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Going regional: distributional effect of taxes and transfers in six EU countries and the UK

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ABSTRACT

Within a context of extended periods of financial crises, regional income inequality and poverty have emerged as topics of substantial policy interest. Taxes and social transfers represent some of the most important policy instruments that governments have in their disposal for the mitigation of economic disparities. The aim of this paper is to analyse the distributional effect of taxes and transfers at the regional level in Czechia, Greece, Spain, France, Italy, Poland and the UK. Using microsimulation techniques, we provide descriptive statistics and estimates of the impact of 2019 tax-benefit policies on poverty and within and between-region inequality. Within-region inequality is found to be the primary explanatory factor of total inequality in all countries studied. Taxation policies do not seem to be able to change the within/between structure of inequality, even in countries with strong regional elements in their income tax policies. Our findings underline the importance of well-designed policies that address territorial inequalities and promote spatial justice, especially in the lowest income regions.

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Keywords: within and between-region inequality, poverty, tax-benefit systems, microsimulation

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1. INTRODUCTION

In a context of extended periods of crises and economic stagnation in the EU, regional income inequality and poverty have emerged as topics of substantial interest for both policymakers and academics and have informed the development of EU Territorial Cohesion policies. According to Farole et al. (2018) inequality between EU member states declined by almost 30% in 2000-2009, and then fluctuated around that level; whilst the OECD (2018) has calculated that between 2000 and 2015 inequality in regional GDP declined by 15% across all OECD countries and by 25% across Europe. However, more detailed analysis has shown that within this broad trend trajectories of regional inequalities have varied spatially and temporally. Inequality between EU regions has increased since 2009, following a period of narrowing from 2000 to 2009 Inequality between regions of the EU in 2016 was as high as it had been in 2005. Furthermore, in several countries, the economic disparities between the regions within the same country grew substantially over this period; in Italy and Spain in particular, less-developed regions lost significant ground against their more affluent counterparts in the period between 2008 and 2015.

In this work, we focus on the significance of taxes and social transfers in the composition of regional income inequality and as tools for addressing territorial inequalities through fiscal equalisation. Taxes and social transfers represent some of the most powerful instruments that governments have in their disposal for the mitigation of inequality (Causa & Hermansen, 2017; Ridao-Cano & Bodewig, 2018). They could potentially form part of an approach to spatial justice and territorial cohesion that is broader than regional economic development policy and engages the redistributive dynamics of wider policies within multi-level governance systems. However, unlike their aggregate effects at the national level, the impact of tax-benefit systems (and each of the policies that comprise it) on regional inequity and poverty have been investigated to a far lesser extent.

The aim of this paper is to analyse the redistributive effect of taxes and transfers at the regional level, using microsimulation techniques. Methodologically, microsimulation has been extensively used as a tool for assessing the distributional impact of taxes and social benefits, as it allows for detailed analysis of policies and their effects on disposable income (Avram et al., 2013; Bargain et al., 2014; IMF, 2014; Picos & Schmitz, 2016; Popova, 2016; Verbist & Van Lancker, 2016). Among the majority of microsimulation studies, we noticed a gap in research on the distributional impact of these policies at the local level. The few studies with a regional perspective are both policy and country-specific. This means that they are attempting to estimate the distributional impact of specific policy changes in specific regions of a country like, for example, the regional impact of reversing universal credit and working tax credit uplifts for the UK, the regional impact of reforming regional minimum income schemes in Spain or the impact of child policies in the four biggest cities of Croatia. To the best of our knowledge, this is the first cross-country comparative study that looks at the distributional impact of the whole tax-benefit system and of each of its components at the regional level. As regional economic disparities are becoming larger in several European countries, this kind of analysis becomes increasingly necessary to better understand which tax-benefit policies are the most effective in mitigating this alarming phenomenon.

For our analysis we make use of the tax-benefit microsimulation model EUROMOD. The model draws micro-data from the European Union Statistics on Income and Living Conditions (EU-SILC).[1] The countries that the research focuses on are Czechia, Greece, Spain, France, Italy, Poland and the UK. They were chosen for their diversity of tax-benefit systems, the availability of regional information in

[1] For the UK the Family Resources Survey (FRS) is used.

EU-SILC (i.e. NUTS-1 or NUTS-2 units), and the existence of simulated regional-level policies in EUROMOD. The policy year of the analysis is 2019.

The advantages of using EUROMOD are twofold. First, the model can be used to calculate with precision, transparency and cross-country comparability the regional distribution of various income sources, such as market incomes, public pensions, means-tested and non-means-tested benefits, as well as the regional distribution of income taxes, property taxes and social insurance contributions. Second, it allows researchers to account for all the complex interactions within and between the tax-benefit policies.

The paper is structured as follows. Section 2 explains the methodology of our work. Section 3 presents our estimates on the distributional effects of tax and benefit policies at the regional level. Section 4 concludes by summarising the most important findings, and by reflecting on the policy implications of this work.

2. METHODOLOGY, DATA AND DEFINITIONS

2.1. MODEL AND DATA

In this work we make use of the tax-benefit microsimulation model EUROMOD. The model uses survey data on gross incomes, labour market status and other characteristics of the individuals and households, which it then applies to the tax and benefit rules in place in order to simulate direct taxes, social insurance contributions and entitlements to cash benefits. The components of the tax–benefit system that cannot be simulated (for example, those depending on prior contributions such as pensions) are read off the data. EUROMOD has been validated both at micro and macro level and has been tested in numerous applications. Examples of such applications include several studies on the distributional impact of tax-benefit systems and on how policies have shaped income distributions over time, disentangling income changes due to policy reforms from changes due to evolution of market incomes and changes in populations' underlying characteristics, performing policy swaps among countries, introducing new EU-wide policies, stress-testing the welfare state, nowcasting exercises, analysing the impact of policy reforms on work incentives, measuring the impact of tax-benefit systems on dimensions other than income, such as health, quality of life etc. For a comprehensive overview, see Sutherland and Figari (2013).

The underlying micro data for six out of the seven countries in question are drawn from the 2017 European Union Statistics on Income and Living Conditions (EU-SILC), a dataset which is specifically designed to provide detailed information on income distribution and social inclusion. The microdata used for the UK are drawn from the 2016-17 Family Resources Survey (FRS), which has very similar characteristics to those of EU-SILC.[2] For information on the sample design of EU-SILC, see Goedemé (2010). Over the course of the last decade, several standard routines that enable researchers to calculate the sampling variance of microsimulation results while taking the sample design into account, have been developed. For a discussion on the importance of testing the statistical significance of microsimulation results, see Goedemé et al. (2013). The geographical breakdown included in SILC is defined according to the NUTS-2 regional classification for Chechia (8 regions), Greece (13 regions), Spain (19 regions), France (22 regions), Italy (21 regions) and the UK (12 regions) and according to the NUTS-1 classification for Poland (6 regions). The existence of this breakdown allows for the examination of the redistributive effects of tax-benefit policies at the regional level.

[2] See https://www.gov.uk/government/statistics/family-resources-survey-financial-year-201617. From 2013 the EU-SILC for the UK is based on the FRS.

The non-availability, at the time of writing, of 'real' data for the policy year in question (i.e. 2019) implied that a synthetic income distribution has to be created for these years. As is standard practice in microsimulation, this involved two steps: updating incomes from EU-SILC income reference period (2026) to the target year (2019) and simulating tax and benefit policies.

Updating incomes is performed by using factors based on the available administrative (or survey) statistics. Specific updating factors are derived for each income source, reflecting the change in their average amount between the income data reference period and the target year. In order to account for differential growth rates in employment/self-employment income, updating factors are disaggregated by economic activity and by private and public sector in cases where such information is available in national administrative statistics. The list of factors used for the uprating of original incomes and non-simulated benefits as well as detailed description of the way in which policies are simulated can be found in the EUROMOD Country Reports (see https://euromod-web.jrc.ec.europa.eu/resources/country-reports).

One important advantage of microsimulation in general, and EUROMOD in particular, is attribution. The model can be used to disentangle the effects of each policy (or other macroeconomic developments) separately, taking into account the complex ways in which taxes interact with benefits and with each other. A direct analysis of actual data cannot do this as well. Simulations are performed on the basis of the tax-benefit rules that are in place on June 30th of the policy year in question. With respect to policies with regional elements modeled in EUROMOD, these include the housing and social assistance benefits for Czechia, personal income tax and child benefits for Spain, personal income tax for Italy and child and working tax credit for the case of the UK.

