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# Indexing out of poverty? Fiscal drag and benefit erosion in cross-national perspective

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# Indexing out of poverty? Fiscal drag and benefit erosion in cross-national perspective*

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## Abstract

We assess how tax-benefit policy developments in 2001-2011 affected the household income distribution in seven EU countries. We use the standard microsimulation-based decomposition method, separating further the effect of structural policy changes and the uprating of monetary parameters, which allows us to measure the extent of fiscal drag and benefit erosion in practice. The results show that despite different fiscal effects, policies overall mostly reduced poverty and inequality and both types of policy developments had sizeable effects on the income distribution. We also find that the uprating of monetary parameters not only had a positive effect on household incomes, meaning fiscal drag and benefit erosion were avoided, but generally also contributed more to poverty and inequality reduction than structural policy reforms.

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**Keywords**: income distribution, tax-benefit policies, decomposition, microsimulation

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# 1 Introduction

The subject of income distribution has seen an upsurge of interest in the economic literature since the 1990s (Atkinson, 1997), and especially so in the aftermath of the Great Recession with the negative consequences of rising inequality moving into the spotlight (e.g. Stiglitz, 2012, Corak, 2013, Piketty, 2014, Atkinson, 2015). Much attention has been paid to tax and benefit policies, which directly influence household income distribution and over which policy makers have more control than other factors (e.g. Bargain et al., 2017, Paulus et al., 2017).

Governments employ two broad types of action to re-shape national tax-benefit systems: the uprating of monetary parameters of existing policy instruments and structural changes involving the introduction of new policy elements (parameters) or abolition of existing ones. Typically these occur in parallel, making it challenging to distinguish between the two. Even though the distinction has both conceptual and practical importance, it has not been attempted in empirical analysis of micro-level impacts of tax-benefit policies.

In this paper, we extend previous literature by quantifying each type of fiscal policy action and measuring their effects on the income distribution. We define *structural effects* as those arising from the modifications to the design of the tax-benefit system (e.g. introduction of a new benefit) and *indexation effects* stemming from the uprating of monetary parameters such as benefit amounts and tax thresholds, either based on automatic statutory indexation or discretionary (ad hoc) adjustments. Insufficient uprating would lead to tax increases through people 'falling' into higher tax brackets and decreasing relative value of cash benefits – referred to as fiscal drag (or bracket creep) and benefit erosion.

Previous research has mainly concentrated on assessing fiscal drag and benefit erosion on the basis of hypothetical scenarios, where prices or incomes are assumed to grow by a certain factor and tax-benefit policies kept constant or adjusted only according to statutory rules (Immervoll, 2005, Immervoll et al., 2006, Sutherland et al., 2008). In contrast, our indexation effect measures *actual* fiscal drag and benefit erosion and how it has contributed to the overall impact of tax-benefit policies. To the best of our knowledge, this has not been estimated before. Our new approach is nested in the broader decomposition framework of Bargain and Callan (2010), relying on tax-benefit microsimulation modelling (Bourguignon and Spadaro, 2006, O'Donoghue, 2014) to construct counterfactual income distributions. Microsimulation

models can identify the (direct) policy effect by simulating alternative tax-benefit policies, while keeping 'everything else' constant, e.g. the population structure and the distribution of gross market incomes.

We apply partial decomposition to study the distributional effects of tax-benefit policies in selected European countries and the role played by fiscal drag and benefit erosion. In the European context, public pensions are usually indexed but most countries do not have automatic indexing regimes to adjust the levels of other benefits or tax thresholds over time. This increases the likelihood of tax-benefit systems lagging behind general developments in the economy and may contribute to larger fiscal drag and benefit erosion. We consider the decade since 2001, when a strong emphasis was placed on reducing poverty and social exclusion at the EU level (European Council, 2000) but which has not received much attention in the literature with international developments in the pre-crisis period particularly understudied. This is also a period which contains episodes of both economic growth and recession and allows us to study indexation effects in the context of a full business cycle. We cover a selection of EU countries – Belgium, Bulgaria, Estonia, Greece, Hungary, Italy and the UK – varying in the size of the welfare state, experience of economic change and fiscal policy reforms and indexation practices.

The specific questions we seek to address are: Did tax-benefit policy developments contribute to increasing or reducing poverty and inequality, even if other factors may have been pushing in the other direction? Did these differ across the business cycle? How important was indexation compared with structural changes to policies? Has the lack of widespread automatic indexation mechanisms contributed to lower progressivity of tax-benefit systems and increased poverty and inequality levels? Were there any common patterns in government decisions across EU countries, despite differences in welfare systems and economic conditions?

Our results show that tax-benefit policy developments in 2001-2011 were on the whole equalising, reducing relative poverty and inequality levels in these countries (with Hungary being a clear exception). However, budgetary effects differed substantially across countries leading to household income losses in some (Greece, Italy and the UK) and gains in others. We also find that both types of policy developments had sizeable effects on the income distribution. However, the way monetary parameters were uprated (indexed) not only had a

positive effect on household incomes – meaning fiscal drag and benefit erosion were generally avoided – but also contributed more to poverty and inequality *alleviation* than changes to the structure of policies. Our analysis helps to better understand policy actions and choices in this period, in a cross-national perspective.

We proceed by discussing the importance of distinguishing between structural changes and indexation effects in Section 2. We then explain our decomposition approach in Section 3 and, in Section 4, consider the implications of chosen benchmark indexation factors, relevant for deriving counterfactual income distributions. Section 5 describes the tax-benefit model EUROMOD and the data used in the analysis. We present our empirical findings in Section 6. The paper is summarised and concluded in Section 7.

## 2 Structural changes and indexation effect

It is for several reasons that the distinction between structural policy reforms and the uprating of monetary parameters matters, which we refer to as the indexation effect. First, even though both types of policy action can be employed to bring about new budget priorities they also have two distinct aims. Structural changes seek to augment the tax-benefit system to achieve a more optimal design, balancing between various objectives and constraints. Uprating is necessary to adjust nominal parameters in the tax-benefit system over time in line with movements in prices and incomes and keep the tax-benefit system 'stable' in a dynamic economic environment. It is this function we mainly focus on in the reminder of the paper. In principle, similar fiscal or distributional outcomes can be achieved through the indexation of monetary parameters of the tax-benefit system and through a change in the design of the system. But this does not necessarily hold for each individual instrument and the two types of changes should therefore be seen as complements rather than substitutes. For example, starting from a universal benefit (i.e. one monetary parameter), it is not possible to introduce means-testing through a set of changes to monetary levels.

Note that our notion of structural changes is a somewhat narrower concept compared to what might usually be referred to as 'reforms'. The latter can include differential uprating of monetary parameters, which would here be captured as part of the indexation effect together with any statutory indexation as such.

Second, different types of policy action are not equally salient for household perceptions, which in turn can have important implications for behavioural reactions (Chetty et al., 2009).

It is possible that the cumulative effect of uprating, or lack of it, is considerably more important for household welfare than even major structural changes in tax-benefit systems though it is often the latter which receive more attention in academic and policy discussions. Similarly, in comparison with regular increments in benefits and tax thresholds, occasional 'giveaways' (with the same budgetary cost) may be more salient to voters and hence more attractive to policymakers (Sutherland et al., 2008), though imply weaker automatic stabilisers and less consumption smoothing. A piecemeal approach also allows policymakers to target different population subgroups in turn (for example, in a series of annual budgets over the election cycle) in an attempt to increase popular votes, while the real shifts in budget priorities are obscured and may be lacking altogether.

# 3 The decomposition method

Our starting point for the analysis is the standard fiscal microsimulation modelling technique. Tax-benefit microsimulation models simulate the detailed rules of taxes and benefits for a representative sample of households under existing or alternative policy rules and hence derive their net incomes under various policy assumptions while holding everything else constant (Figari et al., 2015). In a static framework, household income variation across different scenarios captures then the first-order effect of tax-benefit policies on the income distribution.

Considering specifically the effects of tax-benefit policies over time, Bargain and Callan (2010) suggested a decomposition framework separating the (direct) effect of policies from other factors such as changes in the population structure and market incomes when analysing observed changes in the income distribution. Recognising that household net incomes are a function of the tax-benefit rules and household socio-economic characteristics including market incomes, they identify the contribution of each component to changes in net incomes by varying a single component in turn while keeping others fixed. Several extensions have been proposed to further separate out labour supply effects (Bargain, 2012, Bargain et al., 2015, Creedy and Hérault, 2015, Hérault and Azpitarte, 2016). In this paper, we focus on the role of policies, corresponding to a partial decomposition in the Bargain and Callan (2010) framework, but introduce further subcomponents to distinguish between the structural effect and indexation effect.

Formally, following the notation in Bargain and Callan (2010), we define $y$ as a matrix which contains information on market incomes (and socio-economic and demographic characteristics) of the households, and $d(p, y)$ a function that derives disposable incomes on the basis of $y$, distinguishing between the structure of the tax-benefit system $(d)$ and policy parameters with monetary values $(p)$. Let us also define $I(\cdot)$ as a summary indicator for a part or the whole distribution of disposable income. This could be for example, mean income for a particular group of households or a measure of income inequality or poverty. Subscripts 0 and 1 refer to start-period and end-period values, respectively. Based on this notation, the *policy effect* conditional on *end-period* market income and population $(y_1)$ equals:

$$I[d_1(p_1, y_1)] - I[d_0(\alpha p_0, y_1)] \tag{1}$$

The expression $d_1(p_1, y_1)$ refers to the *actual* income distribution in period 1, while $d_0(\alpha p_0, y_1)$ represents a *counterfactual* income distribution in which we have replaced the tax-benefit policies from period 1 with the policies from period 0. Notice that the counterfactual term has the nominal values of monetary parameters adjusted by a factor α to make them comparable over time. We will discuss the choice and interpretation of α in Section 4. Similarly, the policy effect conditional on *start-period* market income and population $(y_0)$ can be expressed as:

$$I\left[d_1\left(\frac{1}{\alpha}p_1, y_0\right)\right] - I[d_0(p_0, y_0)] \tag{2}$$

where $d_0(p_0, y_0)$ stands for the actual income distribution in period 0 and $d_1\left(\frac{1}{\alpha}p_1, y_0\right)$ is the counterfactual.[1] In analogue, the effect of changes in the population structure and market incomes would be obtained by varying the second argument $(y)$ under fixed policy rules (either from period 0 or 1), so that the two components (policy effect and 'other effect') add up to the total observed change in $I$, i.e. $I[d_1(p_1, y_1)] - I[d_0(p_0, y_0)]$. For more details on the full decomposition approach, see Bargain and Callan (2010). Given our focus on policy effects as well as data limitations (discussed further below), we do not repeat all the details here.

[1] An alternative would have been to deflate year 1 incomes (y1) to year 0 prices in equation 1 and inflate year 0 incomes (y0) to year 1 prices in equation 2. Equation 1 and 2 presented here match our empirical strategy explained at the end of Section 3.

We embed the structural effect and indexation effect in the same framework and obtain these by decomposing the policy effect further. The indexation effect measures how governments have adjusted monetary parameters through a combination of statutory indexation and discrete adjustments relative to the benchmark (e.g. changes in incomes or price levels), hence capturing changes in the effective tax burden (i.e. fiscal drag) and in the relative value of benefits (i.e. benefit erosion). The structural effect captures structural changes, both substantial reforms such as the introduction of new benefits or taxes (or abolishing existing ones) as well as changing the design of existing instruments by altering non-monetary parameters (e.g. tax rate, benefit eligibility conditions). Distinguishing between these effects therefore allows the two types of government action with distinct aims to be quantified, which might either counterbalance or reinforce each other. To achieve this, we rewrite the policy effect component in equation (1) as:

$$\underbrace{I[d_1(p_1, y_1)] - I[d_1(\alpha p_0, y_1)]}_{\substack{\text{Indexation effect conditional on} \\ \text{tax-benefit system 1}}} + \underbrace{I[d_1(\alpha p_0, y_1)] - I[d_0(\alpha p_0, y_1)]}_{\substack{\text{Structural effect conditional on} \\ \text{monetary parameters 0}}} \tag{3}$$

and in equation (2) as

$$\underbrace{I\left[d_1\left(\frac{1}{\alpha} p_1, y_0\right)\right] - I[d_1(p_0, y_0)]}_{\substack{\text{Indexation effect conditional on} \\ \text{tax-benefit system 1}}} + \underbrace{I[d_1(p_0, y_0)] - \mathrm{I}[d_0(p_0, y_0)]}_{\substack{\text{Structural effect conditional on} \\ \text{monetary parameters 0}}} \tag{4}$$

In the estimation of the indexation effect, we keep the tax-benefit rules, $d$, as of period 1 but apply in turn the monetary parameters from the two periods. In the estimation of the structural effect, the monetary parameters, $p$, are as of period 0, and we alter the tax-benefit rules. It is important to notice that by construction, the choice of benchmark indexation factor $\alpha$ affects primarily the indexation effect where it enters one of the terms, rather than the structural effect where it is applied to both terms or neither.

We can now summarise how these equations are applied to measure the (direct) policy effect in the period of interest (2001-11) as well as in two sub-periods, the period before the economic crisis (2001-07) and the years covering its start (2007-11). We have information available on the population characteristics and the distribution of market incomes in 2007 (see Section 5), $\mathrm{y}_{07}$. Hence, we measure the policy effect in 2001-07 with equation (1) and the policy effect in 2007-11 with equation (2), i.e. both conditional on $\mathrm{y}_{07}$. The advantage of measuring the effect in two periods in the same units is that it allows them to be combined

easily to obtain the total policy effect in 2001-11. The policy effect in 2001-07 is decomposed further using equation (3) and the policy effect in 2007-11 using equation (4). When interpreting the results, it is important to remember that these are conditional on the population characteristics being as of 2007.[2]

# 4 The benchmark indexation

When estimating the impact of changes to benefit amounts and tax thresholds on household incomes, these should be considered in the context of broader macroeconomic developments. In this section, we discuss the choice of benchmark (or counterfactual) indexation factor $\alpha$ for adjusting the nominal tax-benefit amounts over time. It is worth emphasising that the choice of $\alpha$ per se is not related to what governments aim to do or actually do – the role of the benchmark index is to offer a yardstick against which to measure the progress of *actual* government policies and each benchmark has a specific economic interpretation.

Similar to previous studies (e.g. Clarke and Leicester 2004, Bargain et al. 2015, 2017), we employ multiple benchmark indexation factors: in one scenario, $\alpha$ equals the change in the Consumer Price Index (CPI), and in another, it reflects growth in average market incomes, which we refer to as the Market Income Index (MII). While Bargain and Callan (2010) make a case for the MII-based benchmark index, this appears to follow from an economic interpretation they give to their decomposition approach rather than being strictly imposed by the method itself. To better understand the implications of each benchmark index, let us first consider how the income distribution would change over time if all monetary parameters were indeed uprated with a given factor and there were no structural policy changes.

