Effects of flat tax reforms in Western Europe on equity and efficiency

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Non-technical summary

Two types of income taxes can be distinguished by the tax rate schedule: graduated rate taxes and flat rate taxes. While graduated rate taxes apply a different tax rate at different income levels, flat rate taxes apply a single tax rate to the whole income range. Until mid-1990s most of the countries in the world relied on graduated rate income taxes and flat income tax was used only in a few countries. Since then flat income tax has gained popularity, especially in Eastern Europe. Such reform proposals are also discussed in Western European countries, however, none of them has adopted it yet with the only exception of Iceland. While flat taxes are considered (among else) to improve peoples' incentive to work, one may argue that they receive less political support in countries with well-established middle class due to their distributional effects.

This paper tries to answer the question what would be the impact on income distribution, e.g. in terms of inequality and poverty, of implementing a flat income tax in Western European countries. Using EUROMOD, which is a tax-benefit calculator for the EU countries, we analyse the potential effects for selected countries. Our flat tax scenarios are constructed to provide comparable and systematic insights also for consequences in terms of work incentives.

Our analysis shows that the selection of flat tax rate and tax base is crucial for the effects of flat tax reforms in terms of equity and efficiency. Low tax rates with existing basic allowances that keep the government tax revenues constant, improve peoples' financial incentives to work. This, however, leads to more inequality, poverty and polarisation as low rates benefit mainly those with high incomes at the expense of low and middle income households. On the other hand, it is possible to keep inequality levels unchanged with higher flat tax rates. Importantly, this does not necessarily imply strong disincentive effects for all countries. In fact, for Southern countries the work incentives increase even for flat tax scenarios with a high marginal rate. These countries have the typical Mediterranean welfare state regime, characterised by high inequality and polarisation of the existing income distribution, implying a lack of a well-established middle class. Therefore, the distributional effects are less adverse than in countries with a more equal income distribution. Switching to a flat tax regime in this situation can reduce inequality and increase efficiency in terms of work incentives.

The immediate and short-term distributional effects analysed in this paper are most likely to be decisive for the political feasibility of a flat tax reform. The main problem of implementing a flat rate tax could be to convince a majority of the population that redistribution in favour of the highest income decile is acceptable. These distributional effects at the expense of the middle class help to explain why flat rate taxes have not been successful in the political process in Western Europe.

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Abstract

The flat income tax has become increasingly popular recently, yet its implementation is limited to Eastern Europe. We analyse the distributional and efficiency effects of flat tax scenarios for Western European countries. Our simulations show that flat tax rates required to attain revenue neutrality with existing basic allowances improve labour supply incentives. However, they result in higher inequality and polarisation. Flat rates necessary to keep the inequality levels unchanged allow for some scope for flat taxes to increase both equity and efficiency. Our analysis suggests that Mediterranean countries are more likely to benefit from flat taxes.

JEL Codes: C81, D31, H24

Keywords: Flat tax reform, income distribution, work incentives, microsimulation

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1   Introduction

Flat income tax, referring broadly to a tax with a single marginal rate, is becoming increasingly popular. Before the 1990s it was only applied in a few countries, most prominently Hong Kong and the Channel Islands. Since 1994 however, after its introduction in Estonia, a number of countries have followed suit. In 2007 there were altogether 22 countries worldwide with flat tax systems, of which half are in Eastern Europe, and such proposals being discussed in several other countries including some in Western Europe.[1] However, among the latter only Iceland recently adopted a flat tax.

There are three main benefits usually associated with flat tax systems. First, flat taxes may enhance labour supply incentives. Although there is a trend of lowering marginal statutory tax rates (and reducing the number of tax brackets), top rates can still be rather high in existing systems, e.g. around 40-60% in EU15 (see Eurostat (2007)). While the gains from lower and flat tax rates are explicit for the top income range, they are not so obvious for low incomes. The results here depend on the chosen flat tax parameters and the underlying income distribution. Second, a flat tax can increase tax compliance and reduce tax evasion. This argument is perhaps weaker in developed countries, but it is often central for this kind of reform in developing and transition countries. Third, as a flat tax is often a part of more fundamental tax reform, it can simplify income taxation significantly. The current systems in Europe have typically evolved to quite complex entities, often violating the principle that taxes ought to be clear and simple. A simpler system is not only easier to grasp from the point of view of a single taxpayer, but is also more transparent at the aggregated level. Simplification can also decrease the costs of administration and compliance.

However, flat taxes can have a serious drawback in terms of their impact on the distribution of tax burdens which could be the main reason limiting its spread in developed countries with a well established middle class. Previous flat tax reforms and typical proposals lower marginal tax rates at the high income levels but increase the tax burden for middle-income ranges, resulting in a widening of the distribution of after-tax incomes.

There have been several previous studies, focussing on a single country and hypothetical reforms in most cases. For example, Ho and Stiroh (1998), Dunbar and Pogue (1998) and Ventura (1999) show for the US that high income households are relieved, whereas especially middle income households are burdened by a flat tax reform. In a study for the Netherlands, Caminada and Goudswaard (2001) also derive the result that a flat tax would yield redistribution at the expense of the lowest income deciles, but the magnitude of these effects is quite small. Several studies, like Aaberge et al. (2000) for Italy, Norway and Sweden, Adam and

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[1]Cf. Keen et al. (2006), Nicodeme (2007) and Mitchell (2007). See also Figure 9 in Appendix A.

Browne (2006) for the UK, Decoster and Orsini (2007) for Belgium, Kuismanen (2000) for Finland and González-Torrabadella and Pijoan-Mas (2006) for Spain[2], find that, in addition to redistribution in favour of high income households, the hypothetical introduction of a flat tax would increase labour supply (incentives). Benedek and Lelkes (2007) simulate a flat tax reform for Hungary. They do not consider work incentives but also find that the reform would lead to a sharp increase in after tax income inequality. Fuest et al. (2007) show for Germany that a flat tax with a high basic allowance and a single rate has less harmful distributional effects than a flat tax with a low rate. The latter scenario, however, is the only alternative that leads to positive, albeit small, labour supply and welfare effects.

Only two actual reforms have been examined in the literature: the 2001 Russian reform by Ivanova et al. (2005) and the 2004 reform in the Slovak Republic by, among others, Brook and Leibfritz (2005). In the Russian case, the reform was followed by significant real growth in personal income tax revenue, but there was no strong evidence that this was caused by the reform itself or by improved law enforcement, nor could any positive labour supply responses be identified.[3] The Slovakian reform was expected to be revenue neutral, to increase the level and efficiency of capital formation and enhance the incentives of unemployed workers to seek work. However, no evidence apart from revenue-neutrality has been reported yet. While it is true that most real world reforms have been very recent, research on their effects is probably also limited due to the lack in those countries of high-quality (micro-)data for the pre-reform period.

The aim of this paper is to undertake a systematic approach for choosing flat tax parameters for a comparative analysis of different flat tax designs for selected Western European countries. Davies and Hoy (2002) show that in the case of revenue neutral flat tax reforms there are two sets of critical parameter values: a lower bound of the flat tax rate below which inequality is always higher compared to a given graduated rate tax, and an upper bound above which inequality is always lower. We rely on these theoretical insights to systematically construct hypothetical flat tax reforms and analyse the distributional and incentive effects of their implementation in European countries.

We use EUROMOD, a tax-benefit microsimulation model for the EU15, to compare the results across countries in a common framework. Among others, we study the effect of polar-

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[2]The findings in González-Torrabadella and Pijoan-Mas (2006) differ from the other country studies in the magnitude of the simulated efficiency gains. While most studies find rather small gains, their model predicts an increase in output by more than 5%. They argue that this is driven mostly by an increase in capital formation, not in employment.

[3]See also Gaddy and Gale (2005) and Gorodnichenko et al. (2007). Furthermore, the situation in Russia is different in comparison to Western European countries insofar as the latter have a long tradition of taxation and a rather large tax administration to ensure tax compliance. Therefore, we assume effects of a flat tax reform on compliance to be less important than in transition countries of Eastern Europe.

isation, which can be used as an indicator of the strength of the middle class, on the results. We ask whether different combinations of tax rates and allowances always have an adverse effect on the middle class and if there are indeed positive incentive effects. We concentrate on the short-term static effects assuming that these decide the political feasibility of a tax reform although there are possibly important long-term effects as well.[4]

Our analysis yields the following results. The flat tax rates required to attain revenue neutrality with existing basic allowances (lower boundary) improve labour supply incentives. However, they benefit mainly those with high incomes at the expense of low and middle income households, resulting in more inequality, poverty and polarisation of the income distributions. On the other hand, revenue neutral flat rates necessary to keep the inequality levels unchanged are rather high and lead to ambiguous incentive effects. In general, a revenue neutral flat tax reform cannot overcome the fundamental equity-efficiency trade-off, but in some cases an increase in equality and work incentives is possible. We show that the different underlying income distributions and compositions of welfare state regimes play a key role for the results in terms of both equity and efficiency. Overall, this could contribute to explaining why flat taxes have not been politically successful in Western Europe so far. This also suggests that Mediterranean countries with a rather small middle-class due to high polarisation are more likely to benefit from such a reform.

The rest of the paper is organised as follows: section 2 provides a brief discussion on the flat tax design and chooses proper parameters. Section 3 contains a short description of the model, datasets and our reform scenarios. Section 4 illustrates the distributional effects in terms of inequality, poverty and richness, polarisation, winners and losers as well as the incentive effects in terms of effective marginal and average tax rates. Section 5 concludes.

2 Flat tax design

Flat income tax implies that some sort of proportionality is embedded in the income tax system. There are two dimensions to be distinguished: the tax schedule and the tax base. In general, a tax schedule can apply the same rate on all sources of income (i.e. comprehensive tax) or different rates on different types of incomes (i.e. schedular tax). Most countries with a flat tax system apply different rates to personal and business income, although a common rate has become more popular among the countries recently implementing these systems. There is

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[4]People tend to judge future gains and losses asymmetrically (see e.g. the "prospect theory" by Kahneman and Tversky (1979)). Starting from a reference point (status quo) and given the same variation in absolute values, there is a bigger impact of losses than of gains (loss aversion). Furthermore, people prefer the status quo over uncertain outcomes in the future ("status-quo-bias", see Kahneman et al. (1991)). Therefore, short-term losses in comparison to the status quo can have a much stronger impact than (possible) future gains. Hence, the short term effects presented here could be decisive.

also a number of countries which tax only capital income at a flat rate and levy a progressive rate schedule on labour income. However, these are usually not considered as flat tax systems but dual or semi-dual income tax systems.[5] For the tax base one can differentiate between concepts allowing or not allowing for any allowances or deductions. In a way, only the one without allowances and deductions is a "pure" flat tax as in this case tax payments are indeed proportional to incomes. A flat income tax as such has been applied only in Georgia so far. In all other cases, the tax incidence on incomes is progressive. A flat tax with a general basic allowance is the most common version. This is also what we consider in this paper.

An important aspect usually not given enough attention in previous empirical studies is the selection of parameters of the suggested tax reform. In terms of flat tax reforms this translates into the question how to set the flat tax rate and the basic allowance. In our case we are interested in the relationship between flat tax parameters and distributional effects. Davies and Hoy (2002) show that inequality of after-tax distribution of income is monotonically declining in the flat tax rate and the associated level of basic allowance generating the same tax yield. For revenue neutral tax reforms replacing a graduated rate tax with a flat rate tax, they prove the existence of critical flat tax rates such that, compared to the graduated tax rate, after-tax income inequality is:

- higher according to any inequality index for any flat tax rate equal to or below a lower bound, $t \leq t_F^l$,

- lower according to any inequality index for any flat tax rate equal to or above an upper bound, $t \geq t_F^u$,

- the same for a given inequality index at a certain flat tax rate, $t = t_F^* \in (t_F^l, t_F^u)$.

