respective governments and analysis of the cost and distributional consequences of the implemented changes.

## IV. Results

We examine the developments in the tax systems for the twelve countries from two perspectives. Results reported in Section 4.1 show differences between the actually adopted policy approaches and the nominal wage system indexation from the point of view of overall tax revenue consequences. In Section 4.2 we then look at the differences between these scenarios from the perspective of progressivity of the system and its implications for inequality.

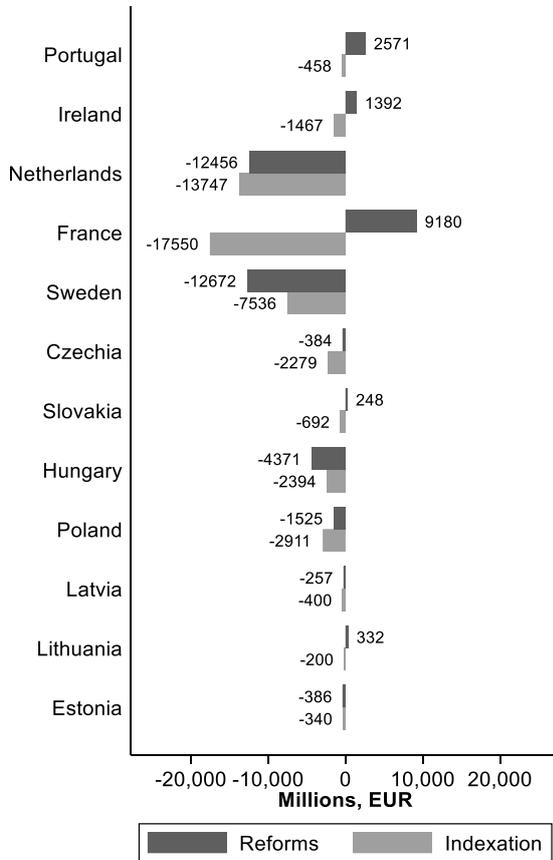
### 1. Revenue effects

Regular indexation of the income tax system is disadvantageous from a revenue perspective due to the passive growth in the average tax rate that occurs when nominal parameters remain frozen. This effect comes out clearly in our analysis in the comparison of the frozen 2009 tax system and the '*indexation system*' and results on the one hand, from the scale of the indexation, which reflects nominal wage growth, and on the other, from the progressivity of the baseline tax system and the scale of income tax revenues, both of which deepen the effect of fiscal drag (Immervoll 2005).

In Figures 3a and 3b, where countries are ranked from top to bottom according to the rate of nominal wage growth, we present the annual budgetary impact of nominal indexation and of actual income tax reforms in Euros and as a percentage of GDP. The effect of indexation on tax revenues that can be observed in Latvia, Estonia and Lithuania, the three countries with the highest wage growth in our sample, varies greatly between -1.3 per cent and -0.4 per cent of GDP. While all three countries had a quasi-linear system in the 2009 baseline, the greater number of allowances in Latvia and Estonia led to a much higher fiscal drag effect compared to Lithuania.

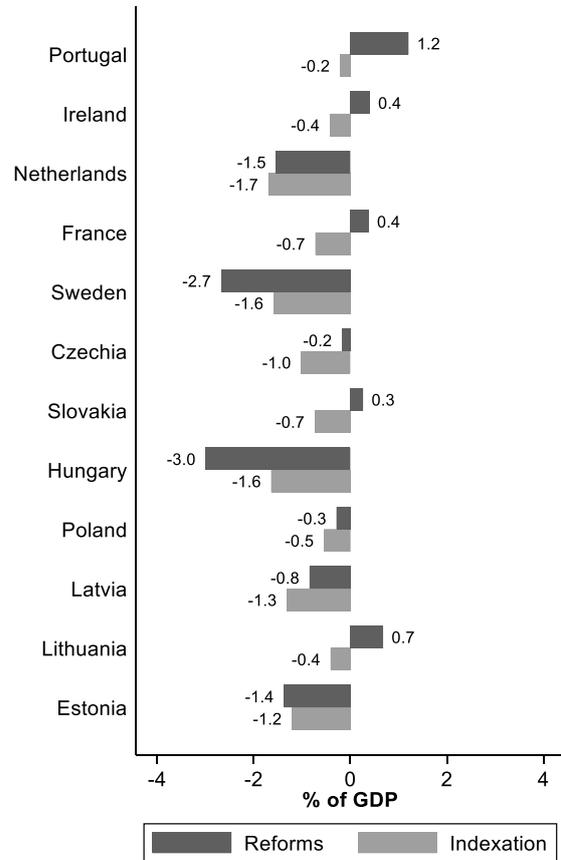
**FIGURE 3A**

**Annual tax revenue effects of reforms vs indexation in 2019, EUR millions**



**FIGURE 3B**

**Annual tax revenue effects of reforms vs indexation in 2019, per cent of GDP**



Source: Own calculations using the EUROMOD model run on EU-SILC 2016 data.

The importance of the system’s structure can be further observed in the Netherlands and Sweden, two countries with relatively low wage growth, which over the same period saw an even greater effect of indexation than the Baltic states. The Netherlands, for example, had the third from lowest wage growth, and yet the highest indexation effect (-1.7 per cent of GDP), and in Sweden we observe a very similar effect (-1.6 per cent of GDP) with fifth from lowest wage growth. This demonstrates how susceptible these highly progressive systems are to increases of the tax burden on households as a result of nominal wage growth. Another factor that causes such a notable effect is the large scale of income tax revenues in 2009, with the Netherlands collecting 8.6 per cent and Sweden collecting 16.4 per cent of GDP through the income tax (European Commission 2009-19). Over the examined period both countries conducted some form of indexation of their nominal tax parameters, although in the Netherlands the parameters were only indexed in some years. In Sweden the parameters were adjusted

annually, and indexation even slightly outpaced the rate of nominal wage growth. These indexations are reflected partly as the reforms' effect in Figures 3a and 3b.

