Benefiting from a European 'fiscal union'? Redistribution vs. stabilization*

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Abstract

The Great recession and the resulting debt crisis have given rise to a debate concerning deeper fiscal integration in Europe. Recent studies mostly take a macro perspective when analyzing possible steps towards a European 'fiscal union'. In contrast, this paper provides an evaluation method at the individual level and calculates the equivalent variation for the benchmark case of a common tax and transfer system relative to the baseline with national systems. Importantly, the approach allows for a decomposition into a redistributive and a stabilization effect. Based on counterfactual simulations and micro data for 27 EU member states, results suggest that especially Eastern European countries would gain from such a reform, mainly due to the redistributive effect. Fiscal integration of fewer but more similar countries generally reduces redistributive and increases the stabilizing effects. However, Pareto improving reforms where at least one country gains while no one loses seem to be possible only for rather severe crisis scenarios with substantial shocks to gross income, or for high levels of individual risk aversion. While the specific results depend on the form of fiscal integration analyzed, it is argued that the general mechanisms identified might hold for various options of a European 'fiscal union'.

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1 Introduction

The Great recession and the following debt crisis renewed a debate about deeper fiscal integration in Europe. Options discussed range from the introduction of balanced budget rules to the more ambitious project of developing a 'fiscal capacity' for the European Union (EU) or at least the euro area (EA). The latter "could take several forms" with "various options" to be explored, as mentioned by the President of the European Council, Herman van Rompuy, in October 2012.[1] Subsequently, EU Commissioner László Andor suggested a European unemployment benefit scheme that could act as an insurance device in presence of macroeconomic shocks, complementary to national unemployment insurances.[2] In November 2012, the European Commission built upon these initiatives when launching an official "blueprint for a deep and genuine economic and monetary union" (European Commission (2012)).

Since then, different options of a European fiscal union have been discussed in various studies (e.g. Allard and et al. (2013), Dullien (2013), Enderlein et al. (2013), Enderlein et al. (2012)) while the question of how to optimally design a (European) fiscal union has also gained renewed interest in the more theoretical literature (e.g. Drèze and Durré (2013), Engler and Voigts (2013), Evers (2012), Werning and Farhi (2012)). These proposals and studies indicate an ongoing debate about fiscal integration in Europe and show that fiscal institutions in the EU could become more similar to those of existing federations like the US, e.g. including elements of a joint tax and transfer system. While the main argument in favor of integrated fiscal mechanisms is that they can act as insurance devices in the presence of asymmetric macroeconomic shocks[3], the main concern in the debate relates to possible permanent transfers across member countries.[4]

[1]'Towards a genuine Economic and Monetary Union', Interim Report, The President of the European Council, Brussels, 12 October 2012, p. 4.

[2]László Andor: 'A strong employment agenda – the pathway to economic recovery', dinner speech at the Conference "Jobs for Europe: The Employment Policy Conference" , Brussels, 6 September 2012, European Commission, SPEECH/12/588.

[3]This is especially important for the EA, where contrary to monetary policy, fiscal policy remained the responsibility of the individual member states which had two implications. First, a joint monetary and exchange rate policy can be too restrictive to cushion asymmetric shocks in single countries. Second, the experiences in the recent economic crisis have shown that national fiscal policy might be unable to fulfill this function when countries are credit constrained. According to the theory of optimal currency areas (Mundell (1961)), asymmetric economic shocks could be counterbalanced by open international labor markets and flexible wages. Though, labor mobility in Europe is known to be rather low.

[4]However, one should note that a certain harmonization of living standards across the European

Most of the recent studies mentioned take a macro perspective when analyzing possible steps towards a European 'fiscal union'. In contrast, this paper provides an evaluation method at the individual level and calculates the equivalent variation for the benchmark case of an EU-wide tax and transfer system relative to the baseline with national systems. Importantly, the approach allows for a decomposition into a "redistributive" and a "stabilization" effect. Our study is closely related to Bargain et al. (2013) and Dolls et al. (2013) who firstly addressed this issue using household micro data. This allows to take individual household heterogeneity across and within EU member countries into account. For 11 founding members of EA and 2001 data, Bargain et al. (2013) analyzed the economic implications of i) an EU-wide integrated tax and transfer system and ii) a fiscal equalization mechanism. Dolls et al. (2013) updated this work to 17 EA members. However, both studies assessed redistributive effects (at the micro level) separately from stabilizing effects (at the macro level). In this paper, we extend their analysis and use an expected utility framework to assess both elements at the individual level in an integrated way. This allows to study the important question under which conditions a European fiscal federation could be Pareto improving such that at least one country gains while no one loses.[5]

We employ the the European tax-benefit calculator EUROMOD which uses harmonized and representative household micro data and allows calculating taxes, transfers and disposable incomes for each household in the sample. On this basis, we construct a European tax and transfer system using data and systems from 2007 for 27 EU member states.[6] As in Bargain et al. (2013) and Dolls et al. (2013), our design of a fiscal union can be interpreted as an average of the national tax-transfer systems. Most importantly, on the one hand, this leads to revenue neutrality of the reform at the EU level, while necessarily implying redistributive effects across countries on the other hand. Though, we argue that an average mechanism including countries' tax-transfer systems weighted by respective population sizes might be the most natural first step in terms of the design of such a system.

The main results go as follows. We find that a majority of countries, repre-

member states is a general goal of the EU (Art. 158 on 'economic and social cohesion' of the Treaty establishing the European Community) and could also be a political aim as such within more fiscal integration.

[5]Though, we are not able to take into account any behavioral adjustments to the reform (see also Section 6).

[6]These are all current EU member states except Croatia, which joined the EU on July 1st, 2013 and is not yet included in EUROMOD.

sented by their median voters, would gain from fiscal integration with equivalent variations ranging from a huge contribution of -530 EUR per month in Ireland to 188 EUR per month in Hungary, and being mainly driven by the redistributive component. Effects across gross income deciles within countries differ greatly and depend on income levels and the structures of existing national systems. We show and explain that countries which benefit (lose) in terms of the redistributive component, generally tend to show relatively low (high) benefits in terms of the stabilizing component. Subsequently, we additionally consider smaller fiscal unions, namely for 17 members of the euro area[7], its 12 founding members, as well as two further subgroups as sometimes discussed in the political debate under the label of a "North" and a "South" euro area. Moving to such groups of more similar countries generally reduces redistributive and increases the stabilizing effects. However, Pareto improving reforms where at least one country gains while no one loses seem to be possible only for rather severe crisis scenarios with substantial shocks to gross income, or for high levels of individual risk aversion.

The reforms we simulate are very prospective from a political viewpoint and rather meant as a conceptual experiment to illustrate the evaluation method proposed and to provide insights in general issues of setting up a European fiscal union. However, common tax-transfer policies are a key element of existing fiscal federations and will certainly be introduced in the EU or EA as well in the medium or long term. While always depending on the specific aim and design of the system, the general mechanisms identified might hold for various options of a European fiscal union where redistributive and stabilizing effects can be expected. The method proposed allows to study the economic effects of such options with a consistent framework at the individual level.

The rest of the paper is structured as follows. In Section 2, we review the most important related literature. Section 3 introduces the concept and design of a fiscal union and develops the framework for an economic evaluation. The microdata and the tax-transfer calculator EUROMOD are presented in Section 4, together with first descriptive information. The presentation of the key findings follows in Section 5. Section 6 discusses the results and limitations of our analysis and concludes.

[7]These are the current EA member countries except Latvia, which joined the EA on January 1st, 2014.

2 Related literature

The related literature addressing issues on the integration of fiscal policies in Europe is vast and we restrict our review to work that specifically studies potential redistributive and/or stabilizing effects of fiscal policy integration in the EU/EMU. We refer to Bargain et al. (2013) for a broader covering.

An important early discussion of the key issues can be found in the MacDougall (1977) Report, which argues that EMU would be impracticable due to the absence of a common fiscal policy which plays a major role in existing economic unions to cushion asymmetric fluctuations. Besides, the report also argued explicitly in favor of a transfer union harmonizing living standards in Europe. Arguments for equalizing welfare of European citizens through economic and fiscal integration can also be found in Wildasin (1991), Casella (2005) or Atkinson (2002) and Atkinson (2013). However, most of the literature focuses on the specific implications of EMU for fiscal policy in Europe, stressing one main issue. Along the lines of Mundell (1961) and Kenen (1969), many economists argued that the Euro area is far from being an optimum currency area and thus, needs to be complemented by a European fiscal federation to counterbalance asymmetric fluctuations (the former President of the European Commission, Jacques Delors, emphasized this already 24 years ago, see Delors (1989)). On the one hand, the reason is that a joint monetary policy might be too restrictive when countries are very heterogeneous which could even reinforce economic fluctuations and the divergence of member state economies. On the other hand, the effectiveness of national fiscal policy in a monetary union to cushion asymmetric shocks seems to be limited (e.g. due to time lags or lack of fiscal discipline); see e.g. Eichengreen (1990), Sachs and Sala-i Martín (1992), Mélitz and Vori (1993), Bayoumi and Masson (1995), Asdrubali et al. (1996), Masson (1996), Eichengreen and Wyplosz (1998), Engwerda et al. (2002), Galí and Perotti (2003), Uhlig (2003) and, for a detailed overview, von Hagen and Wyplosz (2008).

In contrast, Fatás (1998) shows that the cross-regional insurance potential of a European fiscal federation would be limited (around 10% of an income shock). His main objection to some of the other empirical studies is that they fail to distinguish properly between intertemporal transfers on the one hand, and interregional insurance on the other hand. He argues that intertemporal transfers are essentially self-insurance against shocks that can be provided by national governments through debt financing. However, this debt has to be counterbalanced in the future. The same effect has to be taken into account for transfers at a federal level and only the remaining component can be considered as true interregional insurance (risk-sharing). As a response to Fatás (1998), Forni and Reichlin (1999) focus on the latter, too, but find that 40% of long-run income volatility of the EU15 are potentially insurable through a pure joint insurance device, i.e. without generating (ex-ante) redistributive effects. In addition, both studies stress the general difficulty of avoiding (ex-post) redistribution within such an insurance mechanism, namely the additional effect on income levels in the long-run rather than on income volatility only (basically due to time lags or mistargeting). This might cause problems for political implementability (on this, see also von Hagen (1992), Goodhart and Smith (1993), Obstfeld and Peri (1998)).

Two remarks have to be made with view to the present paper. First, we are not able to properly distinguish between intertemporal stabilization and cross-regional insurance. The main reason is data limitation, i.e. we can only use cross-sections for all countries under analysis in a comparable way and are thus not able to provide empirical estimates for intertemporal stabilization at a national level or the amount of insurable risk at a common level (based on country-specific income volatility). We therefore rely on a counterfactual approach using tax-transfer calculators and derive stabilization measures assuming hypothetical shocks to gross income. The advantage of the counterfactual approach is the clear identification of the simulated effect (Bourguignon and Spadaro (2006)) and given that we are interested in hypothetical effects of European fiscal integration (simulated on basis of the same methodology) this seems to be an appropriate strategy. Furthermore, as traditional in public finance, the concept of stabilization we consider is a static one. That is, we consider 'contemporaneous' automatic stabilization of disposable income through the immediate impact of the tax-transfer system following a shock to gross income, without implying any (macro- or microeconomic) feedback mechanism (cf. Dolls et al. (2012)).

Second, given our simulation experiment, we have to consider a relevant case when studying stabilizing effects of fiscal integration. Based on his distinction between intertemporal stabilization and cross-regional insurance, Fatás (1998) argues that only the latter would justify a European fiscal federation. However, this is only true when countries have free access to capital markets in order to finance debt.

That this access in fact can be lost was exactly one of the experiences in the 2008-09 crisis which led to destabilizing effects particularly in some Southern European countries (see e.g. Bertola (2013)). Thus, one main argument for European fiscal integration is the provision of stabilization from a federal budget when individual countries are credit constrained but the union is not.[8] Therefore, assuming credit constraints at the country level is of key importance to our study.

3 Methodology

In this section, we provide the theoretical framework for our analysis. We first describe how a fiscal union is constructed and second, introduce the framework for an economic evaluation at the individual level.

3.1 Concept of a 'fiscal union'

Generally, different concepts of a 'fiscal union' are possible and the political debate in Europe covers options ranging from fiscal rules for the member states for policy coordination and supervision, over crisis resolution mechanisms (as the European Stabilization Mechanism ESM or the ECB Outright Monetary Transactions) up to a European fiscal capacity in form of an EU level unemployment insurance, for instance (see e.g. Bordo et al. (2011), Fuest and Peichl (2012)). The latter element would be a clear step towards an integration (of elements) of the member states' tax and transfers systems. Even if not at the top of the agenda in the current political debate, a EU fiscal union complementing the currency union can be seen as a final step of European economic integration and its analysis will therefore provide interesting and important results. This is the aim of the present paper. We thus define a fiscal union as a (complete) integration of its member states tax and transfer systems.

Net taxes within a single country. Consider first how 'net taxes' at the national level are derived. Gross market income X_i of household i is defined as the sum of all incomes from market activities:

[8] This of course requires that participating countries are sufficiently heterogeneous in the sense that income volatilities are not perfectly correlated such that the fiscal union can be assumed to stay solvent.

$$X_i = E_i + Q_i + I_i + P_i + O_i + SICER_i, \tag{1}$$

where E_i is labor, Q_i business, I_i capital, P_i property, and O_i other income. We also assume that employer social insurance contributions $SICER_i$ are part of gross market income in order to include them into the coverage of the tax and transfer system. Disposable income Y_i is defined as market income minus net government intervention $T_i = TAX_i + SIC_i - BEN_i$:

$$Y_i = X_i - T_i = X_i - (TAX_i + SIC_i - BEN_i), \tag{2}$$

where TAX_i are income taxes, $SIC_i = SICEE_i + SICER_i$ the sum of employee ($SICEE_i$) and employer social insurance contributions, and BEN_i cash benefits (i.e. negative taxes). In the following, we refer to the difference between taxes and social insurance contributions paid and transfers received, T_i, as 'net taxes'. Assuming that individuals i might reside in different countries $k = 1, ..., K$, disposable income will be determined by country-specific net tax schedules

$$T_{ik} = f_k(X_i, \mathbf{z}_i), \tag{3}$$

where $\mathbf{z}_i$ is a vector of all demographic characteristics relevant for taxation, like marriage status, age or number of children and $f_k(X_i, \mathbf{z}_i)$ is a function that transforms market income X_i into disposable income Y_{ik} (which might be non-linear as usually observed in reality).