These results apply to any inequality measure satisfying the Pigou-Dalton principle of transfers under the assumption that behaviour is not affected by tax system changes and the only elements of income tax are basic allowance and tax schedule.

They show that the lower bound corresponds to a flat tax rate if the basic allowance is fixed, i.e. is at the same level as for the pre-reform graduated rate tax. The upper bound is such that a person with the highest income pays the same tax under each scheme. Additionally, the flat rate at the lower bound must exceed the lowest marginal tax rate under graduated rate and the flat rate at the upper bound remains below the highest marginal tax rate under graduated rate. The exact critical value between those boundaries cannot be determined a priori as it depends on a chosen inequality index.[6]

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[5]See OECD (2006) for more about dual income tax systems.

[6]Chiu (2007) demonstrates further that for an index exhibiting downside inequality aversion this value is determined by the strength of the index's downside inequality aversion against its inequality aversion. In the

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However, these theoretical regularities are only approximations for empirical estimations because existing tax systems are further complicated by the presence of other tax deductions and allowances, and not all systems have a (well-defined) basic allowance to start with. More so, the definition of revenue neutrality is not straightforward. If this is only limited to income taxes under consideration then it might not preserve the mean of the disposable income distribution as there are often instruments whose eligibility or amount depend on net income after taxes (e.g. means-tested non-taxable benefits) and, therefore, might change their value when tax systems are modified. If overall net balance from taxes and benefits is retained then income tax revenues rarely remain constant.

In practice, most countries have introduced a flat tax rate at or close to the level of previous lowest marginal rate. Exceptions are Latvia and Lithuania who have chosen rates close to the previous highest marginal rate (Nicodeme (2007)). The Slovak Republic and Estonia initially opted for a rate in the middle range, although the latter is now gradually moving towards the former lowest marginal rate as well. The pattern of setting basic allowances however is less clear. In most countries a fixed allowance was retained or introduced. Exceptions include Russia with gradual withdrawal and Ukraine with sudden withdrawal above certain income levels which makes the effective marginal tax rate high at some stages. However, the amount of allowance varies significantly, most countries having it increased during the reforms (Keen et al. (2006)). For example, Georgia has no allowance at all, the allowance in Russia was about 12% of the average gross wage in the year before and after the reform (i.e. 2000-01), in Estonia it was 40-74% of the minimum wage and 11-21% of the average gross wage in 1994-2006, and in the Slovak Republic it exceeded the minimum wage and was about 60% of the average wage in 2004, more than doubling during the reform (see Brook and Leibfritz (2005)).

3   Flat tax simulations

3.1   EUROMOD: model and database

We use the microsimulation technique to simulate taxes, benefits and disposable incomes under different scenarios for a representative micro-data sample of households. Simulations are done with EUROMOD, a static tax-benefit model covering the EU15 countries. Our analysis is based on the 2003 tax-benefit systems, which is the most recent wave currently available in EUROMOD but it is limited to 10 countries due to data availability, excluding Denmark, France, Ireland, Italy and Sweden (see also Figure 9 in Appendix A).

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case of Generalized Entropy Indices $E(\alpha)$, since a higher α indicates a weaker downside inequality aversion against inequality aversion, it also implies a higher critical flat tax rate between the boundaries.

The main stages of the simulations are the following. First, a micro-data sample and tax-benefit rules are read into the model. Then for each tax and benefit instrument, the model constructs orresponding units of assessment, ascertains which are eligible for that instrument and determines the amount of benefit or tax liability. The result is then either assigned to an individual or allocated to members of the tax unit. Finally, after all taxes and benefits in questions are simulated, disposable income is calculated.

EUROMOD is characterised by greater flexibility than typical national models, to accommodate a range of different tax-benefit systems. For instance, the model can easily handle different units of assessment, income definitions for tax bases and benefit means-tests, the order and structure of instruments. Overall, a common framework allows the comparison of countries in a consistent way.

EUROMOD covers only monetary incomes, excluding unrealised or irregular capital gains and irregular incomes. It can simulate most direct taxes and benefits except those based on previous contributions as this information is usually not available from the cross-sectional survey data used by EUROMOD as input datasets. The model assumes full benefit take-up and tax compliance. Although the latter is an important aspect of flat tax reforms, we do not consider changes in compliance here and limit our analysis to first-order static effects only.

Table 3 in Appendix A gives an overview of the input datasets for EUROMOD. Their sample size varies across countries from less than 2,500 to more than 11,000 households. All monetary variables are updated to year 2003 using country-specific uprating factors, as the survey period for incomes varies from 1999 to 2003. Where net incomes were recorded in the original data, gross incomes have been also imputed. For further information on EUROMOD, see Sutherland (2001) and Sutherland (2007).

3.2   Current income tax systems

The existing income tax systems in the 10 countries under consideration are quite varied. As of 2003, all have graduated rate schedules with a number of brackets ranging from 3 (UK) to 16 (Luxembourg) and the highest marginal tax rate from 38% (Luxembourg) to about 55% (Finland, state and local rate combined). All schedules are piecewise linear except that of Germany which has a unique continuous function for tax rates at some income levels. Seven countries have a general basic allowance, often integrated into the tax schedule; the Netherlands and Portugal apply general (wastable) tax credits and Austria uses both elements. About half of the countries tax capital income (and property income) together with other income and the rest tax it separately applying a flat rate (of 15-30%), in Belgium this is optional.

The countries also differ in the unit of assessment. Again, half of them allow only individual taxation, four countries apply either optional or compulsory joint taxation and Belgium provides

limited income sharing for married couples. Nevertheless, even systems based on individual taxation often have elements assessed at family level or couple level (e.g. family or child allowances) or allow the sharing of non-labour income or household expenditures (e.g. property income, mortgage payments). Table 4 in Appendix A summarises these characteristics.

Overall, although there are few countries with relatively simple income tax systems (e.g. UK), most of them can be characterised as complex systems with the combination of many different components and varying tax units. Additional examples of complexities include progression adjustments in Austria and Germany, income taxation both at the state and the local level in Finland, and an integrated schedule of social insurance contributions and income tax in the Netherlands.

3.3 Reform scenarios

In our flat tax reform simulations we replace all existing personal income tax deductions, allowances and credits with a single personal allowance (which is equivalent to a wastable, i.e. non-refundable, tax credit), and each graduated rate schedule with a flat rate. We only keep refundable tax credits where these are equivalent to benefits.[7] In countries where capital income was taxed at a seperate rate, we abolish this seperate rate and include capital income into the flat tax base. Therefore, our reform scenarios have a good potential to simplify the systems (due to fewer specific deductions) and make them more transparent.[8]

We do not attempt to harmonise tax bases across countries, we limit ourselves to income taxes and do not modify existing social insurance contribution schemes (SIC)[9] or benefits. One could also carry out an exercise of simply flattening tax rate schedules without adjusting the tax base, but this would result in higher flat tax rates due to retained exceptions, therefore, limiting gains in terms of incentives.

We simulate the following three flat income tax scenarios for each country:

- a flat rate with a basic allowance in the existing (or equivalent) amount (S1),

- a 10 percentage points higher flat rate compared to the first scenario and an increased tax allowance to preserve revenue neutrality (S2),

- a 20 percentage points higher flat rate compared to the first scenario and an increased tax allowance to preserve revenue neutrality (S3).

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[7]Examples include the lone parent tax credit in Austria, the tax credit for families with school children in Greece, working mother tax credit in Spain and working tax credit and child credit in the UK.

[8]Further on, abolishing specific deductions and allowances (that may have different values for different persons or income levels) and replacing them with one general allowance leads to a (slightly) broader tax base.

[9]The use of social insurance contributions differs considerably across European countries. Therefore, a reform of these would raise further conceptual questions, e.g. if mandatory contributions should be interpreted as taxes or insurance premia.

All scenarios are revenue neutral with the total income tax revenue within ±0.1% limits of its baseline value. In terms of Davies and Hoy (2002) approach, our first scenario should approximately correspond to the lower bound. Because of additional complexities discussed in section 2 exact critical flat tax rates cannot be identified in a straightforward manner. The 10 and 20 percentage point higher tax rate under the second and the third scenario are chosen to explore the effect on inequality potentially around the upper bound.
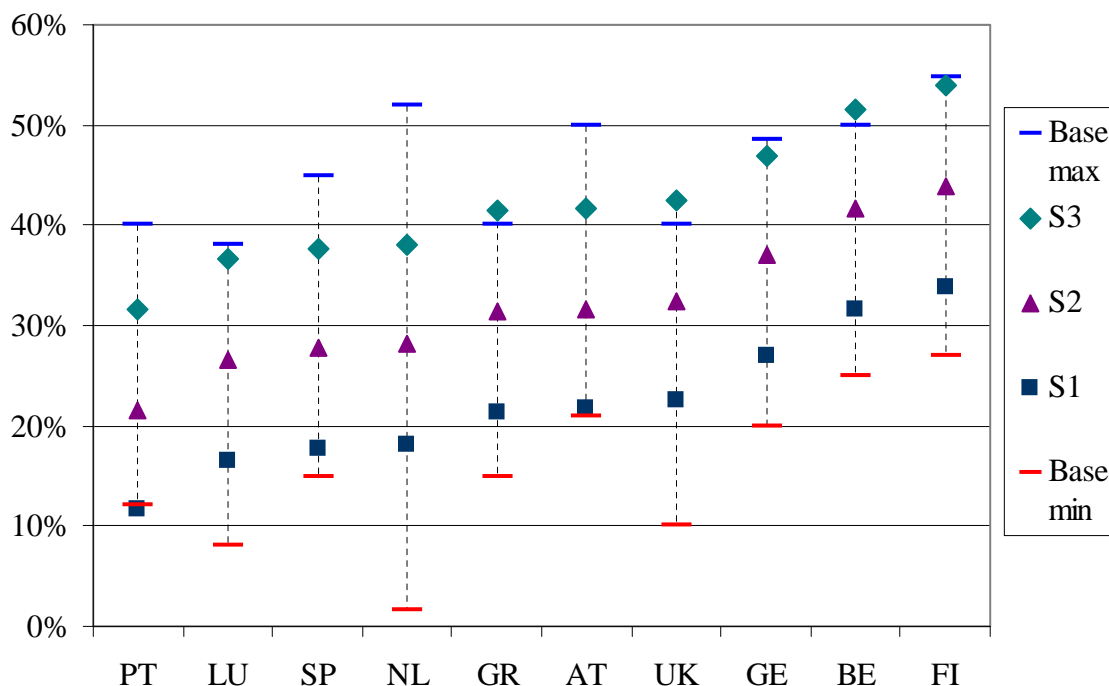
Figure 1: Simulated flat tax rates and existing lowest and highest marginal rate

Figure 1 plots the flat tax rate under each scenario and the lowest and highest (positive) tax rate of the existing tax rate schedules. Because of revenue neutrality the tax allowance is not independent of the tax rate. There is notable variation in the flat tax rate under the first scenario (11.6-33.9%). This variation results from the combination of the underlying pre-tax income distribution and average effective tax burden under the existing system. This also affects the other two scenarios. However, it turns out that for most countries the range of flat tax rates under three scenarios roughly matches the range of existing tax rates. A notable exception is the Netherlands with a very wide range of graduated tax rates.[10]

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[10]The integrated schedule of social insurance contributions and income tax in the Netherlands results in rather low income tax rates for the brackets where full contributions to the "People's Pensions Insurance" have to be paid and rather high rates above the SIC threshold.