2.2. ACCOUNTING FOR TAX EVASION AND BENEFIT NON-TAKE-UP

Aiming at enhancing the credibility and accuracy of our estimates, we made an effort to address the issues of tax evasion (in Greece and Italy) and benefit non-take-up (in Greece and the UK). These adjustments could not be implemented in all countries studied due to data limitations.

In accounting for tax evasion in Greece, individuals were assumed to reveal their real net income to EU-SILC interviewers, though not necessarily to the tax authorities. We focus on three income sources: employment income, farming income and self-employment earnings. We separate the reported from the non-reported part of gross income by applying different income under-reporting rates by source, set equal to the ratio of income reported in a sample of tax returns and in EU-SILC respectively (for more information, see Leventi et al. 2013). EUROMOD treats the former as subject to income tax and social insurance contributions (and in the income assessment for means-tested benefits), and simply adds the latter to individuals' disposable income. In the case of Italy, self-employment income was split in two components, assuming that only part of total income was declared to tax authorities, and then grossed up (see Fiorio & D'Amuri, 2005). A calibration factor was applied to obtain an aggregate amount of the gross self-employment income corresponding to that reported in fiscal data.

In the Greek model, non-take-up adjustments are applied in the case of unemployment assistance, a benefit targeted at long-term unemployed on low income. Moreover, the receipt of guaranteed minimum income (GMI) is restricted to the amount of the budget that was allocated to the benefit. In the UK model, we employ a simple non-take-up correction of the main means-tested benefits by applying the take-up proportions estimated on a caseload basis, using external information from the Department of Work and Pensions and HM Revenue and Customs. Take-up probabilities are applied at the household level for each benefit separately. Although we assume that take-up behaviour is not affected by changes in the size of entitlements, by applying differential take-up probabilities according to type of claimants, some of this effect is captured.

Finally, although considerable progress has been made towards incorporating non-monetary components into EUROMOD (Paulus et al., 2010; Verbist & Matsaganis, 2014), the relevant module is not yet available. Hence, changes in the provision of social benefits in kind (such as education, healthcare, childcare etc.) are ignored in this study. Since EU-SILC provides no information on consumption, indirect taxes are also beyond the scope of this analysis.

2.3. DEFINITIONS AND INDICATORS

In this work we set to explore the regional distribution of the following incomes, benefits and taxes:

- Market income (MI)
- Pensions (PE)
- Means-tested benefits (MB)
- Non-means-tested benefits (NB)
- Total gross income (GI = MI + PE + MB + NB)
- Income taxes (IT)
- Property taxes (PT)[3]
- Social insurance contributions (SC)
- Net (i.e disposable) income (NI = GI – IT – PT – SC)

To assess the distributional impact of policies at the regional level, we use the following indicators. The first is the standard poverty rate, FGT(0), measured in terms of the proportion of the population with an income below 60% of the median equivalised income of the relevant distribution.[4] The second is the squared poverty gap, FGT(2), which measures the severity of poverty for each region, giving greater weight to those that fall far below the poverty line than those that are closer to it. The use of this indicator provides complementary information on the incidence of poverty; it might be the case that some regions have a high poverty rate but a low squared poverty gap, and vice versa. The types of policy interventions needed to help the two regions are thus likely to be different. It is also important to note that the poverty line is not fixed; it is calculated for each income source separately. This can lead to situations where adding a new source of income (e.g. means-tested benefits) to market income could be poverty-increasing, because the median of the new distribution is higher.

With respect to inequality, we use the Mean Log Deviation (MLD) index. MLD is zero when everyone has the same income and takes larger positive values as incomes become more unequal, especially at the high end. The main advantages of MLD is that it is additively decomposable (i.e. it can be expressed as a weighted sum of the inequality values calculated for population subgroups plus the contribution arising from differences between subgroup means), and that it is the only inequality measure that respects both the principle of transfer -i.e. that a transfer from a poorer person to a richer person should always increase inequality- and the principle of monotonicity in distance - i.e. that if two distributions differ only in respect of one individual's income, then the distribution that registers greater distance from equality for this individual's income is the distribution that exhibits greater inequality (Cowell & Flachaire, 2018). Decomposing inequality is crucial for evidence-based policy-making, as it reveals the importance of different factors and allows policies to be targeted

[3] In the case of Spain, the relevant variable in SILC includes wealth rather than property taxes.

[4] In order to reflect differences in a household size and composition, the total disposable household income is divided by the number of "equivalent adults", using the OECD-modified scale. This scale assigns a value of 1 to the household head, of 0.5 to each additional household member aged 14 and over and of 0.3 to each child aged under 14. The resulting figure is called equivalised household disposable income (HDI) and it is equally attributed to each household member.

towards the factors that matter the most. In this study, the overall inequality is decomposed into 'between-regions' and 'within-regions' inequality, following the methodology developed by Jenkins (1995). This decomposition is important as it reveals the driving factor of overall inequality, allowing for more targeted policy interventions.

3. RESULTS

This section provides descriptive statistics and estimates of the distributional impact of the 2019 tax-benefit systems on the poorest and richest region of each country in question. The poorest/richest region of each country is defined as the one with the *lowest/highest mean equivalised disposable income*. Analytical results for all the regions of the seven countries can be found in the Appendix (Tables A1 - A4).

3.1. DESCRIPTIVE STATISTICS

Table 1 shows the (standardised) mean equivalised disposable income of the poorest and richest region of each country; the results are standardised so that 100 corresponds to the mean equivalised disposable income of the country as a whole. The highest dispersion in mean equivalised disposable income is observed in Italy and Spain; these are followed by France, Czechia, Greece and the UK. The country with the smallest dispersion in in mean equivalised net income is Poland. The capital region is the region with the highest mean equivalised disposable income in all countries studied except from Spain (3rd out of the 19 NUT-2 regions) and Italy (10th out of the 21 NUTS-2 regions).

The population shares living in the poorest region of each country also vary substantially: from 2.3% of the total population in the case of Spain to 17.5% of the total population in the case of Poland. With respect to the shares of the population living in the richest region, the respective percentages vary from a mere 0.9% in Italy to as much as 36.2% in Greece.

Table 1. Mean equivalised disposable income (standardised)

	CZ	EL	ES	FR	IT	PL	UK
poorest region	87.7	78.7	72.8	80.5	71.0	86.5	86.6
(pop. share, %)	*(11.5)*	*(6.0)*	*(2.3)*	*(4.3)*	*(8.3)*	*(17.5)*	*(4.0)*
richest region	121.1	112.1	127.5	116.3	129.1	110.5	115.7
(pop. share, %)	*(12.0)*	*(36.2)*	*(4.7)*	*(18.5)*	*(0.9)*	*(20.8)*	*(13.5)*

Notes: 1. Country level = 100
2. Poorest / richest regions in each country: CZ: Moravskoslezsko / Praha; EL: Dytiki Ellada / Attiki; ES: Extremadura / País Vasco; FR: Languedoc-Roussillon / Île de France; IT: Sicilia / Bolzano; PL: East Region / Central Region; UK: North-East / London

Source: EUROMOD Version I2.11

Table 2 presents the (standardised) shares of each income/benefit source and taxes/social insurance contributions on disposable income; the addition of all components sums up to 100.

We observe that the share of market income and income taxes is significantly higher in the richest regions of countries. We find the larger difference between the market income in richest and poorer areas in Italy and the smallest in Spain. With the exception of Spain, the share of social insurance contributions is also higher in these regions, but the difference with respect to the poorest regions is not as high as in the case of income taxes; this is mostly due to the less progressive nature of this policy. The share of property taxes is relatively small in most countries studied; the exceptions are the

UK, Greece and Italy, where their relative contribution to (the reduction of) disposable income is non-trivial. As these taxes do not typically depend on individual/household income (and, hence, do not exempt the income-poor from payment), their share in the poorest and the richest regions does not vary substantially (and, in the case of the UK, is found to be higher in the poorest region of the country). The share of public pensions is significantly higher in the poorest regions of all countries studied apart from Spain. We can see that the relative contribution of pensions to the disposable income of the poorest region of Greece is more than half than the relative contribution of market income. On the contrary, in the UK the relative contribution of pensions to the disposable income of the richest region is rather limited. Finally, as expected, the share of means-tested benefits is substantially higher in the poorest region of each country.