Construction of a fiscal union. Now, countries $k = 1, ..., K$ define a common tax and transfer system denoted $T_{iEU} = f_{EU}(X_i, \mathbf{z}_i)$. An important precondition for its implementation is that the reform will be performed in a revenue neutral way at the overall level. Thus, we assume that this tax system is constructed such that, for the union as a whole and given market incomes, it generates the same net tax revenue as the national tax systems in sum do: $\sum_{i=1}^{N_1} T_{i1} + ... + \sum_{i=1}^{N_K} T_{iK} = \sum_{k=1}^{K} \sum_{i=1}^{N_k} T_{iEU}$. The easiest way to introduce a revenue neutral common tax system by construction is to use the "average" system over all participating countries,

$$T_{iEU} = f_{EU}(X_i, \mathbf{z}_i) = \frac{1}{K} \sum_{k=1}^{K} f_k(X_i, \mathbf{z}_i). \qquad (4)$$

Taking the average of the national system is certainly a specific assumption in constructing a fiscal union and can be debated. However, we argue that as a first step, it appears to be a very natural approach since the national tax systems enter the joint system with the weight of its respective population. Then, the more similar (different) the national tax systems are, the less (more) pronounced will be the "averaging" effect. As shown by Bargain et al. (2013), it is then very straightforward to alter the design of the common system by, for instance, changing its progressivity into the direction of a certain group of countries while compromising on the tax-transfer design of the remaining member states. In the present paper, we do not alter the average system but rather consider various compositions of a fiscal union. We thus provide a first point of reference without entering the debate about generally increasing or decreasing the size of the government nor the debate about which specific tax-transfer design among different countries should be favored.

Effects on overall tax revenue and national budgets. As mentioned above, we assume that the fiscal union will be introduced in a revenue neutral way at the overall level. However, this generally implies non-revenue neutrality at the national level. The reason is that the integrated system collects revenue from all citizens in the participating countries and we assume that this revenue goes to a common budget. Thus, the national countries lose their tax revenue. We therefore have to make an important further assumption, which is, that the net revenue now available at the union level is redistributed to the member states *after* the implementation of the reform such that each national government is fully compensated for the loss in its *initial* net revenue. The main reason for this assumption is that national expenditures on public goods and services, as well as revenue from other tax sources at the national level and national public deficits should be unaffected by the reform. As we do not consider any behavioral adjustments to the tax reform, the revenue collected at the union level will be exactly sufficient to compensate the governments of the member states for their net revenue losses. In sum, what essentially changes are the revenues from direct taxes and the expenses for cash transfers, collected from and paid to the households within the single countries, affecting their net tax burdens, while all revenues and expenditures outside the direct tax and (cash) transfer system are kept constant. In other words, redistribution is performed between households in terms of disposable income, not between countries in terms of revenues.[9]

3.2 The individual value of moving to a 'fiscal union'

Individual expected utility. We assume that individuals derive utility from consumption only using a constant relative risk aversion (CRRA) utility function as standard in the literature:

$$U(C_i) = \frac{C_i^{1-\rho}}{1-\rho}; \rho > 0, \rho \neq 1, \tag{5}$$

where i indexes individuals, and ρ is the coefficient of relative risk aversion. As we consider a single period in time, we assume that individuals do not save and consumption C_i thus equals disposable income Y_i (market income X_i minus net taxes T_i as defined in the previous section). Individuals form expectations about two different situations: one in which they receive the current level of consumption, $C_i^0 = X_i^0 - T_i^0$, and one in which the current level of consumption will be altered due to a shock to market income that occurs with a certain probability α, $C_i^1 = X_i^1 - T_i^1$. Individual expected utility thus reads:

$$E_i[U(C_i)] = (1-\alpha)U(C_i^0) + \alpha U(C_i^1). \tag{6}$$

The degree of risk aversion is reflected by the concavity of the utility function and leads to the fact that $U(E_i[C_i]) > E_i[U(C_i)] = U(CE_i)$. That is, the individual would accept a certain guaranteed level of consumption denoted CE_i which is less than the expected (but insecure) level of consumption $E_i[C_i]$. CE_i is also called the "certainty equivalent" and is a monetary equivalent expression of expected utility $E_i[U(C_i)]$. Precisely, using (5) we get:

$$E_i[U(C_i)] = U(CE_i) = \frac{CE_i^{1-\rho}}{1-\rho} \tag{7}$$

$$\Leftrightarrow \quad CE_i = \{(1-\rho)E_i[U(C_i)]\}^{\frac{1}{1-\rho}}. \tag{8}$$

[9]This is the systematic difference to a fiscal equalization mechanism, cf. Bargain et al. (2013).

Equivalent variation. Assume a group of single countries $k = 1, ..., K$ that form a fiscal union (indexed EU as above in the following) by (completely) integrating their national tax-transfer systems. Under this new tax regime, individuals will receive a level of consumption $C^0_{iEU} = X^0_i - T^0_{iEU}$ in the current situation ($C^1_{iEU} = X^1_i - T^1_{iEU}$ after a shock) which might be different from their former level of consumption $C^0_{ik} = X^0_i - T^0_{ik}$ ($C^1_{ik} = X^1_i - T^1_{ik}$ after a shock). We assume that individuals form expectations after the policy switch $T_k \rightarrow T_{EU}$ in the same way as they did before. We then ask for the change in individual expected utility (in monetary terms) due to the regime change, i.e. for the equivalent variation (EV_i) of the integrated tax-transfer system relative to the baseline with the national system. Precisely, the equivalent variation is defined as the amount such that the individual would be indifferent between (i) the situation under the given national tax and transfer system and receiving the equivalent variation and (ii) the situation under the integrated system. EV_i will then be positive (negative) if the regime change is welfare increasing (decreasing). Using (8) we get an explicit expression for the equivalent variation in terms of the certainty equivalent CE_i:

$$U(CE_{ik} + EV_i) - U(CE_{iEU}) = 0 \tag{9}$$

$$\Leftrightarrow \quad \frac{(CE_{ik} + EV_i)^{1-\rho}}{1-\rho} = \frac{CE_{iEU}^{1-\rho}}{1-\rho} \tag{10}$$

$$\Leftrightarrow \quad CE_{iEU} - CE_{ik} = EV_i. \tag{11}$$

3.3 Decomposition

Redistributive and stabilization value. In the given framework of expected utility, moving to an integrated tax-transfer system will generally have two effects on individual welfare: (i) a "redistributive" effect due to the fact that individual net tax burdens and thus disposable income will change in the baseline situation and (ii) a "stabilization" effect due to the fact that the adjustment of individual net tax burdens, following a shock to market income, might differ as well under the integrated compared to the national system. It is important not to mix that up with the redistributive and insurance capacities of a given tax-transfer system within a single country.[10] In our case, the terms of "redistribution" and "stabilization" only refer to the policy switch, i.e. to the extent to which changes in initial net tax burdens across countries and households on the one hand and the differences in the insurance capacity across the regimes on the other hand affect individual expected utility. In order to express both effects separately, we decompose the total value of the individual equivalent variation EV_i (indexed T in the following and suppressing index i for notational simplicity) accordingly. To perform this, consider first the following decomposition of individual expected utility (independent of the tax regime), adding and subtracting the counterfactual value of consumption where market income is shock adjusted but net taxes are not modified, $X^1 - T^0$ (such that overall expected utility does not change):

$$E[U(C)] = \underbrace{(1-\alpha)U(X^0 - T^0) + \alpha U(X^1 - T^0)}_{\textit{expected utility when } X^1 - X^0 = \Delta X = \Delta C, \textit{ i.e.: } \Delta T = 0} \tag{12a}$$

$$+ \underbrace{\alpha U(X^1 - T^1) - \alpha U(X^1 - T^0)}_{\textit{change in expected utility due to } \Delta T \neq 0}. \tag{12b}$$

We denote the first term of the decomposition $E^*[U(C)]$ and the accordant certainty equivalent CE^* which can be derived from $E^*[U(C)] = U(CE^*)$. When $X^0 > X^1$ and $T^0 > T^1$, we have $E^*[U(C)] < E[U(C)]$ and (12b) will be positive. Using (12a) and (12b) to derive the change in individual expected utility for the regime switch, we get:

$$E[U(C_{EU})] - E[U(C_k)] = \underbrace{(1-\alpha)U(X^0 - T^0_{EU}) + \alpha U(X^1 - T^0_{EU})}_{=E^*[U(C_{EU})]} \tag{13a}$$

$$- \underbrace{(1-\alpha)U(X^0 - T^0_k) + \alpha U(X^1 - T^0_k)}_{=E^*[U(C_k)]} \tag{13b}$$

$$+ \alpha U(X^1 - T^1_{EU}) - \alpha U(X^1 - T^0_{EU}) \tag{13c}$$

$$- [\alpha U(X^1 - T^1_k) - \alpha U(X^1 - T^0_k)]. \tag{13d}$$

[10] See Hoynes and Luttmer (2011) who develop a framework to separately identify both effects using US data.

We interpret $E^*[U(C_{EU})] - E^*[U(C_k)]$ as the "redistributive" effect of the regime change on individual expected utility. It is that part of the overall change in expected utility which is caused by the difference in the level of initial net tax burdens between the national and the integrated tax regime, i.e. by $T_k^0 \neq T_{EU}^0$, and not by how the two regimes respond to the shock in market income in terms of net tax adjustment. In contrast, if we had $T_k^0 = T_{EU}^0$, $E^*[U(C_{EU})] - E^*[U(C_k)]$ would be equal to zero. Using equality $E^*[U(C_{EU})] - E^*[U(C_k)] = U(CE_{EU}^*) - U(CE_k^*)$, the associated value of the equivalent variation, denoted EV_R, can be derived:

$$U(CE_{EU}^* + EV_R) - U(CE_k^*) = 0 \tag{14}$$

$$\Leftrightarrow \quad EV_R = CE_{EU}^* - CE_k^*. \tag{15}$$

The remaining "stabilization" component follows from the difference of (13c) and (13d) and captures the change in individual expected utility which is due to the difference in the adjustment of initial net tax burdens after a shock between the two regimes, $T_0 \rightarrow T_1$ (though, differences in the levels of T_0 and T_1 across systems will impact the size of the adjustment; this is further discussed in the empirical section). Note that without any further assumption, this component can be positive or negative and joining the fiscal union can thus increase or a decrease the extent of automatic stabilization for a single country compared to the initial situation under the national tax system. Formally, the corresponding value for the equivalent variation, denoted EV_S, is given by subtracting (15) from (11):

$$EV_T - EV_R = EV_S \tag{16}$$

Credit constraint at the country level. As pointed out in Section 2, one important feature of a fiscal integration of countries $k = 1, ..., K$ will be the provision of automatic stabilization in presence of a negative income shock when individual countries are credit constrained but the fiscal union is not. We assume that individuals will be informed also about this and modify their formation of expectations accordingly. A credit constraint at the country level essentially implies that a single country k will not be able to finance the implied automatic decrease in taxes (increase in transfers) following a negative shock to market income by issuing debt.[11] That is, in this case we have $\Delta T_k = 0$ and theoretically, individuals would have to bear the full shock to gross income under the national system such that $\Delta X = \Delta C_k$. This leads exactly to the counterfactual level of consumption that has been introduced above, $X^1 - T^0$, and $E[U(C_{EU})] - E[U(C_k)]$ thus becomes:

$$
\begin{aligned}
E[U(C_{EU})] - E[U(C_k)] &= (1-\alpha)U(X^0 - T^0_{EU}) + \alpha U(X^1 - T^0_{EU}) && \text{(17a)}\\
&\quad -(1-\alpha)U(X^0 - T^0_k) + \alpha U(X^1 - T^0_k) && \text{(17b)}\\
&\quad +\alpha U(X^1 - T^1_{EU}) - \alpha U(X^1 - T^0_{EU}) && \text{(17c)}\\
&\quad -\underbrace{[\alpha U(X^1 - T^0_k) - \alpha U(X^1 - T^0_k)]}_{=0} && \text{(17d)}\\
&= E[U(C_{EU})] - E^*[U(C_k)]. && \text{(17e)}
\end{aligned}
$$

Using equality $E[U(C_{EU})] - E^*[U(C_k)] = U(CE_{EU}) - U(CE^*_k)$ and (8) we get the accordant value of the total equivalent variation, denoted EV_{T^*}:

$$
U(CE_{EU} + EV_{T^*}) - U(CE^*_k) = 0 \Leftrightarrow CE_{EU} - CE^*_k = EV_{T^*}. \tag{18}
$$

Note that the redistributive value of the equivalent variation is unchanged and by substituting EV_T with EV_{T^*} in (16), the stabilization value becomes:

$$
EV_{S^*} = EV_{T^*} - EV_R = CE_{EU} - CE^*_k - (CE^*_{EU} - CE^*_k) = CE_{EU} - CE^*_{EU}, \tag{19}
$$

i.e. the "stabilizing" effect on individual expected utility rests entirely on the capacity of the fiscal union to provide insurance against a negative income shock.[12]

[11] In reality, decreasing incomes in a downturn in presence of credit constraints would even imply statutory tax increases/benefit cuts leading to destabilizing effects.

[12] Note that in this case, EV_{S^*} will always be positive (given that $T^0_{EU} > T^1_{EU}$).