As expected, flat tax rates under the first scenario are above the lowest rates in the existing schedules with only Portugal being slightly lower, which is possibly due to the elimination of additional tax allowances. Flat tax rates under the third scenario are around the previous highest marginal rates for six countries and below that for the rest.

4 Simulation results

In this section we present the results of our analysis. First, we consider distributional effects in terms of inequality, poverty and richness. This is followed by the presentation of the distribution of tax payments and disposable income, and then summarised by the share of winners and losers. Finally, we demonstrate how effective average and marginal tax rates change according to the simulated reform scenarios.[11]

4.1 Inequality, poverty and richness

We compute a number of distributional measures to cover several aspects of distribution: inequality, polarisation, poverty and richness. These are based on equivalised household disposable incomes.[12] To analyse income inequality we use the Gini Coefficient and the Generalised Entropy Indices with sensitivity parameters $\alpha = 0$ (Mean Log Deviation), $\alpha = 1$ (Theil index) and $\alpha = 2$. We also calculate the polarisation index of Schmidt (2004) to assess the importance of the middle class.[13] Figure 2 presents the Gini coefficient for each scenario, other measures are presented in Table 8 (Appendix B).

First, note that there are already distinct differences between the countries in terms of inequality in the baseline scenario. Two groups are afferent: inequality is rather high in Southern European countries (Greece, Portugal and Spain) and the UK, and is rather low in Continental Europe (Austria, Belgium Germany, Luxembourg) and Finland. This classification of countries corresponds to the typology by Esping-Andersen (1990) who differentiates between three types of welfare states: conservative (Continental Europe), social-democratic (Nordic Europe) and

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[11] When interpreting the results, one has to be aware of the fact that revenue neutrality in terms of (overall) tax payments does not necessarily imply a constant mean disposable income. This mainly depends on mean-tested benefits which are calculated on the basis of after-tax net income.

[12] We use the modified OECD equivalence scale which weights the household head with a factor of 1, household members aged 14 and older with 0.5, and under 14 with 0.3. The households net income is divided by the sum of the individual weights of each member (=equivalence factor) to compute the equivalence weighted household income.

[13] Schmidt (2004) creates a polarisation index which in analogy to the Gini index (Lorenz curve) is based on a polarisation curve for better comparability of the results and their interpretations. Generally speaking, polarisation is the occurrence of two antipodes. A rising income polarisation describes the phenomenon of a declining middle class resulting in an increasing gap between rich and poor. The proportion of middle income households is declining while the shares of the poor and the rich are both rising.
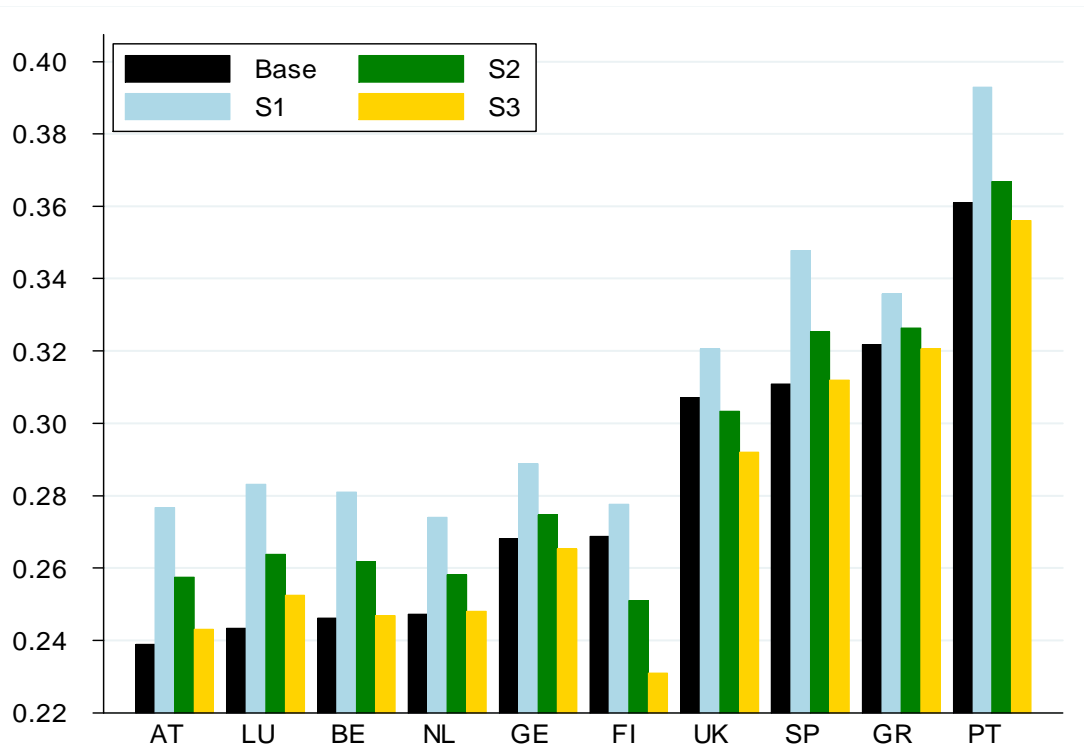
Figure 2: Income inequality by Gini coefficient

liberal (Anglo-Saxon). Arts and Gelissen (2002) further add a fourth category (Mediterranean) to this typology.

Introducing a revenue neutral flat tax increases inequality unambiguously only under the first scenario (S1). In the second scenario (S2) inequality decreases relative to the baseline for Finland and the UK (depending on the inequality measure for the latter) and in the third scenario (S3) also for Belgium, Germany, Greece and Portugal.[14] These differences between countries can be explained to some extent by different tax systems and the resulting distribution of tax payments. The latter is rather narrow in Belgium, Finland and UK (where inequality decreases) with a spread of the effective average tax rate in the baseline between the lowest and highest decile of less than 20 percentage points whereas this spread in most other countries is around or well above 30 percentage points.[15]

The scenarios can be ranked according to the level of inequality as follows: $I(S1) > I(S2) >$

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[14]These derived results are in line with comparable scenarios from single country studies. Fuest et al. (2007), for example, find a similar increase in inequality for scenario S1 and one close to S2 for Germany.

[15]This spread, however, is largest for Greece although a similar development can be observed as for low-spread countries. But when taking a closer look at the distribution of tax payments it can be seen that it is right-skewed and the spread between deciles one and nine is below 20 pp. See subsection 4.2 and Table 10 (Appendix C) for further information.

$I(S3)$.[16] The increases in inequality, however, are similar in absolute terms for most countries with FI and UK being slightly lower. The fact that inequality levels under the third scenario are below or close to those in the baseline scenario show that they correspond approximately to the upper boundary.[17]
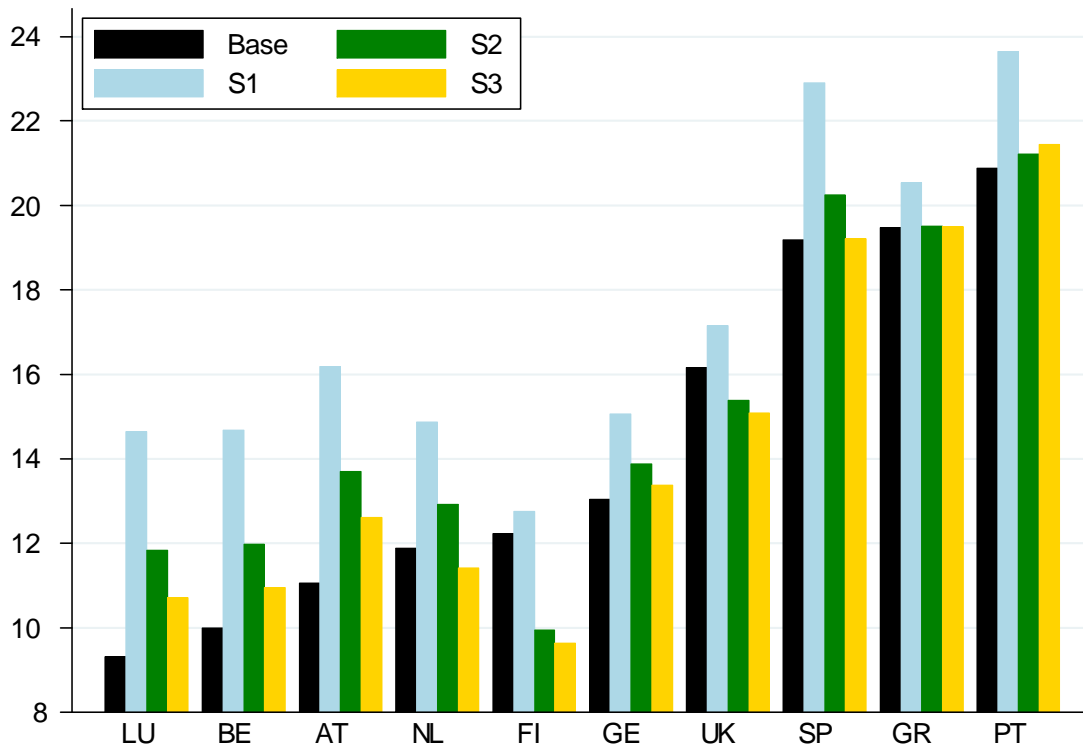
Figure 3: Poverty rates by headcount ratio (with constant poverty line), %

To analyse the effects of flat taxes on poverty we compute the headcount index and the measures of Foster et al. (1984) based on the poverty line taken from the baseline scenario.[18] We compute the poverty lines as 60% of median equivalent income for each country. The results for the headcount ratio (FGT0) are plotted in Figure 3 and the full results are presented in Table 6 (Appendix B). Measuring richness is a much less considered field in the literature than poverty. We compute the headcount index and the measures of Peichl et al. (2006) which are analogously defined to the FGT indices of poverty. The richness line is computed as 200% of

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[16]This ordering is stable when using any inequality index presented in Table 8 (Appendix B).

[17]Inequality under S3 is lower for those countries where flat tax rate under S3 is close or exceeds previous highest rate (LU, GR, UK, GE, BE, FI), except LU and additionally for PT.

[18]We fix the poverty and richness lines at the baseline level to account for (possible) changes in median income. Otherwise, if we would allow for changing poverty (richness) lines an increasing measure of poverty (or a decreasing index of richness) would not necessarily indicate a worse situation for people with low (high) incomes as a result of the changing poverty (richness) line.

median equivalent income. The results for the headcount ratio are presented in Figure 4 and the full results in Table 7 (Appendix B).[19]
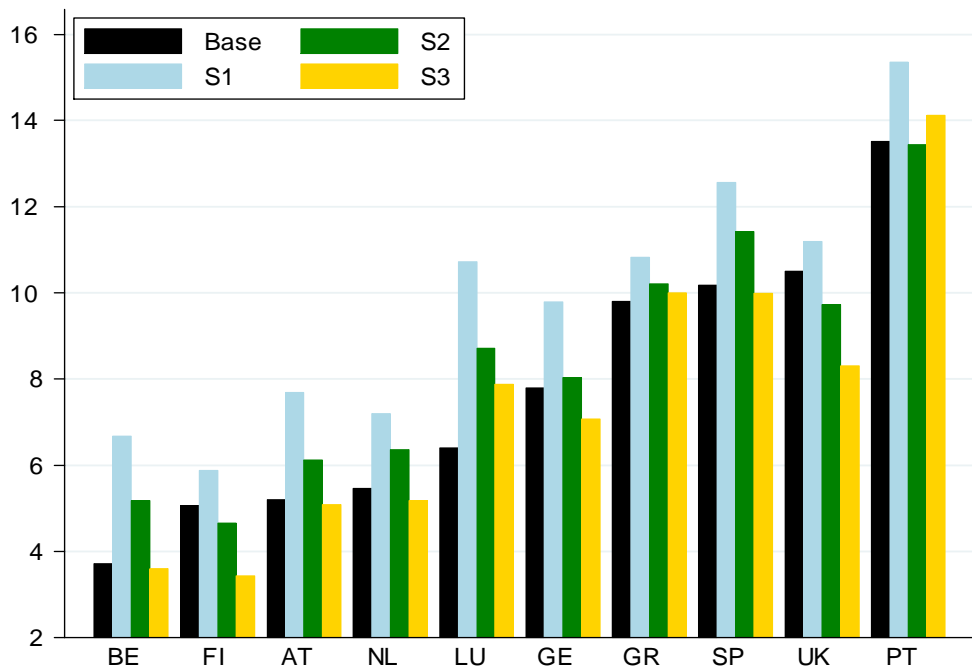
Figure 4: Richness rates by headcount ratio (with constant richness line), %

Again, there are distinct differences between countries in the baseline levels of poverty and richness. The same two groups of countries can be distinguished: like inequality, poverty and richness are rather high in Southern European countries (Greece, Portugal and Spain) and the UK, and low in Continental Europe (Austria, Belgium Germany, Luxembourg) and Finland.