Table 2. Income/tax components disaggregation

	MI	PE	NB	MB	IT	PT	SC
CZ poorest	87.6	26.9	3.9	2.0	-8.8	-0.2	-11.4
richest	105.8	18.0	2.2	0.8	-13.0	-0.2	-13.6
EL poorest	71.8	46.7	0.5	5.1	-7.8	-2.4	-13.9
richest	94.9	33.7	1.1	2.4	-13.8	-2.6	-15.7
ES poorest	77.8	25.3	4.9	10.7	-11.2	0.0	-7.6
richest	90.7	27.9	3.2	3.1	-18.8	0.0	-6.2
FR poorest	77.4	32.3	5.0	7.3	-14.1	0.0	-7.9
richest	99.1	24.0	3.8	4.0	-21.2	-0.5	-9.1
IT poorest	75.2	37.6	5.5	6.5	-15.4	-2.2	-7.1
richest	106.4	23.8	4.8	1.4	-23.8	-1.6	-10.8
PL poorest	92.6	29.4	4.4	5.2	-17.1	-0.4	-14.2
richest	104.8	23.2	3.4	3.3	-20.0	-0.4	-14.4
UK poorest	97.2	11.1	7.3	8.8	-12.6	-4.2	-7.6
richest	117.9	4.8	4.2	7.2	-20.8	-3.1	-10.2

Notes: MI + PE + NB + MB + IT + PT + SC = 100
MI: Market income; PE: pensions; NB: non-means-tested benefits; MB: means-tested benefits; IT: income taxes; PT: property taxes; SC: social insurance contributions

Source: EUROMOD Version I2.11

3.2. IMPACT OF TAX-BENEFIT POLICIES ON FGT(0) AND FGT(2)

Tables 3 and 4 present the regional impact of tax-benefit policies on FGT(0) and FGT(2), i.e. they show how much the addition of pensions, means-tested and non-means-tested benefits to market incomes / the subtraction of income taxes, property taxes and social insurance contributions from gross incomes changes the poverty rate and the squared poverty gap in the poorest and richest region of each country (in percentage points). Positive values represent effects that increase poverty rates and negative values represent effects that reduce poverty rates.

Public pensions are found to be the instrument with the highest poverty-reducing impact in the case of both the richest and the poorest regions of all countries studied apart from the UK. In Britain, the prevalence of private pensions (which are part of market incomes) is much larger and, hence, the impact of public pensions on poverty reduction seems to be rather limited, as evident in Table 3. In Czechia, Greece, France and the UK, the poverty-decreasing impact of pensions is found to be significantly larger in the poorest than in the richest NUTS-2 regions. In the poorest regions of these countries, pensions represent a significantly larger part of disposable income than in the richest ones,

and households receiving income from pensions seem to be lacking other income sources that could keep them above the poverty line in the absence of pensions.

Means-tested benefits seem to play the most important role in the reduction of FGT(0) in the UK, reducing the poverty rate by almost 10 percentage points in the poorest region of the country (North East). The impact of these benefits on poverty reduction is estimated to be close to 9 percentage points also in the case of Spain's poorest NUTS-2 region (Extremadura) and close to 5 percentage points in the poorest regions of Italy and France (Sicilia and Languedoc-Roussillon respectively). The poverty-reducing impact of non-means-tested benefits varies from 0 to 3 percentage points and is less differentiated when looking at the poor vs the rich regions of each country.

As far as taxes are concerned, income taxes are estimated to decrease AROP(0) in both the poorest and the richest regions of all countries, apart from the poorest region in Greece. This counter-intuitive result for Greece is mostly related to the taxation of self-employment income, which in 2019 was subject to a 22% tax from the first euro earned. Income taxes are found to achieve the highest poverty reduction in the case of the richest region of Spain and Czechia, approximately 4 percentage points. The impact of property taxation on FTG(0) is estimated to be either negligeable or poverty-increasing; the latter is the case for the UK and, to a lesser extent, Greece, Italy and Poland. Finally, social insurance contributions (SC) are found to have a poverty-increasing impact in the poorest regions of five out of the seven countries in question. This alarming result is primarily related to the uniform design of these policies, i.e. the lack of SC exemptions (or reductions) for low-income earners.

Looking at the impact of the above-mentioned policies on FGT(2), we observe very similar patterns to those found for FGT(0). However, as, by construction, FTG(2) gives more weight to those that fall far below the poverty line, taxes and social insurance contributions are estimated to have a minor impact on FGT(2); on the contrary, public pensions and means-tested benefits are found to play a very important role in the reduction of the severity of poverty in the poorest regions of these countries.

Table 3. Impact of tax-benefit policies on FGT(0), in percentage points

	PE	NB	MB	IT	PT	SC
CZ poorest	-18.8	-0.5	-1.5	-2.7	0.0	-1.9
richest	-9.6	-0.1	-1.0	-4.0	0.0	-3.7
EL poorest	-17.9	-0.5	-3.3	0.9	0.4	0.8
richest	-12.1	-0.6	-1.5	-1.6	0.2	-1.5
ES poorest	-11.0	-1.5	-8.6	-1.6	0.0	1.4
richest	-11.0	-1.4	-1.7	-4.1	0.0	-0.4
FR poorest	-10.7	-3.6	-4.6	-1.4	0.0	0.7
richest	-6.9	-0.6	-2.9	-2.9	0.0	-0.6
IT poorest	-9.4	-2.9	-4.9	-2.3	0.2	1.0
richest	-8.0	-1.2	0.4	-2.2	0.2	-1.2
PL poorest	-12.2	-1.7	-3.3	-0.6	0.5	0.3
richest	-11.1	-1.8	-2.2	-0.5	0.0	-0.6
UK poorest	-5.4	-2.5	-9.5	-3.2	1.6	-2.2
richest	-1.8	-1.3	-4.4	-3.7	1.0	-3.2

Notes: 1. PE, NB, MB: components are added to MI
IT, PT, SC: components are subtracted from GI
MI: Market income; PE: pensions; NB: non-means-tested benefits; MB: means-tested benefits; GI: total gross income; IT: income taxes; PT: property taxes; SC: social insurance contributions.
2. The poverty line is floating, set to 60% of the median equivalised income of each distribution in question.

Source: EUROMOD Version I2.11

Table 4. Impact of tax-benefit policies on FGT(2), in percentage points

	PE	NB	MB	IT	PT	SC
CZ poorest	-23.1	-1.9	-3.5	-0.1	0.0	0.0
richest	-16.6	-0.2	-0.7	-0.4	0.0	-0.1
EL poorest	-27.7	-0.8	-5.4	-0.1	0.1	-0.2
richest	-18.2	-1.1	-2.6	-0.3	0.1	-0.3
ES poorest	-14.5	-2.6	-12.8	-0.1	0.0	0.2
richest	-14.6	-1.0	-4.6	-0.6	0.0	0.2
FR poorest	-13.5	-4.1	-8.9	-0.4	0.0	-0.1
richest	-9.8	-2.4	-4.9	-0.6	0.0	-0.2
IT poorest	-14.8	-1.5	-10.0	-0.3	0.1	0.0
richest	-11.8	0.1	-0.7	-0.8	0.2	-0.1
PL poorest	-15.2	-5.2	-2.7	-0.2	0.0	0.3
richest	-15.0	-4.2	-1.7	-0.2	0.0	0.2
UK poorest	-6.7	-7.4	-14.0	-0.2	0.3	-0.2
richest	-3.4	-3.9	-10.4	-0.7	0.5	-0.6

Notes: 1. PE, NB, MB: components are added to MI
IT, PT, SC: components are subtracted from GI
MI: Market income; PE: pensions; NB: non-means-tested benefits; MB: means-tested benefits; GI: total gross income; IT: income taxes; PT: property taxes; SC: social insurance contributions.
2. The poverty line is floating, set to 60% of the median equivalised income of each distribution in question.

Source: EUROMOD Version I2.11

3.3. INEQUALITY DECOMPOSITION BETWEEN AND WITHIN REGIONS

We now move to income inequality, as measured by the MLD index. Inequality is decomposed into two components: within and between-region. The decomposability property of the MLD index allows for the sum of the within and the between components of inequality to be equal to total inequality. In general, between-regions inequality is observed to be higher in countries with a large number of regions that exhibit a low degree of economic disparities.