If MII were used to uprate policy parameters, the *aggregate* share of income which is taxed away or added as benefits would remain broadly constant (though the same is unlikely to hold for a given household as their market income can exceed or remain below the average growth rate) and the degree of redistribution unchanged as long as the population structure remains the same.[3] MII-based uprating in practice would hence imply a neutral treatment of

[2] The tax-benefit system $d$ may not be only a function of market incomes and population characteristics but also certain expenditures such as housing costs. As we focus on the static effect of policy reforms, abstracting from individual behavioural responses, expenditures are considered exogenous, similar to market incomes. Hence, expenditures are kept nominally constant at their 2007 level in all counterfactual scenarios.

[3] This holds for tax-benefit systems, which are approximately linearly homogenous (though not necessarily linear). See Callan et al. (2007) for an illustration for Ireland. On that basis, Bargain and Callan (2010) refer to

households on benefits and those with earnings – if household market incomes were rising (falling) in real terms, households on benefits would gain (lose) in real terms. With our decomposition approach and MII as the benchmark index, the indexation effect would capture to what extent actual uprating deviates from such a fiscally neutral scenario.

CPI-based uprating in practice would imply that households on benefits can afford to buy the same basket of goods over time, throughout the business cycle. However, they would lose out (gain) relative to household with earnings if market incomes were increasing (decreasing) in real terms. With real market income growth, tax brackets also grow at a lower rate than market incomes and households end up paying proportionally more tax. This results in total tax revenues growing at a higher rate than benefit expenditures and the public finance position improves. The opposite happens when market incomes are falling in real terms. The indexation effect measured with CPI as the benchmark allows an assessment of whether the actual uprating is adequate to account for inflation. Following Heinemann (2001), the indexation effect using the MII and CPI-based benchmarks could also be interpreted as measuring real and nominal fiscal drag.

We examine the effect of tax-benefit policies over the period 2001-2011, using the two benchmark indexation factors in turn. The policy effect that we capture includes actual indexation practice, which may conform or not to one of the benchmark indices, together with reforms to the structure of tax-benefit systems or individual taxes and benefits. Due to the very different movements in prices and incomes in the countries considered over this period, as shown in Table 1, the assumption about what index to use as the benchmark can make a notable difference to the conclusions that are drawn about the relative size of policy effects across countries.

[TABLE 1 HERE]

# 5 EUROMOD and data

To evaluate household disposable income under different policy scenarios, a tax-benefit microsimulation model is required. We use EUROMOD, which is the only comparative model available for European countries. EUROMOD simulates direct personal tax and social insurance contribution liabilities as well as cash benefit entitlements according to the national

this as a 'distributionally neutral' benchmark. Clark and Leicester (2004) use growth in nominal GDP as a benchmark and interpret it is as a 'constant progressivity' index.

tax-benefit policy rules for a given year and using information available in the input micro-data (see Sutherland and Figari, 2013). The model makes use of micro-data from nationally representative samples of households from the European Union Statistics on Income and Living Conditions (EU-SILC) and Family Resources Survey (FRS) for the UK, which contain detailed information on individual and household characteristics as well as income by source. The model baseline simulations are thoroughly validated and documented[4] and the model has been used in a wide range of applications, see Fernández Salgado et al. (2014), Dolls et al. (2012) and Immervoll et al. (2011) for some examples.

We have selected seven countries for the analysis – Belgium, Bulgaria, Estonia, Greece, Hungary, Italy and the United Kingdom – to represent a wide range across the EU in several relevant dimensions. First of all, our selection of countries features not only those which rank high in the EU in terms of income poverty and inequality – and hence may potentially benefit more from closer scrutiny – but also includes examples of low poverty and inequality levels (Belgium and Hungary) for comparison.[5] Second, the countries vary greatly by the size of the welfare state and hence by their scope for potential policy action: the level of general government expenditure ranges from low (Estonia) to medium (Bulgaria, UK) and high (Belgium, Greece, Hungary, Italy). The redistributive impact of their transfer systems is the lowest for Italy and Greece across the EU, followed closely by Bulgaria and Estonia, while the UK, Belgium and Hungary are in the top-range of the scale.[6] Third, the countries exhibited very different economic performances in the 2000s, relevant for achieving variation in our indexation benchmarks: GDP growth rates in Italy and Greece were among the lowest in the EU, modest in the UK, Belgium and Hungary and among the highest in Estonia and Bulgaria. The dynamics of GDP were especially varied through the economic crisis and include examples of drastic decreases (Greece, Estonia), small recessions (Italy, Hungary, UK) and even modest growth episodes (Belgium, Bulgaria). Price developments were also

[4] See EUROMOD Country Reports available at https://www.euromod.ac.uk/using-euromod/country-reports

[5] Ranking the EU28 countries by the standard at-risk of (relative) poverty rate (Eurostat indicator ilc_li02) shows that HU and BE featured low levels of poverty (12-15%) and other five countries high levels of poverty risk (18-22%) in 2007. Similarly, income inequality as measured by the Gini coefficient (Eurostat indicator ilc_di12) was low in HU and BE (25-26%) and high in the other countries (32-35%) in 2007.

[6] Total general government expenditure as a percent of GDP (Eurostat indicator gov_10a_exp) was low in EE (34%), medium in BG and UK (38% and 41%) and high in the rest (47-50%) in 2007. The redistributive impact as measured by the difference in the Gini coefficient of disposable income without and with social transfers excluding public pensions (Eurostat indicators ilc_di12c and ilc_di12) was the lowest in the EU for IT and EL (1.7-1.8 pp), low in BG and EE (2.6-2.7 pp) and high in UK, BE and HU (7.6-8.8 pp) in 2007.

substantial in all countries and differed markedly.[7] Last but not least, statutory indexation practices diverge between the countries from their coverage being limited to public pensions (Bulgaria, Estonia, Greece, Hungary) to including also some benefits (Italy) as well as tax parameters (Belgium and the UK). Making use of various economic and policy settings in our analysis can contribute to broader insights and strengthen the main conclusions.

For these countries, we have extended the standard version of EUROMOD with the 2001 policy rules (in consultation with national experts) and apply these together with the 2007 and 2011 policies already present in EUROMOD. Our simulations are based on SILC 2008 referring to 2007 market incomes (FRS 2008/09 for the UK), see Table 2. By design, any changes to the demographic structure and socio-economic characteristics of the population such as education level, household structure and employment are not captured in the analysis. However, our results may be sensitive to whether the distribution of market incomes and population characteristics are those from the start or the end of the period, rather than the middle. We will test the sensitivity of our results to the choice of the household survey wave with SILC 2012 (referring to 2011 market incomes), after backrating incomes to 2007 levels, and show that our main findings remain valid (see Section 6.2).

[TABLE 2 HERE]

Some policy instruments are not possible to simulate because of data limitations. These include most contributory benefits and pensions (due to the lack of information on previous employment and contribution history) and disability benefits (because of the need to know the nature and severity of the disability, which is also not present in the data). In the case of non-simulated benefits, we update (backdate) entitlements observed for 2007 with a factor reflecting the growth in the average entitlement and use these as proxies for 2011 (2001) policies. In this case, it is not possible to separate structural effects (unless the instrument was introduced or abolished altogether in this period) and all changes in non-simulated benefits are shown as indexation effects. For public pensions we believe this does not introduce a significant bias as almost all changes to current pensions in payment are due to indexation,

[7] Total GDP growth in 2001-11 (Eurostat indicator nama_10_gdp) was low in IT and EL (2-4%), modest in UK, BE and HU (16-20%) and high in EE and BG (40% and 53%). In 2007-11, the GDP declined significantly in EL and EE (-18% and -11%) and somewhat in IT, HU and UK (between 1-5%), while BE and BG experienced a small growth (3% and 5%). Ranked by Harmonised Index of Consumer Prices (Eurostat indicator prc_hicp_aind), BE, IT and the UK show medium increases in price levels (24-27%) and other four countries high price increases (39-72%) in 2001-11.

while structural changes to pensions (e.g. to pension age or entitlement formulae) typically affect new entrants only. Structural changes may be more relevant for non-simulated instruments other than public pensions and to test the robustness of our assumption, we carry out an alternative assessment where all changes to non-simulated taxes and (non-pension) benefits are treated as part of the structural change and show that our findings are again qualitatively very similar to our baseline approach (see Section 6.2).

In the analysis, we use EUROMOD baseline adjustments for tax evasion and for the non take-up of benefits in cases where there is evidence that these are sizeable phenomena. The adjustments are the same or equivalent in each of the policy scenarios, so we abstract from any change in the extent of evasion or non take-up due to changes in policy systems or other factors. We expect that estimates that assumed full compliance would be amplified to some extent, compared with those shown in the paper, and also that there would be a degree of re-ranking in the baseline income distribution, especially in the case of benefit non take-up. By definition, those not taking up entitlements to income-tested benefits are located towards the bottom of the income distribution.

# 6 Results

We simulate what the distributions of net incomes would have looked like in 2007 if instead of the actual 2007 tax-benefit systems, alternative systems based on those from 2001 and 2011 had been in place, indexing monetary parameters with prices (CPI) and income growth (MII). In this way we isolate the direct effects of policy developments in the seven countries on which we focus. Our results concentrate on the role of tax-benefit policies and abstract from all the other drivers of changes in the income distribution over the period. Importantly, the policy effect also captures the distributional impact of keeping tax-benefit amounts nominally fixed over time, relative to the movement in prices (CPI) or market incomes (MII).

In the following subsections, we present and discuss our findings, starting from whether changes to the tax-benefit policies contributed to reducing or increasing poverty and inequality and examine similarities and differences in policy effects before and after the start of the crisis. We then come to our key point of interest – the impact of structural changes versus uprating of monetary parameters (i.e. the indexation effect) on the income distribution. Based on the latter, we also establish how much fiscal drag and benefit erosion there was, as

well its incidence across the income distribution. Last, we discuss how the results are influenced by the choice of benchmark indexation factor.

### 6.1 The effects of policies on income poverty and inequality in the 2000s

To study the distributional impact of policies over time, we consider effects on income poverty and inequality and mean household disposable income. We use the standard poverty concept, which measures the percentage of the population with household income below 60% of the median equivalised household disposable income in the corresponding scenario, and the Gini coefficient for income inequality. Disposable income is defined as the sum of gross market income and cash benefits, net of direct taxes and social insurance contributions. Throughout it is adjusted for differences in household size and composition using the modified OECD equivalence scale.

The main results are provided in Table 3 (poverty), Table 4 (inequality) and Table 5 (mean incomes), showing the impact of policy changes as estimated with the MII- and CPI-based benchmark index. Column 3 in each table shows the baseline indicator in 2007, while columns 2 and 4 show the indicator value if the 2001 and 2011 tax-benefit policies (indexed) had instead been in place in 2007. Further columns summarise the policy effect in each sub-period (2001-07 and 2007-11) and overall (2001-11). In each period, the total policy effect (TPE) is also decomposed into the indexation effect (IE) and structural changes (SC), which will be discussed in Section 6.2. All key estimates include asymptotic standard errors (or confidence intervals) with a confidence level of 95% to account for sampling variation. The calculations reflect survey weights and clustering at the household level.

Poverty estimates obtained with the income- and price-indexed benchmarks (Table 3, last column) show that policy developments overall in 2001-11 were poverty-reducing or poverty-neutral in all countries except Hungary where poverty was higher under alternative policies. This also largely holds when distinguishing between the period of economic growth (2001-07) and economic crisis (2007-11) – policies had a substantial poverty-increasing effect only in Hungary in both periods and a small but still statistically significant effect in Belgium (MII) and Italy (CPI) in one of the subperiods (graphically presented in Figure 1, top panel).

[TABLE 3 AND FIGURE 1 HERE]

Given that this widely used poverty concept relies on a poverty line defined with respect to median income, policy measures can impact measured poverty levels not only through direct

effects on household incomes but also by affecting the poverty line. To gauge the importance of the latter channel, Table A1 in the Appendix provides estimates of policy effects on poverty when holding the poverty line constant (at the 2007 level). The differences compared to Table 3 (last column) are drastic for Greece, revealing that the overall poverty-reducing effect of policies was due to the impact of policies on median incomes rather than the lower part of the income distribution per se. To a lesser extent, the same is also true for Italy, while the opposite is (partly) shown for Hungary. We can therefore conclude that the shifting poverty line is not the dominant factor in most cases.

The effect on inequality is measured by the Gini coefficient (see Table 4, last column). Policy developments between 2001 and 2011 have clearly increased inequality in Hungary when their effect is assessed relative to price- and income-indexed benchmarks, and also in Bulgaria with the MII indexation. The effects across countries are qualitatively similar to results for the poverty rate, which due to a relative (and shifting) poverty line can also be thought of as a particular inequality measure that is sensitive only to changes in the lower half of the income distribution. A decomposition by subperiods (see also Figure 1, middle panel) reveals small inequality increases also in Italy (MII and CPI) and Belgium (MII). However, what is notable is that, measured against the CPI benchmark, policy measures in the first period (2001-07) were universally inequality-reducing in all countries.

[TABLE 4 HERE]

This may reflect more opportunities for governments to act when the economic conditions were more favourable (2001-07), despite both prices and market incomes generally growing faster, and as such could point to the need to achieve more in periods of economic growth in general to overcome the negative effect of crisis periods. To explore this further, we assess how policies affected average household disposable income. There is a large heterogeneity across countries in both periods and with either benchmark index, as relative changes in disposable incomes reveal both substantial gains and losses (Table 5 and Figure 1, bottom panel). However, no clear relationship emerges between fiscal and distributional policy effects for the period as a whole – recall that apart from Hungary, policies were essentially poverty and inequality-reducing, no matter their effect on public finances. The case of Hungary demonstrates clearly that policies raising household incomes do not necessarily bring a reduction in inequality and poverty and that the design of policies matters.

[TABLE 5 HERE]

The findings suggest that tax-benefit policies in the 2000s had mostly poverty and inequality-reducing effect in these countries. For further discussion of the key policy changes that took place in each country, see Hills et al. (2019). Our results for the overall impact on poverty and inequality of policy changes are also consistent with the existing evidence for some of these countries and/or the crisis period: e.g. for the UK: Adam and Browne, 2010, Bargain et al., 2017, for Belgium: Decoster et al., 2015, for EU countries during the crisis: De Agostini et al., 2016, Paulus and Tasseva, 2018.

### 6.2 Indexation effects versus structural changes

We further separate the policy effect into the indexation effect, which measures the contribution of changes in benefit amounts and tax thresholds over time, and structural changes where systems were redesigned in other ways, such as changes in percentage rates of tax. As such, the indexation effect captures *actual* fiscal drag and benefit erosion and, to our knowledge, our analysis represents the first attempt to measure it size and distribution for the tax-benefit systems as a whole. The results for this additional decomposition can be found in Table 3 (poverty), Table 4 (inequality) and Table 5 (mean incomes).