Poverty increases in terms of all measures in all scenarios compared to the baseline, except for the Netherlands in S3 and Finland and the UK in S2 and S3. When analysing poverty, one has to take into account the fact that the lowest deciles of the income distribution seldom pay income taxes. There is, therefore, limited scope for a reduction in income poverty through reduced marginal tax rates. The pattern of changes in richness measures matches closely the inequality measures, i.e. increasing richness in the first scenario for all countries and measures, decreasing richness for Finland and the UK in the second scenario relative to the baseline and additionally for Belgium and Germany in the third scenario. These effects differ slightly when using more sophisticated richness measures (R_α) that also account for changes in the dimension of richness and not only the number of people above a richness line. Richness is then

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[19]One should note, though, that measuring richness depends on the quality of micro data as the upper tail of the income distribution in surveys is especially prone to non-response and measurement error bias.

also decreasing for Portugal and Greece in S3.

The polarisation of the income distribution is also high in Southern countries and the UK and low in Continental Europe and Finland. A high income polarisation describes the phenomenon of a declining middle class resulting in an increasing gap between rich and poor. Therefore, the middle class is of less importance in the Southern countries and the UK. And indeed, in these countries, which have high baseline values of inequality, inequalty decreases in scenario S3 (and S2 in the UK). The polarisation increases in most countries and scenarios (except for Finland and the UK in S2 and S3) implying a further declining middle class (see Table 8 in Appendix B). This measure is therefore summarising the effects on poverty and richness.

4.2   Redistribution
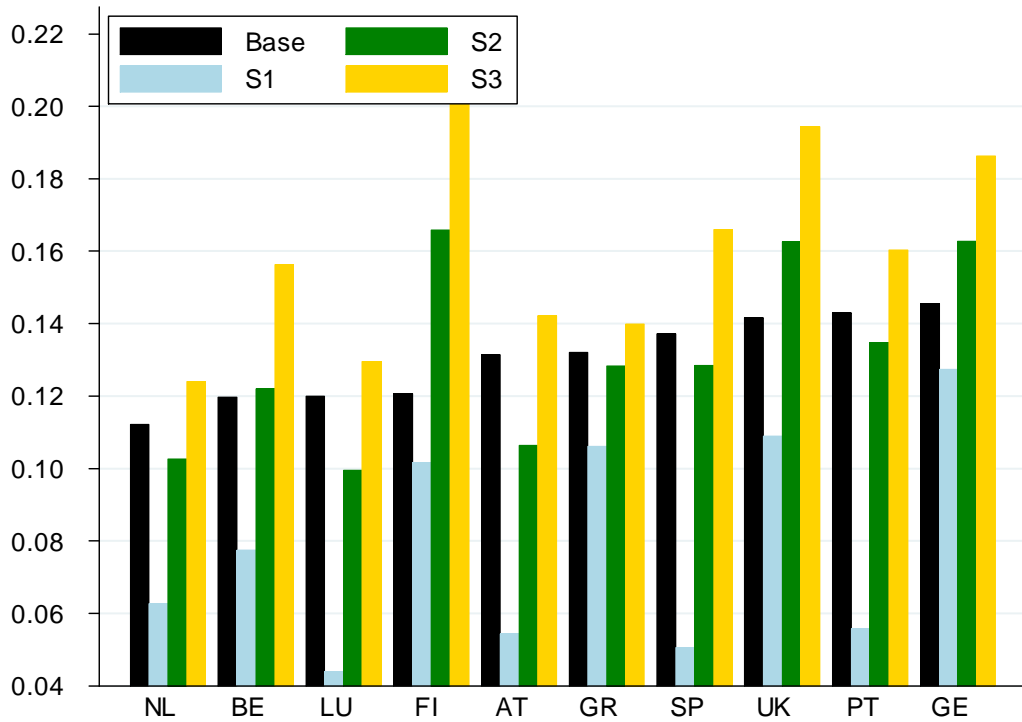
Figure 5: Tax progression by Kakwani index

To analyse the impact of flat tax reforms on the redistributive effects of the tax system we compute several measures of tax progression.[20] Figure 5 presents the values for the Kakwani

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[20]We compute the measure of effective progression by Musgrave and Thin (1948) ,$P_{MT} = \frac{1-G_Y}{1-G_X}$, the indices of disproportionality by Kakwani (1977) ,$P_K = C_T - G_X$, and Reynolds and Smolensky (1977) ,$P_{RS} = G_X - C_Y$, as well as the redistributive effect (of taxes) $P_{RE} = G_X - G_Y$ (with Y disposable income, X gross income,

index. In terms of progression the differences between the countries in the baseline scenario are rather small. Therefore it is not easy to distinguish homogeneous groups of countries in termsof tax progression. Progression is rather low in the Netherlands, Belgium, Luxembourg and Finland, average in Austria, Greece and Spain whereas it is rather high in the UK, Portugal and Germany. Tax progression decreases under scenario S1 with a low tax rate in all countries in comparison to the baseline scenario. The values for scenario S2 and S3 depend on the country. Nevertheless the scenarios can be ranked in terms of all indices of progression in the following way: $I_{PR}(S1) < I_{PR}(S2) < I_{PR}(S3)$.

The introduction of a revenue neutral tax reform always yields gainers and losers. Different groups of taxpayers are affected differently by tax schedule flattening and tax base broadening.[21] In the first scenario with the lowest tax rates the gains are solely concentrated in the top 1-2 deciles (only in Belgium also involving the 7th and 8th deciles). In the second scenario, some 9th decile households start losing instead of gaining; in the case of Finland and the UK the top decile loses as well while the bottom and middle deciles start gaining. In the third scenario only three countries are left with gains for the top decile (Luxembourg, the Netherlands and Spain). In addition to Finland and the UK, Greece, the Netherlands, Portugal and Spain also show gains for the lowest deciles. Germany under the third scenario is an exceptional case as only the middle income deciles gain.

The changes in mean disposable income are increasing (decreasing) with flat tax parameters (i.e. marginal tax rate and basic allowance) for low (high) income households. In other words, the lower (higher) the flat tax parameters the higher (lower) are the gains (losses) for high (low) income households. In most countries the relative losses in terms of disposable income remain high (or are even highest) for middle income households. These groups, however, usually play an important role in the political process of a mature welfare state. Thus, these effects might explain why a flat tax is not very popular in Western Europe.[22]

Figure 6 summarises gainers and losers[23] by presenting the exact shares for each, which differ considerably between countries and scenarios. There are more losers than winners in every country under the first scenario. Belgium, Finland and Germany show about the same share of winners and losers under the second scenario, while Greece, Portugal and the UK have most of the people with unchanged income. In the third scenario, only Austria and Luxembourg

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T taxes, G Gini coefficient and C coefficient of concentration). See Table 11 in Appendix C for the detailed results.

[21]See Table 9 in Appendix C for the effect in terms of changes in mean disposable income by deciles. The range of changes is somewhat higher for the first (from -9.7% to +12.1%) and the third scenario (-13.1% to 8.0%) compared with the second scenario (-5.5% to 6.2%).

[22]Fuest et al. (2007) for Germany and Caminada and Goudswaard (2001) for the Netherlands find similar results for comparable scenarios.

[23]Households whose disposable income does not change more than 10 Euros per month in either direction are regarded as „unchanged". See also Table 11 in Appendix C.
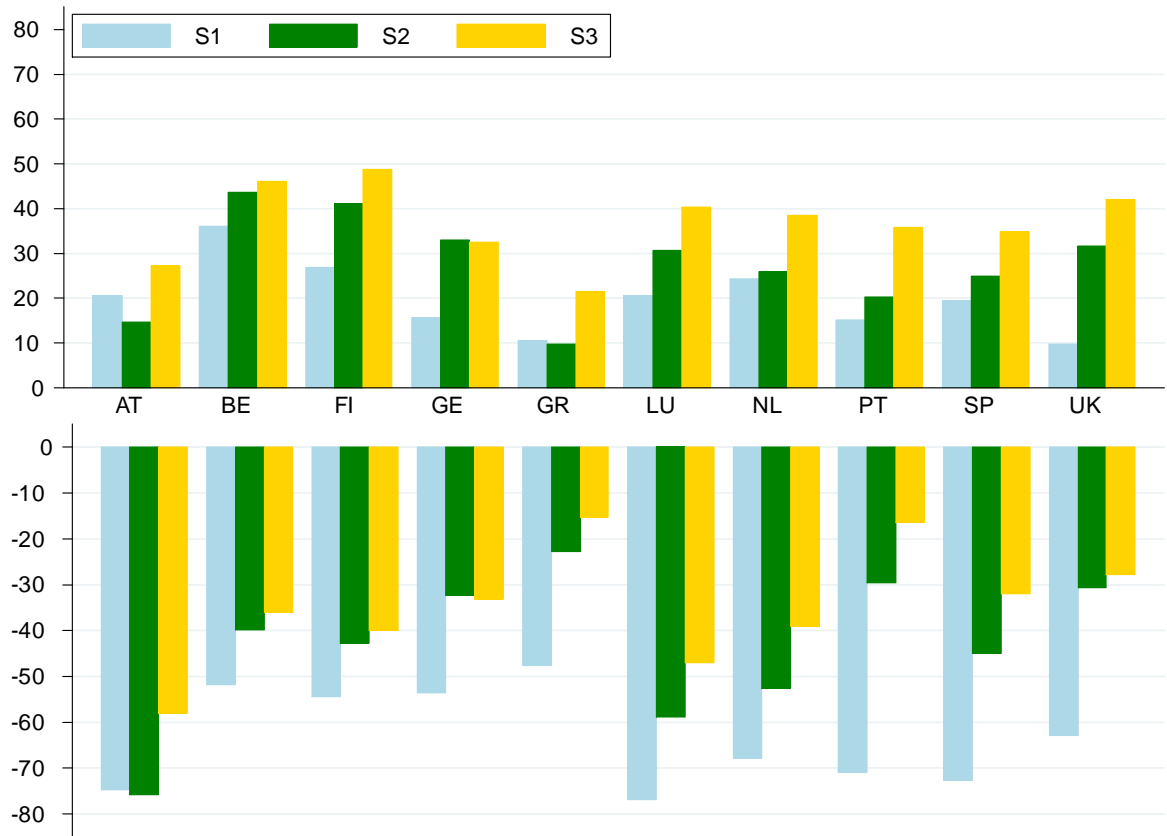
Figure 6: Share of winners and losers, %

have still more losers; Germany, the Netherlands and Portugal have again roughly the same share of those gaining and losing and most people in Greece remain still in the 'no-change' category. The highest fraction of winners appears in Belgium and Finland for all scenarios and it is increasing over scenarios for most countries (except for Austria, Germany and Greece). If disposable income was chosen as the only criterion for an election decision, only the third flat tax scenario would have a majority (in the sense of more winners than losers) in the population for most countries.