As can be seen in Table 5, within-region inequality is the main responsible for the overall inequality in all seven countries studied, accounting from 90% of the total in the case of Italy to as much as 97.5% of the total in the case of Poland. This finding holds for all income concepts under examination, i.e. total gross incomes, and total gross income minus (a) income taxes; (b) property taxes and (c) social insurance contributions. This suggests that, even in countries such as Spain and Italy, where income taxes have a strong regional element, the latter is not able to change the pattern of inequality depicted in total gross incomes.

Out of the three policy instruments under consideration, income taxes are found to be the most efficient instrument in terms of MLD reduction. Property taxes are estimated to have a much smaller impact on inequality; in the case of Greece and the UK, their impact is inequality-increasing; they are found to increase the MLD index by 6.5% and 2.1% respectively, whereas in the rest of the countries they increase/decrease the index by less than 1%. Social insurance contributions are found to have smaller, but also more mixed inequality effects: they increase the MLD index in the case of Czechia and Spain and slightly decrease it in Greece, France, Italy and the UK.

Table 5. MLD index and inequality decomposition between & within regions

	GI	GI-IT	GI-PT	GI-SC
CZ	0.133	0.109	0.133	0.124
between / within (%)	*4.5 / 95.5*	*4.5 / 95.5*	*4.5 / 95.5*	*4.4 / 95.6*
EL	0.192	0.162	0.196	0.185
between / within (%)	*4.0 / 96.0*	*3.6 / 96.4*	*3.9 / 96.1*	*4.1 / 95.9*
ES	0.250	0.199	0.250	0.259
between / within (%)	*6.2 / 93.8*	*6.0 / 94.0*	*6.2 / 93.8*	*6.2 / 93.8*
FR	0.170	0.136	0.169	0.164
between / within (%)	*4.3 / 95.7*	*4.0 / 96.0*	*4.2 / 95.8*	*4.3 / 95.7*
IT	0.225	0.176	0.224	0.221
between / within (%)	*10.0 / 90.0*	*9.9 / 90.1*	*10.1 / 89.9*	*9.8 / 90.2*
PL	0.158	0.142	0.159	0.158
between / within (%)	*2.5 / 97.5*	*2.3 / 97.7*	*2.5 / 97.5*	*2.5 / 97.5*
UK	0.217	0.165	0.231	0.203
between / within (%)	*3.4 / 96.6*	*2.9 / 97.1*	*3.2 / 96.8*	*3.5 / 96.5*

Notes: between / within: as % of total inequality
GI: total gross income; IT: income taxes; PT: property taxes; SC: social insurance contributions

Source: EUROMOD Version I2.11

3.4. IMPACT OF TAX-BENEFIT SYSTEMS ON BETWEEN-REGIONS INEQUALITY

Turning our attention to the impact of policies on between-regions inequality, we now create a hypothetical scenario where each population member is awarded the mean equivalised income of his/her region of residence. This scenario fully eliminates the within-regions inequality and allows us to solely focus on the effect of policies (both with and without regional elements) on the percentage change in the MLD index.

With the exception of the UK and Spain, public pensions are found to be the instrument that achieves the highest reduction in between-regions inequality. Their inequality-reducing effect varies from 19.4% in the UK to as much as 48.7% in the case of Greece. This result is correlated with the relative significance of these policies in the two countries (as shown in Table 2). In Spain, means-tested benefits and income taxes achieve a slightly higher inequality reduction than pensions; in the UK income taxes achieve by far the strongest reduction in the MLD index.

Income taxes are estimated to be a very efficient policy instrument in terms of between-regions inequality reduction; they are found to reduce the MLD index from approximately 15% in Poland and Czechia to 33% in the UK and a bit less than 30% in France and Greece. Same as in Table 5, property taxes are found to have a relatively small impact on between-regions inequality, slightly increasing it in the UK, Czechia and Greece. The results for social insurance contributions are, again, mixed: assuming zero within-region inequality, this (regionally-uniform) policy decreases between-regions inequality in four out of the seven countries and increases it in the remaining three countries.

Finally, the targeting of means-tested benefits at the bottom of the income distribution explains their higher inequality-reducing impact with respect to non-means-tested benefits in most countries studied. However, in the case of the UK and Czechia, the impact of non-means-tested benefits on between-regions inequality reduction is found to be higher; this indicates that in these two countries the population characteristics are such that non-means-tested benefits are also mostly directed to the

lowest part of the income distribution (e.g. families with more dependent children, individuals receiving unemployment benefits etc.).

Table 6. Impact of tax-benefit policies on between-regions inequality (%)

	PE	NB	MB	IT	PT	SC
CZ	-34.9	-6.9	-4.8	-16.0	0.3	-6.8
EL	-48.7	-1.2	-9.4	-27.9	0.2	2.7
ES	-19.4	-3.7	-23.6	-22.1	0.0	2.9
FR	-39.2	-7.2	-12.7	-28.6	-1.6	0.6
IT	-29.3	-4.8	-13.3	-22.0	-0.2	-3.5
PL	-37.5	-8.9	-20.3	-15.3	-0.3	-1.0
UK	-19.4	-14.5	-10.5	-33.2	1.1	-3.5

Notes: Each population member is awarded the mean equivalised income of his/her region of residence. Percentage change in MLD index when PE, NB, MB are added to market income / when IT, PT, SC are subtracted from gross income.

Source: EUROMOD Version I2.11

4. CONCLUSIONS AND POLICY RECOMMENDATIONS

In this research we set out to explore the distributional effect of taxes and transfers at the regional level in Czechia, Greece, Spain, France, Italy, Poland and the UK. Using the tax-benefit microsimulation model EUROMOD with underlying data coming from 2017 EU-SILC and FRS 2016-17, we provide descriptive statistics and estimates of the impact of 2019 tax-benefit policies on poverty and within and between-region inequality. Our analysis focuses on the poorest and richest region of each country (defined in terms of mean disposable income), but detailed results for all the regions are also provided in the Appendix. Our main results are the following.

First, we observe that, as was mostly expected, the share of market incomes and income taxes on disposable income is significantly higher in the richest regions of countries. On the contrary, the share of pensions and means-tested benefits is considerably higher in the poorest regions.

Second, public pensions seem to be playing a very important role in terms of poverty reduction at the regional level. They are estimated to achieve the highest reduction in FGT(0) and FGT(2) in both the poorest and the richest regions of all countries apart from the UK, with their impact being more pronounced in the poorest regions. Not surprisingly, means-tested benefits are also found to have a high poverty-reducing impact, especially on the poorest regions of the UK, Spain and Italy. This result has been confirmed in several studies that look at the impact of means-tested benefits on poverty at the national level (Leventi et al., 2016).

Third, within-region inequality is found to be the primary explanatory factor of total inequality in all countries studied, accounting from 90% of the total in the case of Italy to 97.5% of the total in the case of Poland. This is consistent with the findings of Bayar (2016) for the case of Turkey, where within-regions inequality is estimated to play a much more important role on overall inequality than between-regions inequality. Strikingly, taxation policies do not seem to be able to change the within/between structure of inequality, even in countries with strong regional elements in their income tax policies, such as Spain and Italy. This result highlights the central role that nationwide policies are playing in the shaping of the overall inequality pattern of a country.

Fourth, income taxes seem to be a highly efficient instrument in reducing regional inequalities, as measured by the MLD index. On the contrary, property taxes and social insurance contributions are

estimated to be increasing between-regions inequality in a number of countries. This finding underlines the importance of well-designed policies that protect (or do no harm to) the lowest part of the income distribution and that in policy instruments such as property taxes and social insurance contributions there is still scope for improvement. Policy learning from countries where these policies are designed in a more progressive and inequality-reducing way could be of value.

Finally, an important conclusion of this research, which has been largely neglected or left unnoticed in the relevant literature, is that the policies that are the most efficient in terms of poverty reduction at the local level are not necessarily equally effective in mitigating regional inequalities. Moreover, it seems that the existence of regional tax-benefit policies per se is not able to alter the structure of within/between-regions inequality; it is mostly the design of tax and benefit policies (both at the regional and at the national level) that can either exacerbate or alleviate them.

A certain amount of caution is called for when interpreting these results. The main issues, to do either with the approach or with the assumptions used, are briefly discussed below.