The different revenue effects of income tax reforms in each country reflect the variety of reforms presented in Table A1 and discussed in Section 3. In many countries we see moves directed at the reduction of the income tax through tax reforms. At the same time income tax policy in Poland during the decade leading up to 2019 was nearly stagnant with the most significant adjustment in the form of the amendment of the tax-free allowance in 2017. The reform raised the allowance for low-income earners, while implementing a staggered withdrawal for richer households. Ultimately it had a slightly redistributive effect, but essentially remained revenue neutral. Thus, the revenue effect of the reform system in Poland amounts to a mere -0.3 per cent of GDP. Importantly, the small budgetary loss that could be observed did not outpace the effect of the alternative indexation scenario, indicating that the government still increased the average tax rate.

Similarly, as in Poland, the Czech Republic, Latvia, the Netherlands saw a lower cost of implemented income tax interventions when compared to the indexation of the tax system. While the implemented reforms reduced the average tax rate, wage-linked indexation would have been more beneficial to households. This difference between indexation and reforms was most pronounced in the Czech Republic, where indexation would have reduced tax revenues by 1.0 per cent of GDP annually, while the actual reforms only cost the government 0.2 per cent of GDP. Thus, after accounting for changing wages, in the Czech Republic the tax burden on households increased by 0.8 per cent of GDP, when compared to the 2009 baseline.

In Portugal income tax revenues increased by 1.2 per cent of GDP as a result of tax reforms, the highest increase out of all twelve countries, resulting from an increase in tax rates across all seven brackets. In Estonia the changes to the income tax system effectively mirrored the additional revenues from fiscal drag; indexation would have cost the government 1.2 per cent of GDP, while the reformed system led to decline of 1.4 per cent of GDP in tax revenues. Both Estonia and Latvia introduced a progressively scaled tax-free allowance to replace the universal version, while Latvia also abolished the flat tax in 2018 and introduced a progressive scale. In Latvia this combination of reforms cost the government 0.8 per cent of GDP, which was still 0.5 percentage points less than simple indexation. Hungary, on the other hand, reduced its income tax revenues by 3.0 per cent of GDP as a result of its newly implemented flat tax. Even with a very high indexation effect on tax revenues of -1.6 per cent of GDP, the reforms outpaced these budgetary losses by a further 1.4 per cent of GDP. To a varying degree, in every country,

the fiscal drag effect worked as a revenue raising mechanism and granted additional budgetary leeway to policymakers to reduce income taxes through reforms. This shows how in times of economic expansion fiscal constraints can be reduced, providing greater flexibility in policy design. Estonia, Hungary and Sweden were the only three countries in which the cost of implemented reforms outweighed the simulated cost of indexing the system with nominal wage growth, indicating that in all other cases the government still made a net fiscal gain in income tax as a result of wage growth. The reforms implemented in Portugal, Ireland, France, Slovakia and Lithuania raised revenues over and above the effect of fiscal drag. In Portugal government revenues grew by 1.2% of the GDP as a result of the entire 2009-2019 reform package, while in the other three countries respectively by 0.4%, 0.4%, 0.3% and 0.7% of the GDP.

**TABLE 2**  
**Implications for income inequality and progressivity of the income tax systems:**  
**Gini and Reynolds-Smolensky indices**

| Country     | Baseline (2009) |       | Reform (2019) |                  |       |                | Indexation (2019) |                  |       |                |
|-------------|-----------------|-------|---------------|------------------|-------|----------------|-------------------|------------------|-------|----------------|
|             | Gini            | RS    | Gini          | $\Delta$ in Gini | RS    | $\Delta$ in RS | Gini              | $\Delta$ in Gini | RS    | $\Delta$ in RS |
| Czechia     | 25.04           | 0.031 | 24.78         | -0.26            | 0.032 | 0.001          | 24.98             | -0.05            | 0.029 | -0.002         |
| Estonia     | 31.75           | 0.022 | 30.65         | -1.11            | 0.033 | 0.011          | 31.12             | -0.63            | 0.028 | 0.006          |
| France      | 28.88           | 0.033 | 27.97         | -0.91            | 0.041 | 0.008          | 28.98             | 0.10             | 0.032 | -0.001         |
| Hungary     | 26.94           | 0.062 | 30.17         | 3.23             | 0.021 | -0.041         | 26.97             | 0.03             | 0.058 | -0.004         |
| Ireland     | 30.09           | 0.071 | 29.48         | -0.61            | 0.078 | 0.007          | 30.46             | 0.37             | 0.067 | -0.004         |
| Lithuania   | 35.09           | 0.022 | 34.07         | -1.02            | 0.033 | 0.011          | 34.82             | -0.27            | 0.024 | 0.002          |
| Latvia      | 34.60           | 0.024 | 34.07         | -0.53            | 0.030 | 0.006          | 34.01             | -0.59            | 0.030 | 0.006          |
| Netherlands | 25.20           | 0.072 | 24.96         | -0.24            | 0.062 | -0.010         | 25.68             | 0.48             | 0.066 | -0.006         |
| Poland      | 28.72           | 0.015 | 28.31         | -0.40            | 0.019 | 0.004          | 28.89             | 0.17             | 0.013 | -0.002         |
| Portugal    | 34.07           | 0.050 | 33.25         | -0.82            | 0.058 | 0.008          | 34.22             | 0.15             | 0.048 | -0.002         |
| Sweden      | 26.34           | 0.050 | 26.56         | 0.22             | 0.047 | -0.003         | 26.94             | 0.60             | 0.043 | -0.007         |
| Slovakia    | 22.77           | 0.022 | 22.73         | -0.04            | 0.022 | 0.000          | 22.73             | -0.04            | 0.020 | -0.002         |

Source: Own calculations using the EUROMOD model run on EU-SILC 2016 data.