4.3 Work incentives: effective average and marginal tax rates

In this section, we analyse the effects of flat tax reforms on the effective marginal (EMTR) and average (EATR) income tax rates faced by different groups of taxpayers as a measure for efficiency effects. The underlying idea is that average and marginal income tax rates affect labour supply and savings incentives. Therefore, changes in effective income tax rates may be considered as rough indicators for distortions caused by the tax system. Effective marginal

tax rate shows at which rate an additional unit of income is taxed, whereas effective marginal tax rate shows the proportion of total taxes (including SICs) to market income.[24] Changes in effective average tax rates are of special interest for the extensive labour supply margin which seems to be more important for particular subgroups at the bottom of the income distribution than the intensive margin which is affected by the effective marginal tax rate (see Heckman (1993) and Immervoll et al. (2007)).
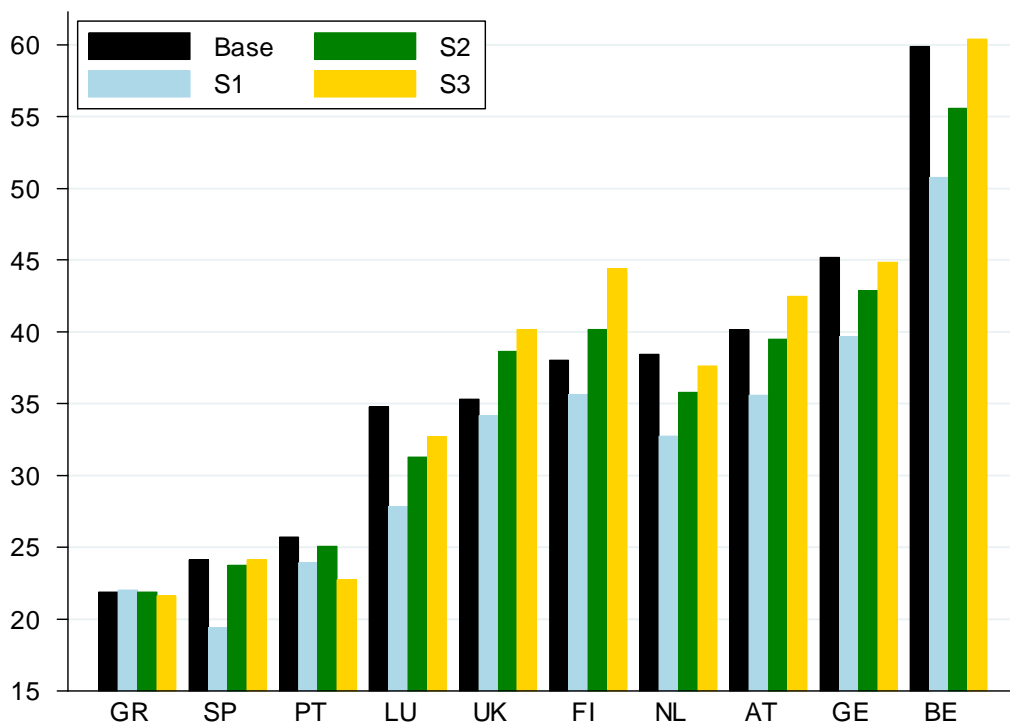
Figure 7: Effective marginal tax rates (mean), %

Figures 7 and 8 present EMTRs and EATRs for the flat tax scenarios.[25] Both measures already differ distinctively in the baseline scenario across countries. This can be attributed to several factors like, for example, the overall size of the government (and therefore the demand

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[24]We calculate EMTRs for the working age population (those aged 18-64) with positive employment or self-employment income, increasing earnings of each individual in the household in turn by 3% while the change in all taxes and benefits (including social insurance contributions) is observed at the household level. We use the following formula: $EMTR_i = 1 - \frac{\Delta Y_j}{d_i}$, where d_i is the income increment for individual i and Y_j disposable income of household j to which this individual belongs to. The effective average tax rate is also calculated for the working age population as: $EATR_i = \frac{T_i}{X_i}$, where T_i is total tax payments and X_i the market income of individual i.

[25]See Tables 13, 14 and 15 in the appendix for the detailed results. The concentration (polarisation) of the EMTR distribution decreases (increases) with an increasing marginal tax rate, i.e. more people face low or high EMTRs whereas less individuals face medium EMTRs.

for public funds) and the general tax mix (i.e. the importance of the income tax) as well as economic differences between the countries. Mediterranean countries with the lowest EMTRs and EATRs have rather low income levels as well as the lowest relative levels of income taxation and social insurance contributions resulting in high inequality and polarisation of the income distribution. Finland and the UK which have average ETRs attribute much more importance to the income tax whereas social insurance contributions are relatively low. These social insurance contributions, however, play an important role in financing the Continental European welfare states where SIC are almost as high as income taxes [26]

The effective marginal tax burden is rather low in Mediterranean countries like Greece, Spain and Portugal; average in Luxembourg, UK, Finland and the Netherlands, and rather high in Austria, Germany and Belgium. The scenarios can be ranked in the following (for most countries): $EMTR(S1) < EMTR(S2) < EMTR(S3)$. Therefore, effective marginal rates are increasing with statutory rates although revenue is kept constant. In scenario S1 the EMTRs decrease in all countries in comparison to the baseline, scenarios S2 and S3 depend on the country.
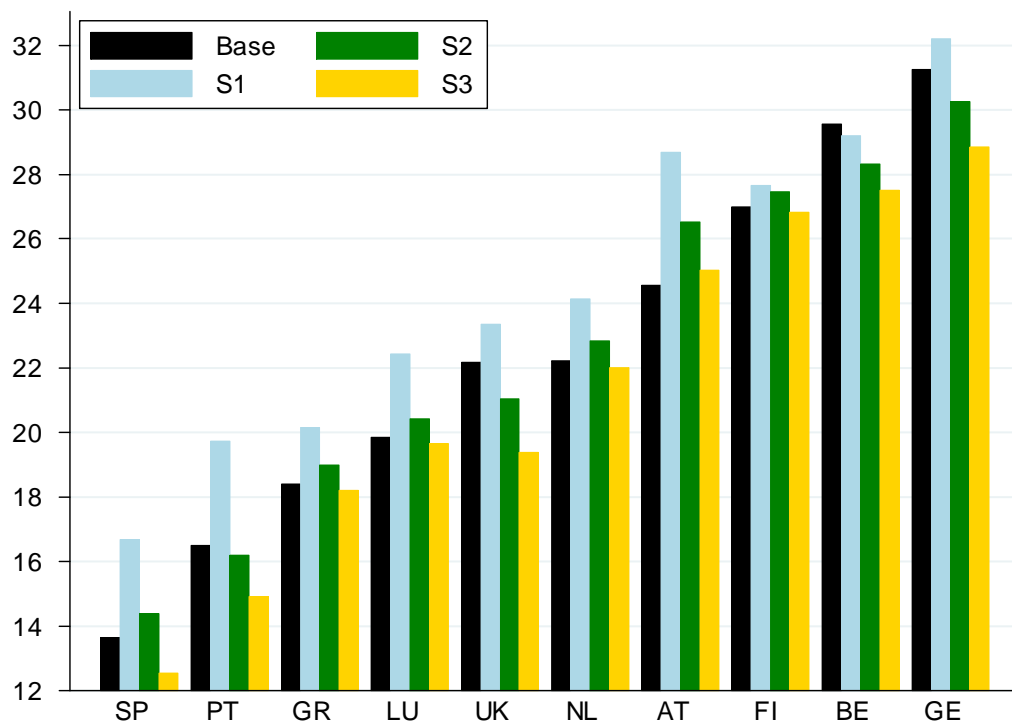
Figure 8: Effective average tax rates (mean), %

The effective average tax burden is rather low in Spain, Portugal, Greece, and Luxembourg, average in UK, the Netherlands, and Austria and rather high in Finland, Belgium and Germany. The scenarios can be ranked in the following: $EATR(S1) > EATR(S2) > EATR(S3)$. Therefore, increasing the allowance dominates the increase in (statutory) marginal rate and leads to decreasing EATRs although the revenue is kept constant. In scenario S1 the EATRs increase in all countries (except BE) in comparison to the baseline, scenario S3 is always lower and S2 depends on the country.

To sum up, flat tax rates required to attain revenue neutrality with existing personal allowances (the first scenario) decrease EMTRs in all countries leading to increasing labour supply incentives.[27] On the other hand, (revenue neutral) flat rates necessary to keep the inequality levels close to their baseline values (the third scenario) lead to ambiguous effects. Incentives improve in Mediterranean and most Continental countries but worsen in other countries.

4.4   Summary of results

There are already distinct differences between the analysed countries under the present systems. In terms of distributional measures two groups of countries can be differentiated: inequality, polarisation, (relative) poverty and richness are rather high in Southern European countries (Greece, Portugal and Spain) and the UK, whereas they are rather low in Continental Europe (Austria, Belgium, Germany, Luxembourg) and Finland. In terms of redistribution two different groups become visible: progression is rather low in Finland, the UK, Germany, Austria and the Netherlands, whereas it is rather high in Belgium, Greece, Portugal, Luxembourg and Spain. When looking at both dimensions a matrix with 4 groups emerges (see Table 1) resembling the modified typology of Esping-Andersen[28]: Mediterranean countries with high inequality and progression, Anglo-Saxon (or liberal) with high inequality and low progression, Continental European (or conservative) with low inequality and high progression and Nordic (or social-democratic) countries with low inequality and progression. This classification, however, is not completely consistent with Esping-Andersen (1990) as Germany and Austria are classified as social-democratic welfare states whereas Esping-Andersen sees them as prototypical conservative Continental European welfare states.

The variation in the effects of the scenarios across countries is summarised in Table 2.

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[27]One should note, however, that higher incentives do not necessarily lead to higher labour supply and welfare depending on the directions of the income and substitution effects based on the respective labour supply elasticities. However, recent studies for the Netherlands by Jacobs et al. (2007) and Germany by Fuest et al. (2007) are comparable with our scenarios S1 and S2. In summary, these studies find and increase in labour supply (and inequality) for scenario S1, whereas in scenario S2 inequality is held constant resulting in negligible efficiency effects.

[28]See Arts and Gelissen (2002).

Progression		Inequality/Poverty/Richness	
		low	high
Progression	low	AT, FI, GE (social-democratic)	UK (liberal)
	high	BE, LU, NL (conservative)	GR, PT, SP (Mediterranean)

Table 1: Classification of countries based on the existing tax-benefit systems

Different groups can be classified according to the welfare state typology. In the Nordic and Anglo-Saxon countries inequality increases (and progression decreases) only in scenario S1. In the Southern European countries inequality increases in scenarios S1 and S2 whereas progression decreases in S1 (and S2 in Spain). In Continental Europe inequality increases (and progression decreases) in all three scenarios (except Germany). In general, the effects of a flat tax reform also differ with changes in the marginal tax rate and the basic tax allowance. Incentives increase in all countries for scenarios S1 and S2 (except FI, UK) as well as for Mediterranean and Continental countries in scenario S3.