Using a tax-benefit model allows us to simulate the distributional effect of policies in the light of what we know about the distribution of pre-tax incomes, the composition of households, the labour market and demographic characteristics of household members, and other relevant information. And yet, for all the effort put into capturing as much detail as possible, simulations remain a simplification of the complexity of real life. In particular, surveys such as EU-SILC and FRS tend to underestimate the prevalence of property taxes and not to provide all the necessary information needed for a detailed simulation of these policies. Hence, our results regarding property taxes have to be considered as lower-bound estimates. Moreover, accounting for benefit non-take-up is limited to some of the benefits considered in the analysis, namely to those where there is reliable information that non-take-up is a major problem; a more uniform treatment of this issue would enhance the comparability of our estimates.

Keeping in mind the above-mentioned caveats, this research offers a sound approximation of the distributional impact of tax-benefit policies at the regional level. Given the relevance of the questions addressed and the public interest in the answers, research based on microsimulation can offer useful insights on these complex issues, and an evidence-based way to identify the policies that are better suited for achieving convergence via reducing regional economic disparities.

Taxes and social transfers should be recognised as part of the resources available to states to address territorial inequalities and promote spatial justice, especially in the lowest income regions. Analysis such as that presented in this paper can help to refine and configure state tax and benefit policies to maximise impacts on regional inequalities. Yet, as responsibility for taxes and social benefits primarily remains with national governments in EU member states, the potential for them to be employed as a mechanism for EU territorial cohesion is restricted. Indeed, our analysis shows that the components of tax and benefit systems have differentiated impacts in different countries, such that they contribute towards the uneven pace of progress in reducing territorial inequalities in different parts of Europe and have potential to act against the effect of EU interventions in some cases. At the same time, the redistributive capacity of tax and benefit policies rests on centralised fiscal management, even in countries where elements of the tax and benefits system have been devolved to regions, and as such could act as a counterweight to arguments for enhanced territorial autonomy as a strategy for spatial justice.

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APPENDIX

Table A1. Mean standardised equivalised disposable income (MEDI) and population shares

	MEDI	pop. share
Czechia	**100.0**	**100.0**
Praha	121.1	12.0
Stredni Cechy	107.9	12.6
Jihozapad	97.3	11.6
Severozapad	90.6	10.5
Severovychod	96.9	14.3
Jihovychod	100.6	16.0
Stredni Morava	96.0	11.5
Moravskoslezsko	87.7	11.5
Greece	**100.0**	**100.0**
Anatoliki Makedonia, Thraki	90.9	5.4
Kentriki Makedonia	100.0	17.3
Dytiki Makedonia	83.3	2.6
Thessalia	94.5	6.6
Ipeiros	92.1	3.1
Ionia Nisia	92.5	1.8
Dytiki Ellada	78.7	6.0
Sterea Ellada	91.0	4.7
Peloponnisos	95.0	5.2
Attiki	112.1	36.2
Voreio Aigaio	91.3	1.8
Notio Aigaio	99.2	3.4
Kriti	89.9	5.7
Spain	**100.0**	**100.0**
Galicia	98.5	5.8
Principado de Asturias	105.3	2.2
Cantabria	97.5	1.3
País Vasco	127.5	4.7
Comunidad Foral de Navarra	122.1	1.4
La Rioja	108.0	0.7
Aragón	107.9	2.8
Comunidad de Madrid	118.1	13.9
Castilla y León	99.8	5.2
Castilla-La Mancha	83.4	4.4
Extremadura	72.8	2.3
Cataluña	114.7	16.0
Comunidad Valenciana	88.3	10.7
Illes Balears	110.3	2.5
Andalucía	83.8	18.1
Región de Murcia	81.9	3.2
Ciudad Autónoma de Ceuta	87.2	0.2
Ciudad Autónoma de Melilla	94.6	0.2

Canarias	82.1	4.6
France	**100.0**	**100.0**
Île de France	116.3	18.5
Champagne-Ardenne	83.6	2.4
Picardie	89.5	2.7
Haute-Normandie	94.1	2.6
Centre	96.0	3.6
Basse-Normandie	91.7	2.2
Bourgogne	106.3	2.5
Nord - Pas-de-Calais	92.0	8.5
Lorraine	95.2	4.3
Alsace	101.5	2.6
Franche-Comté	90.3	1.6
Pays de la Loire	109.8	6.7
Bretagne	95.7	5.5
Poitou-Charentes	94.9	3.6
Aquitaine	94.6	5.4
Midi-Pyrénées	100.8	4.3
Limousin	95.1	1.4
Rhône-Alpes	102.8	8.8
Auvergne	92.0	1.6
Languedoc-Roussillon	80.5	4.3
Provence-Alpes-Côte d'Azur	98.2	6.5
Corse	86.9	0.3
Italy	**100.0**	**100.0**
Piemonte	104.3	7.2
Valle d'Aosta	106.7	0.2
Lombardia	117.1	16.5
Bolzano	129.1	0.9
Trento	115.6	0.9
Veneto	111.6	8.1
Friuli-Venezia Giulia	112.7	2.0
Liguria	109.6	2.6
Emilia-Romagna	119.0	7.3
Toscana	110.5	6.2
Umbria	104.2	1.5
Marche	104.1	2.5
Lazio	104.7	9.7
Abruzzo	89.1	2.2
Molise	80.0	0.5
Campania	73.9	9.7
Puglia	85.0	6.7
Basilicata	81.0	0.9
Calabria	74.5	3.3
Sicilia	71.0	8.4
Sardegna	88.2	2.7
Poland	**100.0**	**100.0**

Central Region	110.5	20.8
South Region	100.9	20.8
East Region	86.5	17.5
Northwest Region	97.7	16.0
Southwest Region	108.1	9.9
North Region	96.8	15.0
UK		
North East	86.6	4.0
North West	92.4	11.0
Yorkshire and the Humber	92.8	8.3
East Midlands	93.8	7.2
West Midlands	91.7	8.9
East of England	105.0	9.3
London	115.7	13.5
South East	111.8	13.7
South West	100.1	8.4
Wales	89.8	4.7
Scotland	97.3	8.1
Northern Ireland	87.5	2.9