4 Data and empirical implementation

4.1 EU-SILC and EUROMOD

As in Bargain et al. (2013), we use EUROMOD as a basis for our analysis. EUROMOD is a static tax-benefit calculator for the EU countries which allows for comparative analysis of tax-benefit systems and their impact on the income distribution in a consistent way through a common framework. However, in contrast to those authors, we are able to apply the latest version of EUROMOD available which uses input-data mainly on basis of the European Union Statistics on Income and Living Conditions (EU-SILC) released by Eurostat, starting from 2006 up to 2008, and which allows for a simulation of policy systems up to 2010 for 27 EU member countries.

The simulated components include most direct taxes (especially income taxes on all sources of income including tax credits, payroll taxes and social insurance contributions) and benefits (e.g. welfare benefits, social assistance and partly also transfers based on previous contributions, e.g. unemployment benefits). Information on consumption is missing in the data; hence indirect taxes and taxes on corporate profits are not included in the model, likewise in-kind benefits. Clearly, these elements differ between countries and would affect the results presented. However, with view to an integration of tax-transfer policies across EU member states, one can argue that also existing fiscal unions do not cover all taxes and transfers at the federal level. Also, EUROMOD assumes full benefit take-up and tax compliance focusing on the intended effects of tax-benefit systems only.

The main stages of the simulations are as follows. First, a representative micro-data sample of individuals in households (essentially including information on all gross income components as well as all demographic characteristics that are relevant to determine taxes and benefits) and the respective tax-benefit rules are read into the model. Subsequently, the model constructs corresponding assessment units (for instance the individual or household) for each tax and benefit instrument, according to the underlying eligibility rules. On that basis, all taxes and benefits are simulated, and finally, disposable income is calculated.

In this paper, we use EU-SILC wave 2008, covering information for 2007, i.e.

income data from the year before the crisis, and apply 2007 tax-transfer rules.[13] While simulations are usually carried out for counterfactual situations, EUROMOD also simulates various taxes and transfers for the baseline that are not observed in the original data. For our purpose, we use the original data provided by EUROMOD complemented by those simulated components. For more detailed information on the current version of EUROMOD and the underlying input data, see Sutherland and Figari (2013). In the next section, we explain how the EUROMOD data and model is used to construct an integrated EU-wide tax-benefit model.

4.2 Tax-transfer integration

With the EUROMOD data at hand (i.e. all relevant demographic characteristics taken from the original data source but homogeneously coded and named plus the net income/net tax components as simulated by EUROMOD), we construct an EU-wide tax-benefit system in two main steps. However, rather than utilizing EUROMOD directly for this task, we opt for a regression approach which can be seen as a "short-cut" way to design a tax-transfer calculator, being more flexible for our purpose. Therefore, we first predict net taxes calculated by EUROMOD as precisely as possible for each country in the sample in the following way. As explained above, EUROMOD simulates the country specific net taxes (income and payroll taxes minus benefits) $T_{ik} = f_k(X_i, \mathbf{z}_i)$ as a function of gross market income X_i and a vector of non-income factors (demographic characteristics) $\mathbf{z}_i$ taken from the original data, while $f_k(X_i, \mathbf{z}_i)$ covers the set of all country-specific tax-benefit rules that are read into EUROMOD. We take the same set of characteristics $(X_i, \mathbf{z}_i)$ as our right-hand side variables and regress T_{ik} as simulated by EUROMOD using a very flexible OLS specification, including higher order polynomials to account for non-linear effects and interaction terms of income with all relevant characteristics observed in the data for the assignment of taxes and benefits (for similar approaches, see e.g. Frenette et al. (2007), Biewen and Juhasz (2012), Bargain et al. (2013)). That is, we estimate the following function separately for each country k but using the same specification:[14]

[13]For three countries, France, Malta and the UK, we use uprated incomes provided by EUROMOD as 2007 data is not directly available.

[14]Note that even if our analysis below is entirely performed at the individual level, the tax functions are estimated and validated at the household level. The main reason is that most of

$$T_{ik} = \tilde{f}_k(X_i, \mathbf{z}_i) + \epsilon_i. \quad (20)$$

$\tilde{f}_k(.)$ denotes a transformation $(X_i, \mathbf{z}_i) \rightarrow T_{ik}$ which now is (technically) different from $f_k(.)$ and ϵ_i is the OLS residual. Subsequently, $\hat{T}_{ik}$ is predicted and validated against T_{ik}. Tables A.3 and A.4 in the appendix summarize this information and show the mean values for disposable income as simulated by EUROMOD and predicted with our tax function across gross income deciles, together with the average percentage error in the prediction as indicated in the note to the tables. With errors of usually around $0-1\%$ and almost always below 5% (the same is true for the overall Gini coefficient and the decile ratio), we can conclude that our estimated net tax functions do a pretty good job in predicting EUROMOD net taxes for the single countries.

For consistency reasons, predicted net taxes $\hat{T}_{ik}$ are then used in the second main step (i.e. rather than taking T_{ik}) to estimate the integrated net tax function on the pooled sample in the same way over all countries (i.e. single-country systems in the baseline and the counterfactual EU tax function are based on exactly the same specification):

$$\hat{T}_{ik} = \omega_i \tilde{f}_{EU}(X_i, \mathbf{z}_i) + \epsilon_i. \quad (21)$$

Note that by construction, this is the "average" approach to the design of an integrated tax-transfer system as defined in the previous section, capturing the cross-country differences in $\hat{T}_{ik}$. Accordingly, $\tilde{f}_{EU}(.)$ denotes the "average" transformation $(X_i, \mathbf{z}_i) \rightarrow \hat{T}_{ik}$ and ω_i is the household sample weight. In Section 5 below, five different fiscal unions with altering number and composition of participating countries are analyzed, namely the EU27 (27 member countries of the EU), EA17 (17 current member countries of the euro area), EA12 (12 founding members of the euro area) and a hypothetical "North" and "South" euro area with each five member countries. For all five unions, we use the same specification but separately estimate the average function in order to predict a unique system. The main estimation output is summarized in Table A.5 in the appendix, showing the most important

the taxes and transfers across countries are assigned to the household as the assessment unit, rather than to the individual. Thus, a regression of household net taxes on household income and characteristics turned out to be the superior approach.

single coefficients such as all gross income components, number and age of children or age, hours worked and marital status of the different adult household members. Most coefficients turn out to be significant and show signs as expected. In all five cases, the fit of the regression in terms of the $R2$-measure is around 0.98. In the last step, the average function is then used to predict net taxes $\hat{T}_{iEU}$, i.e. the net taxes that households would have to pay if they were entirely taxed under the integrated system. In the following, $\hat{T}_{ik}$ and $\hat{T}_{iEU}$ (and accordant predictions for simulated shocks to gross income X_i) are the key ingredients to our analysis.

4.3 Descriptive information

In this section, we provide descriptive information on the most important variables used as well as on the estimated EU tax system. Table 1 reports values of these variables for the overall EU level and all 27 EU member countries. With view to the individual-level concept of expected utility, our unit of observation throughout the analysis is the individual aged 18-59. However, we account for differences in family size and composition using equivalized income.[15] After the population shares in column 1, columns 2 and 3 report means of gross and disposable income per month and columns 4-7 of gross taxes, (employer plus employee) social insurance contributions (SIC), gross benefits and net taxes.

[Table 1 about here.]

The member countries from Eastern Europe make up the lower end of the overall income distribution (with 205 EUR of disposable income in Romania which is only 15% of the EU average) while Luxembourg is the richest country with 2905 EUR (207% of the EU average), followed by Ireland. Note however, that income levels are not adjusted for differences in purchasing power.[16] Scandinavian countries show the highest levels of gross taxes, followed by Belgium, the UK and the Continental European countries. They are particularly low for most Southern and Eastern European countries. SIC are especially important in France. Benefit levels

[15] We adjust all income variables using the OECD modified equivalence scale. That is, for each person, the equivalized (per-capita) income is its household income divided by the household specific equivalence scale which is a sum of weights equal 1.0 for the household head plus 0.5 for every additional adult member and 0.3 for each child aged less than 14.

[16] The main reason is that also existing fiscal unions are not based on purchasing power adjusted income. Also, Bargain et al. (2013) re-calculated their key findings using purchasing power parities and did not get significant differences.

are most generous in Ireland and Luxembourg and lowest in the Eastern European countries, with more than 100 EUR per month in Slovenia only. Resulting net taxes in column 7 are highest for the scandinavian and most of the Continental European countries, while especially low for Ireland compared to its level of gross income.

Finally, column 8 shows how net taxes would look like under the EU average system, revealing considerable differences to the initial situation. Unsurprisingly, the member countries from Eastern Europe benefit the most with net taxes less than 10 EUR for Bulgaria and Hungary and being even negative in Romania (-63 EUR). Ireland and Luxembourg are the largest contributors to the system. Surprising at first glance, most of the Southern European countries would have to contribute as well, especially Cyprus, Greece and Malta. The reason is, that compared to the other countries, they show quite low levels of taxes and SIC relative to their gross income (as Ireland and Luxembourg) as well as relative to the level of benefits they grant. This becomes more obvious with Figures A.1 and A.2 in the appendix which plot net taxes corresponding to columns 7 and 8 in Table 1 for the gross income distribution in each country. High income households in all three countries mentioned pay much lower net taxes compared to similar households in the EU while especially low income households in Malta also receive less benefits. On the contrary, a further inspection reveals that high income households in Belgium, Finland and Sweden will benefit from the reform due to high initial progression under their national systems (while the average system apparently would be quite close to existing tax systems in Austria, Germany and the Netherlands). In Eastern European countries, almost all households across the income distribution gain from the reform due to very low income levels compared to the rest of Europe while in Ireland and Luxembourg, it is the other way round. The fact that different parts of the income distribution within countries are often affected differently raises the question about incerasing/decreasing income inequality. Table A.1 in the appendix reports Gini coefficients and Musgrave-Thin indices (as a measure of redistribution/effective progression), as well as Generalized Entropy indices, and shows that inequality *between* countries is declining through the reform but also raising *within* a couple of member states.

5 Results

In this section, we present the key results of our analysis in three subsections. All subsections focus on equivalent variations of an integrated EU tax-transfer system relative to the baseline with national systems for (i) the median voters of the countries and (ii) for gross income deciles within countries (first two subsections). Section 5.1 considers a fiscal union for 27 EU member states. In Section 5.2 the focus is narrowed to the 17 members of the current euro area and three further subgroups, namely the 12 founding members of the euro area as well as a hypothetical "North" and "South" euro area. A sensitivity analysis with respect to the model parameters is provided in Section 5.3.

5.1 Baseline results: EU27

This section considers the economic effects when moving from the existing national tax-transfer systems to a fully integrated system for the EU27 member states, utilizing the framework developed in Section 3. Even if unrealistic in terms of political feasibility (in the short run), we focus on this case as a benchmark. Bargain et al. (2013) have shown that altering the degree of integration for such a system in terms of the weight of the supranational regime does change quantitative magnitudes but not qualitative findings. The authors also considered various rules for political implementability, including the voting rules of the Treaty of Nice (currently in force) and the Lisbon Treaty (supposed to be enacted from 2014 onwards). However, decisions of the Council of the European Union in tax matters so far require unanimity. As explained above, by construction, our approach is very likely to produce "winner" and "loser" countries in terms of equivalent variations. We therefore do not focus on different scenarios for political feasibility but stick to the unanimity rule when discussing the possibility of Pareto improving reforms in Section 5.3.

In the baseline, the parameter values for computing equivalent variations are set as follows. For the coefficient of relative risk aversion, we assume a value of three ($\rho = 3$), which appears to be standard in the literature (see e.g. Hoynes and Luttmer (2011)). With view to the working age population, the probability that an income shock occurs is set to 0.08, the mean unemployment rate in the EU in 2007. As in Dolls et al. (2012), the shock itself is assumed to be a 5% reduction in market income, proportional across all countries and households. One might argue that a 5% decrease in market income is quite low with view to an income shock following unemployment. However, we start with rather modest parameters to identify the implications of our framework sequentially and introduce a more substantial shock in Section 5.3. There, we also alter the baseline values of the other parameters.[17]

Table 2 presents median values for five different equivalent variations as defined in Section 3. For the initial case when countries are not assumed to be credit constrained, column 1 presents the total value of EV (EV_T) and columns 2-3 present its components, the redistributive (EV_R) and stabilizing value (EV_S). Immediately obvious, the total EV is driven by the redistributive component and the stabilization value remains marginal with more (less) than 1 EUR only in two cases. This is due to the relatively modest assumptions for the shock parameters in the baseline. Overall, 17 out of 27 countries would benefit from the regime change. EV_T ranges between 186 EUR per month for Hungary and -535 EUR for Ireland as well as -489 EUR for Luxembourg. The latter are huge contributions and reflect the implications of a full implementation of the average system in terms of redistribution. Generally, all Eastern European countries would gain from the introduction of the EU system, with EVs of less than 100 EUR only for Bulgaria, the Czech Republic, Poland and Slovenia. Consistent with the findings for disposable income above, many Southern European countries would also lose in terms of EV_T, while some Northern and Continental European countries as Finland, Sweden, Belgium or France would gain. This becomes explainable again when considering Figures A.1 and A.2 together with Figures 1 and 2, which plot the mean total EV across gross income deciles within countries. In these countries, especially the higher income deciles also gain in terms of EV_T while the lower deciles sometimes even lose. In the Southern European countries however, it is rather the other way round.

[Table 2 about here.]