	Inequality			Progression			Poverty			Richness			EMTRs		
	S1	S2	S3	S1	S2	S3	S1	S2	S3	S1	S2	S3	S1	S2	S3
AT	+	+	+	-	-	(-)	+	+	+	+	+	(+)	-	-	+
BE	+	+	(~)	-	(-)	(-)	+	+	+	+	+	-	-	-	+
FI	+	-	-	-	+	+	(+)	-	-	+	-	-	-	+	+
GE	+	+	(-)	-	(-)	+	+	+	+	+	+	-	-	-	-
GR	+	+	-	-	-	(+)	+	(~)	(~)	+	+	(~)	(~)	(~)	(~)
LU	+	+	+	-	-	(-)	+	+	+	+	+	+	-	-	-
NL	+	+	+	-	-	(~)	+	(+)	-	+	+	(+)	-	-	-
PT	+	+	-	-	-	+	+	+	(+)	+	+	+	-	-	-
SP	+	+	(~)	-	-	(-)	+	+	+	+	+	(-)	-	-	(~)
UK	+	-	-	-	+	+	+	-	-	+	-	-	-	+	+

Table 2: Summary of simulation results
Note: the symbols have the following meanings: + / - : significant increase (decrease) in all measures considered, (+) / (-): significant increase (decrease) in most measures, (~): ambiguous results or no significant changes.

Our analysis shows that the selection of the schedule and tax base parameters is crucial for the effects of flat tax reforms in terms of equity and efficiency. Low parameter values that attain revenue neutrality with existing personal allowances decrease EMTRs and therefore increase labour supply incentives. This, however, leads to more inequality, poverty and polarisation as low rates benefit mainly those with high incomes at the expense of low and middle income households. On the other hand, higher flat rates keep the inequality levels unchanged. However, this does not necessarily imply strong disincentive effects for all countries. In fact, for some

countries the EMTRs decrease in all three scenarios resulting in increasing incentives even in for scenario S3 with a high marginal rate.

5   Conclusion

Flat income taxes have become increasingly popular in Eastern Europe. However, this popularity has not yet reached Western European countries with well-established middle classes. Using EUROMOD we provide a microsimulation analysis of different flat tax designs for selected Western European countries in a common framework.

In general, a revenue neutral flat tax reform cannot overcome the fundamental equity-efficiency trade-off. However, in some cases such as Greece, Portugal and Spain an increase in both equity and incentives is possible. These countries have the typical Mediterranean welfare state regime, characterised by high inequality, poverty, richness and polarisation of the income distribution. These distributional characteristics imply a lack of a well-established middle class. Therefore, the distributional effects are less adverse than in countries with a more equal income distribution. Switching to a flat tax regime in this setting can reduce inequality and increase efficiency in terms of labour supply incentives. However, the resulting flat rates are rather high.

When interpreting these results, one has to be aware of the fact that we limit our analysis to static models. However, flat taxes are also supposed to have positive dynamic efficiency and growth effects.[29] These long-term effects might make increasing inequality acceptable. Nevertheless, the question arises whether a personal income tax reform is the best instrument to increase growth and employment. The user costs of labour and capital play an important role in determining the labour and investment demand. These user costs, however, are determined more by social security contributions and corporate taxes than by personal income tax.

Nevertheless, the immediate and short-term distributional effects analysed in this paper are most likely to be decisive for the political feasibility of a flat tax reform. The main problem of implementing a flat rate tax could be to convince a majority of the population that redistribution in favour of the highest income decile is acceptable. These distributional effects at the expense of the middle class help to explain why flat rate taxes have not been successful in the political process in Western Europe. However, our analysis shows that for some Mediterranean countries a flat tax can increase both equity and efficiency. This also suggests that these and other countries with similar income distributions and welfare state structures are more prone to follow such reforms.

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[29]Cf. Stokey and Rebelo (1995) or Cassou and Lansing (2004).

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Appendices

A   EUROMOD
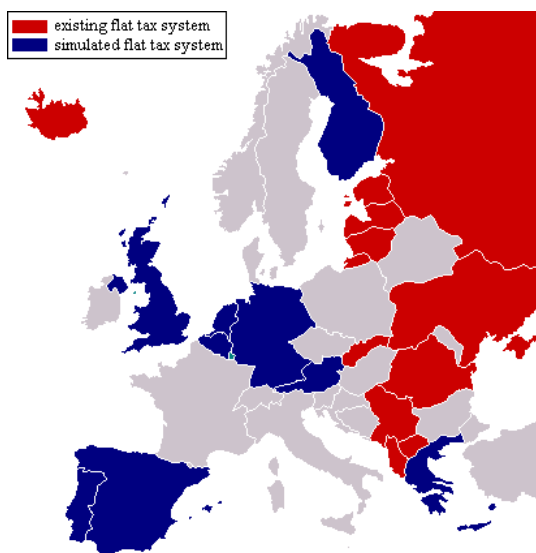
Figure 9: Existing and simulated flat tax systems in Europe

	Input dataset for EUROMOD	No of households	Date of col-lection	Reference time period for incomes
AT	Austrian version of EU-SILC	4,521	2004	annual 2003
BE	Panel Survey on Belgian Households	2,975	2002	annual 2001
FI	Income distribution survey	10,736	2001	annual 2001
GE	German Socio-Economic Panel	11,303	2002	annual 2001
GR	Household Budget Survey	6,555	2004/5	annual 2003/4
LU	PSELL-2	2,431	2001	annual 2000
NL	Sociaal-economisch panelonderzoek	4,329	2000	annual 1999
PT	European Community Household Panel	4,588	2001	annual 2000
SP	European Community Household Panel	5,048	2000	annual 1999
UK	Family Expenditure Survey	6,634	2000/1	month in 2000/1

Table 3: EUROMOD input datasets (version C13)

	No of brackets	Lowest (pos) rate	Highest rate	Form of the main tax relief	Capital taxation	Tax unit
AT	4	21%	50%	0% tax bracket, tax credit	flat tax (25%)	individual
BE	5	25%	50%	tax allowance	optional flat tax (15%)	some sharing
FI	5	state 12%, local 15%	state 35%, local 19.75%	0% tax bracket (state), tax allowance (local)	flat tax (29%)	individual
GE	4	19.9%	48.5%	0% tax bracket	integrated	optional joint
GR	3	15%	40%	0% tax bracket	integrated	individual
LU	16	8%	38%	0% tax bracket	integrated	joint
NL	4	1.7%	52%	tax credit	flat tax (30%)	individual
PT	6	12%	40%	tax credit	flat tax (20%)	joint
SP	5	15%	45%	tax allowance	integrated	optional joint
UK	3	10%	40%	tax allowance	one bracket slightly reduced	individual

Table 4: Income tax systems, 2003

	Original Income	Taxes	SIC	Benefits
AT	98.74	19.99	16.75	38.01
BE	108.20	28.31	13.06	38.27
FI	103.69	30.62	5.27	32.14
GE	108.06	21.16	17.24	30.30
GR	93.94	9.79	13.78	29.63
LU	94.45	13.65	11.86	31.05
NL	114.30	13.57	21.53	20.84
PT	100.40	12.08	10.02	21.70
SP	97.42	16.07	5.78	24.48
UK	107.15	22.79	5.82	21.46

Table 5: Mean value of income components in relation to DPI, baseline 2003 in %

B   Inequality, poverty and richness

	PL	FGT0 (HCR)				FGT1				FGT2			
		Base	S1	S2	S3	Base	S1	S2	S3	Base	S1	S2	S3
AT	859.22	11.06	16.19	13.70	12.61	1.93	2.97	2.45	2.25	0.58	0.87	0.73	0.69
BE	809.52	10.00	14.68	11.97	10.94	3.39	4.10	3.74	3.63	1.99	2.25	2.16	2.14
FI	838.33	12.24	12.76	9.95	9.64	2.17	2.17	1.75	1.74	0.63	0.60	0.52	0.52
GE	801.56	13.04	15.06	13.88	13.38	2.74	3.00	2.84	2.81	0.97	1.02	1.00	1.00
GR	437.40	19.48	20.54	19.51	19.50	6.36	6.50	6.37	6.36	3.34	3.37	3.34	3.34
LU	1,274.24	9.31	14.64	11.83	10.72	1.10	2.09	1.46	1.30	0.25	0.46	0.31	0.28
NL	871.00	11.87	14.87	12.93	11.41	2.37	2.82	2.42	2.28	1.20	1.30	1.19	1.16
PT	347.43	20.89	23.65	21.22	21.44	4.75	5.59	4.78	4.71	1.40	1.71	1.40	1.38
SP	548.13	19.18	22.89	20.26	19.21	5.40	6.78	5.75	5.41	2.47	3.03	2.58	2.47
UK	575.07	16.17	17.16	15.38	15.08	3.00	3.13	2.90	2.88	1.05	1.08	1.03	1.03

Table 6: Poverty line and rate
Sources: own calculation using EUROMOD version C13.
Note: PL: poverty line, FGTα: Foster et al. (1984) poverty measure.

	RL	R0 (HCR)				R1				R2			
		Base	S1	S2	S3	Base	S1	S2	S3	Base	S1	S2	S3
AT	2,864.06	5.19	7.68	6.12	5.08	1.02	1.83	1.40	1.03	0.35	0.70	0.51	0.36
BE	2,698.39	3.72	6.67	5.17	3.61	0.78	1.37	0.97	0.72	0.32	0.51	0.37	0.28
FI	2,794.42	5.06	5.88	4.65	3.43	1.23	1.52	1.12	0.79	0.53	0.65	0.47	0.33
GE	2,671.85	7.79	9.79	8.03	7.07	1.48	2.16	1.66	1.29	0.46	0.76	0.55	0.39
GR	1,458.00	9.81	10.82	10.21	10.00	2.24	2.77	2.46	2.23	0.82	1.13	0.95	0.80
LU	4,247.46	6.41	10.72	8.71	7.88	1.22	2.37	1.86	1.51	0.38	0.86	0.63	0.47
NL	2,905.09	5.46	7.20	6.36	5.18	0.96	1.63	1.28	1.01	0.29	0.59	0.44	0.34
PT	1,158.09	13.51	15.36	13.44	14.12	4.16	5.31	4.34	4.00	1.83	2.59	1.98	1.69
SP	1,827.09	10.18	12.57	11.42	9.99	2.12	3.26	2.60	2.11	0.70	1.25	0.93	0.71
UK	1,921.48	10.51	11.19	9.73	8.30	2.40	2.86	2.23	1.76	0.87	1.12	0.83	0.61

Table 7: Richness line and rate
Sources: own calculation using EUROMOD version C13.
Note: RL: richness line, Rα: Peichl et al. (2006) richness measure.