Notes: Country level = 100

Source: EUROMOD Version I2.11

Table A2. Income/tax components disaggregation

	MI	PE	NB	MB	IT	PT	SC
Czechia	**96.1**	**23.2**	**2.7**	**1.1**	**-10.4**	**-0.2**	**-12.4**
Praha	105.8	18.0	2.2	0.8	-13.0	-0.2	-13.6
Stredni Cechy	101.7	20.5	2.1	0.7	-11.4	-0.2	-13.4
Jihozapad	95.2	24.0	2.5	0.7	-10.1	-0.2	-12.1
Severozapad	92.7	24.6	2.6	2.1	-9.6	-0.2	-12.1
Severovychod	92.9	25.0	3.0	0.9	-9.7	-0.2	-12.0
Jihovychod	95.3	23.7	2.7	1.0	-10.1	-0.2	-12.3
Stredni Morava	93.1	24.8	3.0	0.8	-9.8	-0.2	-11.8
Moravskoslezsko	87.6	26.9	3.9	2.0	-8.8	-0.2	-11.4
Greece	**87.2**	**38.0**	**1.1**	**2.9**	**-11.5**	**-2.6**	**-15.3**
Anatoliki Makedonia, Thraki	79.8	41.7	1.3	3.8	-8.8	-2.4	-15.4
Kentriki Makedonia	86.1	38.1	1.1	2.9	-10.5	-2.5	-15.3
Dytiki Makedonia	85.4	39.5	1.3	3.8	-10.9	-2.4	-16.9
Thessalia	79.1	43.6	0.9	2.9	-9.6	-2.2	-14.6
Ipeiros	78.2	45.7	0.7	3.4	-11.0	-2.4	-14.6
Ionia Nisia	93.5	30.8	2.4	2.9	-10.9	-3.8	-15.0
Dytiki Ellada	71.8	46.7	0.5	5.1	-7.8	-2.4	-13.9
Sterea Ellada	73.4	49.9	0.8	2.6	-9.7	-2.7	-14.3
Peloponnisos	79.6	43.2	1.1	2.7	-9.2	-2.5	-14.9
Attiki	94.9	33.7	1.1	2.4	-13.8	-2.6	-15.7
Voreio Aigaio	81.1	44.3	1.0	2.6	-11.0	-2.6	-15.4
Notio Aigaio	97.2	29.2	2.0	2.6	-11.6	-3.1	-16.5
Kriti	80.2	40.4	1.7	3.9	-8.6	-3.0	-14.6
Spain	**89.2**	**25.2**	**3.4**	**4.4**	**-15.4**	**-0.1**	**-6.7**
Galicia	80.2	30.3	2.8	6.2	-13.2	-0.1	-6.2
Principado de Asturias	78.4	37.3	2.9	3.3	-16.0	-0.1	-5.8
Cantabria	86.9	29.6	1.7	3.1	-14.5	0.0	-6.7
País Vasco	90.7	27.9	3.2	3.1	-18.8	0.0	-6.2
Comunidad Foral de Navarra	89.0	28.1	3.5	2.3	-16.5	-0.1	-6.4
La Rioja	89.0	26.9	2.9	2.8	-14.8	-0.1	-6.7
Aragón	91.2	25.7	1.9	2.9	-15.1	0.0	-6.6
Comunidad de Madrid	97.7	21.4	3.2	2.3	-18.0	-0.1	-6.5
Castilla y León	84.3	29.5	2.5	3.9	-13.4	0.0	-6.8
Castilla-La Mancha	87.4	22.4	5.0	5.2	-11.7	-0.1	-8.2
Extremadura	77.8	25.3	4.9	10.7	-11.2	0.0	-7.6
Cataluña	95.7	23.3	3.6	2.4	-18.0	0.0	-6.9
Comunidad Valenciana	84.0	27.1	4.0	5.1	-13.3	-0.1	-6.9
Illes Balears	104.3	17.0	3.4	1.9	-19.5	-0.1	-7.1
Andalucía	81.9	25.9	3.7	8.1	-13.0	-0.1	-6.6
Región de Murcia	86.3	22.4	4.0	5.7	-11.3	-0.1	-7.1
Ciudad Autónoma de Ceuta	95.1	20.2	2.3	5.4	-15.7	-0.1	-7.3
Ciudad Autónoma de Melilla	93.5	19.5	4.1	4.9	-14.8	0.0	-7.1
Canarias	83.8	24.3	3.4	7.3	-11.8	0.0	-6.9
France	**90.6**	**27.9**	**4.2**	**4.6**	**-17.9**	**-0.2**	**-9.2**
Île de France	99.1	24.0	3.8	4.0	-21.2	-0.5	-9.1

Champagne-Ardenne	77.1	34.2	5.9	5.8	-14.3	-0.1	-8.6
Picardie	81.0	32.0	4.7	5.7	-15.4	-0.2	-7.8
Haute-Normandie	89.5	26.3	4.1	5.2	-16.1	0.0	-8.9
Centre	89.4	28.1	4.0	4.0	-16.5	0.0	-9.0
Basse-Normandie	84.5	32.1	3.0	6.1	-15.8	-0.1	-9.7
Bourgogne	94.5	26.9	3.6	3.9	-19.6	-0.1	-9.1
Nord - Pas-de-Calais	86.8	27.1	4.5	6.0	-16.0	-0.1	-8.4
Lorraine	86.6	29.6	4.4	4.6	-16.4	-0.1	-8.8
Alsace	90.2	27.4	4.5	4.0	-16.9	0.0	-9.2
Franche-Comté	89.7	24.5	6.1	5.1	-15.9	-0.1	-9.3
Pays de la Loire	100.8	23.1	4.8	4.0	-21.1	-0.1	-11.5
Bretagne	88.5	28.4	4.1	4.5	-16.2	0.0	-9.4
Poitou-Charentes	83.7	33.0	3.9	4.7	-16.5	-0.1	-8.7
Aquitaine	81.3	34.8	4.6	5.0	-16.6	-0.1	-9.0
Midi-Pyrénées	92.3	27.9	3.9	4.0	-17.9	-0.2	-10.0
Limousin	81.0	35.2	3.5	4.7	-16.7	0.0	-7.8
Rhône-Alpes	94.7	25.4	4.2	4.1	-18.0	-0.6	-9.9
Auvergne	91.5	24.6	2.4	5.7	-14.2	0.0	-10.0
Languedoc-Roussillon	77.4	32.3	5.0	7.3	-14.1	0.0	-7.9
Provence-Alpes-Côte d'Azur	84.0	33.7	4.1	4.0	-17.6	-0.2	-8.2
Corse	70.6	42.4	2.9	7.1	-14.6	-0.2	-8.2
Italy	**91.9**	**34.2**	**5.1**	**2.5**	**-22.3**	**-2.3**	**-9.1**
Piemonte	90.4	35.6	6.0	2.0	-22.9	-2.1	-9.0
Valle d'Aosta	94.9	31.6	5.9	2.0	-21.7	-3.3	-9.3
Lombardia	100.3	31.0	4.6	1.6	-25.7	-1.9	-9.8
Bolzano	106.4	23.8	4.8	1.4	-23.8	-1.6	-10.8
Trento	98.4	28.3	6.8	1.9	-23.6	-2.4	-9.6
Veneto	95.8	31.4	4.8	1.3	-22.1	-1.8	-9.6
Friuli-Venezia Giulia	90.5	36.3	5.4	1.6	-22.8	-1.7	-9.2
Liguria	91.4	39.7	4.2	1.4	-24.0	-3.8	-9.0
Emilia-Romagna	97.3	33.1	5.3	1.5	-24.7	-2.5	-9.9
Toscana	92.6	36.8	5.0	1.4	-23.7	-2.8	-9.3
Umbria	86.4	38.9	4.9	1.8	-21.1	-2.3	-8.6
Marche	87.6	36.2	5.1	2.3	-20.5	-2.2	-8.6
Lazio	98.3	33.7	4.4	2.3	-26.0	-3.4	-9.2
Abruzzo	82.0	38.7	6.4	2.8	-19.0	-2.2	-8.6
Molise	78.0	41.9	4.6	2.7	-17.6	-1.8	-7.8
Campania	84.1	31.8	4.8	6.0	-16.1	-2.3	-8.2
Puglia	81.2	36.8	6.8	3.1	-17.6	-2.5	-7.8
Basilicata	78.4	36.2	5.8	4.1	-15.2	-1.6	-7.8
Calabria	80.6	36.9	4.9	5.2	-17.5	-2.0	-8.1
Sicilia	75.2	37.6	5.5	6.5	-15.4	-2.2	-7.1
Sardegna	79.4	41.6	4.1	3.8	-18.9	-1.5	-8.5
Poland	**98.6**	**26.7**	**3.7**	**4.2**	**-18.7**	**-0.4**	**-14.1**
Central Region	104.8	23.2	3.4	3.3	-20.0	-0.4	-14.4
South Region	95.4	29.8	3.6	4.2	-18.6	-0.4	-13.9
East Region	92.6	29.4	4.4	5.2	-17.1	-0.4	-14.2

Northwest Region	98.7	26.4	3.8	4.0	-18.7	-0.4	-13.9
Southwest Region	101.0	25.9	3.5	3.5	-19.5	-0.4	-14.1
North Region	97.3	25.9	4.0	5.0	-18.0	-0.4	-13.9
UK	**109.1**	**9.0**	**5.4**	**6.1**	**-16.4**	**-3.9**	**-9.2**
North East	97.2	11.1	7.3	8.8	-12.6	-4.2	-7.6
North West	102.2	9.9	7.5	7.5	-14.2	-4.0	-8.9
Yorkshire and the Humber	104.2	9.9	5.9	6.4	-14.1	-3.9	-8.5
East Midlands	105.1	9.9	6.5	5.1	-13.7	-4.1	-8.9
West Midlands	103.7	9.9	6.2	7.0	-14.0	-4.0	-8.8
East of England	113.3	9.5	4.0	4.6	-18.1	-4.0	-9.2
London	117.9	4.8	4.2	7.2	-20.8	-3.1	-10.2
South East	115.9	8.5	4.5	4.4	-19.5	-4.2	-9.7
South West	109.2	10.5	4.0	5.0	-15.6	-4.4	-8.7
Wales	101.9	11.0	6.2	6.5	-12.4	-4.4	-8.8
Scotland	109.6	9.7	5.6	6.1	-16.7	-4.3	-10.0
Northern Ireland	95.5	8.8	7.6	7.6	-10.9	0.0	-8.7