With view to column 3, one important issue needs to be stressed. As explained above, without any further assumption, moving from the national to an integrated tax-transfer system can increase or decrease the extent of automatic fiscal stabi-

[17]Also, introducing heterogeneity for the parameters across countries or even households could be a reasonable objection. Yet, at least for the coefficient of relative risk aversion, one would need a good theory and reliable empirical estimates for country specific parameters. Since we consider our exercise as a first step, we assume homogeneous values across countries in order to ease comparability and focus on general implications.

lization. First of all, the countries that pay much higher net taxes under the EU compared to their national system benefit in terms of EV_S, as e.g. Ireland, Luxembourg or the UK, but also Cyprus, Greece, Spain or Malta. This is due to a well-known feature of the concept of automatic stabilization, namely that the extent of income stabilization will be higher for higher tax rates. For example, in the presence of a proportional income tax with a tax rate of 30% versus a tax rate of 40%, a shock to gross income of 100 EUR (given the same level of gross income for both tax rates) leads to a decline in disposable income of 70 EUR in the first and 60 EUR in the second case, i.e. the tax absorbs 30% versus 40% of the shock to gross income. The same would be true for a negative tax rate (a benefit), i.e. the more negative a tax rate is, the higher would be the extent of income stabilization. Table A.2 in the appendix provides a more detailed analysis. First, for comparison, income stabilization coefficients at the aggregated level (as defined by Dolls et al. (2012)) are calculated for the national as well as the integrated system in columns 1 and 2. Differences between both levels of the income stabilization coefficient are qualitatively in line with the EV-based findings in this section. Also, all countries which have very low (high) initial stabilization coefficients, i.e. clearly below (above) the EU average of 0.49, benefit (lose) in terms of stabilization. Second, to better understand the differences in automatic stabilization across the regimes, we calculate average effective tax rates (AETR) under both systems before and after the shock in columns 3-6.[18] Finally, we compare the magnitudes of income stabilization in columns 7 and 8. One main lesson can be drawn: generally, the higher (lower) effective taxation is under one of the two regimes compared to the other, the lower (higher) is also the reduction in disposable income after a negative shock. This leads to the observation that countries which especially benefit (lose) in terms of redistribution under the EU compared to the national system, lose (benefit) in terms of stabilization. This is especially true for the Eastern European countries, simply because their initial level of effective net tax rates decreases dramatically under the EU system.[19] However, average effective tax rates can only be a first indicator for

[18]If we use these AETRs to calculate average effective marginal tax rates (EMTRs) we get exactly the same values as for the income stabilization coefficients, which we did as a check. That means, income stabilization coefficients can be interpreted as EMTR at the aggregated level (for details see e.g. Immervoll (2004); OECD (2013)).

[19]Interestingly, this is also true for Romania where AETRs seem to be “not negative enough” yet to invert that finding. Compare this to the results in Bargain et al. (2013), where Greece and Spain gain most in terms of redistribution for a similar fiscal integration of the founding members

the extent of income stabilization, which is not only determined by the size of the government but also depends on the structure of the tax-transfer system and the design of the different components (i.e. taxes and benefits are usually not designed as a proportional rate), which explains exceptions from this observation.

Yet, one main argument for a European fiscal union is the provision of stabilization from a federal budget when individual countries are credit constrained but the union is not. Thus, assuming credit constraints at the country level is of key importance. Otherwise, changes in stabilization would entirely depend on differences in the levels of net taxes and the structure of the national versus the EU system. In other words, there is no guarantee that an integrated tax-transfer system would do a better job in stabilizing income than the countries would themselves do when they have free access to credit markets. For simplicity and reasons of comparability we therefore assume that countries are fully credit constrained when computing EV_{T^*} and EV_{S^*} in columns 4 and 5 of Table 2 as defined above. By definition, all countries show positive values of EV_{S^*} now. However, they are still too low in order to significantly increase EV_{T^*}. EV_{S^*} values are relatively higher for those countries that still pay higher net taxes in absolute terms due to higher income levels. Note the difference to the situation without credit constraints: now, the tax system that determines EV_{S^*} is the same for all countries and different levels of EV_{S^*} are only due to different levels in income or differences in demographic composition. This becomes also obvious with view to Figures 3 and 4, which plot mean values of EV_S and EV_{S^*} across gross income deciles within countries. Furthermore, due to the same effect, always the highest income deciles within a country gain most in terms of EV_{S^*}.

[Figures 1, 2, 3 and 4 about here.]

In the next section, we analyze if fiscal integration for different subgroups of the EU27 leads to different results.

of the Eurozone (except Luxembourg and using 2001 data), but show also substantial increases in automatic stabilization. The reason is that both countries receive huge negative net taxes under the EU average system (-59 and -36 EUR per week, respectively, versus -63 EUR per month for Romania in this analysis). Besides, one should bear in mind that we use data from 2007 versus 2001 in Bargain et al. (2013). Further differences are the focus on the working age population, the individual as the unit of analysis and the inclusion of employer SIC in this paper.

5.2 Results for the euro area

The first subgroup for which we analyze the introduction of an EU average tax system is the euro area with its current 17 member states (EA17). For this group, political steps towards a fiscal union are probably more important and especially more likely in the nearer future. The parameter assumptions are the same as in the previous section. Table 3 presents equivalent variations for median voters, focusing on the most relevant cases of EV_{T^*} and EV_{S^*}. The first two columns reveal a pattern for the EA17 which is pretty similar to that of the EU27, i.e. all countries that would benefit (lose) from an average tax system of the EU27 would also benefit (lose) now, such that a slight majority of nine countries would favor the integrated system. For some countries, EV_{T^*} values are even more pronounced. Estonia and Slovakia would gain more than 200 EUR each, while both Ireland and Luxembourg would lose more than 500 EUR. Greece and Spain would still have to contribute as well, yet, substantially less compared to the EU27 system.

[Table 3 about here.]

How does the situation change when moving to a union for the founding members of the euro area (EA12) in columns 3-4? At first glance, fiscal integration would become even more unlikely as half of the participating countries gains while the other half loses. The signs of EV_{T^*} for the countries are the same as in case of the EA17 system, however, magnitudes increase. The reason is that the EA12 countries are more similar in terms of income levels and the structure of tax-benefit systems compared to the EA17. This reduces the redistributive effect. In contrast, the benefits in terms of stabilization increase substantially.

This picture prevails when further narrowing down the scope of a fiscal union, looking at two subgroups of even more similar countries, as sometimes labeled in the political debate as a "North" and "South" euro area (columns 5-8). In the "North" euro area (EA-N), we include Austria, Belgium, Finland, the Netherlands, and Germany as the "leading" country in terms of population weight. The "South" euro area (EA-S) would be dominated by France and Italy and further includes Greece, Spain and Portugal.[20] In both unions, the median voter in three out of

[20]France could also be considered as a rather Continental European country that better fits the other group. However, for reasons of comparability we aimed at building two groups of countries that are sufficiently "strong" in terms of economic conditions as well as population weight such that they would able to form a viable fiscal union.

five countries would favor fiscal integration while the contributions for the other four countries in terms of EV_{T^*} are above 50 EUR only for the Netherlands. The stabilization gains are even higher for EA-N while more moderate for EA-S, given the lower income levels. Interestingly, the two countries that would not favor a "South" euro area are still Greece and Spain, which means that more households in these two countries still pay less net taxes under the national system compared to similar households in France, Italy and Portugal. This becomes obvious when looking at mean EVs for gross income deciles in Figure 7b). For Greece and Spain, EV_{T^*} values decrease over the income distribution and sharply for the highest deciles while in France and Italy, especially those deciles show up with high values of EV_{T^*}. For the "North" euro area in Figure 7a), this is true for Belgium and Finland. Generally, the adverse effect that high income deciles benefit at the expense of the lower ones within some countries is one of the questionable features of the averaging approach (EV_{T^*} across income deciles for EA17 and EA12 in Figures 5 and 6, respectively).

[Figures 5, 6, 7a) and 7b) about here.]

In sum, even narrowing down fiscal integration to more similar groups of countries does not lead to a fiscal union that would be favored by all participating countries, i.e. that would be Pareto improving. In the last step of our analysis we check the influence of the parameter assumptions for this result.

5.3 Sensitivity analyses

In the last two sections, the redistributive value of the equivalent variation clearly dominated the stabilizing value. In consequence, Pareto improving reforms where at least one country gains (in terms of the median voter) while no one loses seem to be very unlikely for our design of a fiscal union. However, this might change for different parameter assumptions in the underlying model. In the following, we provide accordant robustness checks, focusing on increasing parameters. Reconsider the decomposition of the overall change in expected utility in Section 3.3, i.e. (17a) to (17e). For an increasing shock probability α, the change in expected utility due to the after-shock net tax adjustment under the EU regime, (17c), will be increasing as well (given that $T_0 > T_1$), while the effect on the rest of the overall change in expected utility is twofold. In consequence, EV_{S^*} also increases and might turn a negative value of EV_{T^*} at some point into a positive one. The same is equivalently true for more negative shocks to gross income ΔX, where (17c) will be increasing due to $\Delta T_1 < 0$ compared to the baseline, and a higher coefficient of relative risk aversion, in which $U(C)$ is increasing.

In a first step, we set $\alpha = 0.1$, $\Delta X = -10\%$ and $\rho = 5$, in a second step $\alpha = 0.15$, $\Delta X = -15\%$ and $\rho = 10$. Clearly, a value of $\rho = 10$ might seem unrealistically high. However, we have sequentially tested the impact of further values between $\rho = 5$ and $\rho = 10$ with almost no significant impact.[21] The same is true when separately changing one of the other parameters while taking baseline values for the remaining two. In Table 4, we therefore only present two sets of results where all parameters are altered at the same time. For the first set of parameters, values for EV_{S^*} increase substantially in all scenarios of a fiscal union (from EU27 down to EA-N and EA-S). However, they are still not high enough to let those median voters benefit who lose in the baseline. The picture changes for the second set of parameters. Now, single countries in all unions start to benefit from fiscal integration due to high gains in terms of stabilization. Moving to a "North" and "South" euro area would be even Pareto improving as each single country reaches a positive value of EV_{T^*}.

[Table 4 about here.]

Finally, we analyze the influence of a more dramatic shock to gross income, closer to one that could be expected if individuals really got unemployed. Therefore, we calculate the mean replacement rate for the EU27 in 2007, $r = 0.65$, and set $\Delta X = -(1 - r) * 100 = -35\%$.[22] Again for reasons of comparability and since we consider illustrative calculations, we take the same value $\Delta X = -35\%$ for all fiscal federation scenarios in Table 5. The coefficient of relative risk aversion and the shock probability are specified as in the baseline (i.e. $\rho = 3$ and $\alpha = 0.08$). The influence of a 35%-shock to gross income is pretty similar to that of the second scenario in Table 4, though, EV values even increase to some extent. In the EU27, Spain and Denmark gain additionally now, i.e. a negative redistributive value of EV is more

[21] There is a literature on empirical estimates of relative risk aversion. Depending on the context, findings differ greatly. For instance, Chetty (2006) provides estimates for an upper bound of $\rho < 2$ in a labor supply context using elasticity estimates of more than thirty studies. In contrast, in the finance literature, much higher values for constant relative risk aversion seem to be common, up to $\rho = 30$ (see e.g. Mehra and Prescott (1985) or Kandel and Stambaugh (1991)).

[22] Precisely, r is calculated as an average over (i) all relevant family types as specified in the OECD database on Benefits and Wages and (ii) all countries (except Bulgaria and Romania for which data is not available).

than counterbalanced through substantial gains in stabilization. The same is true for Greece in the EA17. Again, installing fiscal unions for EA-N and EA-S would be Pareto improving.

In sum, these results show that Pareto improving reforms - if taken as a criteria for political feasibility based on unanimity - seem to be possible only for smaller groups of more similar countries, and when expecting rather severe crisis scenarios or high levels of individual risk aversion.[23]

[Table 5 about here.]

6 Concluding discussion

The recent economic and resulting debt crisis have initiated an ongoing debate about deeper fiscal integration in Europe. This paper proposes an approach to evaluate the individual economic value of possible steps towards a European fiscal union. Precisely, based on an expected utility approach, the equivalent variation of common fiscal rules relative to the baseline with the national systems is calculated. Importantly, the approach allows for a decomposition into a "redistributive" and a "stabilization" component. The method is illustrated for the benchmark case of an EU-wide tax and transfer system.

Based on the tax-transfer calculator EUROMOD and household microdata for 27 EU member states, results show that a majority of 17 countries, represented by their median voters, would benefit from fiscal integration in the EU27, mainly driven by the redistributive component. The Eastern European countries would gain most with the highest equivalent variation (188 EUR) per month in Hungary. Ireland and Luxembourg would be the largest contributors. Surprisingly at first glance, also many Southern European countries would lose. Generally, countries which benefit (lose) in terms of the redistributive component, tend to show relatively low (high) benefits in terms of the stabilizing component. Effects across gross income deciles within countries differ greatly and depend on income levels and the structures of existing national systems. We additionally considered smaller fiscal unions, namely for the the 17 members of the euro area in 2013, its 12 founding members as well

[23] A straightforward extension of the analysis in this section would be to numerically search for the country-specific minimal parameters that would let a country benefit from a fiscal federation.

as two further subgroups as sometimes discussed in the political debate under the label of a "North" and a "South" euro area. Moving to such groups of more similar countries generally reduces redistributive and increases the stabilizing effects. However, Pareto improving reforms where at least one country gains while no one loses seem to be possible only for rather severe crisis scenarios with substantial shocks to gross income, or for high levels of individual risk aversion.

These results should be interpreted taking into account the specific framework constructed and the simplifying assumptions made. First of all, this applies to the average design of the common tax system which by construction implies redistribution from high to low income countries. One step further, a more precise approach would be to use a social objective function and to calculate an optimal EU redistribution scheme (see e.g. Kopczuk et al. (2005) for an approach to world redistribution). However, if political desirability of any (ex-ante) redistributive effects across countries is generally questioned, the setup of a pure insurance mechanism would be required.

Second, we assumed that shocks affect countries and households proportionally and with the same probability for reasons of comparability. However, introducing heterogeneity across countries, households or even further subgroups (as for instance high and low educated individuals) could be a valuable next step. Related to this, the expected utility framework that we used remained very simplified given that expectations are formed over two different situations only, mainly due to data limitations. Yet, the method could generally be extended to more than one year only, taking into account country specific income volatility over time.