Comparing the structural changes and the indexation effect of 2001-11 policies on poverty (graphically shown in Figure 2, top panel), we find that the indexation effect and structural changes were both sizeable and their relative importance varies across countries. However, while structural changes have had a mixed impact on poverty, the indexation effect has been poverty-reducing or essentially poverty-neutral. This conclusion is robust to the choice of benchmark indexation factor and also similar for inequality outcomes (Figure 2, middle panel). Furthermore, the results suggest that adjustments by governments to monetary values of policy parameters over this period were often instrumental in driving the overall policy effect on poverty and inequality.

[FIGURE 2 HERE]

The more favourable impact of the indexation effect compared to the structural changes is even more emphasised for average household disposable income (Figure 2, bottom panel). Our estimates show that across the countries, apart from Italy, benefit amounts and tax thresholds were increased by more than growth in prices and also stayed ahead of growth in market incomes. This implies that on the whole, in the period 2001-11 the evolution of public

policies in these countries did not result in increased tax revenues due to fiscal drag or decreased social expenditure due to benefit erosion. This is highly informative and demonstrates the added value of this assessment compared with studies on fiscal drag and benefit erosion, which focus on hypothetical economic scenarios without policy action. In interpreting the generally rather positive influence of indexation effects on the income distribution, it is important to remember that they include the effects of both regular statutory indexation and discretionary increases (or decreases) to benefit levels and tax thresholds. Exploring policy effects also by type of policy instruments (Figures A3 to A6 in the Appendix), reveals that the indexation effects were primarily due to public pensions or other benefits, while the structural changes stemmed from developments to taxes and social insurance contributions.

Considering changes to disposable income across the distribution, Figure 3 shows the effect of the two types of policy on disposable income by income decile groups. Except in Hungary and Bulgaria (in the MII scenario), income gains due to policies are proportionally larger (or losses smaller) for lower income groups, meaning the overall policy effect is pro-poor. It is notable how different the distributional profiles of the indexation effect and structural changes are, even opposite in some cases. The progressive impact tends to be driven by the indexation effect, which makes a positive contribution to household incomes across the income distribution in all countries but Italy and Bulgaria (with the MII-based benchmark index). Structural changes are more heterogenous showing a mix of positive and negative impacts on household incomes across deciles and countries, though they appear more often regressive with only Italy and the UK showing a progressive impact.

[FIGURE 3 HERE]

Distinguishing further between the two subperiods, it is notable that the structural changes in the crisis period (2007-11) had no statistically significant poverty- or inequality-reducing effect (Table 3 and Table 4). On the other hand, the indexation effect in the crisis period contributed to lower poverty and inequality in all countries except in Italy (where the effect was positive though small). In the period of economic growth (2001-07), the two effects were more varied across countries.

We have also carried out two alternative assessments to check the sensitivity and robustness of our key results. In the first one, we tested the sensitivity of our main results to changes in

the distribution of market incomes and population characteristics to the extent possible with available data. Specifically, we estimated the effect of policy changes on income poverty, inequality and mean income using more recent micro-data on market incomes and population characteristics (SILC 2012 and for the UK FRS 2012/13), after backrating incomes to 2007 levels. Although the magnitude of the policy effect changes in some cases (detailed results are provided in section B in the Appendix), our general insights remain valid.

Secondly, we carried out a robustness check where all changes in non-simulated taxes and (non-pension) benefits are treated as part of the structural change, rather than the indexation effect as in our baseline approach. The alternative estimates of the effect of policy changes on income poverty, the Gini coefficient and mean income (detailed results are provided in section C in the Appendix) confirm that our main finding are qualitatively very similar to our baseline approach and our conclusions are also robust to the treatment of non-simulated instruments.

### 6.3 The role of the benchmark indexation factor

Finally, we discuss how empirical results *for a given country* are influenced by the choice of benchmark index α. First of all, the results for the effect of policies on average disposable income (Table 5) confirm that the estimated income gains are higher (or losses smaller), the lower the benchmark indexation factor (Table 1). There is also a general pattern of the policy effect being less pro-poor the higher the value of the benchmark indexation factor (Table 3 and Table 4). Unsurprisingly, there is greater variation in the results for a given country by indexation factor where the indexation factors themselves differ from each other more, i.e. countries with a large income growth or inflation like Bulgaria and Estonia.

Our finding that the effect of taxes and benefits is less pro-poor the higher the benchmark indexation factor in a given country is also demonstrated with the ranking of lines in Figure 3 being inversely related to the size of benchmark index. This in turn implies that failing to index in practice relative to the chosen benchmark also has a pro-rich effect. This is further illustrated in Figure A1 in the Appendix, which shows the policy effect on the Kakwani index (Kakwani, 1977) by the main tax-benefit components (benefits, pensions, taxes and social insurance contributions). It reveals that the pro-poor pattern of policy effects tends to be reduced or even becomes pro-rich the higher the benchmark indexation factor.

Indexing counterfactual monetary parameters such as benefit amounts and tax bracket thresholds (or allowances) adjusts counterfactual benefit entitlements and tax liabilities in proportion to the benchmark indexation factor.[8] How this in turn affects estimated income gains (or losses) from policy changes and their incidence, depends on the nature of the scheme. For a progressive scheme such as a means-tested benefit or a progressive tax, a lower value of the benchmark indexation factor provides a larger relative gain from policies for those with lower incomes.[9] For a regressive scheme such as a proportional tax with an upper limit on the tax base, it results in smaller relative losses for those with higher incomes.

Overall, tax-benefit systems are highly progressive in all seven countries (see Figure A2 in the Appendix) and it is for this reason that for a given country a larger benchmark indexation factor reduces policy-related income gains (cf. equation 1 and 2 in Section 3). Intuitively, for a progressive system, any government action is assessed to be less generous the higher the chosen benchmark index. Furthermore, as counterfactual disposable income reacts more in relative terms to an increase in the benchmark index (i.e. elasticity with respect to $\alpha$ is higher) at lower income levels, the impact of policies on income is reduced faster for low income households and overall becomes less pro-poor. Our finding is consistent with previous work, which has demonstrated the pro-rich effects of price indexation when this has lagged behind income growth (e.g. Clark and Leicester, 2004, Sutherland et al., 2008) and our discussion above provides an explanation for that pattern.

These insights highlight the importance of the choice of the benchmark indexation factor as it affects not only the measurement of size but also the progressivity of tax-benefit policy reforms. Varying the factor should not only be used as a robustness check as has mostly been done in the previous literature, it has implications both for how governments uprate policy parameters in practice to achieve their fiscal and distributional goals but also for how one intends to measure them.[10]

[8] As long as a given tax or benefit instrument is linearly homogenous.

[9] This is easiest to see for a lump-sum benefit. Using a higher benchmark index to derive the counterfactual value reduces policy-related income gains by the same absolute amount for everyone, but the loss is greater for low income households relative to their total income.

[10] These results use a ranking of households based on their 2007 disposable income in each scenario. We also tested sensitivity of results to alternative rankings using household incomes from the 2001 and 2011 policy scenarios (and indexation assumption-specific values). The comparisons suggest that while the different rankings do indeed alter the pictures to some extent, especially at the bottom of the distributions, the story that they tell is broadly the same.

# 7 Conclusions

In this paper, we assess the effects of tax and benefit policies in 2001-2011 on the distribution of household disposable income in selected EU countries. There are many factors, which can influence the labour market and the income distribution (e.g. demographic changes), but the focus here is on the direct impact of fiscal policy changes over this decade. To quantify the effects of tax-benefit policy developments, we construct counterfactual income distributions using the microsimulation method. We further decompose the policy effect distinguishing between structural policy changes and how policy parameters such as benefit amounts and tax bracket thresholds have evolved over time (the indexation effect). We also split the period of analysis into two, using 2007 as the mid-point to investigate policy effects before and since the Great Recession.

Our main results of the empirical analysis are as follows. The combined effect of changes in taxes (direct taxes and social insurance contributions) and transfers (social security benefits and public pensions) in the 2000s managed to alleviate poverty and inequality in most countries. While the result is robust to the two benchmark indexation factors we use, the latter nevertheless affect the estimates of the size and incidence of income gains or losses. For a given country, the higher the benchmark indexation factor (i.e. the more is demanded from a government), the smaller and less pro-poor are the *measured* income gains.

We also find that benefit amounts and tax thresholds were in practice mostly increased by more than growth in prices and, during the crisis, also stayed ahead of growth in average market incomes (as it lagged behind price increases). Hence, the component capturing the indexation effect typically achieved more in terms of *reducing* poverty and inequality than changes to the structure of policies, which were nevertheless often large in absolute terms. In particular, the structural changes that governments introduced in the 2007-11 crisis period notably failed to contribute to the reduction of poverty- and inequality. This means that countries redesigned their systems rather than resorted to less explicit fiscal drag and benefit erosion when their public finances came under pressure. This has important implications for understanding government choices but also for future research on household responses to changes in marginal effective tax rates (for an earlier analysis exploiting fiscal drag to analyse household responses, see Saez, 2003).

Our analysis covers seven EU countries that are diverse in terms of the size and type of welfare state and their recent economic experiences. Nevertheless, and with some exceptions noted above, our general findings are robust across countries. This demonstrates the value of multi-country analysis within a consistent and comparable framework. Empirical results that for one country might be interpreted as applicable only in that case, are likely to have wider implications if they remain valid in many cases.

The main policy lesson from our findings is the need to understand the important influence of the way governments uprate (index) policies on poverty and inequality. Certainly, policy efforts aimed at reducing inequalities should not solely focus on structural changes and the two types of policy instruments should be seen as complements. However, it remains an open question, whether the governments in the countries studied here systematically overestimated the need for uprating the monetary parameters of their tax-benefit policies or consciously sought to reduce inequalities through the use of indexation.

Despite our encouraging empirical results for a specific period, a comprehensive system of statutory indexation could help to ensure further that the tax-benefit system is not lagging behind economic developments and also to limit the scope for political credit being claimed when policy changes are merely keeping pace. Furthermore, no matter how extensive the statutory indexation system is, it is equally important that governments are open about their long-term indexation targets which could then provide a clear basis to measure progress or lack of it against those targets. From a research perspective, on the other hand, the need to develop a definition of the optimal level of indexation taking account of relevant outcomes such as income distribution, work incentives, fiscal balance and economic growth offers avenues for future work.

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**Table 1: Benchmark income- and price-indices**

| Country | MII | | | CPI | | |
|---|---|---|---|---|---|---|
| | 2001-07 | 2007-11 | 2001-11 | 2001-07 | 2007-11 | 2001-11 |
| Belgium | 1.162 | 1.070 | 1.243 | 1.122 | 1.112 | 1.247 |
| Bulgaria | 1.759 | 1.580 | 2.780 | 1.404 | 1.233 | 1.731 |
| Estonia | 2.039 | 1.152 | 2.349 | 1.252 | 1.193 | 1.494 |
| Greece | 1.425 | 0.989 | 1.409 | 1.220 | 1.141 | 1.391 |
| Hungary | 1.673 | 1.129 | 1.889 | 1.369 | 1.205 | 1.65 |
| Italy | 1.161 | 1.039 | 1.206 | 1.150 | 1.084 | 1.247 |
| UK | 1.258 | 1.083 | 1.362 | 1.114 | 1.104 | 1.229 |

*Sources:* MII is calculated using the tax-benefit microsimulation model EUROMOD to derive the change in average market income. The 2007 values are taken from the input dataset (see Table 2) and the 2001 and 2011 values are obtained by updating (or backdating) 2007 incomes with separate factors by income source reflecting their average growth. The same CPI index which is used internally in EUROMOD is also used as the basis of the counterfactual indexation, for consistency. See EUROMOD Country Reports for more information on market income updating and the specific CPI sources (https://www.euromod.ac.uk/using-euromod/country-reports).

**Table 2: Data description**

| Country | Input dataset | Income reference period | Number of households | Number of individuals |
|---|---|---|---|---|
| Belgium (BE) | EU-SILC 2008 | 2007 (annual) | 6,300 | 15,072 |
| Bulgaria (BG) | EU-SILC and National SILC variables 2008 | 2007 (annual) | 4,339 | 12,148 |
| Estonia (EE) | National SILC 2008 | 2007 (annual) | 4,744 | 12,999 |
| Greece (EL) | National SILC 2008 | 2007 (annual) | 6,504 | 16,814 |
| Hungary (HU) | EU-SILC 2008 | 2007 (annual) | 8,818 | 22,335 |
| Italy (IT) | National SILC 2008 | 2007 (annual) | 20,928 | 52,135 |
| United Kingdom (UK) | FRS 2008/9 | 2008/9 (monthly) | 25,088 | 57,276 |

*Source:* EUROMOD version F6.36.