Table 8: Income inequality

	Gini				GE0				GE1				GE2				PS			
	Base	S1	S2	S3	Base	S1	S2	S3	Base	S1	S2	S3	Base	S1	S2	S3	Base	S1	S2	S3
AT	0.239	0.277	0.257	0.243	0.095	0.127	0.110	0.099	0.102	0.143	0.122	0.106	0.131	0.211	0.172	0.141	0.228	0.259	0.242	0.231
BE	0.246	0.281	0.262	0.247	0.108	0.128	0.112	0.101	0.116	0.142	0.121	0.105	0.196	0.237	0.189	0.150	0.231	0.270	0.251	0.237
FI	0.269	0.278	0.251	0.231	0.127	0.134	0.112	0.096	0.175	0.186	0.151	0.122	0.587	0.618	0.452	0.315	0.243	0.251	0.224	0.206
GE	0.268	0.289	0.275	0.265	0.119	0.137	0.125	0.117	0.120	0.144	0.128	0.117	0.141	0.183	0.156	0.136	0.261	0.277	0.267	0.262
GR	0.322	0.336	0.326	0.321	0.191	0.205	0.195	0.189	0.175	0.198	0.183	0.173	0.209	0.258	0.228	0.205	0.305	0.310	0.306	0.304
LU	0.243	0.283	0.264	0.252	0.094	0.127	0.110	0.101	0.099	0.139	0.119	0.107	0.117	0.178	0.149	0.129	0.242	0.275	0.258	0.249
NL	0.247	0.274	0.258	0.248	0.103	0.126	0.113	0.105	0.102	0.132	0.116	0.105	0.119	0.174	0.148	0.128	0.245	0.265	0.251	0.244
PT	0.361	0.393	0.367	0.356	0.211	0.250	0.218	0.206	0.229	0.282	0.240	0.220	0.313	0.416	0.337	0.292	0.321	0.335	0.322	0.315
SP	0.311	0.348	0.325	0.312	0.177	0.216	0.191	0.178	0.167	0.216	0.188	0.169	0.210	0.315	0.260	0.221	0.293	0.319	0.302	0.295
UK	0.307	0.321	0.303	0.292	0.153	0.167	0.151	0.140	0.166	0.189	0.166	0.149	0.235	0.302	0.248	0.206	0.298	0.302	0.293	0.289

Sources: own calculation using EUROMOD version C13.

Note: GEc indices of the generalised entropy (GE) family, PS: polarisation index of Schmidt (2004).

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C Distribution of tax payments and disposable income

	AT			BE			FI			GE			GR		
	S1	S2	S3	S1	S2	S3	S1	S2	S3	S1	S2	S3	S1	S2	S3
1	-8.01	-4.44	-2.79	-7.05	-3.68	-2.46	0.70	5.27	5.83	-1.18	-0.54	-0.51	-0.13	0.01	0.01
2	-9.70	-5.51	-2.73	-8.19	-4.09	-1.34	-1.47	4.80	7.98	-3.62	-1.19	-0.05	-1.29	-0.04	0.08
3	-8.22	-4.76	-1.73	-9.01	-5.07	-1.15	-1.51	3.96	7.72	-5.14	-1.40	0.97	-1.90	-0.40	0.22
4	-7.51	-4.44	-1.68	-6.48	-2.98	0.21	-1.72	2.54	6.17	-4.76	-1.46	1.05	-2.66	-0.66	0.47
5	-6.04	-3.53	-1.24	-4.38	-1.19	1.59	-1.90	0.51	3.07	-4.32	-1.84	0.53	-2.65	-0.95	0.22
6	-4.73	-3.04	-0.99	-1.59	-0.30	1.22	-1.90	-0.71	1.01	-3.49	-1.12	1.20	-2.89	-1.43	-0.26
7	-3.42	-2.57	-1.47	0.27	0.79	1.75	-1.35	-1.36	-0.67	-2.64	-1.27	0.31	-2.90	-1.39	-0.21
8	-1.70	-1.85	-1.27	2.26	1.31	0.81	-1.13	-2.26	-2.56	-1.59	-1.14	-0.34	-2.01	-0.96	0.11
9	1.21	-0.45	-1.19	4.24	2.28	1.00	0.07	-2.58	-4.41	0.70	-0.88	-1.88	-1.71	-0.94	0.38
10	11.57	5.16	-0.52	9.26	2.63	-3.49	3.62	-5.01	-13.13	7.38	2.02	-2.68	6.88	2.51	-0.89

	LU			NL			PT			SP			UK		
	S1	S2	S3	S1	S2	S3	S1	S2	S3	S1	S2	S3	S1	S2	S3
1	-8.08	-2.64	-1.13	-3.41	0.14	1.29	-3.66	0.10	0.21	-7.59	-0.82	0.26	-0.58	0.54	0.66
2	-9.15	-4.36	-2.11	-4.34	-1.05	0.70	-5.38	-0.34	0.42	-9.22	-2.89	0.05	-1.32	1.44	2.54
3	-8.16	-3.99	-1.54	-5.09	-1.66	0.11	-6.42	-1.69	-0.30	-8.08	-3.05	0.15	-1.99	1.43	3.23
4	-8.75	-5.23	-2.94	-4.60	-2.16	-0.43	-6.45	-0.35	0.89	-7.51	-3.43	-0.84	-2.24	1.80	4.27
5	-7.92	-5.30	-3.51	-3.86	-2.08	-0.53	-6.08	-0.69	1.30	-5.76	-2.36	0.41	-2.45	1.15	4.21
6	-6.10	-4.61	-2.79	-2.50	-1.59	-0.41	-6.57	-0.88	1.78	-5.30	-2.53	-0.12	-2.40	0.50	3.17
7	-4.58	-4.42	-3.73	-2.53	-2.08	-1.10	-5.82	-1.02	1.77	-2.65	-1.34	0.28	-2.15	-0.07	2.45
8	-2.65	-2.97	-2.51	-0.88	-1.21	-1.03	-4.07	-1.60	1.84	-0.81	-1.20	-0.69	-1.42	-0.85	0.31
9	2.63	0.45	-0.46	1.37	-0.10	-0.73	0.06	-1.08	0.95	1.76	-0.16	-0.67	-0.48	-1.60	-1.61
10	12.05	6.16	1.51	9.75	4.91	0.95	11.24	2.59	-2.99	11.79	5.19	0.05	6.23	-0.26	-5.77

Table 9: Changes in disposable income by income decile, %
Sources: own calculation using EUROMOD version C13.

Table 10: Average tax payment by income decile and changes under simulated scenarios (%)

	AT				BE				FI				GE				GR			
	Base	S1	S2	S3	Base	S1	S2	S3	Base	S1	S2	S3	Base	S1	S2	S3	Base	S1	S2	S3
1	7.66	543.09	98.97	-25.07	0.29	9,863.46	4,441.63	2,606.60	44.74	-12.37	-69.79	-75.43	0.56	585.90	-24.44	-92.66	-0.05	-299.30	21.87	21.87
2	33.61	146.72	44.63	-13.40	30.64	230.57	111.32	32.78	86.44	14.17	-36.22	-61.46	11.96	140.40	3.80	-47.83	0.49	583.40	15.07	-37.04
3	60.99	73.92	25.14	-16.20	61.26	120.10	60.47	5.82	132.39	10.37	-20.63	-42.37	39.59	74.48	7.19	-29.96	2.05	265.30	54.17	-31.88
4	84.84	54.51	21.67	-8.59	111.08	46.52	18.93	-6.31	178.49	9.72	-9.39	-26.28	64.78	50.99	8.01	-22.96	4.10	225.53	50.55	-40.45
5	114.04	37.67	15.23	-4.95	160.26	25.13	6.45	-9.92	222.20	9.31	0.07	-10.22	102.78	33.54	9.65	-13.19	10.76	103.57	34.21	-10.66
6	149.05	24.79	11.95	-3.03	227.20	6.70	0.90	-5.87	268.66	8.24	4.43	-1.62	150.92	21.56	4.38	-12.52	17.41	79.45	35.02	1.62
7	185.30	14.25	8.43	0.95	291.79	0.27	-2.32	-6.30	326.57	5.84	6.36	4.26	208.77	13.63	4.63	-5.81	27.72	58.98	24.96	0.26
8	250.15	4.83	5.21	1.83	370.76	-6.36	-3.85	-2.76	395.46	4.52	8.69	9.95	305.01	6.46	3.49	-1.17	51.24	28.22	11.30	-3.93
9	355.53	-7.48	-0.56	2.51	491.19	-11.33	-6.35	-3.23	518.16	0.84	8.79	14.18	453.96	-2.90	2.14	5.00	81.44	18.08	8.62	-6.45
10	914.86	-31.31	-14.51	0.42	993.50	-19.46	-5.82	6.77	1,080.43	-7.49	13.22	32.61	988.16	-18.71	-5.56	5.91	342.60	-26.08	-9.57	3.08

	LU				NL				PT				SP				UK			
	Base	S1	S2	S3	Base	S1	S2	S3	Base	S1	S2	S3	Base	S1	S2	S3	Base	S1	S2	S3
1	5.35	816.08	88.44	-97.10	11.35	122.97	-20.78	-59.29	0.33	1,634.80	-54.17	-100.00	0.48	2,924.37	282.53	-97.00	2.33	114.37	-82.14	-96.11
2	12.34	496.20	119.38	-43.21	19.91	135.04	18.80	-28.50	0.82	1,194.20	60.55	-96.38	3.88	751.69	199.89	-9.13	12.12	57.93	-50.02	-83.00
3	28.16	254.62	82.20	-9.69	29.62	124.23	28.24	-10.32	3.12	483.39	102.51	3.02	14.16	226.00	76.63	-7.30	23.27	53.04	-30.76	-61.43
4	37.38	219.80	98.18	23.56	44.57	84.14	30.67	-0.63	4.83	370.87	17.91	-52.96	23.32	148.22	60.49	9.79	42.55	31.99	-24.71	-53.65
5	55.37	162.49	90.43	42.26	63.10	57.29	25.86	0.12	8.64	232.86	23.95	-51.64	41.31	73.97	27.63	-9.13	67.98	23.93	-12.27	-41.34
6	110.48	71.58	45.34	12.48	95.52	31.91	17.23	-0.55	12.77	203.50	24.59	-55.36	52.03	60.32	27.14	-2.19	92.04	19.67	-5.10	-27.48
7	168.60	35.53	31.02	20.00	119.30	29.80	22.16	8.09	20.82	127.71	22.74	-38.98	87.10	22.01	9.99	-4.85	133.36	14.00	-0.42	-17.62
8	242.43	12.76	13.91	7.93	169.36	11.53	12.01	7.86	42.29	54.09	21.58	-23.98	125.00	5.87	7.09	2.21	185.32	8.34	4.30	-3.04
9	442.46	-16.78	-6.03	-2.27	268.54	-5.11	2.68	4.85	91.40	1.37	9.01	-7.36	198.57	-7.90	1.27	2.89	258.12	3.36	7.82	6.96
10	1,134.19	-39.52	-21.09	-6.68	671.41	-33.01	-16.32	-2.87	371.10	-39.06	-8.53	10.80	517.62	-35.29	-15.41	0.05	637.00	-17.39	1.79	17.89

Sources: own calculation using EUROMOD version C13.