Third, our study abstracts from any behavioral effects and focuses on direct impacts of the simulated reforms only. However, one can immediately think of a range of behavioral margins that would be affected. This certainly includes labor supply, but also tax evasion behavior, cross-country migration or the adjustment of remaining national fiscal policies through the governments as a reaction to fiscal integration. For a discussion of these issues, see Bargain et al. (2013), who did account for the first aspect in their analysis. Additionally, we have assumed away any administration costs of installing a European fiscal federation, basically presuming that administrations work equally efficient in every country after the regime change and that there are no costs of adaption to the new tax-transfer regulations.

These caveats point to the fact that the reforms we simulated are rather meant as a conceptual experiment to illustrate the evaluation method proposed and to provide insights in general issues of setting up a European fiscal union. However, common tax-transfer policies are a key element of existing fiscal unions and will certainly be introduced in the EU or EA as well in the medium or long term. The political main motivation at this time is the provision of insurance against asymmetric shocks, e.g. in form of a European basic unemployment insurance scheme. Yet, while always depending on the specific aim and design of the system, this might also include – intentionally or not – redistributive effects. The general mechanisms identified in this paper might hold for various options of a European fiscal union where redistributive and stabilizing effects can be expected. The method proposed allows to study the economic effects of such options with a consistent framework at the individual level.

7 Tables and figures

Table 1: Individual average monthly income and taxes (2007 EUR)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
EU	1.000	2,046	1,402	318	536	210	644	644
AT	0.017	2,662	1,819	359	791	307	843	880
BE	0.021	2,621	1,680	528	692	280	941	862
BG	0.016	310	230	29	79	28	80	6
CY	0.002	1,847	1,661	122	250	186	187	550
CZ	0.022	837	578	68	275	85	259	150
DE	0.167	2,671	1,735	443	737	245	935	935
DK	0.011	3,189	2,298	1,032	274	415	892	1,037
EE	0.003	863	582	110	224	53	281	138
GR	0.022	1,455	1,138	158	317	158	317	435
ES	0.095	1,765	1,274	169	463	141	492	570
FI	0.010	2,797	1,841	612	658	314	956	899
FR	0.117	2,453	1,569	252	898	266	884	816
HU	0.021	598	386	88	226	102	212	1
IE	0.009	2,637	2,351	395	348	457	286	815
IT	0.117	2,270	1,521	376	650	277	748	695
LT	0.007	632	414	104	159	46	217	58
LU	0.001	3,749	2,905	458	827	440	844	1,408
LV	0.005	730	481	116	185	52	249	77
MT	0.001	1,140	965	100	174	98	176	223
NL	0.033	2,930	1,942	395	809	217	987	1,021
PL	0.082	636	455	85	187	90	182	98
PT	0.022	1,246	934	127	320	134	312	314
RO	0.046	278	205	40	73	39	74	-63
SE	0.017	2,960	1,848	609	843	339	1,112	996
SI	0.004	1,335	976	135	407	183	359	285
SK	0.012	637	456	35	216	70	180	61
UK	0.120	2,917	2,174	583	428	269	743	944

Note: (1) Population share; (2) gross income; (3) disposable income; (4) taxes; (5) SIC; (6) benefits; (7)=(4)+(5)-(6) net taxes; (8) net tax that the individual would have to pay under the estimated EU average tax system. *Source*: Own calculations based on EU-SILC and EUROMOD.

Table 2: Equivalent variations of median voters for EU27

	EV_T	EV_R	EV_S	EV_{T^*}	EV_{S^*}
EU	14.9	14.9	-0.0	18.8	3.5
AT	-27.4	-26.7	-0.5	-19.3	5.5
BE	44.6	45.5	-1.4	50.6	5.9
BG	58.8	58.9	-0.1	59.3	0.4
CY	-310.5	-311.6	1.7	-308.7	3.7
CZ	88.8	88.9	-0.1	90.7	1.6
DE	38.2	38.3	-0.2	43.8	5.2
DK	-131.7	-132.2	0.1	-122.6	7.3
EE	129.1	129.2	0.0	130.9	1.5
GR	-109.9	-110.6	0.5	-107.5	2.6
ES	-85.6	-86.0	0.5	-82.0	3.4
FI	40.6	40.7	-0.3	46.9	6.1
FR	82.0	82.3	-0.2	87.8	5.3
HU	186.2	186.8	-0.4	188.1	0.9
IE	-535.3	-535.5	0.6	-530.0	5.1
IT	54.2	54.6	-0.2	59.1	3.7
LT	138.6	138.9	-0.1	140.0	0.9
LU	-489.1	-490.4	0.8	-481.9	7.3
LV	154.3	154.0	-0.1	155.6	1.1
MT	-62.5	-63.3	0.8	-61.1	2.1
NL	-35.6	-35.8	0.1	-30.1	6.1
PL	54.1	54.1	-0.0	55.4	0.9
PT	0.4	0.5	0.2	3.7	1.9
RO	120.6	120.8	-0.1	121.6	0.4
SE	98.2	98.5	-0.3	105.5	6.6
SI	64.5	64.4	0.2	66.9	2.7
SK	105.7	106.0	-0.1	107.4	1.1
UK	-209.8	-210.6	0.7	-204.8	5.4

Note: (EV_T) Total value of EV; (EV_R) redistributive value of EV; (EV_S) stabilization value of EV; (EV_{T^*}) total value of EV under credit constraint; (EV_{S^*}) stabilization value of EV under credit constraint; all in monthly EUR. *Source*: Own calculations based on EU-SILC and EUROMOD.

Table 3: Equivalent variations of median voters for different euro areas

	EA17		EA12		EA-N		EA-S	
	EV_{T^*}	EV_{S^*}	EV_{T^*}	EV_{S^*}	EV_{T^*}	EV_{S^*}	EV_{T^*}	EV_{S^*}
AT	-90	6	-77	19	-10	20	.	.
BE	53	6	75	20	127	20	.	.
CY	-281	4	.	.	.	.	.	.
DE	33	5	54	17	33	18	.	.
EE	223	1	.	.	.	.	.	.
GR	-44	2	-24	8	.	.	-17	7
ES	-51	3	-35	11	.	.	-30	10
FI	9	6	28	21	37	22	.	.
FR	62	5	80	18	.	.	37	18
IE	-533	5	-511	17	.	.	.	.
IT	49	4	66	12	.	.	47	12
LU	-568	8	-557	26	.	.	.	.
MT	-54	2	.	.	.	.	.	.
NL	-98	6	-90	21	-53	21	.	.
PT	19	2	37	6	.	.	6	5
SI	136	3	.	.	.	.	.	.
SK	231	1	.	.	.	.	.	.

Note: (EV_{T^*}) Total value of EV under credit constraint; (EV_{S^*}) stabilization value of EV under credit constraint; both in monthly EUR. *Source*: Own calculations based on EU-SILC and EUROMOD.

Table 4: Equivalent variations of median voters for varying parameter assumptions

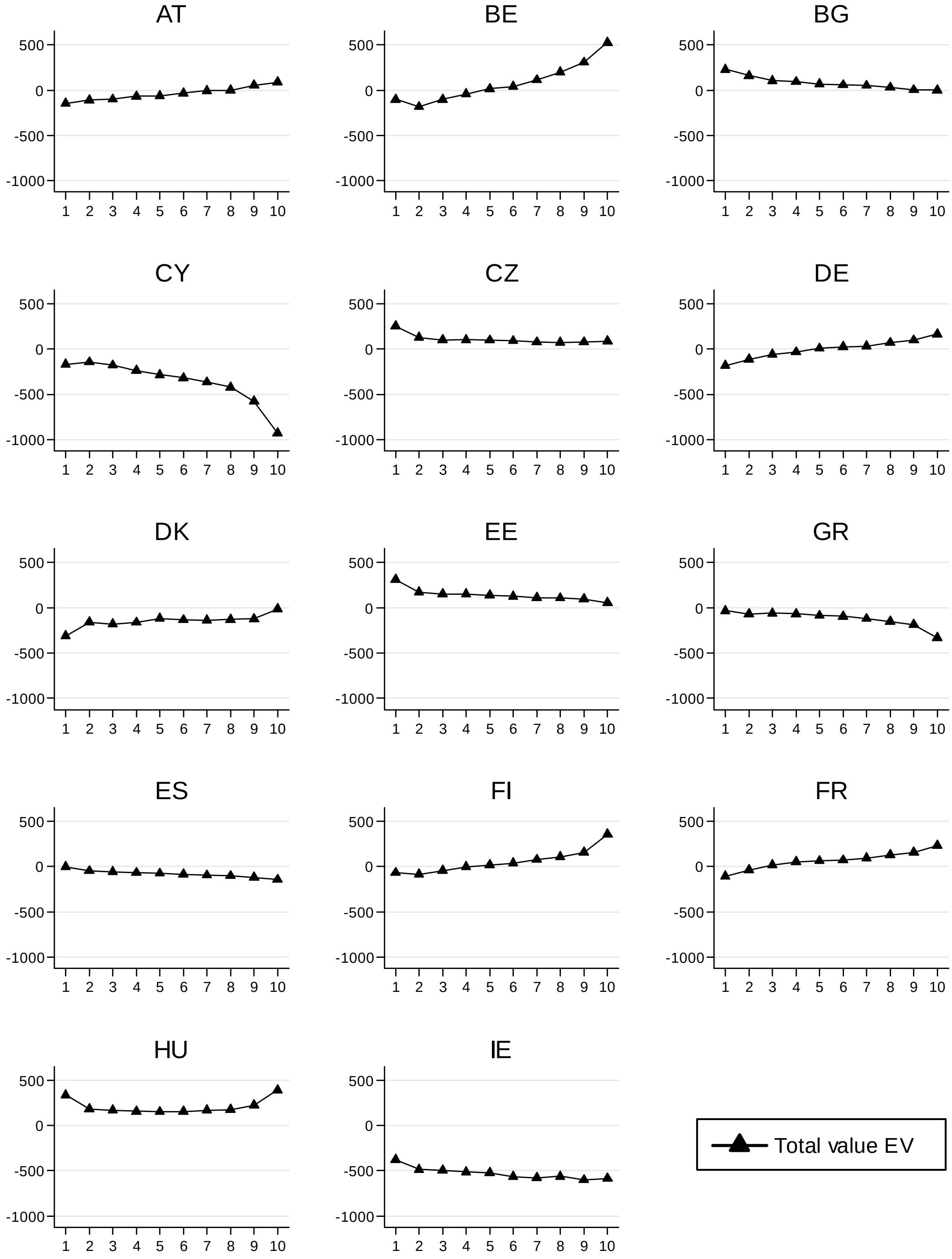
	$\rho = 5$, $\alpha = 0.1$, $\Delta X = -10\%$										$\rho = 10$, $\alpha = 0.15$, $\Delta X = -15\%$									
	EU27		EA17		EA12		EA-N		EA-S		EU27		EA17		EA12		EA-N		EA-S	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
AT	-5	20	-73	21	-75	21	-8	21	.	.	*75*	*95*	*14*	*102*	*12*	*102*	***83***	***101***	.	.
BE	68	22	69	23	77	23	130	23	.	.	153	111	155	114	165	113	***228***	***110***	.	.
BG	60	1	.	.	.	.	.	.	.	.	70	5	.	.	.	.	.	.	.	.
CY	-301	13	-273	13	.	.	.	.	.	.	-262	64	-236	62	.	.	.	.	.	.
CZ	96	5	.	.	.	.	.	.	.	.	123	25	.	.	.	.	.	.	.	.
DE	58	19	50	19	57	19	36	20	.	.	133	96	131	97	139	97	***113***	***99***	.	.
DK	-105	26	.	.	.	.	.	.	.	.	-4	130	.	.	.	.	.	.	.	.
EE	135	5	227	4	.	.	.	.	.	.	166	24	255	18	.	.	.	.	.	.
GR	-102	9	-38	9	-23	8	.	.	-16	8	-60	43	-3	39	*9*	*39*	.	.	***14***	***37***
ES	-72	12	-43	12	-34	12	.	.	-29	11	-16	60	*4*	*58*	*13*	*57*	.	.	***14***	***54***
FI	64	22	26	23	30	23	39	24	.	.	150	106	118	111	126	111	***135***	***116***	.	.
FR	104	19	78	20	83	20	.	.	39	20	190	95	163	97	167	97	.	.	***126***	***99***
HU	191	3	.	.	.	.	.	.	.	.	210	13	.	.	.	.	.	.	.	.
IE	-516	18	-518	19	-510	19	.	.	.	.	-464	87	-470	87	-462	87	.	.	.	.
IT	70	12	61	13	67	12	.	.	48	12	127	54	117	55	122	55	.	.	***101***	***55***
LT	144	3	.	.	.	.	.	.	.	.	164	14	.	.	.	.	.	.	.	.
LU	-462	28	-546	29	-555	29	.	.	.	.	-372	140	-445	149	-452	150	.	.	.	.
LV	160	4	.	.	.	.	.	.	.	.	184	16	.	.	.	.	.	.	.	.
MT	-56	7	-51	7	.	.	.	.	.	.	-35	33	-25	31	.	.	.	.	.	.
NL	-13	22	-83	23	-87	23	-52	23	.	.	*76*	*109*	*6*	*117*	*3*	*117*	***34***	***115***	.	.
PL	59	3	.	.	.	.	.	.	.	.	81	13	.	.	.	.	.	.	.	.
PT	11	7	26	6	38	6	.	.	7	6	40	31	55	28	71	27	.	.	***37***	***27***
RO	123	1	.	.	.	.	.	.	.	.	133	5	.	.	.	.	.	.	.	.
SE	124	24	.	.	.	.	.	.	.	.	228	118	.	.	.	.	.	.	.	.
SI	75	9	145	9	.	.	.	.	.	.	116	41	186	38	.	.	.	.	.	.
SK	111	4	234	3	.	.	.	.	.	.	132	17	255	11	.	.	.	.	.	.
UK	-190	20	.	.	.	.	.	.	.	.	-108	100	.	.	.	.	.	.	.	.