**Table 3: Effect of policies on income poverty: decomposing the total policy effect (TPE) into the indexation effect (IE) and structural change (SC)**

| Country | Poverty rate (%) | | | Change (percentage points) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2001 | 2007 | 2011 | 2001-07 | | | 2007-11 | | | 2001-11 | | |
| | | | | *IE* | *SC* | *TPE* | *IE* | *SC* | *TPE* | *IE* | *SC* | *TPE* |
| MII indexation | | | | | | | | | | | | |
| Belgium | 11.1 | 11.6 | 9.5 | -0.2† | 0.7† | 0.5‡ | -2.0* | -0.1 | -2.1* | -2.2* | 0.6† | -1.6* |
| | | | | (0.07) | (0.27) | (0.26) | (0.20) | (0.18) | (0.26) | (0.21) | (0.26) | (0.28) |
| Bulgaria | 22.0 | 21.1 | 21.2 | -1.0* | 0.2 | -0.9† | -0.2 | 0.3‡ | 0.1 | -1.3* | 0.5 | -0.8 |
| | | | | (0.26) | (0.38) | (0.43) | (0.31) | (0.19) | (0.34) | (0.39) | (0.41) | (0.51) |
| Estonia | 21.5 | 19.5 | 17.9 | -2.3* | 0.3 | -2.0* | -1.6* | 0.0 | -1.6* | -3.9* | 0.2 | -3.6* |
| | | | | (0.28) | (0.24) | (0.28) | (0.24) | (0.15) | (0.25) | (0.37) | (0.27) | (0.37) |
| Greece | 20.2 | 20.0 | 19.6 | 0.5* | -0.6* | -0.2 | -0.7† | 0.3 | -0.4‡ | -0.2 | -0.4 | -0.6‡ |
| | | | | (0.17) | (0.20) | (0.22) | (0.34) | (0.32) | (0.27) | (0.38) | (0.36) | (0.32) |
| Hungary | 10.7 | 12.9 | 13.6 | -0.4‡ | 2.7* | 2.3* | 0.5† | 0.1 | 0.6† | 0.1 | 2.7* | 2.9* |
| | | | | (0.21) | (0.33) | (0.29) | (0.25) | (0.23) | (0.27) | (0.26) | (0.33) | (0.31) |
| Italy | 19.0 | 17.8 | 17.8 | 0.3* | -1.5* | -1.2* | 0.0 | 0.0 | 0.0 | 0.2* | -1.5* | -1.2* |
| | | | | (0.06) | (0.13) | (0.12) | (0.06) | (0.02) | (0.07) | (0.08) | (0.13) | (0.12) |
| UK | 19.8 | 16.8 | 16.3 | 0.5* | -3.5* | -3.0* | -1.4* | 1.0* | -0.4* | -0.9* | -2.5* | -3.4* |
| | | | | (0.08) | (0.17) | (0.17) | (0.10) | (0.13) | (0.15) | (0.12) | (0.22) | (0.21) |
| CPI indexation | | | | | | | | | | | | |
| Belgium | 11.5 | 11.6 | 9.9 | -0.8* | 0.9* | 0.1 | -1.4* | -0.3 | -1.7* | -2.2* | 0.6† | -1.5* |
| | | | | (0.13) | (0.25) | (0.24) | (0.16) | (0.19) | (0.25) | (0.21) | (0.25) | (0.27) |
| Bulgaria | 24.8 | 21.1 | 19.2 | -4.1* | 0.3 | -3.7* | -2.0* | 0.1 | -1.9* | -6.1* | 0.4 | -5.7* |
| | | | | (0.38) | (0.27) | (0.44) | (0.46) | (0.21) | (0.49) | (0.59) | (0.32) | (0.61) |
| Estonia | 26.4 | 19.5 | 18.7 | -6.8* | -0.1 | -6.9* | -0.7* | 0.0 | -0.8* | -7.5* | -0.1 | -7.7* |
| | | | | (0.38) | (0.18) | (0.41) | (0.19) | (0.15) | (0.21) | (0.44) | (0.22) | (0.45) |
| Greece | 20.6 | 20.0 | 19.9 | 0.0 | -0.6† | -0.6† | -0.5‡ | 0.4 | -0.1 | -0.5 | -0.2 | -0.8† |
| | | | | (0.24) | (0.30) | (0.26) | (0.29) | (0.35) | (0.30) | (0.37) | (0.52) | (0.32) |
| Hungary | 11.9 | 12.9 | 13.8 | -1.0* | 2.1* | 1.0* | 0.8* | 0.0 | 0.8* | -0.2 | 2.0* | 1.8* |
| | | | | (0.24) | (0.31) | (0.28) | (0.24) | (0.23) | (0.27) | (0.28) | (0.33) | (0.30) |
| Italy | 19.1 | 17.8 | 18.0 | 0.2* | -1.5* | -1.3* | 0.1‡ | 0.0 | 0.2† | 0.4* | -1.4* | -1.1* |
| | | | | (0.06) | (0.13) | (0.12) | (0.08) | (0.02) | (0.08) | (0.09) | (0.13) | (0.13) |
| UK | 20.8 | 16.8 | 16.5 | -0.3* | -3.8* | -4.0* | -1.2* | 1.0* | -0.2 | -1.5* | -2.8* | -4.3* |
| | | | | (0.08) | (0.17) | (0.18) | (0.10) | (0.13) | (0.15) | (0.12) | (0.21) | (0.21) |

*Source:* own calculations using EUROMOD. *Notes:* Column 3 shows the baseline poverty rate in 2007 while columns 2 and 4 show the poverty rate if the 2001 and 2011 tax-benefit policies had instead been in place in 2007. Poverty line is 60% of national median equivalised disposable income. Asymptotic standard errors at a 95% confidence level shown in parentheses. ‡ $p<0.1$, † $p<0.05$, * $p<0.01$.

**Table 4: Effect of policies on income inequality: decomposing the total policy effect (TPE) into the indexation effect (IE) and structural change (SC)**

| Country | Gini coefficient (%) | | | Change (percentage points) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2001 | 2007 | 2011 | 2001-07 | | | 2007-11 | | | 2001-11 | | |
| | | | | *IE* | *SC* | *TPE* | *IE* | *SC* | *TPE* | *IE* | *SC* | *TPE* |
| MII indexation | | | | | | | | | | | | |
| Belgium | 22.7 | 22.9 | 22.1 | 0.0 | 0.2* | 0.2* | -0.8* | 0.0† | -0.8* | -0.8* | 0.2* | -0.6* |
| | | | | (0.01) | (0.06) | (0.06) | (0.02) | (0.02) | (0.03) | (0.03) | (0.06) | (0.06) |
| Bulgaria | 34.6 | 35.2 | 36.0 | 0.1* | 0.4* | 0.6* | -0.2* | 1.1* | 0.9* | -0.1 | 1.6* | 1.4* |
| | | | | (0.05) | (0.10) | (0.11) | (0.05) | (0.06) | (0.08) | (0.09) | (0.12) | (0.16) |
| Estonia | 31.2 | 30.8 | 30.1 | -0.6* | 0.2* | -0.4* | -0.6* | 0.0‡ | -0.6* | -1.2* | 0.1† | -1.1* |
| | | | | (0.05) | (0.06) | (0.06) | (0.03) | (0.01) | (0.03) | (0.06) | (0.06) | (0.08) |
| Greece | 33.3 | 33.3 | 32.7 | 0.5* | -0.4* | 0.0 | -1.6* | 1.0* | -0.6* | -1.2* | 0.6* | -0.6* |
| | | | | (0.03) | (0.05) | (0.06) | (0.12) | (0.14) | (0.04) | (0.13) | (0.15) | (0.07) |
| Hungary | 24.9 | 25.0 | 27.2 | -1.0* | 1.1* | 0.1 | -0.5* | 2.8* | 2.2* | -1.5* | 3.8* | 2.3* |
| | | | | (0.03) | (0.09) | (0.09) | (0.04) | (0.14) | (0.12) | (0.06) | (0.11) | (0.09) |
| Italy | 32.0 | 30.7 | 30.9 | 0.1* | -1.4* | -1.3* | 0.0* | 0.2* | 0.2* | 0.1* | -1.2* | -1.1* |
| | | | | (0.01) | (0.02) | (0.02) | (0.01) | (0.02) | (0.02) | (0.01) | (0.02) | (0.03) |
| UK | 33.8 | 33.2 | 32.5 | 0.5* | -1.1* | -0.6* | -1.1* | 0.4 | -0.7* | -0.6* | -0.7* | -1.3* |
| | | | | (0.02) | (0.05) | (0.06) | (0.02) | (0.22) | (0.24) | (0.02) | (0.20) | (0.20) |
| CPI indexation | | | | | | | | | | | | |
| Belgium | 23.0 | 22.9 | 22.4 | -0.3* | 0.2* | -0.1† | -0.5* | 0.1* | -0.5* | -0.8* | 0.2* | -0.6* |
| | | | | (0.01) | (0.06) | (0.06) | (0.02) | (0.02) | (0.03) | (0.02) | (0.06) | (0.06) |
| Bulgaria | 36.8 | 35.2 | 33.9 | -1.8* | 0.2* | -1.6* | -2.3* | 1.0* | -1.3* | -4.1* | 1.2* | -2.9* |
| | | | | (0.07) | (0.08) | (0.11) | (0.09) | (0.06) | (0.11) | (0.14) | (0.11) | (0.18) |
| Estonia | 35.5 | 30.8 | 30.5 | -4.7* | 0.1 | -4.7* | -0.3* | 0.0‡ | -0.3* | -5.0* | 0.0 | -5.0* |
| | | | | (0.11) | (0.04) | (0.12) | (0.02) | (0.01) | (0.02) | (0.13) | (0.04) | (0.14) |
| Greece | 33.6 | 33.3 | 33.2 | -0.2* | -0.1† | -0.3* | -0.6* | 0.5* | -0.1‡ | -0.7* | 0.3† | -0.4* |
| | | | | (0.03) | (0.06) | (0.05) | (0.11) | (0.12) | (0.05) | (0.11) | (0.13) | (0.07) |
| Hungary | 26.2 | 25.0 | 27.6 | -2.2* | 1.0* | -1.2* | -0.1‡ | 2.7* | 2.6* | -2.3* | 3.7* | 1.4* |
| | | | | (0.06) | (0.09) | (0.11) | (0.04) | (0.14) | (0.12) | (0.08) | (0.11) | (0.09) |
| Italy | 32.1 | 30.7 | 31.1 | 0.1* | -1.5* | -1.4* | 0.2* | 0.2* | 0.4* | 0.3* | -1.2* | -1.0* |
| | | | | (0.00) | (0.02) | (0.02) | (0.01) | (0.02) | (0.02) | (0.01) | (0.02) | (0.03) |
| UK | 34.8 | 33.2 | 32.7 | -0.2* | -1.4* | -1.6* | -0.9* | 0.4 | -0.5† | -1.1* | -1.1* | -2.1* |
| | | | | (0.01) | (0.05) | (0.05) | (0.02) | (0.22) | (0.24) | (0.02) | (0.20) | (0.22) |

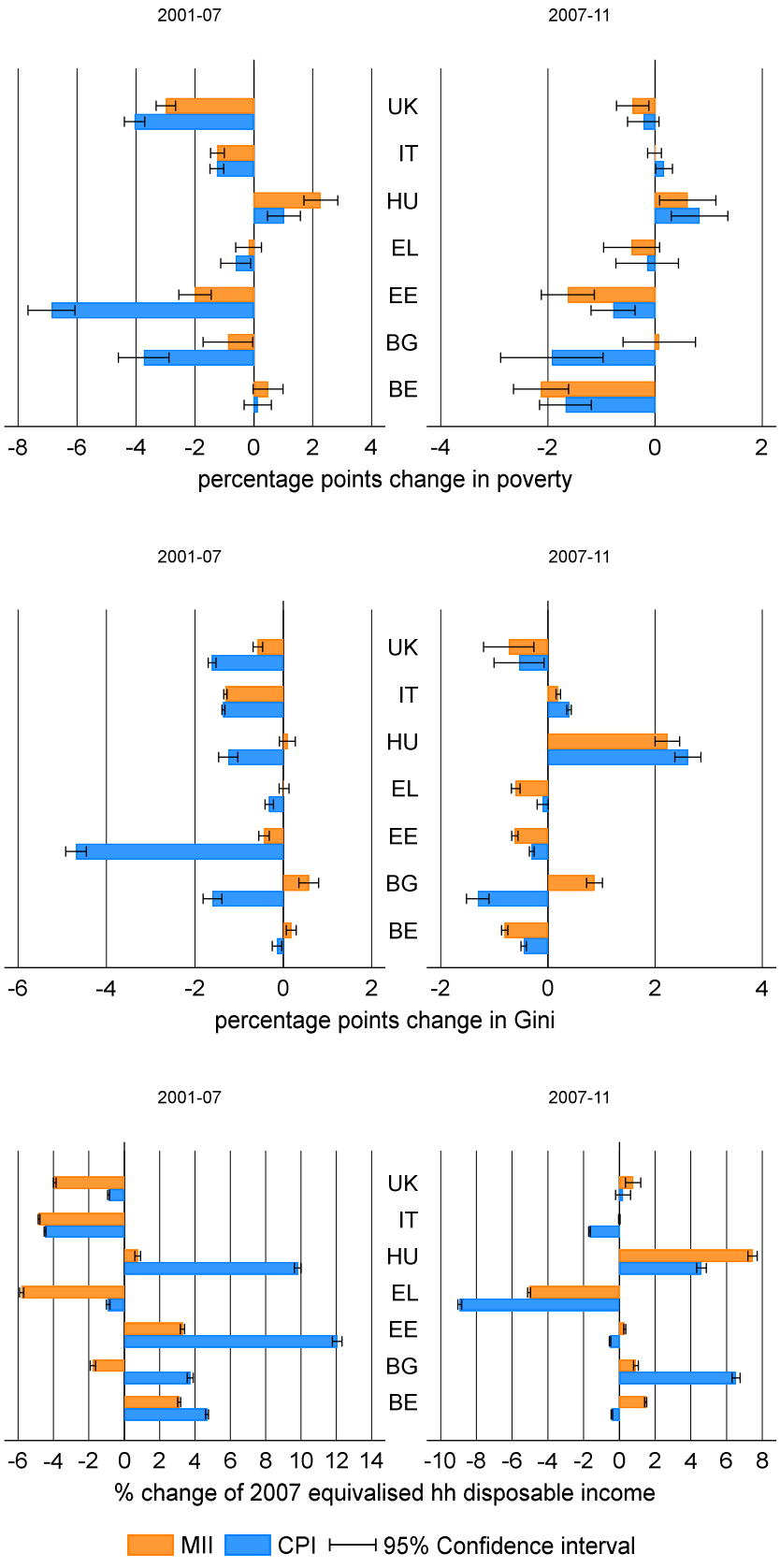
*Source:* own calculations using EUROMOD. *Notes:* Column 3 shows the baseline income inequality in 2007 while columns 2 and 4 show the Gini coefficient if the 2001 and 2011 tax-benefit policies had instead been in place in 2007. Asymptotic standard errors at a 95% confidence level shown in parentheses. ‡ p<0.1, † p<0.05, * p<0.01.