Notes: RS: Reynolds-Smolensky Index.  $\Delta$  reflects change with respect to the baseline system.

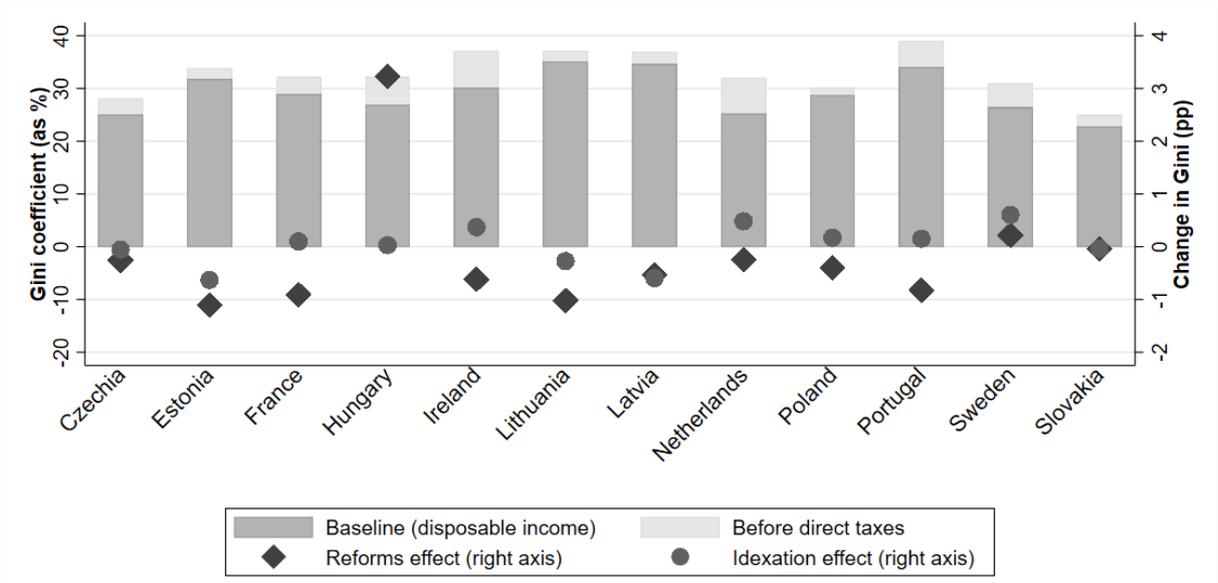
## 2. Inequality reduction through the PIT system

The distributional consequences of income tax system adjustments in each country are considered from the perspective of changes in the Gini index on the one hand, and through the Reynolds-Smolensky (RS) Index on the other (Reynolds and Smolensky 1977). In Table 2 we present these two measures for the three simulated systems. In the 2009 baseline system Lithuania, Latvia, Portugal and Estonia, in descending order, had the highest levels of disposable income inequality, with a Gini coefficient of over 31 per cent in all four countries.

Conversely, Slovakia, Czechia, and the Netherlands had the most equal income distribution in 2009.

In Figure 4 we combine the information from Table 2 and present the redistributive effect of the baseline tax system and the change in the Gini coefficient as a result of indexation and reforms. Simulations of the ‘baseline’ income tax system from 2009 on equivalised household disposable income indicate that of the twelve countries, in descending order, Portugal, Lithuania and Ireland had the highest level of inequality of disposable income before direct taxes. However, the Irish and Portuguese baseline tax systems were relatively efficient in lowering income inequality, with a reduction in the Gini coefficient of 7.0 and 4.9 percentage points (p.p.) respectively, making them the first and third most redistributive systems, with the Dutch system in between (reduction of 6.80 p.p.). The performance of the Lithuanian quasi-linear direct tax systems was far poorer at reducing income inequality, and despite the high levels of underlying income inequality only managed a reduction in the Gini coefficient of 2.1 p.p. Poland’s tax system was the least redistributive in the baseline scenario, accounting for a meagre reduction of 1.4 p.p. in the Gini index.

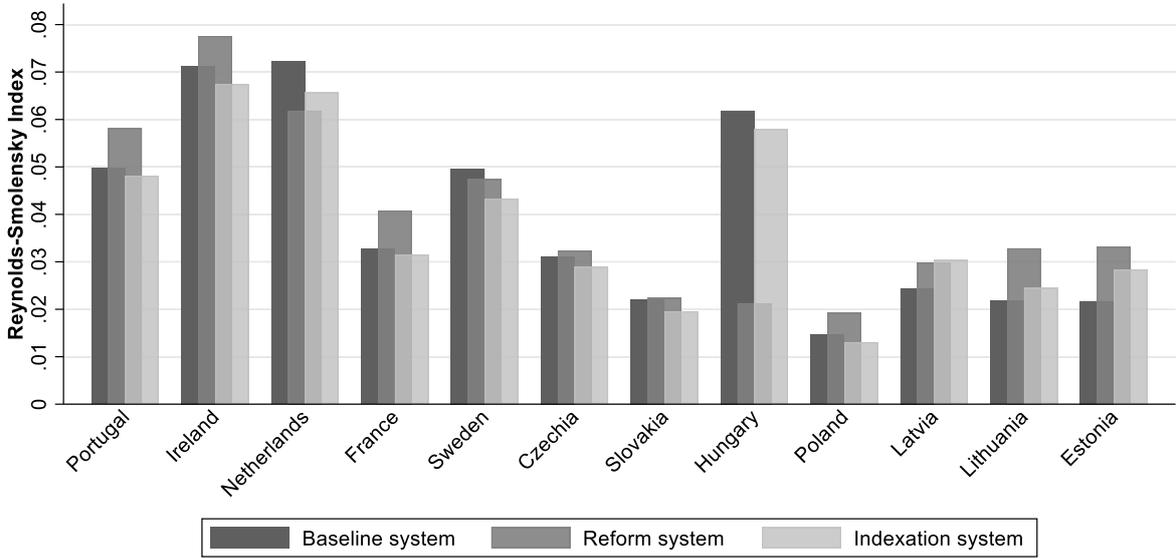
**FIGURE 4**  
**PIT reforms and indexation: Gini indices before and after**