Notes: 1. MI + PE + NB + MB + IT + PT + SC = 100
MI: Market income; PE: pensions; NB: non-means-tested benefits; MB: means-tested benefits; IT: income taxes; PT: property taxes; SC: social insurance contributions

Source: EUROMOD Version I2.11

Table A3. Impact of tax-benefit policies on FGT(0)

	PE	NB	MB	IT	PT	SC
Czechia	**-15.7**	**-0.7**	**-1.1**	**-2.6**	**0.0**	**-1.9**
Praha	-9.6	-0.1	-1.0	-4.0	0.0	-3.7
Stredni Cechy	-13.7	-1.1	-1.0	-2.7	0.2	-2.0
Jihozapad	-14.6	0.0	-1.8	-3.2	0.2	-2.0
Severozapad	-16.8	-1.0	-1.3	-1.5	0.3	-1.0
Severovychod	-16.9	-1.0	-1.0	-3.5	0.1	-2.1
Jihovychod	-17.1	-0.9	-0.6	-2.7	0.0	-1.9
Stredni Morava	-18.1	-0.2	-1.7	-1.3	0.0	-0.8
Moravskoslezsko	-18.8	-0.5	-1.5	-2.7	0.0	-1.9
Greece	**-14.3**	**-0.5**	**-1.2**	**-1.3**	**0.3**	**-0.9**
Anatoliki Makedonia, Thraki	-16.1	-0.5	-2.3	-1.1	0.2	0.2
Kentriki Makedonia	-15.1	-0.8	-1.0	-1.5	0.2	-1.7
Dytiki Makedonia	-10.1	0.0	-2.0	0.1	1.0	-0.6
Thessalia	-15.4	-0.5	-2.0	-0.8	0.4	-0.9
Ipeiros	-15.7	0.0	-2.9	-0.4	0.4	2.1
Ionia Nisia	-16.6	-1.9	-2.0	0.8	1.5	-1.6
Dytiki Ellada	-17.9	-0.5	-3.3	0.9	0.4	0.8
Sterea Ellada	-21.3	-0.8	-0.3	0.2	0.1	-0.1
Peloponnisos	-16.7	0.1	-2.0	-0.1	0.5	-1.3
Attiki	-12.1	-0.6	-1.5	-1.6	0.2	-1.5
Voreio Aigaio	-20.8	1.6	-1.4	-0.4	-0.1	-2.1
Notio Aigaio	-14.8	-0.5	-1.0	-0.8	0.4	-1.6
Kriti	-17.8	-1.6	-3.3	-0.7	-0.4	0.8
Spain	**-8.1**	**-1.1**	**-2.7**	**-2.7**	**0.0**	**-0.1**
Galicia	-9.4	0.1	-2.1	-1.7	0.0	0.6
Principado de Asturias	-12.0	-1.8	-1.2	-3.7	0.0	1.9
Cantabria	-11.4	-1.5	-3.9	-1.7	0.0	1.8
País Vasco	-11.0	-1.4	-1.7	-4.1	0.0	-0.4
Comunidad Foral de Navarra	-10.6	1.0	-0.2	-5.2	0.0	-1.6
La Rioja	-14.6	-3.6	-2.3	-4.8	0.0	0.4
Aragón	-8.3	-0.4	-0.5	-5.9	0.0	-1.7
Comunidad de Madrid	-6.3	-1.3	-1.6	-2.3	0.0	0.0
Castilla y León	-11.0	0.1	-1.7	-4.9	-0.2	0.5
Castilla-La Mancha	-8.8	-1.0	-3.4	-0.8	0.0	4.7
Extremadura	-11.0	-1.5	-8.6	-1.6	0.0	1.4
Cataluña	-9.2	-0.2	-1.5	-3.2	0.0	0.3
Comunidad Valenciana	-8.3	-1.6	-1.6	-1.2	0.0	0.3
Illes Balears	-4.8	0.0	-0.4	-1.3	0.0	2.7
Andalucía	-9.8	-1.1	-8.0	-1.5	0.0	0.7
Región de Murcia	-7.1	-1.2	-2.3	-3.8	0.0	-1.1
Ciudad Autónoma de Ceuta	-8.5	-7.1	-9.4	0.0	0.0	0.3
Ciudad Autónoma de Melilla	-3.6	-2.5	-5.6	-2.1	0.0	-0.3
Canarias	-3.8	-0.6	-3.4	-3.0	0.0	-0.7
France	**-12.9**	**-1.9**	**-3.1**	**-2.6**	**0.0**	**-1.6**
Île de France	-6.9	-0.6	-2.9	-2.9	0.0	-0.6

Champagne-Ardenne	-16.9	-2.6	-4.1	-3.2	0.0	-1.4
Picardie	-9.7	-0.9	-3.8	-2.2	0.0	0.8
Haute-Normandie	-6.4	-0.5	-2.5	-2.1	0.0	0.0
Centre	-17.9	-2.7	-2.0	-3.2	0.0	-2.9
Basse-Normandie	-16.4	-3.8	-4.1	-0.9	0.0	-1.6
Bourgogne	-18.1	-2.8	-3.8	-1.9	0.0	-1.1
Nord - Pas-de-Calais	-11.5	-0.3	-4.9	-1.4	0.0	-1.6
Lorraine	-12.8	-1.0	-4.8	-2.1	0.0	-2.0
Alsace	-11.3	-1.8	-0.2	-2.5	0.0	-2.0
Franche-Comté	-13.8	-1.2	-4.4	-2.6	0.0	2.3
Pays de la Loire	-15.1	-1.3	-1.8	-1.7	0.0	-2.1
Bretagne	-13.2	-1.2	-3.6	-2.8	0.0	-0.4
Poitou-Charentes	-11.4	-2.4	0.3	-1.7	0.0	-1.9
Aquitaine	-12.0	-0.9	-2.5	-2.6	0.0	-2.8
Midi-Pyrénées	-11.8	-2.4	-1.1	-1.4	0.0	-1.4
Limousin	-15.1	-1.8	-3.3	-5.8	0.0	-4.5
Rhône-Alpes	-13.2	-1.2	-1.8	-1.0	0.0	-0.7
Auvergne	-12.8	-2.5	-3.5	-0.5	0.0	-1.1
Languedoc-Roussillon	-10.7	-3.6	-4.6	-1.4	0.0	0.7
Provence-Alpes-Côte d'Azur	-15.8	-2.1	-2.5	-1.3	0.0	-0.8
Corse	-5.5	-1.1	-1.0	0.0	0.0	0.0
Italy	**-9.3**	**-1.1**	**-1.3**	**-3.4**	**0.1**	**0.1**
Piemonte	-11.9	-0.4	-0.3	-2.8	-0.4	-0.9
Valle d'Aosta	-13.2	-2.3	-2.9	-2.1	0.5	-0.3
Lombardia	-12.3	-0.9	-1.1	-2.7	0.0	-0.5
Bolzano	-8.0	-1.2	0.4	-2.2	0.2	-1.2
Trento	-11.3	-1.5	-3.0	-2.5	0.4	-0.1
Veneto	-10.5	-1.3	-0.5	-2.7	0.5	-0.6
Friuli-Venezia Giulia	-14.4	-1.0	-1.0	-1.4	0.7	-0.6
Liguria	-11.1	1.1	-0.5	-2.0	0.3	-1.1
Emilia-Romagna	-13.0	-2.0	-0.9	-3.1	0.2	0.1
Toscana	-9.9	0.8	-1.0	-3.2	0.4	-1.0
Umbria	-16.4	-0.6	-1.9	-2.7	-0.9	-0.3
Marche	-10.3	0.8	-1.5	-2.5	0.3	-0.1
Lazio	-8.4	0.3	-0.6	-3.2	-0.1	-0.1
Abruzzo	-10.1	-0.9	0.3	-2.1	-1.0	-0.3
Molise	-11.8	-2.8	-0.7	-2.4	0.4	-0.1
Campania	-11.5	-0.2	-3.1	-3.6	-0.1	-1.5
Puglia	-10.5	-4.2	-1.8	-4.4	0.2	0.4
Basilicata	-11.1	-3.7	-0.4	-0.8	0.3	-1.0
Calabria	-11.6	-1.8	-3.8	-3.4	-1.2	-2.1
Sicilia	-9.4	-2.9	-4.9	-2.3	0.2	1.0
Sardegna	-11.4	-1.1	-1.1	-3.4	0.0	1.5
Poland	**-10.5**	**-1.3**	**-3.0**	**-1.0**	**0.1**	**-0.3**
Central Region	-11.1	-1.8	-2.2	-0.5	0.0	-0.6
South Region	-11.5	-1.2	-4.2	-1.3	0.2	-0.5
East Region	-12.2	-1.7	-3.3	-0.6	0.5	0.3