**Table 5: Effect of policies on mean household disposable income: decomposing the total policy effect (TPE) into the indexation effect (IE) and structural change (SC)**

| Country | Mean annual income (in thousand) | | | Change (%) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2001 | 2007 | 2011 | 2001-07 | | | 2007-11 | | | 2001-11 | | |
| | | | | *IE* | *SC* | *TPE* | *IE* | *SC* | *TPE* | *IE* | *SC* | *TPE* |
| MII indexation | | | | | | | | | | | | |
| Belgium | 18.4 | 19.0 | 19.3 | -0.5* | 3.6* | 3.1* | 2.1* | -0.7* | 1.5* | 1.7* | 2.9* | 4.6* |
| | | | | (0.01) | (0.05) | (0.05) | (0.03) | (0.01) | (0.03) | (0.03) | (0.05) | (0.05) |
| Bulgaria | 5.3 | 5.2 | 5.3 | -0.2* | -1.6* | -1.8* | 1.2* | -0.3* | 0.9* | 1.0* | -1.9* | -0.9* |
| | | | | (0.04) | (0.07) | (0.08) | (0.03) | (0.07) | (0.07) | (0.06) | (0.11) | (0.12) |
| Estonia | 95.4 | 98.7 | 99.0 | 0.2* | 3.1* | 3.3* | 1.1* | -0.8* | 0.3* | 1.2* | 2.4* | 3.6* |
| | | | | (0.04) | (0.06) | (0.06) | (0.03) | (0.01) | (0.03) | (0.06) | (0.06) | (0.08) |
| Greece | 13.8 | 13.0 | 12.3 | -0.4* | -5.4* | -5.8* | 5.9* | -11.0* | -5.1* | 5.5* | -16.4* | -10.9* |
| | | | | (0.03) | (0.06) | (0.06) | (0.08) | (0.10) | (0.04) | (0.09) | (0.11) | (0.08) |
| Hungary | 1,117 | 1,125 | 1,209 | 4.7* | -3.9* | 0.8* | 3.1* | 4.3* | 7.5* | 7.8* | 0.4* | 8.2* |
| | | | | (0.04) | (0.07) | (0.08) | (0.05) | (0.16) | (0.13) | (0.08) | (0.13) | (0.09) |
| Italy | 18.5 | 17.7 | 17.7 | -0.1* | -4.7* | -4.8* | -0.1* | 0.1* | 0.0 | -0.2* | -4.6* | -4.8* |
| | | | | (0.01) | (0.03) | (0.03) | (0.01) | (0.02) | (0.02) | (0.01) | (0.03) | (0.03) |
| UK | 16.6 | 16.0 | 16.1 | -1.9* | -2.0* | -3.9* | 3.0* | -2.2* | 0.8* | 1.1* | -4.2* | -3.2* |
| | | | | (0.02) | (0.02) | (0.04) | (0.04) | (0.19) | (0.22) | (0.02) | (0.18) | (0.20) |
| CPI indexation | | | | | | | | | | | | |
| Belgium | 18.1 | 19.0 | 18.9 | 0.7* | 4.0* | 4.7* | 0.6* | -1.1* | -0.4* | 1.4* | 2.9* | 4.3* |
| | | | | (0.01) | (0.04) | (0.04) | (0.02) | (0.01) | (0.02) | (0.03) | (0.04) | (0.05) |
| Bulgaria | 5.0 | 5.2 | 5.6 | 3.6* | 0.1† | 3.7* | 6.6* | -0.1‡ | 6.5* | 10.3* | 0.0 | 10.3* |
| | | | | (0.07) | (0.05) | (0.09) | (0.12) | (0.07) | (0.12) | (0.18) | (0.09) | (0.18) |
| Estonia | 86.8 | 98.7 | 98.2 | 9.1* | 2.9* | 12.1* | 0.2* | -0.8* | -0.5* | 9.3* | 2.2* | 11.5* |
| | | | | (0.13) | (0.04) | (0.14) | (0.02) | (0.01) | (0.02) | (0.15) | (0.04) | (0.15) |
| Greece | 13.1 | 13.0 | 11.8 | 4.2* | -5.1* | -0.9* | 2.5* | -11.4* | -8.9* | 6.7* | -16.5* | -9.8* |
| | | | | (0.03) | (0.06) | (0.05) | (0.08) | (0.08) | (0.06) | (0.07) | (0.10) | (0.06) |
| Hungary | 1,015 | 1,125 | 1,177 | 12.1* | -2.2* | 9.8* | 0.7* | 3.9* | 4.6* | 12.7* | 1.7* | 14.4* |
| | | | | (0.07) | (0.06) | (0.10) | (0.04) | (0.16) | (0.14) | (0.10) | (0.13) | (0.09) |
| Italy | 18.5 | 17.7 | 17.4 | 0.1* | -4.5* | -4.5* | -1.7* | 0.1* | -1.7* | -1.7* | -4.5* | -6.2* |
| | | | | (0.01) | (0.03) | (0.03) | (0.01) | (0.02) | (0.02) | (0.01) | (0.03) | (0.03) |
| UK | 16.2 | 16.0 | 16.0 | 0.5* | -1.4* | -0.9* | 2.4* | -2.2* | 0.2 | 3.0* | -3.6* | -0.7* |
| | | | | (0.01) | (0.02) | (0.03) | (0.03) | (0.19) | (0.21) | (0.04) | (0.19) | (0.22) |

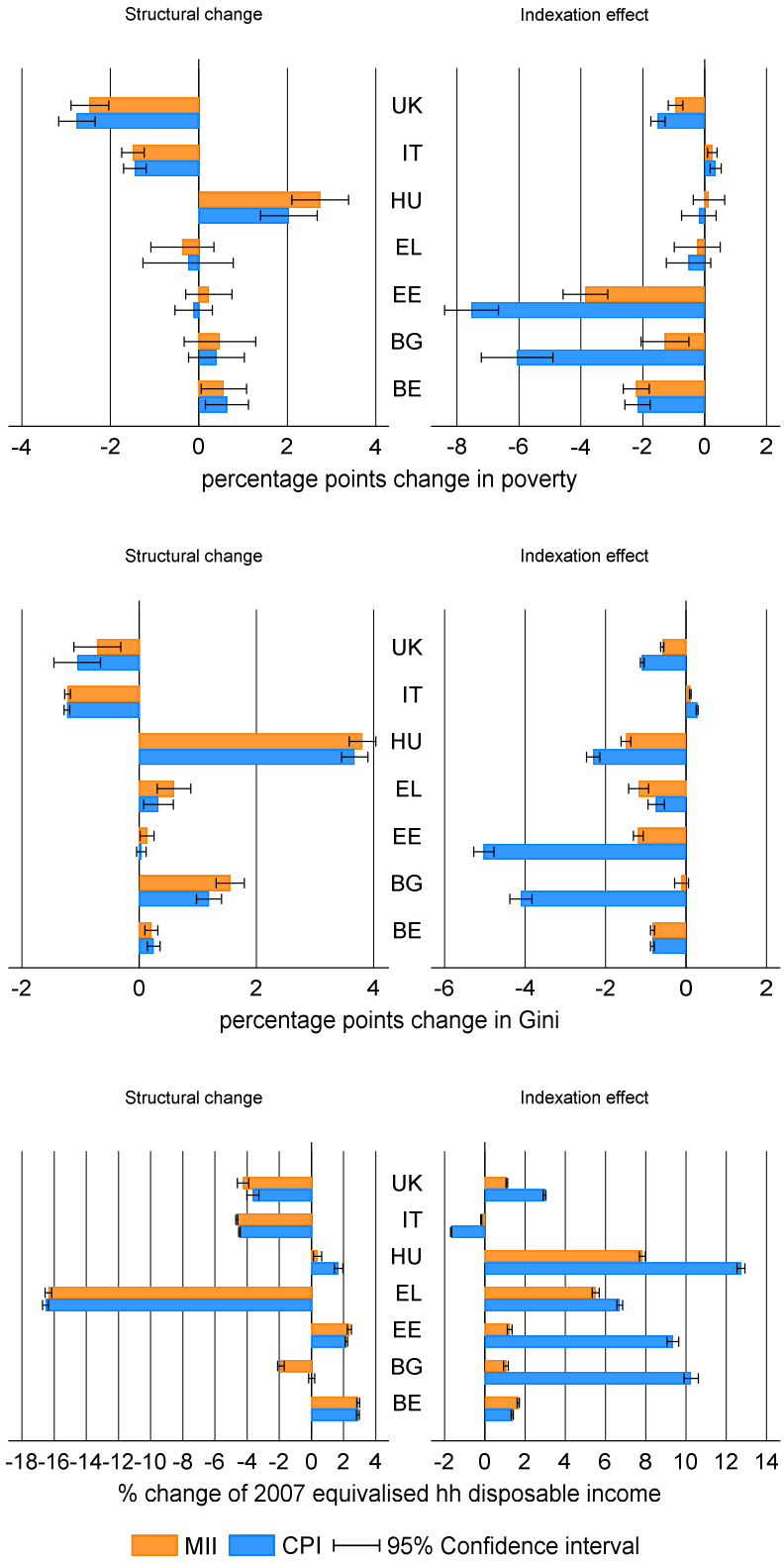
*Source:* own calculations using EUROMOD. *Notes:* Column 3 shows the baseline mean income in 2007 while columns 2 and 4 show mean income if the 2001 and 2011 tax-benefit policies had instead been in place in 2007. Income refers to equivalised household disposable income in 2007 terms, in national currency units. Asymptotic standard errors at a 95% confidence level shown in parentheses. ‡ $p<0.1$, † $p<0.05$, * $p<0.01$.

**Figure 1: The effect of 2001-07 and 2007-11 policy changes**



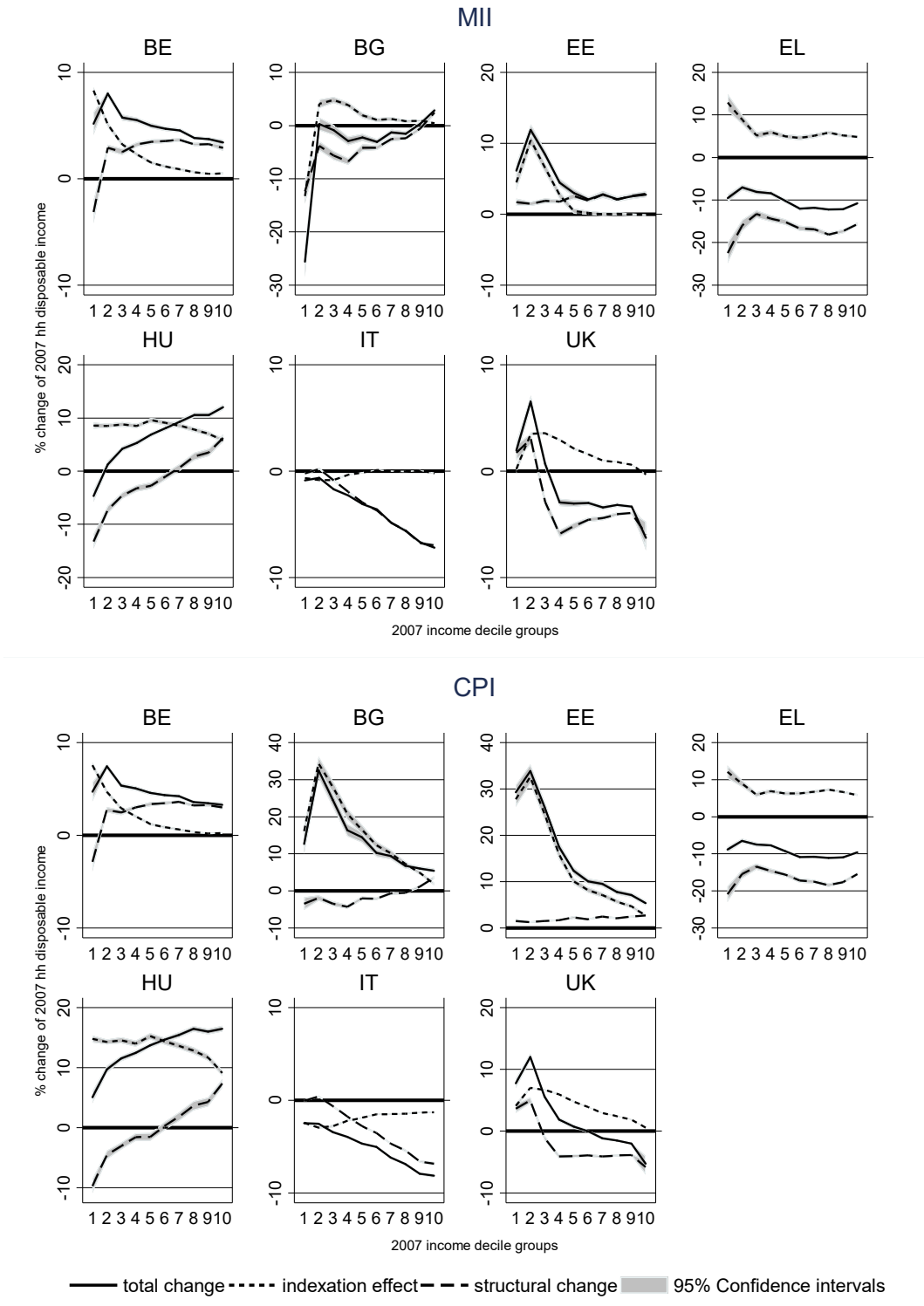

*Source:* own calculations using EUROMOD. *Notes:* poverty line is 60% of national median equivalised disposable income. Asymptotic standard errors at a 95% confidence level. The charts are drawn to different scales, but the interval between gridlines on each of them is the same (2 percentage points).

**Figure 2: The structural change and indexation effect of 2001-11 policy changes**




*Source:* own calculations using EUROMOD. *Notes:* poverty line is 60% of national median equivalised disposable income. Asymptotic standard errors at a 95% confidence level. The charts are drawn to different scales, but the interval between gridlines on each of them is the same (2 percentage points).

**Figure 3: The effect of 2001-11 policies on disposable income by income decile groups**




*Source:* own calculations using EUROMOD. *Notes:* The charts are drawn to different scales, but the interval between gridlines on each of them is the same (10 percentage points).