Source: Own calculations using the EUROMOD model run on EU-SILC 2016 data.

The Gini index is known to be insensitive to policy adjustments, thus the scale of change resulting from individual reforms is often minimal in absolute terms (Gale, Kearney, and Orszag 2015). However, the direction of change in income inequality as a result of the tax system over the course of the decade provides indication of the policy priorities of the government. Once again, most notable is the case of Hungary, which is the only country which considerably reduced the progressivity of its tax system. Hungary had the most drastic shift in the Gini coefficient among all twelve countries, amounting to a decrease in the redistributive effect of the income tax system by 3.2 p.p. of the Gini Index (see Table 2). It is also the only country which saw a significant increase (from 18.1 per cent to 20.4 per cent) in the at-risk-of-poverty rate, set at 60 per cent of the national median equivalised disposable income (See Table A3 in the appendix for all AROP rates). These two indicators demonstrate the well-established consequences of the flat tax – erosion of the redistributive quality of the tax system and, as a consequence, greater divergence of disposable incomes between the top and bottom earners.

**FIGURE 5**  
**Redistributive effects of PIT systems**



Source: Own calculations using the EUROMOD model run on EU-SILC 2016 data.

Furthermore, in every case apart from Hungary and Latvia, the implemented reforms were more redistributive than indexation would have been. Latvia also lowered tax rates for most of the population while markedly increasing them for the highest earners, thus increasing the redistributive effect of the system. However, in Latvia fiscal drag had an especially regressive

effect on the system, and despite the progressivity of the reforms, regular indexation of the 2009 parameters would have been a slightly more effective method for inequality reduction.

### 3. Redistributive effect of reforms

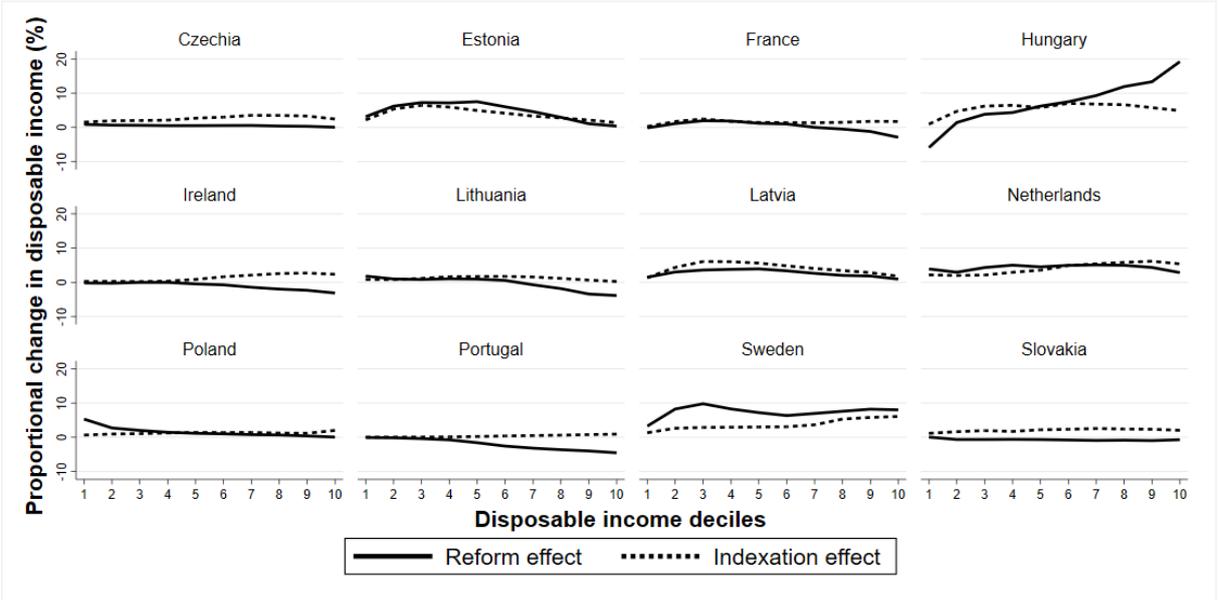
The strength of the redistributive effect of direct taxes is markedly larger in the older free-market economies as opposed to the seven post-communist countries (see Figure 5). In 2009, the highest RS index could be observed in the Netherlands (0.072) and Ireland (0.071). The power of these systems was more than three times as effective in redistributing incomes than the tax systems in Estonia, Lithuania, or Slovakia (RS of 0.022), and nearly five-fold than that of Poland (RS of 0.015). While in the Netherlands the RS index declined to 0.062 by 2019, in Ireland it further increased to 0.078, the largest redistribution that any of the tax systems in this analysis achieved. Apart from Hungary, the other post-communist countries have all used the additional revenue from fiscal drag to increase the redistributive effect of the tax system. For example, policy interventions in Estonia focused on PIT allowances expanded the capacity of the tax system for inequality reduction by 50 per cent, increasing the RS index from 0.022 to 0.033. Hungary, on the other hand, drastically reduced the redistributive effect of the income tax system, cutting the RS index from 0.062 to 0.021. This change resulted in a drop from the 3<sup>rd</sup> most redistributive PIT system in 2009 to 11<sup>th</sup> out of twelve in 2019. Of note, the countries with the lowest nominal wage growth, Portugal and Ireland, both increased the redistributive effect of their already highly progressive baseline systems, indicating a continued commitment to inequality reduction despite the lowest growth in their tax base between 2009-19. Moreover, the Netherlands, Hungary and Latvia were the only countries where indexation would have implied more redistribution than the reforms.