Note: ρ denotes the risk aversion parameter ($\rho = 3$ in the baseline), α the shock probability ($\alpha = 0.08$ in the baseline), ΔX the shock to gross income X in % ($\Delta X = -5\%$ in the baseline). (1) EV_{T^*}, total value of EV under credit constraint; (2) EV_{S^*}, stabilization value of EV under credit constraint; both in monthly EUR. Switch from negative to positive EV compared to baseline for single countries in *italics*, Pareto improving move to an EU system in ***bold-faced italics***. *Source*: Own calculations based on EU-SILC and EUROMOD.

Table 5: Equivalent variations of median voters for 35% income shock

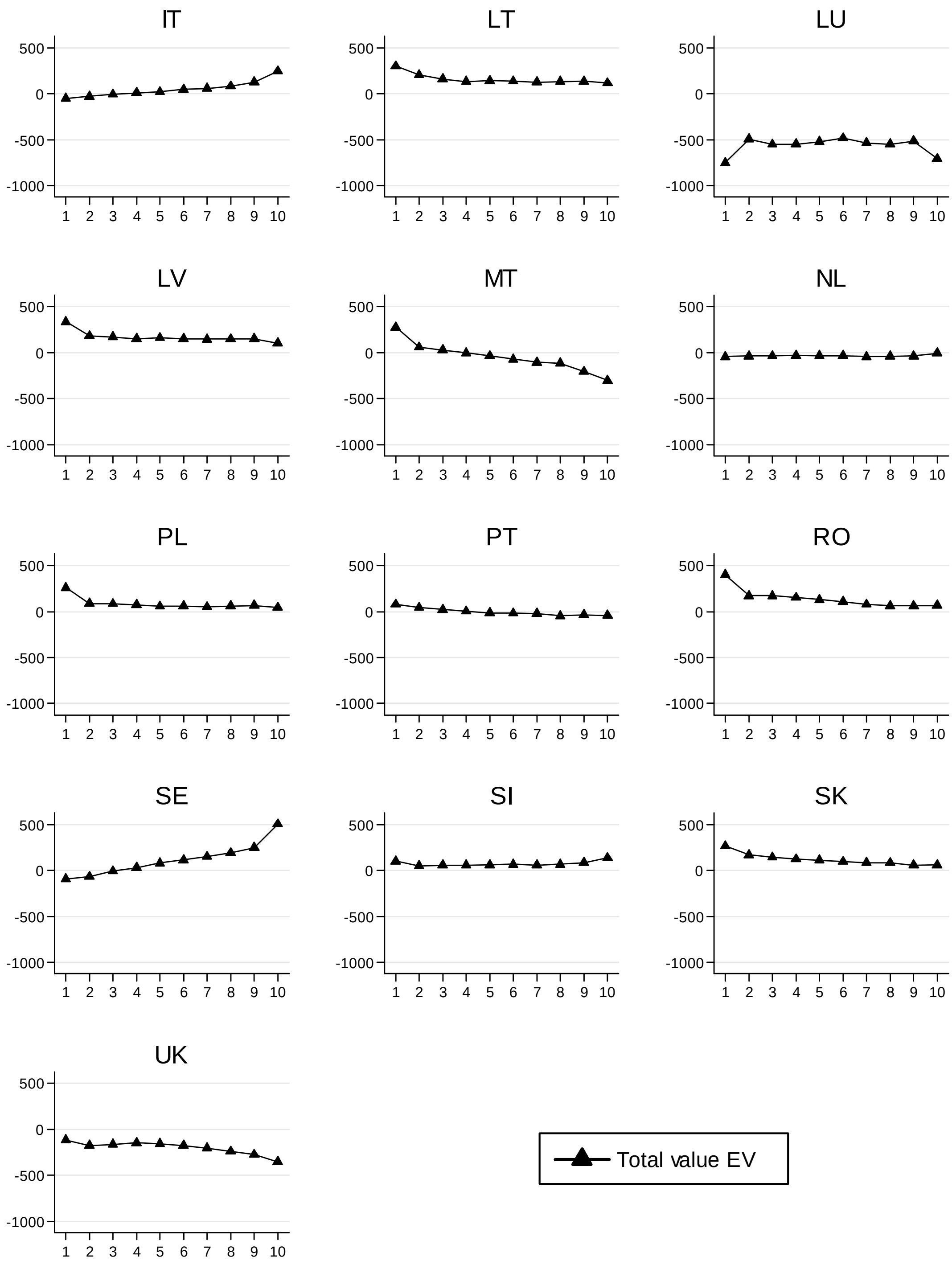
	$\rho = 3$, $\alpha = 0.08$, $\Delta X = -35\%$									
	EU27		EA17		EA12		EA-N		EA-S	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
AT	*105*	*127*	*49*	*138*	*44*	*138*	***119***	***133***	.	.
BE	202	160	201	163	214	162	***295***	***151***	.	.
BG	80	5	.	.	.	.	.	.	.	.
CY	-251	81	-227	79	.	.	.	.	.	.
CZ	138	30	.	.	.	.	.	.	.	.
DE	176	137	174	139	182	138	***151***	***142***	.	.
DK	*41*	*173*	.	.	.	.	.	.	.	.
EE	179	28	268	20	.	.	.	.	.	.
GR	-47	57	*11*	*50*	*23*	*48*	.	.	***26***	***45***
ES	*6*	*77*	*23*	*73*	*32*	*72*	.	.	***32***	***67***
FI	191	139	162	149	168	149	***183***	***152***	.	.
FR	236	125	206	130	211	131	.	.	***168***	***136***
HU	224	14	.	.	.	.	.	.	.	.
IE	-446	112	-450	112	-440	110	.	.	.	.
IT	147	66	137	66	143	66	.	.	***117***	***66***
LT	178	17	.	.	.	.	.	.	.	.
LU	-343	197	-408	219	-414	220	.	.	.	.
LV	202	19	.	.	.	.	.	.	.	.
MT	-27	41	-19	39	.	.	.	.	.	.
NL	*117*	*151*	*54*	*166*	*50*	*167*	***78***	***160***	.	.
PL	95	16	.	.	.	.	.	.	.	.
PT	50	38	64	34	83	33	.	.	***47***	***33***
RO	142	5	.	.	.	.	.	.	.	.
SE	283	157	.	.	.	.	.	.	.	.
SI	132	50	203	45	.	.	.	.	.	.
SK	142	20	264	12	.	.	.	.	.	.
UK	-72	136	.	.	.	.	.	.	.	.

Note: (1) EV_{T^*}, total value of EV under credit constraint; (2) EV_{S^*}, stabilization value of EV under credit constraint; both in monthly EUR. Switch from negative to positive EV compared to baseline for single countries in *italics*, Pareto improving move to an EU system in ***bold-faced italics***. *Source*: Own calculations based on EU-SILC and EUROMOD.



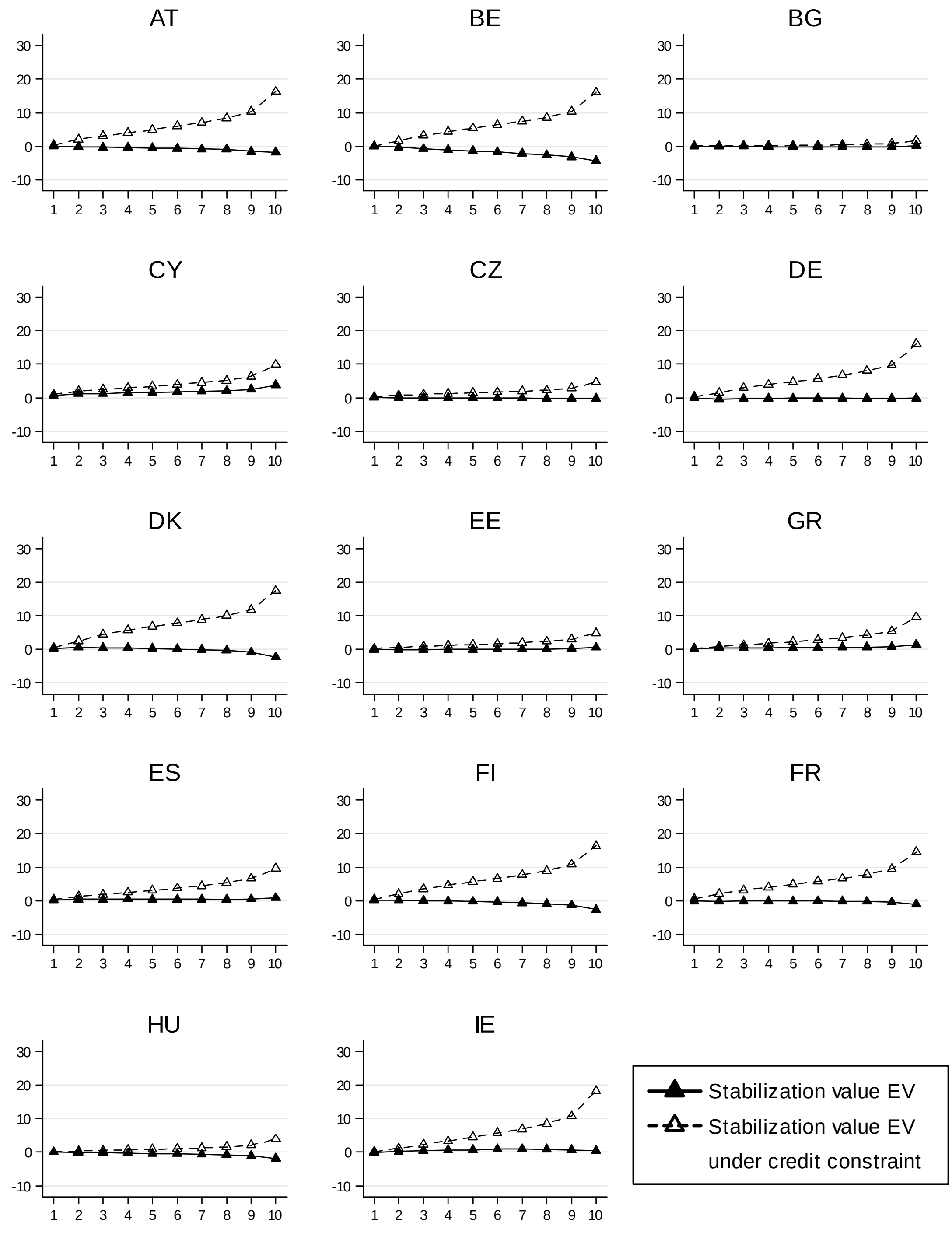
Note: Based on means for gross income deciles; monthly 2007 EUR.
Source: Own calculations based on EU-SILC and EUROMOD.

Figure 1: Equivalent variations across income deciles when moving to an EU27 average tax system



Note: Based on means for gross income deciles; monthly 2007 EUR.
Source: Own calculations based on EU-SILC and EUROMOD.

Figure 2: Equivalent variations across income deciles when moving to an EU27 average tax system (ctd.)



Note: Based on means for gross income deciles; monthly 2007 EUR.
Source: Own calculations based on EU-SILC and EUROMOD.

Figure 3: Equivalent variations across income deciles when moving to an EU27 average tax system: stabilization value