# Supplementary materials (online appendix)

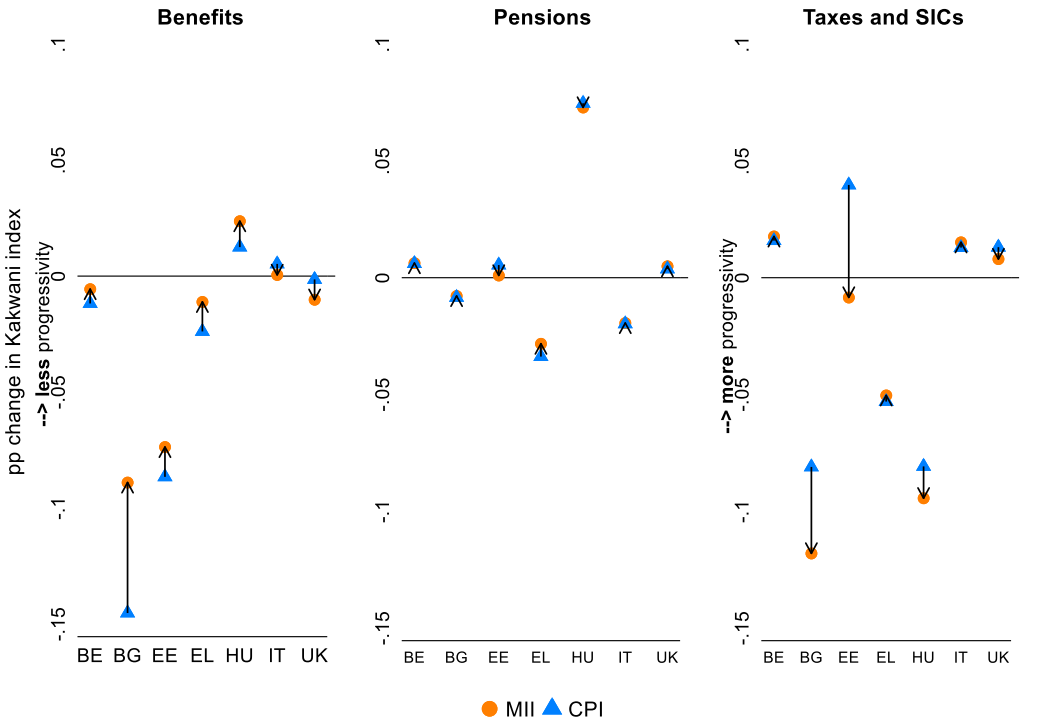
## A. Supplementary tables and figures for the baseline calculations

**Table A1: Effect of policies on anchored income poverty: decomposing the total policy effect (TPE) into the indexation effect (IE) and structural change (SC)**

| Country | *Anchored* poverty rate (%) | | | Change (percentage points) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2001 | 2007 | 2011 | 2001-07 | | | 2007-11 | | | 2001-11 | | |
| | | | | *IE* | *SC* | *TPE* | *IE* | *SC* | *TPE* | *IE* | *SC* | *TPE* |
| MII indexation | | | | | | | | | | | | |
| Belgium | 12.4 | 11.6 | 8.8 | 0.2‡ | -1.0* | -0.8* | -2.9* | 0.1 | -2.8* | -2.7* | -0.9* | -3.6* |
| | | | | (0.12) | (0.28) | (0.27) | (0.26) | (0.18) | (0.31) | (0.29) | (0.31) | (0.35) |
| Bulgaria | 21.0 | 21.1 | 21.0 | -1.0* | 1.1* | 0.1 | -2.0* | 1.9* | -0.1 | -3.0* | 3.0* | 0.0 |
| | | | | (0.26) | (0.39) | (0.44) | (0.29) | (0.32) | (0.34) | (0.40) | (0.49) | (0.51) |
| Estonia | 23.0 | 19.5 | 17.7 | -2.1* | -1.4* | -3.5* | -2.1* | 0.4* | -1.8* | -4.2* | -1.1* | -5.3* |
| | | | | (0.27) | (0.24) | (0.30) | (0.25) | (0.13) | (0.25) | (0.37) | (0.23) | (0.36) |
| Greece | 17.8 | 20.0 | 21.6 | 1.0* | 1.2* | 2.2* | -3.7* | 5.3* | 1.6* | -2.7* | 6.5* | 3.8* |
| | | | | (0.16) | (0.20) | (0.25) | (0.29) | (0.39) | (0.29) | (0.34) | (0.43) | (0.37) |
| Hungary | 11.8 | 12.9 | 12.0 | -3.2* | 4.4* | 1.2* | -1.3* | 0.4‡ | -0.9* | -4.6* | 4.8* | 0.3 |
| | | | | (0.28) | (0.36) | (0.27) | (0.21) | (0.22) | (0.25) | (0.32) | (0.39) | (0.28) |
| Italy | 17.7 | 17.8 | 18.0 | 0.4* | -0.2† | 0.1 | 0.1 | 0.1* | 0.2† | 0.4* | -0.1 | 0.3* |
| | | | | (0.07) | (0.09) | (0.09) | (0.08) | (0.02) | (0.08) | (0.09) | (0.09) | (0.09) |
| UK | 17.6 | 16.8 | 15.4 | 1.7* | -2.6* | -0.9* | -3.5* | 2.1* | -1.4* | -1.7* | -0.5* | -2.3* |
| | | | | (0.11) | (0.17) | (0.16) | (0.15) | (0.13) | (0.16) | (0.13) | (0.20) | (0.20) |
| CPI indexation | | | | | | | | | | | | |
| Belgium | 13.7 | 11.6 | 10.3 | -1.0* | -1.1* | -2.1* | -1.6* | 0.3† | -1.3* | -2.6* | -0.8* | -3.4* |
| | | | | (0.13) | (0.27) | (0.29) | (0.19) | (0.16) | (0.24) | (0.24) | (0.25) | (0.32) |
| Bulgaria | 26.4 | 21.1 | 15.2 | -5.5* | 0.2 | -5.3* | -7.4* | 1.6* | -5.9* | -12.9* | 1.8* | -11.1* |
| | | | | (0.39) | (0.26) | (0.46) | (0.46) | (0.32) | (0.40) | (0.63) | (0.41) | (0.58) |
| Estonia | 30.4 | 19.5 | 19.0 | -9.7* | -1.2* | -10.9* | -0.9* | 0.4* | -0.5* | -10.6* | -0.9* | -11.5* |
| | | | | (0.44) | (0.20) | (0.48) | (0.20) | (0.13) | (0.21) | (0.48) | (0.24) | (0.48) |
| Greece | 20.3 | 20.0 | 23.7 | -2.0* | 1.7* | -0.3 | -1.3* | 5.1* | 3.7* | -3.3* | 6.8* | 3.4* |
| | | | | (0.26) | (0.27) | (0.25) | (0.28) | (0.38) | (0.33) | (0.38) | (0.54) | (0.36) |
| Hungary | 19.2 | 12.9 | 13.6 | -8.9* | 2.7* | -6.2* | 0.2 | 0.5† | 0.7† | -8.7* | 3.2* | -5.5* |
| | | | | (0.39) | (0.33) | (0.35) | (0.22) | (0.23) | (0.27) | (0.41) | (0.37) | (0.34) |
| Italy | 17.9 | 17.8 | 19.2 | 0.2* | -0.3* | -0.1 | 1.3* | 0.1* | 1.4* | 1.5* | -0.2† | 1.3* |
| | | | | (0.06) | (0.09) | (0.09) | (0.12) | (0.02) | (0.12) | (0.13) | (0.09) | (0.12) |
| UK | 20.4 | 16.8 | 16.0 | -0.8* | -2.8* | -3.6* | -2.9* | 2.1* | -0.8* | -3.7* | -0.7* | -4.4* |
| | | | | (0.07) | (0.17) | (0.17) | (0.13) | (0.13) | (0.16) | (0.15) | (0.19) | (0.22) |

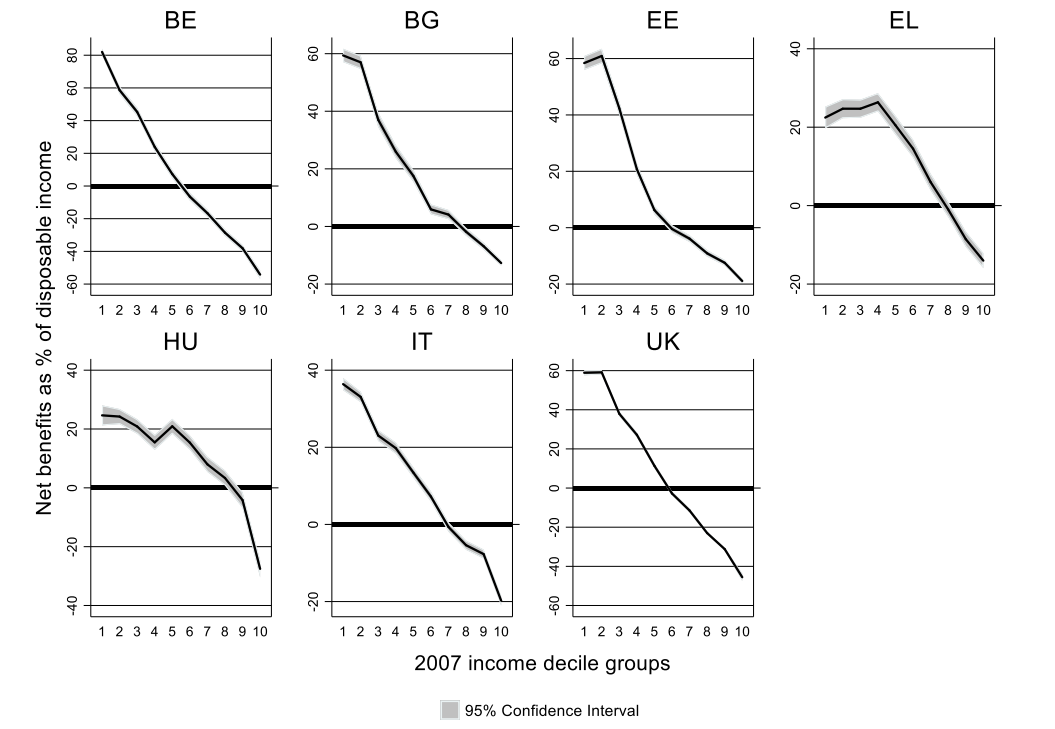
*Source:* own calculations using EUROMOD. *Notes:* poverty line is 60% of national median equivalised disposable income; anchored poverty rates are all calculated using 2007 poverty lines. Asymptotic standard errors at a 95% confidence level shown in parentheses. ‡ p<0.1, † p<0.05, * p<0.01.

**Figure A1: The effect of 2001-11 policy changes on the progressivity of the tax-benefit system**



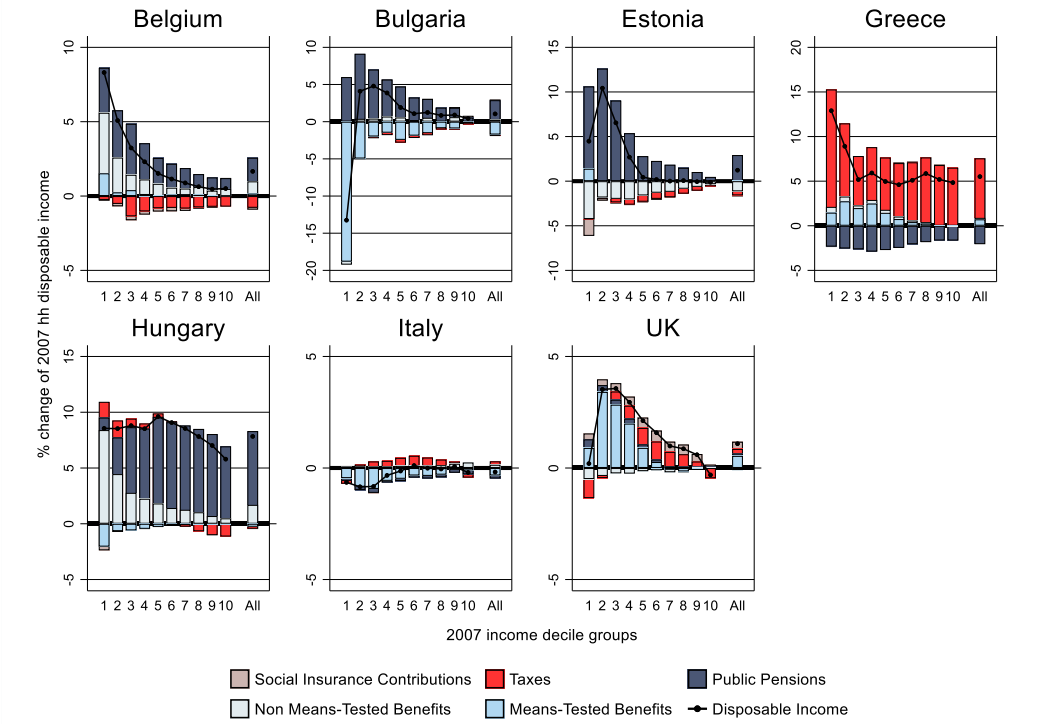

*Source:* own calculations using EUROMOD. *Notes:* For taxes and social insurance contributions (SIC), a higher Kakwani index means increasing progressivity (i.e. more pro-poor), while for benefits and pensions it is the opposite. In the graphs for benefits and pensions, an upward (downward) pointed arrow indicates that the value of MII is larger (smaller) than that of CPI, for a given country. In the graph for taxes and SICs, the opposite is true.

**Figure A2: Mean net benefit as a share of disposable income by decile groups, 2007**



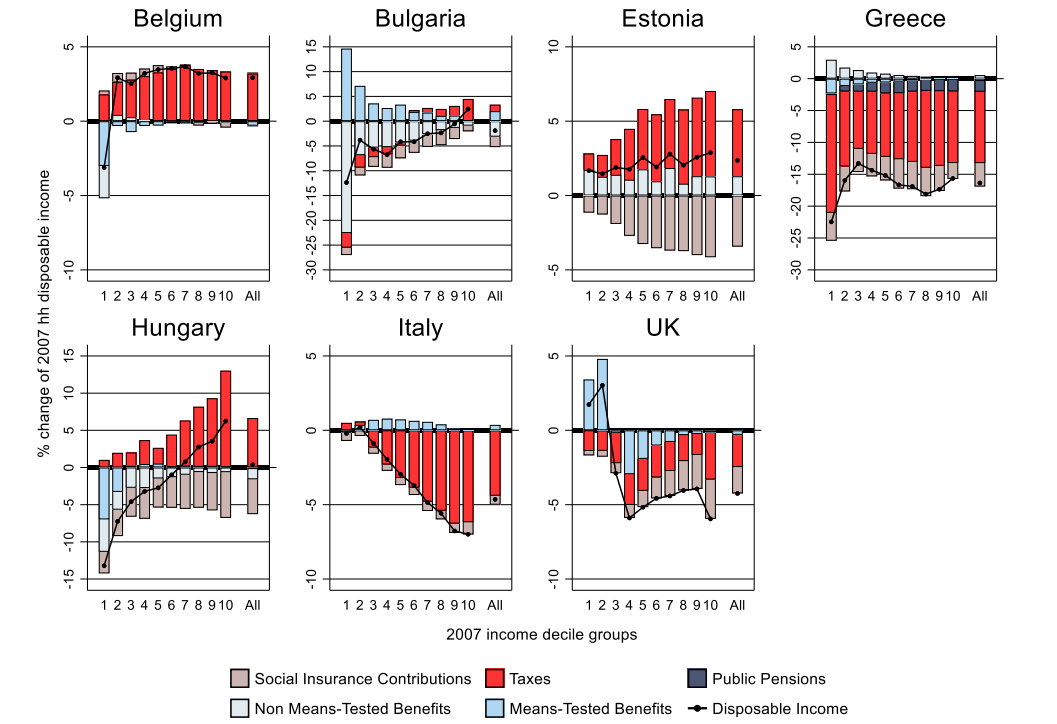

*Source:* own calculations using EUROMOD. *Notes:* Net benefit is the difference between disposable income and market income. A negative value means a net contribution. The charts are drawn to different scales, but the interval between gridlines on each of them is the same (20 percentage points).