Table 11: Tax progression

	Musgrave-Thin				Kakwani				Reynolds-Smolensky				Vertical Equity				Reranking				Suits			
	Base	S1	S2	S3	Base	S1	S2	S3	Base	S1	S2	S3	Base	S1	S2	S3	Base	S1	S2	S3	Base	S1	S2	S3
AT	1.102	1.041	1.085	1.116	0.131	0.054	0.106	0.142	0.046	0.019	0.039	0.052	0.048	0.021	0.041	0.054	0.002	0.002	0.002	0.002	0.200	0.068	0.150	0.215
BE	1.104	1.071	1.115	1.149	0.120	0.078	0.122	0.156	0.043	0.029	0.047	0.060	0.049	0.032	0.050	0.064	0.006	0.003	0.003	0.004	0.193	0.122	0.201	0.267
FI	1.088	1.075	1.127	1.164	0.121	0.102	0.166	0.208	0.042	0.035	0.060	0.078	0.043	0.037	0.062	0.080	0.001	0.001	0.002	0.002	0.163	0.126	0.223	0.294
GE	1.095	1.082	1.111	1.129	0.146	0.127	0.163	0.186	0.048	0.041	0.056	0.065	0.055	0.048	0.062	0.071	0.007	0.007	0.006	0.006	0.189	0.150	0.212	0.258
GR	1.082	1.065	1.080	1.087	0.132	0.106	0.128	0.140	0.030	0.024	0.029	0.032	0.031	0.025	0.030	0.033	0.001	0.001	0.001	0.001	0.254	0.176	0.238	0.277
LU	1.072	1.027	1.064	1.083	0.120	0.044	0.100	0.130	0.029	0.011	0.025	0.033	0.031	0.012	0.026	0.034	0.002	0.001	0.001	0.001	0.217	0.071	0.175	0.241
NL	1.084	1.046	1.078	1.095	0.112	0.063	0.103	0.124	0.036	0.020	0.034	0.041	0.039	0.022	0.036	0.044	0.003	0.002	0.002	0.003	0.160	0.053	0.127	0.174
PT	1.090	1.034	1.085	1.101	0.143	0.056	0.135	0.160	0.031	0.012	0.029	0.034	0.032	0.012	0.030	0.035	0.001	0.001	0.001	0.001	0.277	0.084	0.245	0.318
SP	1.090	1.033	1.085	1.110	0.137	0.051	0.128	0.166	0.029	0.011	0.028	0.036	0.030	0.011	0.028	0.036	0.001	0.000	0.000	0.000	0.287	0.078	0.244	0.346
UK	1.094	1.072	1.109	1.131	0.142	0.109	0.163	0.194	0.039	0.030	0.046	0.055	0.041	0.031	0.047	0.056	0.001	0.001	0.001	0.001	0.219	0.147	0.248	0.319

Table 11: Tax progression

Sources: own calculation using EUROMOD version C13.

Table 12: Share of winners and losers, %

	S1			S2			S3		
	W	0	L	W	0	L	W	0	L
AT	20.52	4.67	74.81	14.62	9.56	75.81	27.14	14.87	57.99
BE	36.04	12.18	51.78	43.67	16.46	39.87	46.04	17.86	36.10
FI	26.78	18.77	54.44	41.06	16.14	42.79	48.72	11.22	40.06
GE	15.58	30.84	53.58	33.08	34.55	32.38	32.54	34.20	33.26
GR	10.44	41.87	47.69	9.71	67.51	22.78	21.46	63.26	15.28
LU	20.46	2.62	76.92	30.69	10.43	58.88	40.29	12.69	47.03
NL	24.26	7.85	67.89	25.79	21.61	52.60	38.55	22.39	39.06
PT	15.08	13.97	70.95	20.26	50.19	29.55	35.88	47.64	16.48
SP	19.40	7.79	72.81	24.91	30.07	45.02	34.88	33.02	32.10
UK	9.79	27.37	62.85	31.71	37.66	30.63	42.08	30.14	27.78

Table 12: Share of winners and losers, %

Note: category '0' refers to disposable income changes less than 10 euros per month.

Sources: own calculation using EUROMOD version C13.

D Efficiency: effective average and marginal tax rate

		AT	BE	FI	GE	GR	LU	NL	PT	SP	UK
Base	median	26.56	33.39	27.41	33.70	19.45	17.73	26.55	13.92	13.62	24.71
	mean	24.56	29.55	27.00	31.27	18.41	19.86	22.23	16.49	13.65	22.18
S1	median	31.61	32.87	30.01	36.87	21.56	22.44	28.78	19.85	18.80	26.10
	mean	28.69	29.20	27.67	32.21	20.15	22.43	24.13	19.73	16.67	23.36
S2	median	29.55	32.48	29.89	31.92	19.45	20.90	29.13	13.52	15.21	23.82
	mean	26.54	28.33	27.46	30.25	18.99	20.42	22.85	16.20	14.39	21.05
S3	median	26.02	31.37	28.81	26.56	19.45	17.74	26.76	11.00	8.60	19.23
	mean	25.03	27.52	26.83	28.85	18.21	19.66	22.02	14.92	12.53	19.39

Table 13: Effective average tax rates at the individual level
Sources: own calculation using EUROMOD version C13.
Note: EATR defined as (Income tax + SIC) / (market income). Includes individuals aged 18-64 with employment income but no self-employment and replacement incomes

		AT	BE	FI	GE	GR	LU	NL	PT	SP	UK
Base	median	41.04	51.02	43.40	50.01	19.45	35.46	45.36	23.00	28.83	31.40
	mean	40.16	59.90	38.07	45.20	21.87	34.76	38.45	25.72	24.11	35.30
S1	median	35.37	40.54	39.62	45.98	21.40	26.85	33.26	21.32	22.88	31.90
	mean	35.59	50.76	35.60	39.66	22.02	27.84	32.76	23.92	19.43	34.17
S2	median	43.62	49.23	49.16	49.87	19.45	35.94	32.27	21.60	27.65	41.90
	mean	39.52	55.57	40.19	42.85	21.89	31.29	35.78	25.08	23.76	38.65
S3	median	51.66	57.93	58.70	49.59	19.45	38.52	39.00	11.00	37.65	49.20
	mean	42.49	60.42	44.41	44.85	21.62	32.70	37.64	22.74	24.11	40.18

Table 14: Effective marginal tax rates at the individual level
Sources: own calculation using EUROMOD version C13.
Note: EMTR defined as [1 – (change in hh disposable income) / (increase in individual earnings)] and includes individuals aged 18-64 with positive earnings.

		AT	BE	FI	GE	GR	LU	NL	PT	SP	UK
Base	< 0	0.0	0.2	0.4	0.3	0.0	0.0	2.8	0.0	0.0	0.0
	[0-0.1)	6.3	0.5	12.0	8.5	24.2	0.6	5.5	8.9	21.3	4.4
	[0.1-0.2)	11.5	1.9	5.8	1.3	32.4	21.3	0.5	28.8	4.6	1.6
	[0.2-0.3)	0.9	0.9	7.6	7.9	10.3	18.2	10.8	29.5	44.4	9.5
	[0.3-0.4)	12.5	4.5	14.0	11.7	11.0	25.6	10.4	17.6	25.8	61.6
	[0.4-0.5)	59.9	25.5	41.6	20.2	21.3	29.6	57.0	11.5	3.6	12.1
	[0.5-0.6)	6.1	57.9	16.1	40.9	0.8	1.4	8.5	0.4	0.0	1.1
	[0.6-0.7)	0.1	0.6	0.6	6.0	0.0	0.0	0.8	0.0	0.1	4.2
	[0.7-0.8)	0.1	0.4	0.6	1.9	0.0	0.1	0.6	0.2	0.0	3.0
	[0.8-0.9)	0.1	0.5	0.2	0.1	0.0	0.0	0.6	1.4	0.0	1.0
	[0.9-1)	0.0	0.8	0.1	0.0	0.0	0.2	0.3	1.5	0.0	0.4
	> 1	2.5	6.3	1.2	1.1	0.0	3.0	2.6	0.3	0.2	1.1
S1	< 0	0.0	0.1	0.0	0.3	0.0	0.0	2.7	0.0	0.0	0.0
	[0-0.1)	4.0	1.0	14.6	12.0	19.9	0.5	4.8	3.5	7.9	4.4
	[0.1-0.2)	0.4	2.4	0.7	0.7	16.4	16.7	15.4	16.0	37.8	0.1
	[0.2-0.3)	10.7	0.1	0.9	21.7	25.3	76.2	23.3	57.3	53.9	18.8
	[0.3-0.4)	78.3	28.8	76.8	6.1	37.7	3.3	16.7	19.4	0.0	65.0
	[0.4-0.5)	3.3	57.6	3.2	47.0	0.7	0.0	7.7	0.1	0.0	1.0
	[0.5-0.6)	0.1	0.5	0.5	6.8	0.0	0.1	24.3	0.2	0.0	0.3
	[0.6-0.7)	0.0	0.6	0.9	1.3	0.0	0.1	0.8	0.0	0.0	4.3
	[0.7-0.8)	0.1	0.5	0.8	2.8	0.0	0.1	0.7	0.1	0.1	3.5
	[0.8-0.9)	0.1	0.3	0.4	0.1	0.0	0.1	0.4	1.3	0.0	1.1
	[0.9-1)	0.2	1.4	0.1	0.0	0.0	0.6	0.5	0.9	0.0	0.5
	> 1	2.9	6.8	1.2	1.2	0.0	2.4	2.6	1.1	0.2	1.1
S2	< 0	0.0	0.1	0.0	0.1	0.0	0.0	2.7	0.0	0.0	0.0
	[0-0.1)	6.2	1.8	20.6	14.4	25.9	0.7	5.2	4.7	24.4	11.0
	[0.1-0.2)	10.2	6.8	0.9	1.0	31.2	26.5	0.3	37.7	0.3	3.9
	[0.2-0.3)	0.8	0.1	0.7	13.5	1.0	9.9	27.1	10.6	28.7	1.0
	[0.3-0.4)	10.4	0.3	1.0	17.6	18.6	56.9	31.9	32.8	46.3	18.0
	[0.4-0.5)	69.8	74.2	71.5	5.2	22.7	2.9	2.4	10.6	0.0	57.7
	[0.5-0.6)	0.0	8.4	2.4	29.5	0.5	0.1	25.4	0.1	0.0	0.8
	[0.6-0.7)	0.1	0.3	0.5	15.7	0.0	0.0	0.8	0.2	0.1	0.5
	[0.7-0.8)	0.1	0.5	0.6	1.1	0.0	0.1	0.8	0.2	0.0	3.2
	[0.8-0.9)	0.1	0.6	0.6	0.9	0.0	0.1	0.5	1.4	0.0	2.6
	[0.9-1)	0.0	0.6	0.1	0.1	0.0	0.2	0.4	1.5	0.0	0.5
	> 1	2.4	6.5	1.0	1.1	0.0	2.7	2.6	0.3	0.2	1.1
S3	< 0	0.0	0.1	0.0	0.1	0.0	0.0	2.7	0.0	0.0	0.0
	[0-0.1)	6.4	1.9	25.1	15.4	28.6	0.7	5.5	8.0	43.1	20.3
	[0.1-0.2)	20.2	11.4	1.1	2.2	38.9	40.9	0.2	58.1	0.5	6.7
	[0.2-0.3)	1.6	0.3	0.7	20.4	1.7	1.5	12.5	0.4	0.4	1.1
	[0.3-0.4)	0.3	0.3	1.1	1.3	0.4	9.5	37.0	23.7	23.9	1.2
	[0.4-0.5)	11.3	0.4	1.2	16.9	16.3	42.2	22.3	0.6	31.9	21.1
	[0.5-0.6)	57.7	72.0	66.9	2.4	14.2	2.1	3.8	0.0	0.0	43.8
	[0.6-0.7)	0.0	6.0	1.9	28.7	0.0	0.0	12.0	5.9	0.1	1.0
	[0.7-0.8)	0.0	0.5	0.4	10.8	0.0	0.1	0.7	0.2	0.0	0.1
	[0.8-0.9)	0.0	0.8	0.4	0.2	0.0	0.0	0.4	1.4	0.0	2.6
	[0.9-1)	0.1	0.5	0.3	0.5	0.0	0.2	0.3	1.4	0.0	1.1
	> 1	2.4	5.9	0.8	1.1	0.0	2.8	2.5	0.3	0.2	1.1

Table 15: Distribution of effective marginal tax rates by intervals (%)
Sources: own calculation using EUROMOD version C13.
Note: EMTR defined as [1 − (change in hh disposable income) / (increase in individual earnings)] and includes individuals aged 18-64 with positive earnings.