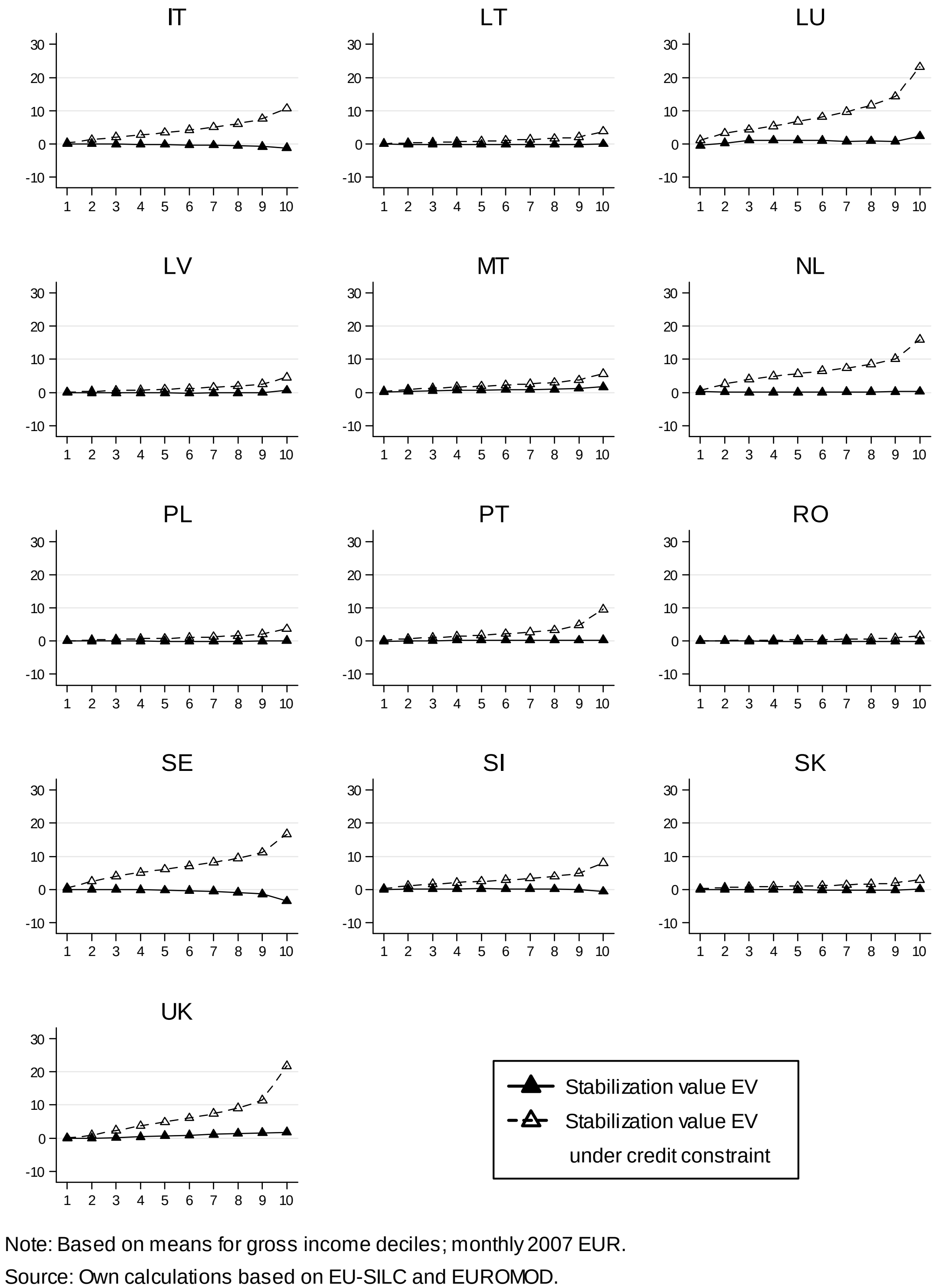
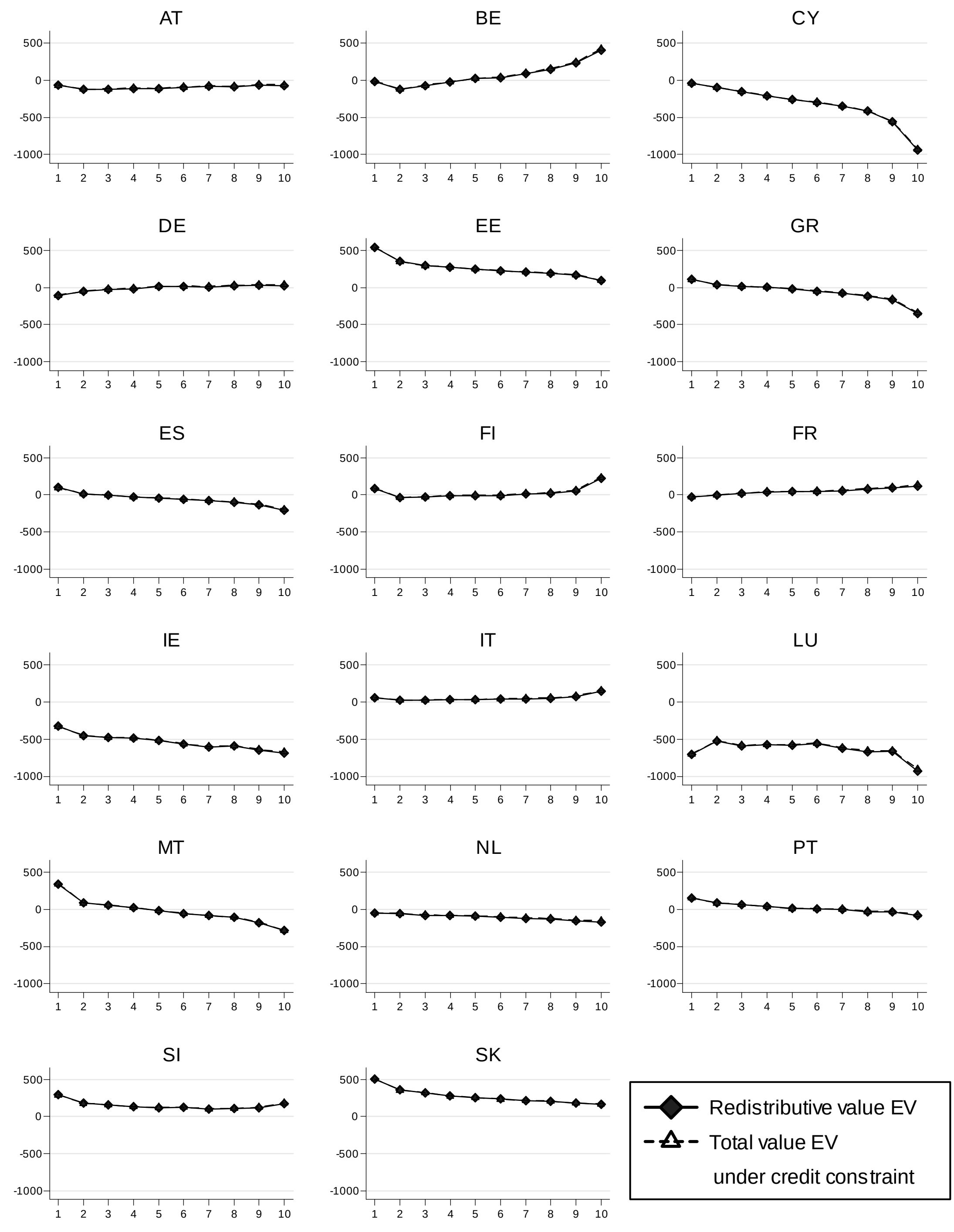
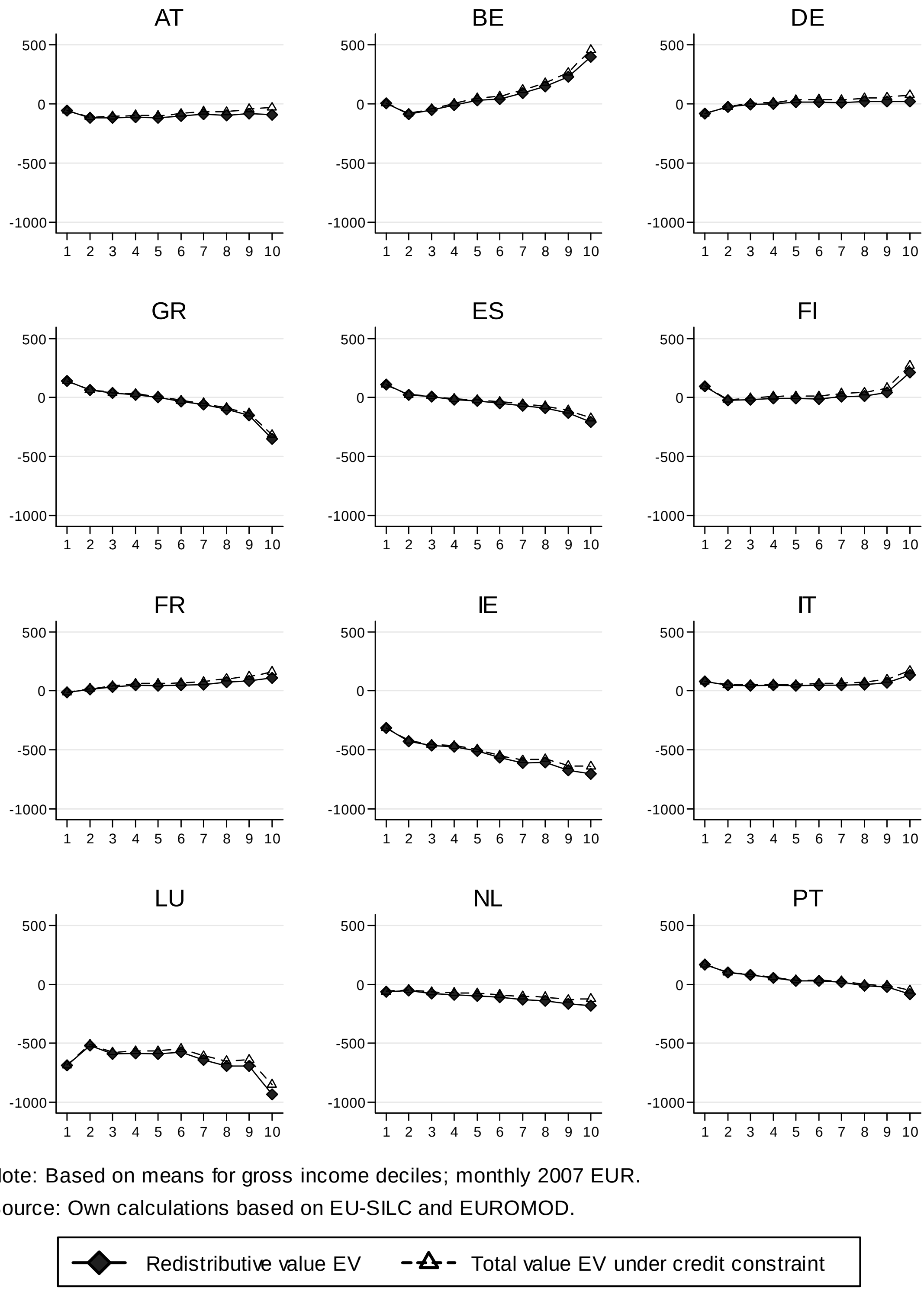


Figure 4: Equivalent variations across income deciles when moving to an EU27 average tax system: stabilization value (ctd.)



Note: Based on means for gross income deciles; monthly 2007 EUR.
Source: Own calculations based on EU-SILC and EUROMOD.

Figure 5: Equivalent variations across income deciles when moving to an EA17 average tax system



Note: Based on means for gross income deciles; monthly 2007 EUR.

Source: Own calculations based on EU-SILC and EUROMOD.

Figure 6: Equivalent variations across income deciles when moving to an EA12 average tax system

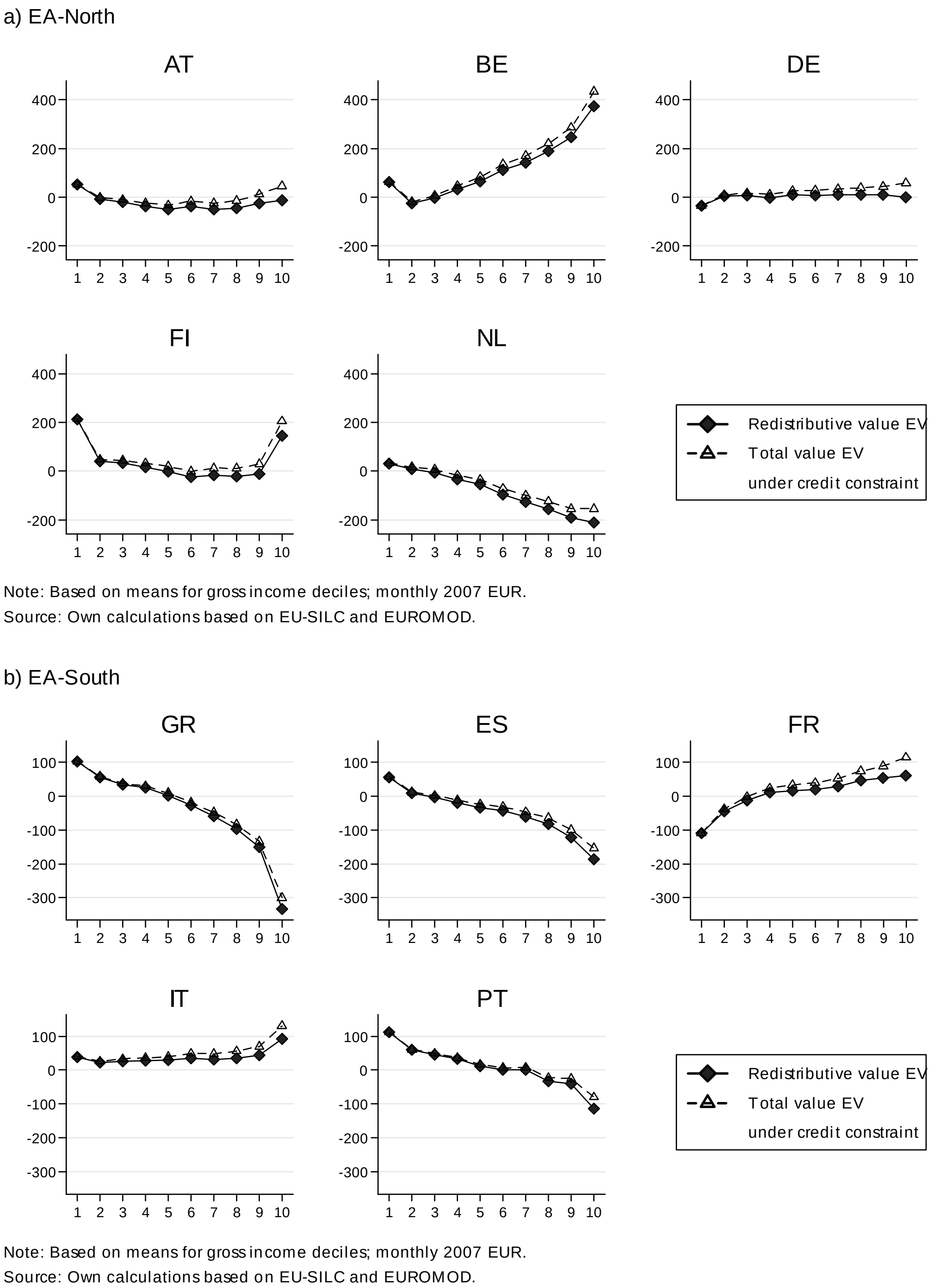


Figure 7: Equivalent variations across income deciles when moving to a "North" and a "South" EA average tax system