**Figure A3: The indexation effect (with MII benchmark index) on mean income in 2001-11**



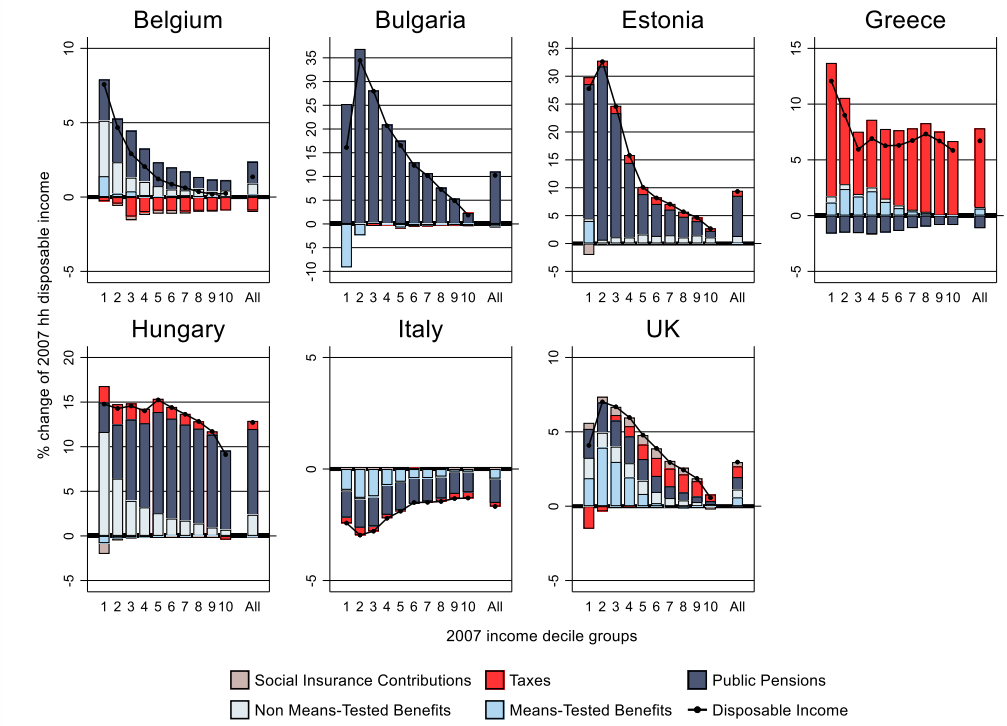

*Source:* own calculations using EUROMOD. *Notes:* Income deciles are derived based on 2007 household equivalised disposable incomes. The charts are drawn to different scales, but the interval between gridlines on each of them is the same (5 percentage points).

**Figure A4: The effect of structural changes (with MII benchmark index) on mean income in 2001-11**



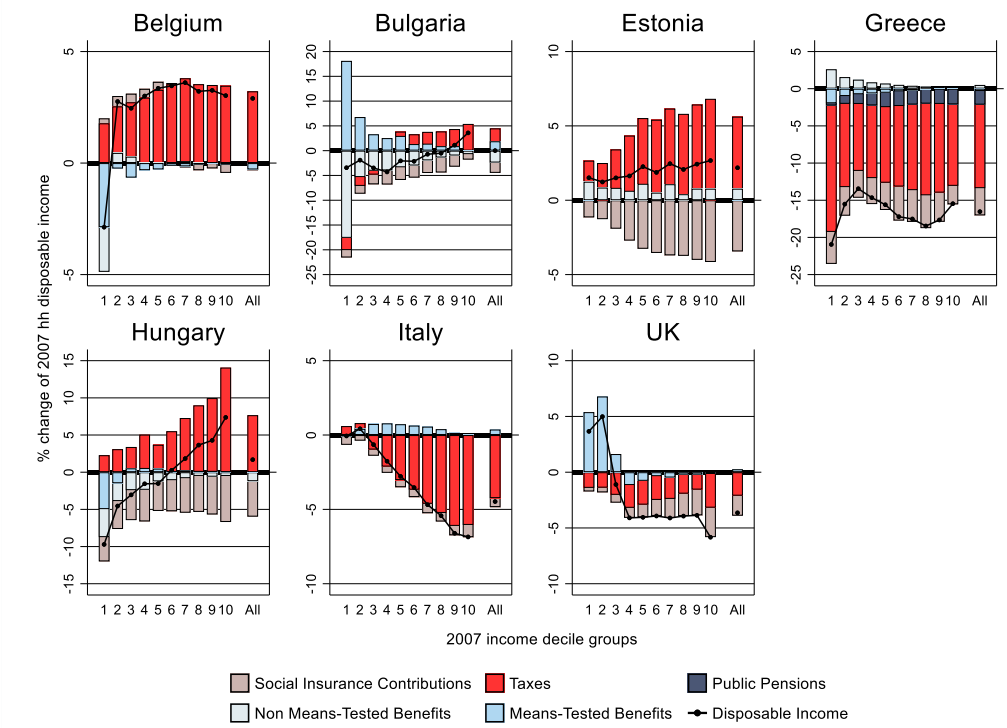

*Source and Notes:* see Figure A3.

**Figure A5: The indexation effect (with CPI benchmark index) on mean income in 2001-11**




*Source and Notes:* see Figure A3.

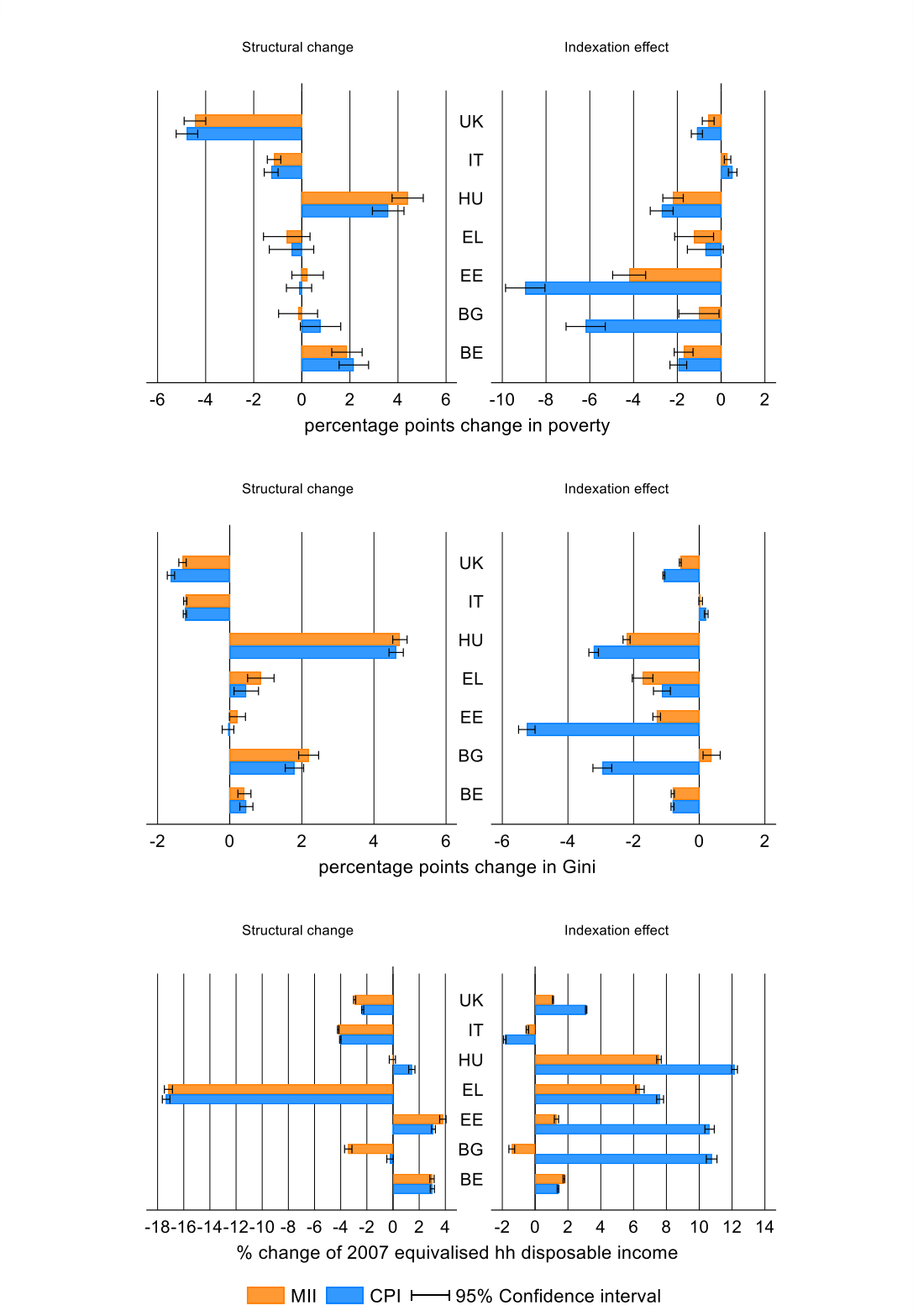
**Figure A6: The effect of structural changes (with CPI benchmark index) on mean income in 2001-11**




*Source and Notes:* see Figure A3.

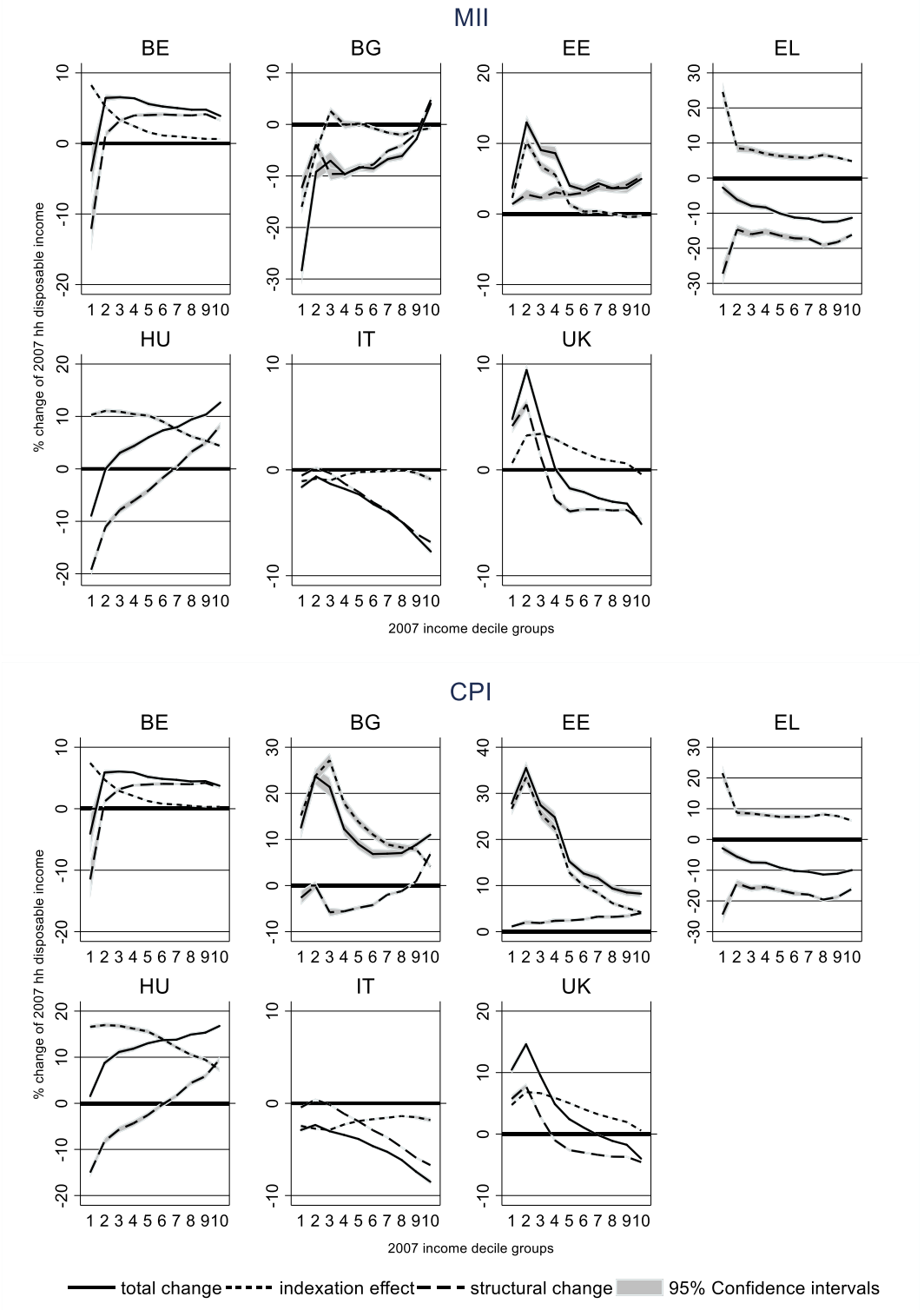
## B. Sensitivity analysis: the policy effect conditional on a different household survey wave

**Figure B1: The structural change and indexation effect of 2001-11 policy changes**



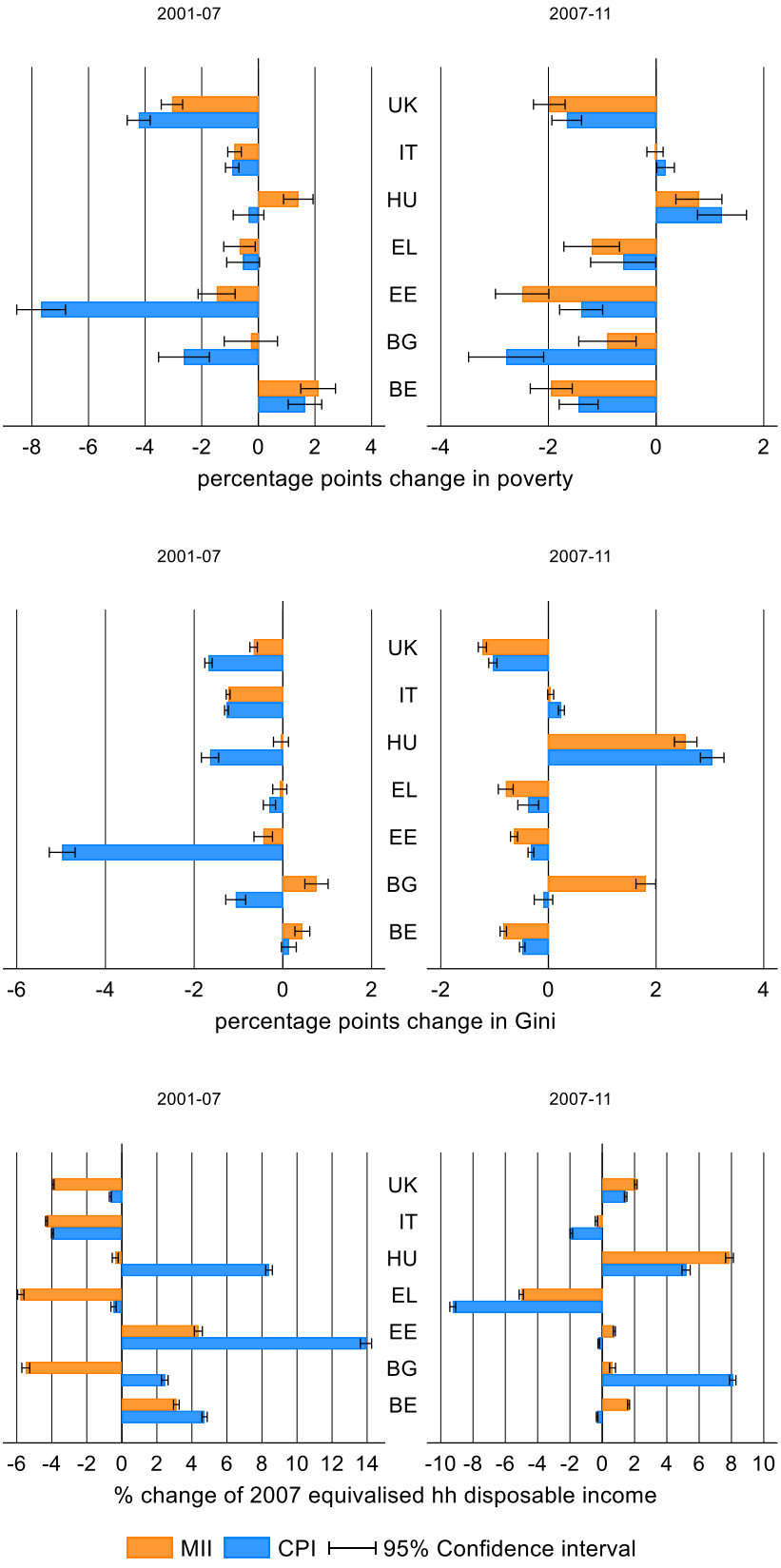

*Source:* own calculations using EUROMOD. *Notes:* poverty line is 60% of national median equivalised disposable income. Asymptotic standard errors at a 95% confidence level. The charts are drawn to different scales, but the interval between gridlines on each of them is the same (2 percentage points).