### 4. Decile decomposition

In this Section we look in more detail at the implications of the adopted reforms for incomes across the income distribution in comparison to the nominal indexation scenario. In Figure 6 we present decile distribution graphs showing the proportional change in disposable incomes resulting from tax reforms and the counterfactual indexation system. Unsurprisingly, the most significantly affected decile group can be observed in Hungary, where the richest 10 per cent of households have benefited by as much as 19.2 per cent of their disposable income due to the introduced flat tax and the expansion of family allowances. Furthermore, the percentile distribution sheds a new light on the aforementioned rising relative poverty measure by demonstrating that the driving factor of this effect is an outcome of both increased taxation of

low-earners through the erosion of personal credits and tax allowances for some households in the 2<sup>nd</sup> and 3<sup>rd</sup> deciles. Our analysis is in line with the findings of Bartha's (2014) *ex-post* study, which found that Hungary had to levy other taxes to support the deficit created by the flat tax; the foremost cited arguments in support of the flat tax, namely improvements in efficiency, increased labour force participation and lower administrative costs, have not compensated for the distributive and budgetary consequences of the reform (Bartha 2014).

**FIGURE 6**  
**Proportional effect of reforms and indexation on disposable income**



Source: Own calculations using the EUROMOD model run on EU-SILC 2016 data.  
 Notes: income deciles calculated using equivalised disposable income in the baseline (2009) scenario.

Portugal and Ireland, the two countries with the lowest rates of wage growth, both targeted households across all decile groups with increased taxes, but the richest deciles most heavily. In these countries households in the 10<sup>th</sup> decile lost 4.5 per cent and 3.1 per cent of their equivalised disposable income to the PIT reforms, respectively. With the lowest revenue effect from fiscal drag out of all twelve countries, Portugal and Ireland increased taxes on the highest earners to consolidate their fiscal position, while simultaneously reducing income inequality. France, which has a notably less progressive income tax system than the other four Western European countries, increased the redistributive effect of its tax system by nearly 30 per cent (see Table 2) through a similar raise of the income tax on top earners, accompanied by small reductions in taxes for households that were lower in the distribution. Estonia on the other hand, which had one of the highest revenue effects of systemic indexation (-1.2 per cent of GDP), was able to introduce highly redistributive reforms that lowered taxes across the entire

distribution and concentrated most of the gains among middle income households, with the average household in the 5<sup>th</sup> decile benefiting by 7.5 per cent of their disposable income. Slovakia, despite adding a second tax bracket to their linear tax system, implemented a package of reforms that ultimately had a minimal effect on disposable incomes and was essentially neutral in terms of income redistribution. However, out of the twelve countries, Slovakia had the lowest income inequality across all three tax systems due to very low pre-tax income inequality. Reforms in Poland and Lithuania aimed at decreasing inequality by lowering the income tax on the poorest households. While the scale of redistribution in the examined countries differs, in most of them in the examined period we see some efforts to increase the progressivity of the income tax system, a shift which is particularly visible in the majority of the countries from Central and Eastern Europe.

## V. Conclusions

The financial crisis of 2008 spurred an intensive discussion about growing levels of inequality in many developed countries (O.E.C.D. 2011). In response to that one could have expected to see significant reforms in the design of income taxation – one of the most obvious instruments governments can use for redistribution. Such expectations have been raised again recently in light of the consequences of the crisis caused by the COVID-19 pandemic and the economic uncertainties related to the consequences of the Russian invasion of Ukraine.

In our paper we compare income tax policies implemented in the decade following the financial crisis (2009-2019) in twelve European countries setting the scale and the distributional character of the introduced packages against the fiscal leeway the respective governments could take advantage of. We show that the degree of this leeway has been heavily differentiated and depended, on the one hand, on the dynamics of nominal wages, and on the other, on the baseline progressivity of the income tax system. In the analysis we compare developments in seven post-communist countries who joined the EU in 2004, with those in five older free market economies.

As we show, none of the countries considered implemented reforms which would substantially increase the redistributive character of its income tax system – both in comparison to the 2009 baseline and relative to a wage-indexed benchmark. Moreover, in 2019 the two groups of countries continue to be differentiated by the degree of progressivity of their income tax

systems. These are significantly more redistributive in the western EU countries, compared to the EU member states from Central and Eastern Europe. In fact, the introduction of a linear tax in Hungary in 2011 means that its system became much more ‘in tune’ with the systems of the other CEE countries, compared to the 2009 baseline which had been significantly more redistributive. High income dynamics between the financial crisis and the outbreak of the COVID-19 pandemic in all seven of the CEE countries offered some fiscal leeway facilitating tax reforms, and all these countries took advantage of it. In Estonia, Latvia and Poland the reforms essentially redistributed this leeway, while in Lithuania and Slovakia they were designed in such a way as to actually further increase the revenues from direct taxation. In Hungary reforms implied a revenue loss of 3.0% of GDP, i.e. twice as much as the extra revenues resulting from income growth. Among the five Western European countries reforms in Portugal, Ireland and France resulted in additional government revenues from income tax, the Netherlands redesigned its system within the leeway offered by fiscal drag, while Sweden is a country which reduced revenues from income tax beyond it.