Northwest Region	-11.9	-1.2	-2.4	-1.0	0.3	-0.4
Southwest Region	-10.5	-1.3	-4.4	-1.1	0.1	-1.4
North Region	-10.1	0.0	-3.1	-1.7	0.1	-0.1
UK	**-3.7**	**-2.2**	**-4.9**	**-2.8**	**1.0**	**-2.3**
North East	-5.4	-2.5	-9.5	-3.2	1.6	-2.2
North West	-5.0	-2.3	-5.7	-1.8	0.8	-1.7
Yorkshire and the Humber	-4.1	-1.3	-4.1	-2.8	0.9	-2.5
East Midlands	-5.1	-3.2	-5.7	-2.6	1.0	-1.5
West Midlands	-4.8	-2.3	-6.6	-2.5	1.6	-0.8
East of England	-5.3	-0.7	-3.1	-2.8	1.6	-1.9
London	-1.8	-1.3	-4.4	-3.7	1.0	-3.2
South East	-1.6	-0.8	-2.3	-2.4	1.2	-2.3
South West	-4.0	-2.6	-4.6	-2.6	0.8	-1.6
Wales	-4.4	-3.3	-6.3	-1.9	1.1	-1.7
Scotland	-3.6	-1.7	-2.5	-2.8	0.9	-3.3
Northern Ireland	-3.1	-2.4	-6.3	-1.8	0.0	-1.1

Notes: PE, NB, MB: components are added to MI
IT, PT, SC: components are subtracted from GI

Source: EUROMOD Version I2.11

Table A4. MLD index

	GI	GI-IT	GI-PT	GI-SC
Czechia	**0.133**	**0.109**	**0.133**	**0.124**
Praha	0.145	0.118	0.145	0.138
Stredni Cechy	0.143	0.117	0.143	0.135
Jihozapad	0.098	0.079	0.098	0.092
Severozapad	0.128	0.106	0.128	0.117
Severovychod	0.107	0.087	0.107	0.100
Jihovychod	0.130	0.108	0.131	0.120
Stredni Morava	0.136	0.111	0.136	0.127
Moravskoslezsko	0.128	0.105	0.128	0.119
Greece	**0.192**	**0.162**	**0.196**	**0.185**
Anatoliki Makedonia, Thraki	0.194	0.171	0.198	0.184
Kentriki Makedonia	0.184	0.158	0.188	0.176
Dytiki Makedonia	0.167	0.144	0.172	0.156
Thessalia	0.180	0.153	0.184	0.175
Ipeiros	0.193	0.162	0.197	0.188
Ionia Nisia	0.172	0.150	0.180	0.164
Dytiki Ellada	0.152	0.135	0.155	0.144
Sterea Ellada	0.164	0.138	0.168	0.159
Peloponnisos	0.159	0.137	0.162	0.156
Attiki	0.204	0.170	0.207	0.196
Voreio Aigaio	0.182	0.153	0.186	0.173
Notio Aigaio	0.176	0.144	0.180	0.172
Kriti	0.142	0.122	0.146	0.139
Spain	**0.250**	**0.199**	**0.250**	**0.259**
Galicia	0.204	0.164	0.204	0.212
Principado de Asturias	0.224	0.177	0.223	0.232
Cantabria	0.181	0.141	0.181	0.187
País Vasco	0.219	0.173	0.219	0.223
Comunidad Foral de Navarra	0.157	0.127	0.157	0.162
La Rioja	0.180	0.137	0.180	0.192
Aragón	0.170	0.133	0.170	0.177
Comunidad de Madrid	0.279	0.223	0.279	0.287
Castilla y León	0.175	0.139	0.175	0.183
Castilla-La Mancha	0.211	0.169	0.211	0.228
Extremadura	0.219	0.172	0.219	0.229
Cataluña	0.224	0.175	0.224	0.232
Comunidad Valenciana	0.233	0.187	0.233	0.246
Illes Balears	0.301	0.228	0.301	0.326
Andalucía	0.262	0.212	0.262	0.268
Región de Murcia	0.221	0.180	0.220	0.227
Ciudad Autónoma de Ceuta	0.342	0.287	0.341	0.335
Ciudad Autónoma de Melilla	0.211	0.172	0.211	0.211
Canarias	0.243	0.199	0.243	0.249
France	**0.170**	**0.136**	**0.169**	**0.164**
Île de France	0.202	0.160	0.200	0.199

Champagne-Ardenne	0.127	0.105	0.127	0.118
Picardie	0.133	0.108	0.132	0.129
Haute-Normandie	0.140	0.115	0.139	0.136
Centre	0.123	0.099	0.123	0.117
Basse-Normandie	0.120	0.098	0.119	0.114
Bourgogne	0.214	0.171	0.214	0.207
Nord - Pas-de-Calais	0.158	0.128	0.158	0.153
Lorraine	0.166	0.134	0.166	0.159
Alsace	0.131	0.108	0.131	0.126
Franche-Comté	0.108	0.084	0.107	0.104
Pays de la Loire	0.235	0.184	0.235	0.220
Bretagne	0.130	0.107	0.130	0.125
Poitou-Charentes	0.136	0.111	0.136	0.135
Aquitaine	0.140	0.115	0.140	0.133
Midi-Pyrénées	0.180	0.146	0.180	0.171
Limousin	0.158	0.131	0.158	0.155
Rhône-Alpes	0.142	0.114	0.140	0.138
Auvergne	0.114	0.096	0.114	0.109
Languedoc-Roussillon	0.148	0.122	0.147	0.141
Provence-Alpes-Côte d'Azur	0.157	0.128	0.156	0.153
Corse	0.135	0.109	0.134	0.125
Italy	**0.225**	**0.176**	**0.224**	**0.221**
Piemonte	0.184	0.145	0.183	0.181
Valle d'Aosta	0.184	0.147	0.184	0.178
Lombardia	0.208	0.161	0.207	0.205
Bolzano	0.147	0.116	0.150	0.143
Trento	0.208	0.159	0.209	0.206
Veneto	0.169	0.135	0.169	0.166
Friuli-Venezia Giulia	0.163	0.128	0.162	0.159
Liguria	0.218	0.179	0.217	0.215
Emilia-Romagna	0.187	0.148	0.185	0.183
Toscana	0.193	0.152	0.191	0.191
Umbria	0.165	0.124	0.163	0.163
Marche	0.177	0.138	0.175	0.174
Lazio	0.252	0.192	0.250	0.251
Abruzzo	0.178	0.141	0.175	0.176
Molise	0.173	0.135	0.175	0.171
Campania	0.215	0.169	0.213	0.210
Puglia	0.194	0.152	0.194	0.193
Basilicata	0.172	0.135	0.172	0.168
Calabria	0.232	0.181	0.233	0.229
Sicilia	0.212	0.164	0.209	0.207
Sardegna	0.235	0.186	0.235	0.230
Poland	**0.158**	**0.142**	**0.159**	**0.158**
Central Region	0.189	0.169	0.190	0.192
South Region	0.147	0.131	0.148	0.147
East Region	0.140	0.128	0.141	0.144

Northwest Region	0.143	0.129	0.144	0.143
Southwest Region	0.164	0.147	0.165	0.160
North Region	0.137	0.124	0.138	0.133
UK	**0.217**	**0.165**	**0.231**	**0.203**
North East	0.194	0.152	0.208	0.180
North West	0.202	0.155	0.213	0.185
Yorkshire and the Humber	0.200	0.154	0.212	0.187
East Midlands	0.182	0.146	0.195	0.169
West Midlands	0.203	0.156	0.215	0.187
East of England	0.210	0.156	0.224	0.199
London	0.267	0.200	0.281	0.253
South East	0.216	0.163	0.232	0.205
South West	0.192	0.146	0.206	0.180
Wales	0.190	0.155	0.210	0.173
Scotland	0.210	0.158	0.224	0.194
Northern Ireland	0.161	0.130	0.161	0.146

Source: EUROMOD Version I2.11