**Figure B2: The effect of 2001-11 policies on disposable income by income decile groups**




*Source:* own calculations using EUROMOD. *Notes:* The charts are drawn to different scales, but the interval between gridlines on each of them is the same (10 percentage points).

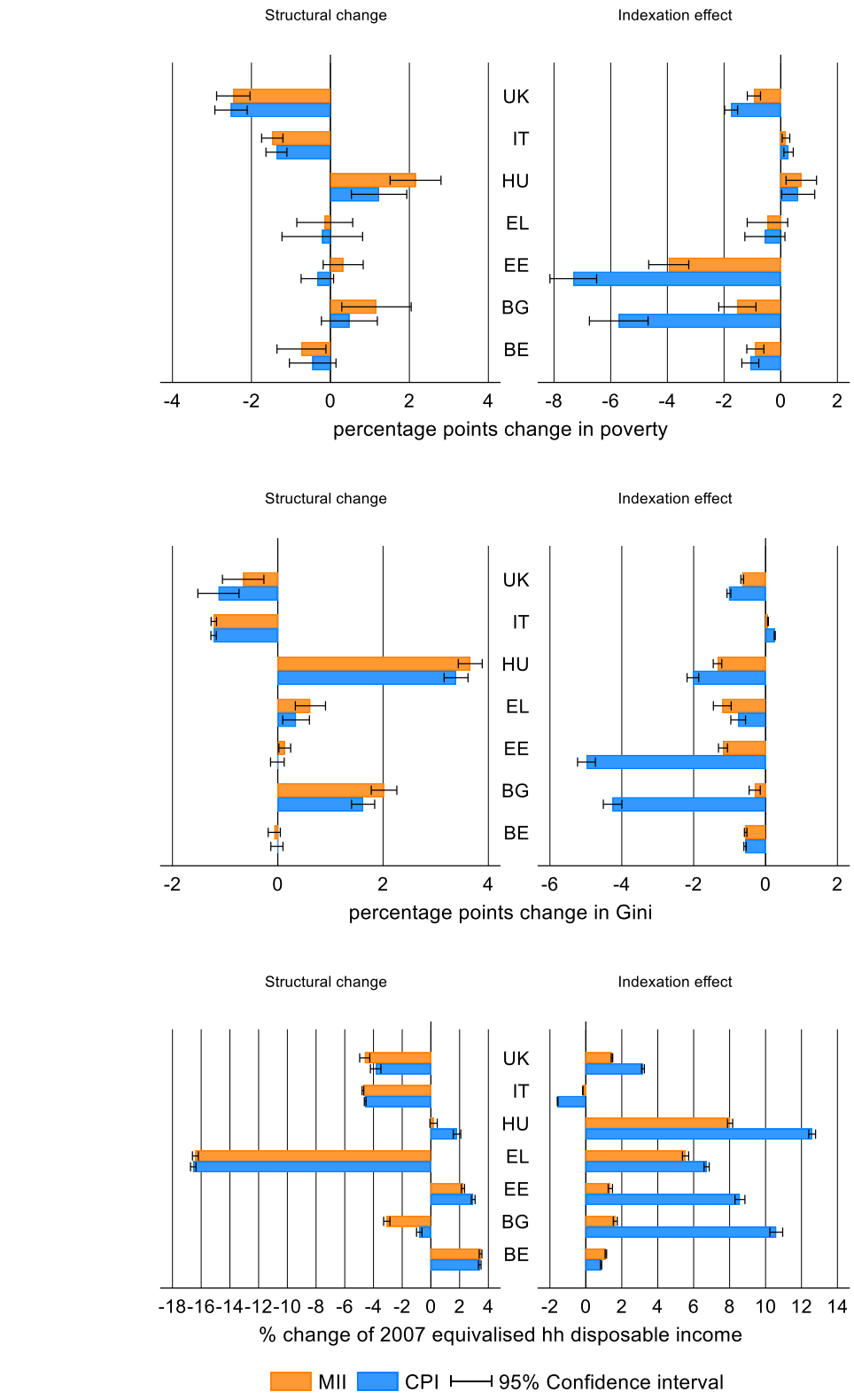
**Figure B3: The effect of 2001-07 and 2007-11 policy changes**




*Source:* own calculations using EUROMOD. *Notes:* poverty line is 60% of national median equivalised disposable income. Asymptotic standard errors at a 95% confidence level. The charts are drawn to different scales, but the interval between gridlines on each of them is the same (2 percentage points).

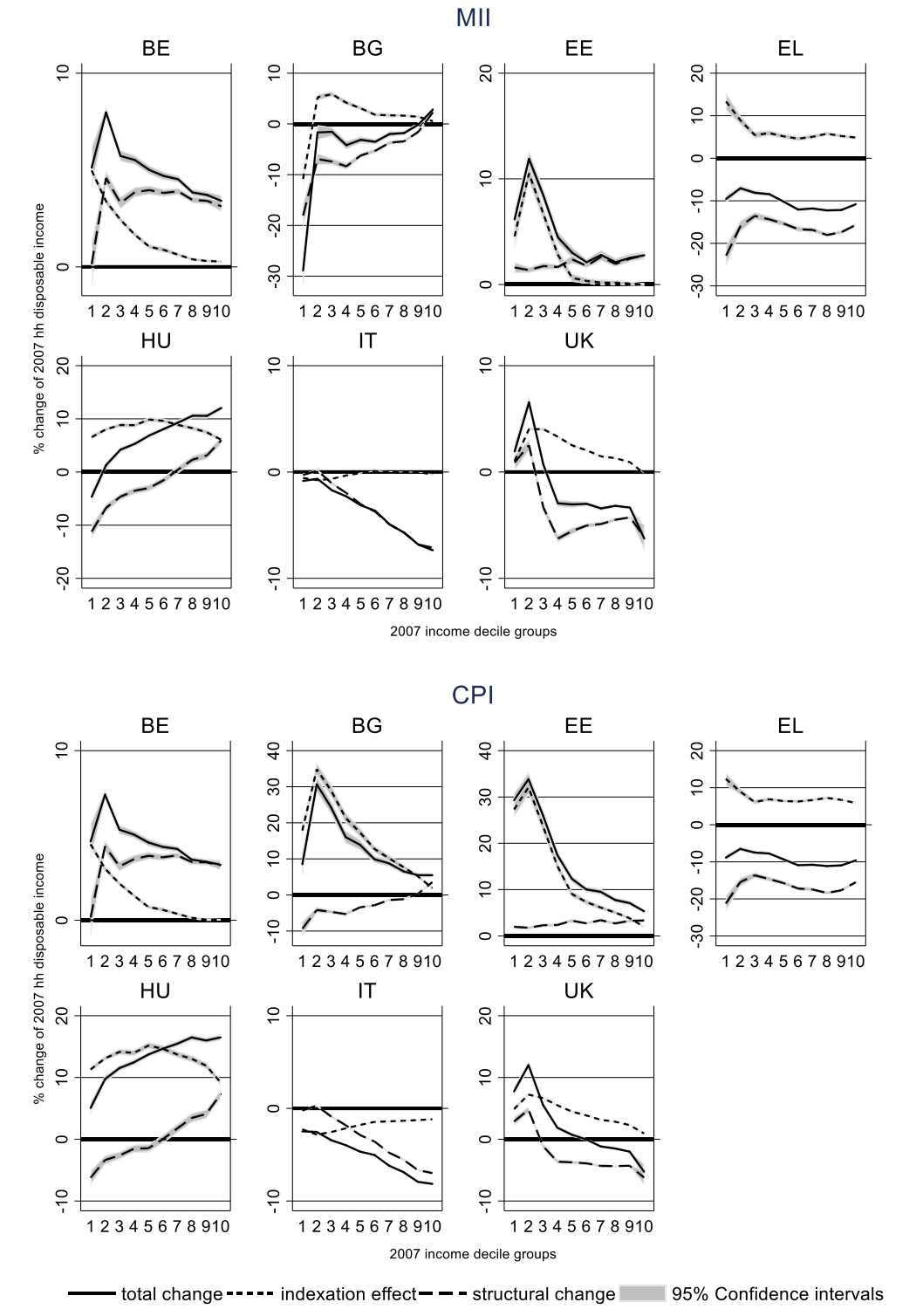
## C. Robustness check: changes to non-simulated, non-pension benefits and non-simulated taxes as part of the structural change

**Figure C1: The structural change and indexation effect of 2001-11 policy changes**



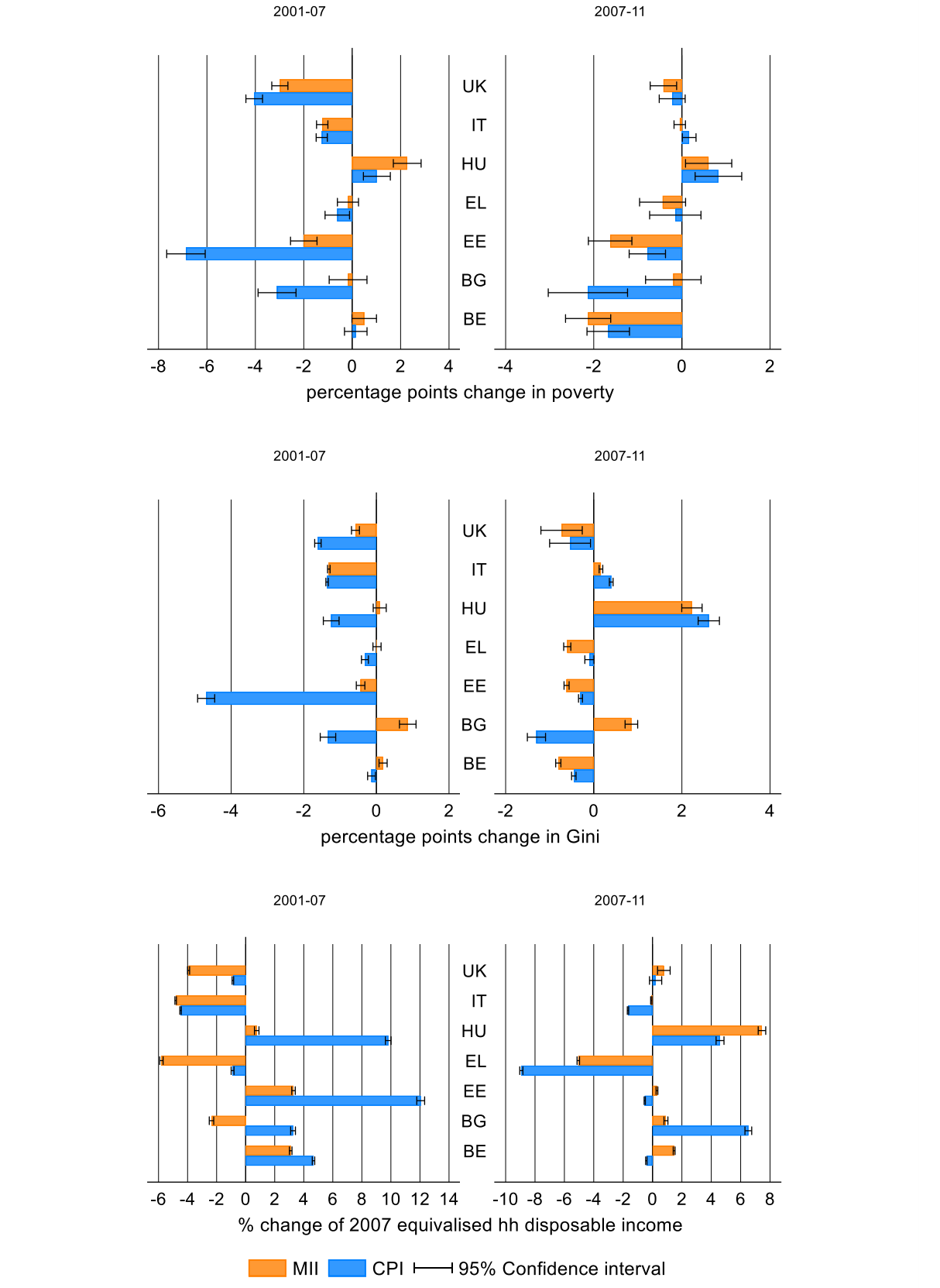

*Source:* own calculations using EUROMOD. *Notes:* poverty line is 60% of national median equivalised disposable income. Asymptotic standard errors at a 95% confidence level. The charts are drawn to different scales, but the interval between gridlines on each of them is the same (2 percentage points).

**Figure C2: The effect of 2001-11 policies on disposable income by income decile groups**




*Source:* own calculations using EUROMOD. *Notes:* The charts are drawn to different scales, but the interval between gridlines on each of them is the same (10 percentage points).

**Figure C3: The effect of 2001-07 and 2007-11 policy changes**




*Source:* own calculations using EUROMOD. *Notes:* poverty line is 60% of national median equivalised disposable income. Asymptotic standard errors at a 95% confidence level. The charts are drawn to different scales, but the interval between gridlines on each of them is the same (2 percentage points).