Income tax reforms introduced in most examined CEE countries led to small increases in the degree of redistribution relative to the baseline, with most progressive changes implemented in Lithuania and Estonia. Even in these two countries, however, redistribution extended through income tax continues to fall significantly short of that in countries such as Ireland or the Netherlands. For example, the Reynolds-Smolensky index in Estonia between 2009 and 2019 went up from 0.022 to 0.033, compared to the baseline figure of 0.071 in Ireland, which increased by 2019 to 0.078. Still, even though progressivity of income tax in such countries as Ireland, Portugal and France increased, despite much discussion about the need for greater redistribution in the follow up of the 2008 financial crisis, we find little evidence of major breakthroughs. In fact, reforms in the Netherlands and Sweden resulted in systems which are characterised by a lower degree of progressivity.

Our results showing the degree of differentiation of the fiscal drag in income tax across countries are noteworthy given the context of redesigning income taxes in the follow up of the COVID-19 pandemic and of the uncertain economic conditions related to the Russian invasion in Ukraine (O.E.C.D. 2021). Nominal increases in incomes generate additional revenues for the government and, conditional on income dynamics, the design of income tax is a strong determinant of the extent of this leeway. These additional revenues may facilitate further reforms including those which can increase the degree of redistribution through income tax. Paradoxically thus, at times of high dynamics of incomes – whether nominal or real – countries

with strongly redistributive income tax systems may find it easier to increase redistribution further relative to those with low tax progression. In conditions of high inflation and at times requiring tight fiscal policy, the countries of Central and Eastern Europe may thus find it difficult to implement large scale reforms required to bring the progressivity of their income tax systems to the levels observed in Western Europe.

## References

- Altig, David, and Charles T. Carlstrom. 1993. 'Using Bracket Creep to Raise Revenue: A Bad Idea Whose Time Has Passed'. *Federal Reserve Bank of Cleveland, Economic Review* 29 (2).
- Andrienko, Yuri, Patricia F. Apps, and Ray Rees. 2014. 'Optimal Taxation, Inequality and Top Incomes'. *Sydney Law School Research Paper*, no. 14/103 (May).
- Avram, Silvia, Francesco Figari, Chrysa Leventi, Horacio Levy, Jekaterina Navicke, Manos Matsaganis, Eva Militaru, Alari Paulus, Olga Rastringina, and Holly Sutherland. 2013. 'The Distributional Effects of Fiscal Consolidation in Nine EU Countries'. EUROMOD Working paper.
- Bargain, Olivier, and Tim Callan. 2010. 'Analysing the Effects of Tax-Benefit Reforms on Income Distribution: A Decomposition Approach'. *The Journal of Economic Inequality* 8 (1): 1–21.
- Bartha, Zoltán. 2014. 'Mid-Term Effects of the Flat Rate Personal Income Tax in Hungary'. *Humanities and Social Sciences* 19: 21.
- Ben-David, Dan, and David H Papell. 1998. 'Slowdowns and Meltdowns: Postwar Growth Evidence from 74 Countries'. *Review of Economics and Statistics* 80 (4): 561–71.
- Bernardi, Luigi, Mark W.S. Chandler, and Luca Gandullia, eds. 2005. *Tax systems and tax reforms in new EU members*. Routledge.
- Dabla-Norris. 2015. *Causes and Consequences of Income Inequality: A Global Perspective*. International Monetary Fund.
- European Commission. 2009a. *Directorate-General of Employment, Social Affairs and Inclusion. Labour Market and Wage Developments in 2008*. European Commission.
- . 2009b. *Taxation Trends in the European Union*. 2009th–2019th ed. Luxembourg: Directorate-General for Taxation and Customs Union, European Commission, Publications Office of the European Union.
- Evans, Anthony John, and Paul Dragos Aligica. 2008. 'The Spread of the Flat Tax in Eastern Europe: A Comparative Study'. *Eastern European Economics* 46 (3): 49–67.
- Gale, William G., Melissa S. Kearney, and Peter R. Orszag. 2015. 'Would a Significant Increase in the Top Income Tax Rate Substantially Alter Income Inequality?' *Economic Studies at Brookings*.
- Hall, Robert E., and Alvin Rabushka. 2007. *The Flat Tax*. 2nd ed. Palo Alto, CA: Hoover Institution Press.
- Heer, Burkhard, and Bernd Süßmuth. 2013. 'Tax Bracket Creep and Its Effects on Income Distribution'. *Journal of Macroeconomics* 38: 393–408.

- Heinemann, Friedrich. 2001. 'After the Death of Inflation: Will Fiscal Drag Survive?' *Fiscal Studies* 22 (4): 527–46.
- Immervoll, H. 2005. 'Falling Up The Stairs: The Effects of "Bracket Creep" on Household Incomes'. *Review of Income and Wealth* 51 (1): 37–62.
- Meghir, Costas, and David Phillips. 2010. 'Labour Supply and Taxes'. *Dimensions of Tax Design: The Mirrlees Review*, 202–74.
- O.E.C.D. 2011. 'An Overview of Growing Income Inequalities in OECD Countries: Main Findings.' *Divided We Stand: Why Inequality Keeps Rising*.
- . 2021. 'Tax and Fiscal Policies after the COVID-19 Crisis'.
- Paulus, H.Sutherland, and I. Tasseva. 2019. 'Indexing Out of Poverty? Fiscal Drag and Benefit Erosion in Cross-National Perspective'. *Review of Income and Wealth*.
- Reynolds, Morgan O., and Eugene Smolensky. 1977. *Public Expenditures, Taxes, and the Distribution of Income: The United States*. New York: Academic Press.
- Rose, Sara, and Crina Viju. 2014. 'Income Inequality in Post-Communist Central and Eastern European Countries.' *Eastern Journal of European Studies* 5 (1).
- Saez, Emmanuel. 2003. 'The Effect of Marginal Tax Rates on Income: A Panel Study of "Bracket Creep"'. *Journal of Public Economics* 87 (5–6): 1231–58.
- Sobotka, Tomas. 2016. 'Fertility and Family Policies in Central and Eastern Europe after 1990'. *Comparative Population Studies*.
- Sutherland, H., and F. Figari. 2013. 'EUROMOD: The European Union Tax-Benefit Microsimulation Model'. *International Journal of Microsimulation* 6 (1): 4–26.
- Sutherland, Holly, Ruth Hancock, John Hills, and Francesca Zantomio. 2008. 'Keeping up or Falling behind? The Impact of Benefit and Tax Uprating on Incomes and Poverty'. *Fiscal Studies* 29 (4): 467–98.
- Verbist, Gerlinde, and Francesco Figari. 2014. 'The Redistributive Effect and Progressivity of Taxes Revisited: An International Comparison across the European Union'. EUROMOD Working Papers EM6/14. EUROMOD at the Institute for Social and Economic Research. <https://EconPapers.repec.org/RePEc:ese:emodwp:em6-14>.

## Appendix

TABLE A1

Summary of income tax systems and major reforms between 2009-19

| Country        | Baseline system (2009)  | Reforms Summary (2009-19)  |
|----------------|---|--|
| Czech Republic | Flat tax of 15 per cent, with some credits and allowances   | <p>2013: Introduced a 7 per cent solidarity tax for those earning 48 times the average salary.</p> <p>2015: Increased Child Tax Credit for second and subsequent child.</p> <p>2017: Increased Child Tax Credit for second and subsequent child.</p> <p>2018: Increased Child Tax Credit for the first child.</p>  |
| Estonia        | Flat tax of 21 per cent, tax free allowance, additional tax free allowance for second and subsequent children   | <p>2016-17: Increased the basic allowance.</p> <p>2018: Increased basic allowance for low earners, but implemented withdrawal according to increasing income. Joint declaration replaces with supplementary basic allowance for spouse. Non-payable tax credit for low-income earners abolished.</p>   |
| France         | 5 tax brackets, various family tax allowances, system unique in that allowances capped for entire the family  | <p>2011: raised the tax rate for the top bracket from 40 per cent to 41 per cent</p> <p>2013: added an additional (6th) tax bracket with a rate of 45 per cent</p> <p>2017: introduced a 20 per cent income tax reduction for low earners</p> <p>2018-2019: Increase in the rate of the Contribution sociale généralisée (compensated by a decrease in employees' social contributions)</p>  |
| Hungary        | 2 tax brackets (18 per cent and 36 per cent), employment tax credit   | <p>2010: Replaced the 'Family Tax Credit' with the 'Family Tax Allowance'</p> <p>2011: Implemented a flat tax. Implemented a tax credit on employment income. Abolished tax credit for non-taxable emolument (progression proviso).</p>  |
| Ireland        | 2 tax brackets (20 per cent and 41 per cent), 'Additional Income Levy' functions as two additional tax brackets, personal tax credit, earned income tax credit, rent tax credit, single parent tax credit | <p>2011: Replace the 'Additional Income Levy' with the 'Universal Social Charge' - 0 per cent for income below € 4 004, 2 per cent for income up to € 10 036, 4 per cent from € 10 037 to € 16 016 and 7 per cent for income above the latter amount</p> <p>2017: reduced all rates of the Universal Social Charge</p> <p>2018: increased tax credits. Further reduction of the top two rates of the Universal Social Charge, and increased thresholds</p> <p>2019: further adjustments of the Universal Social Charge</p> |

*Continued on next page...*

|             |   |   |
|-------------|---|---|
| Latvia      | Flat tax of 23 per cent, tax free allowance, additional tax-free allowance for children and dependents, pensioner's allowance   | <p>2010: Increased PIT rate to 26 per cent.</p> <p>2011: Reduced PIT rate to 25 per cent. Increased non-taxable minimum. Increased allowances for dependant persons.</p> <p>2013: reduced PIT rate to 24 per cent.</p> <p>2015: reduced PIT rate to 23 per cent.</p> <p>2016: Introduced income dependent tax-free allowance.</p> <p>2018: Abolished the flat tax and introduced a three-tier progressive system of 20 per cent, 23 per cent, and 31 per cent. Introduced a PIT allowance for non-working spouse. Increased allowance for dependents.</p>   |
| Lithuania   | Flat tax of 15 per cent + 6 per cent HIC = 21 per cent, tax free allowance withdrawn for high earners, additional tax-free allowance for children   | <p>2015-17: Increased the basic allowance.</p> <p>2018: Increased the basic allowance. introduced income tax credit for the self-employed. Abolished additional tax allowance for families with dependent children.</p> <p>2019: Abolished the flat tax and introduced a two bracket system of 20 per cent and 27 per cent.</p>   |
| Netherlands | 4 tax brackets (2.35 per cent, 10.85 per cent, 42 per cent, 52 per cent), progressive tax free allowance with many brackets, child tax credit   | <p>2009-17: the system was subject to a large number of minimal rate adjustments (generally amounting to less than 1 per cent).</p> <p>2014-17: various small reforms to the system that increased the general tax credit and earned income tax credit, increasing their maximum value but also adding withdrawal with increasing incomes (greater progressivity).</p> <p>2019: reduced 4 tax brackets to 3.</p>  |
| Poland      | 2 tax brackets (18 per cent and 32 per cent), tax free allowance, earned income tax credit, child tax credit depending on number of children  | <p>2017: Increased the tax free allowance for low income earners. Implemented a scale for withdrawal for those with higher incomes.</p> <p>2018: Increased progressivity of the tax free allowance</p> <p>2019: Introduction of the 'Solidarity Levy' - individuals whose total income in the fiscal year will exceed PLN 1 000 000 will pay a solidarity levy of 4 per cent of the excess over this amount.</p>  |
| Portugal    | 7 tax brackets (10.5 per cent, 13 per cent, 23.5 per cent, 34 per cent, 36.5 per cent, 40 per cent, 42 per cent), personal tax credit which is linked to the minimum wage and to the family situation of the taxpayer | <p>2010: added an 8th tax bracket with a rate of 45.88 per cent, minor increase in the rate of the other 7 brackets</p> <p>2011: increased progressivity of the system by lowering rates on bottom tax brackets and increasing rates on top brackets. Implemented solidarity surcharge of 2.5 per cent.</p> <p>2013: Reduced number of brackets to 5. Implemented additional surcharge of 3.5 per cent on all aggregated categories of income subject to individual income tax. Solidarity surcharge (introduced in 2011), has become progressive: as of 2013 the rate of 2.5 per cent is applicable to taxpayers with a taxable income between EUR 80 000 and EUR 250 000, while a rate of 5 per cent is applicable to taxpayers with a taxable income higher than EUR 250 000</p> <p>2017: eliminated solidarity surcharge</p> <p>2018: increased number of tax brackets to 7</p> |

*Continued on next page...*

|          |   |  |
|----------|---|--|
| Slovakia | Flat tax of 19 per cent, tax free allowance, employee tax credit (operates as a negative income tax)  | 2011: cut basic tax allowance from 22.5*minimum subsistence level to 19.2*minimum substance level<br>2013: abolished the flat tax of 19 per cent and implemented a two-bracket system of 19 per cent and 25 per cent. Introduced spouse allowance eligibility criteria (must be disabled, unemployed, caring for a child up to 3 years old or 6 years old if disabled)<br>2019: increased child tax credit for children up to the age of 6 |
| Sweden   | Income Tax divided between central and local: national rates of 20 per cent and 25 per cent (2 brackets) with municipal rates that vary (on average around 30 per cent), tax free (basic) allowance, earned income tax credit | 2009-19: annual indexation of income tax parameters.<br>2016: Reduction of income tax for pensioners, additional tax of 6.15 per cent for employees over 65 that are receiving their pensions.<br>2018: Increased basic allowance for the pensioners.<br>2019: Increased basic allowance for pensioners. Increased in-work tax credit. Upward adjustment of threshold for state income tax.  |

Source: Eurostat, 2009-19.

Notes: For clarity only the most significant structural reforms with distributional consequences were selected to be presented here. For a country-by-country detailed yearly summary of all the changes to the income tax systems see the 'Taxation trends in the European Union' statistical book published by Eurostat.

TABLE A2  
Sample size of individuals and households by country

| Country     | Number of individuals | Number of households |
|-------------|-----------------------|----------------------|
| Czechia     | 18,934                | 8,507                |
| Estonia     | 15,160                | 6,026                |
| France      | 26,560                | 11,459               |
| Hungary     | 18,796                | 8,003                |
| Ireland     | 13,107                | 5,219                |
| Latvia      | 13,833                | 6,042                |
| Lithuania   | 10,895                | 4,808                |
| Netherlands | 29,454                | 12,748               |
| Poland      | 32,510                | 11,982               |
| Portugal    | 26,507                | 10,616               |
| Slovakia    | 16,480                | 5,738                |
| Sweden      | 14,010                | 5,787                |
| Total       | 236,246               | 96,935               |

Source: EU-SILC 2016 data.

TABLE A3

Disposable income at-risk-of-poverty rates across the three simulated tax systems

| Country     | Baseline (2009) | Reforms (2019) | $\Delta$ Poverty (p.p.) | Indexation (2019) | $\Delta$ Poverty (p.p.) |
|-------------|-----------------|----------------|-------------------------|-------------------|-------------------------|
| Czechia     | 10.21%          | 10.04%         | -0.17%                  | 10.75%            | 0.53%                   |
| Estonia     | 20.95%          | 20.66%         | -0.29%                  | 20.26%            | -0.70%                  |
| France      | 12.93%          | 13.28%         | 0.36%                   | 13.40%            | 0.47%                   |
| Hungary     | 18.09%          | 20.41%         | 2.32%                   | 18.46%            | 0.38%                   |
| Ireland     | 15.25%          | 15.12%         | -0.13%                  | 16.39%            | 1.15%                   |
| Latvia      | 21.47%          | 20.90%         | -0.57%                  | 21.88%            | 0.41%                   |
| Lithuania   | 22.38%          | 22.21%         | -0.17%                  | 21.93%            | -0.44%                  |
| Netherlands | 10.08%          | 10.43%         | 0.35%                   | 10.54%            | 0.46%                   |
| Poland      | 15.40%          | 15.09%         | -0.31%                  | 15.66%            | 0.26%                   |
| Portugal    | 19.12%          | 18.25%         | -0.88%                  | 19.24%            | 0.12%                   |
| Slovakia    | 16.16%          | 15.75%         | -0.41%                  | 16.54%            | 0.38%                   |
| Sweden      | 12.02%          | 11.81%         | -0.21%                  | 12.04%            | 0.03%                   |

Source: Own calculations using the EUROMOD model run on EU-SILC 2016 data.