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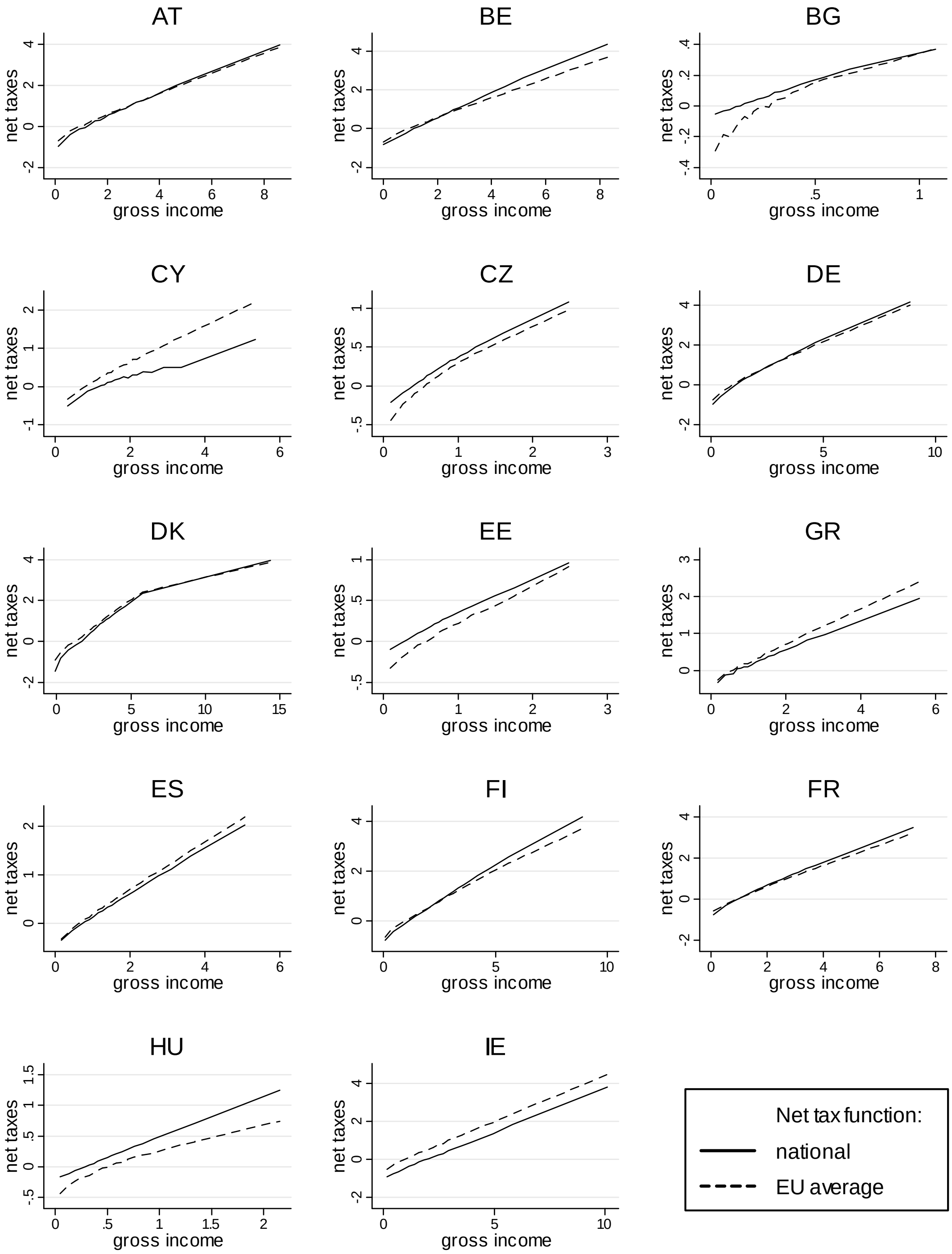
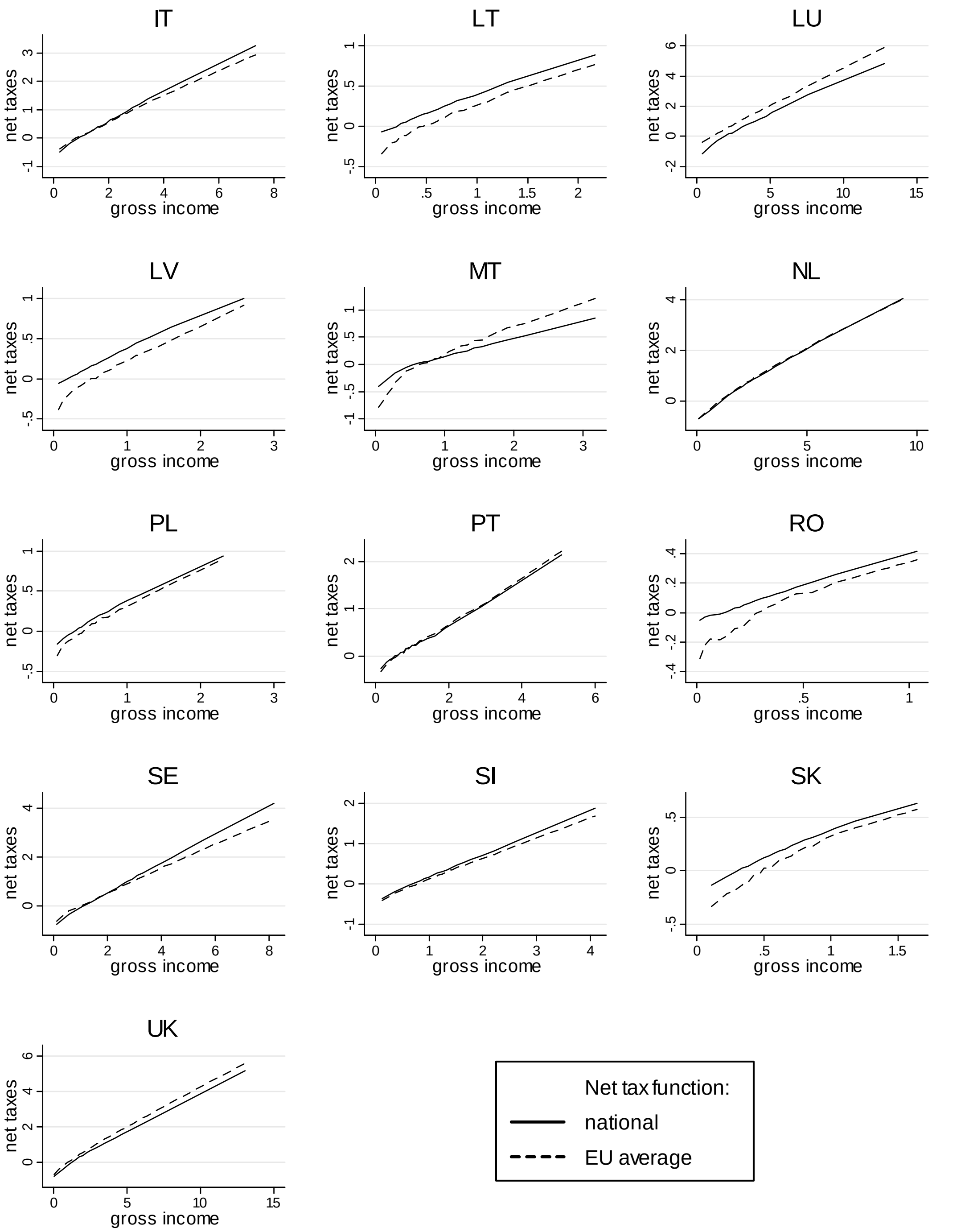
A Appendix

On the following pages we first provide some additional results referred to in the paper (net tax plots; detailed inequality and progression indices; income stabilization coefficients and average effective tax rates), and second, statistics on the validation of the estimated net tax functions (predictions with estimated national tax functions; main estimation output for estimated average tax functions).



Note: Based on means for gross income ventiles; monthly thousand EUR.
Source: Own calculations based on EU-SILC and EUROMOD.

Figure A.1: Plots for estimated net tax function: national vs. EU27 average



Note: Based on means for gross income ventiles; monthly thousand EUR.
Source: Own calculations based on EU-SILC and EUROMOD.

Figure A.2: Plots for estimated net tax function: national vs. EU27 average (ctd.)

Table A.1: Inequality and effective progression: national vs. EU average system

(a) Gini coefficients and Musgrave-Thin indices

	Gini(X)	Gini(Y_k)	Gini(Y_{EU})	MT	ΔMT
EU	0.475	0.381	0.368	1.179	2.1
AT	0.376	0.253	0.274	1.197	-2.8
BE	0.379	0.226	0.275	1.247	-6.3
BG	0.400	0.316	0.301	1.140	2.2
CY	0.303	0.247	0.220	1.081	3.5
CZ	0.341	0.233	0.211	1.164	2.9
DE	0.395	0.265	0.282	1.215	-2.4
DK	0.337	0.241	0.269	1.146	-3.7
EE	0.354	0.293	0.226	1.094	9.5
GR	0.410	0.322	0.311	1.149	1.6
ES	0.359	0.276	0.275	1.128	0.2
FI	0.373	0.244	0.273	1.206	-3.8
FR	0.355	0.244	0.255	1.171	-1.4
HU	0.417	0.239	0.228	1.306	1.5
IE	0.437	0.265	0.321	1.306	-7.7
IT	0.371	0.284	0.293	1.139	-1.3
LT	0.396	0.325	0.264	1.118	9.1
LU	0.364	0.247	0.292	1.184	-6.0
LV	0.410	0.356	0.274	1.093	12.6
MT	0.336	0.264	0.225	1.109	5.2
NL	0.357	0.264	0.269	1.146	-0.7
PL	0.420	0.305	0.299	1.200	0.7
PT	0.427	0.327	0.307	1.176	3.0
RO	0.455	0.343	0.291	1.206	7.9
SE	0.341	0.219	0.251	1.185	-4.1
SI	0.345	0.226	0.226	1.182	0.1
SK	0.314	0.219	0.192	1.138	3.5
UK	0.472	0.339	0.356	1.253	-2.7

(b) Generalized entropy indices

	$GE(0)$	$GE(0)w$	$GE(0)b$	$GE(1)$	$GE(1)w$	$GE(1)b$
National	0.304	0.143	0.160	0.278	0.164	0.113
EU average	0.255	0.145	0.110	0.258	0.173	0.085

Note: Gini(X) refers to inequality in gross market, Gini(Y_k) to inequality in disposable income under national systems, Gini(Y_{EU}) to inequality in disposable income under EU system. The MT index (Musgrave and Thin (1948)) is defined as MT=(1−Gini(Y))/(1−Gini(X)) and is a measure of redistribution/effective progression. ΔMT indicates the %-change in the MT index when moving from the national to the EU average system. By construction, a positive (negative) ΔMT coincides with a decrease (increase) in the Gini index. $GE(0)$ and $GE(1)$ are measures from the Generalized Entropy (GE) class of inequality indices (Shorrocks (1980)), denoted $GE(\alpha)$, with α being a parameter indicating more sensitivity towards changes at the top (bottom) of the income distribution the more positive (negative) α is. $GE(0)$ is also known as mean log deviation and $GE(1)$ as the Theil index (Theil (1967)). Both measures are decomposable into a weighted average of inequality within subgroups of a given population, plus inequality among those subgroups. Here, $GE(\alpha)w$ ($GE(\alpha)b$) is the within- (between-) country inequality and $GE(\alpha)w + GE(\alpha)b = GE(\alpha)$. *Source*: Own calculations based on EU-SILC and EUROMOD.

Table A.2: Income stabilization coefficients and AETRs

	τ_k	τ_{EU}	$AETR^0_k$	$AETR^1_k$	$AETR^0_{EU}$	$AETR^1_{EU}$	ΔC_k	ΔC_{EU}
EU	0.49	0.49	0.31	0.31	0.31	0.31	-49.8	-49.9
AT	0.57	0.51	0.32	0.30	0.33	0.32	-56.2	-63.8
BE	0.63	0.49	0.36	0.34	0.33	0.32	-50.6	-68.6
BG	0.39	0.33	0.26	0.25	0.02	0.00	-9.3	-10.3
CY	0.28	0.49	0.10	0.09	0.30	0.29	-65.8	-46.7
CZ	0.48	0.47	0.31	0.30	0.18	0.16	-21.8	-22.2
DE	0.51	0.50	0.35	0.34	0.35	0.34	-61.3	-63.0
DK	0.52	0.50	0.28	0.27	0.33	0.32	-76.5	-78.7
EE	0.42	0.45	0.33	0.32	0.16	0.14	-25.0	-23.7
GR	0.38	0.47	0.22	0.21	0.30	0.29	-44.3	-38.4
ES	0.42	0.48	0.28	0.27	0.32	0.31	-49.5	-44.8
FI	0.55	0.51	0.34	0.33	0.32	0.31	-63.1	-68.8
FR	0.53	0.51	0.36	0.35	0.33	0.32	-58.0	-60.0
HU	0.63	0.45	0.35	0.34	0.00	-0.02	-10.9	-16.2
IE	0.46	0.49	0.11	0.09	0.31	0.30	-71.6	-67.0
IT	0.54	0.51	0.33	0.32	0.31	0.30	-42.1	-45.2
LT	0.44	0.42	0.34	0.34	0.09	0.07	-17.6	-18.4
LU	0.46	0.49	0.23	0.21	0.38	0.37	-101.1	-94.0
LV	0.43	0.43	0.34	0.34	0.11	0.09	-20.6	-20.5
MT	0.30	0.46	0.15	0.15	0.20	0.18	-38.5	-30.0
NL	0.48	0.49	0.34	0.33	0.35	0.34	-73.8	-72.4
PL	0.46	0.46	0.29	0.28	0.15	0.14	-15.2	-15.3
PT	0.44	0.47	0.25	0.24	0.25	0.24	-34.9	-33.0
RO	0.44	0.39	0.26	0.26	-0.22	-0.26	-7.8	-8.4
SE	0.55	0.51	0.38	0.37	0.34	0.33	-66.4	-72.6
SI	0.48	0.50	0.27	0.26	0.21	0.20	-34.8	-33.2
SK	0.44	0.44	0.28	0.27	0.10	0.08	-17.5	-17.6
UK	0.42	0.47	0.25	0.25	0.32	0.32	-85.9	-78.4

Note: Results for a negative 5%-shock to gross income X_i. $\tau = \sum_i(\Delta X_i - \Delta Y_i)/\sum_i \Delta X_i$ with disposable income Y_i. $AETR = \sum_i(X_i - Y_i)/\sum_i X_i$. ($\tau_k$) Income stabilization coefficient of national tax systems; (τ_{EU}) income stabilization coefficient under EU average system; ($AETR^0_k$) national average effective tax rate before shock; ($AETR^1_k$) national AETR after shock; ($AETR^0_{EU}$) AETR under EU average system before shock; ($AETR^1_{EU}$) AETR under EU average system after shock; (ΔC_k) change in disposable income under national system; (ΔC_{EU}) change in disposable income under EU average system; ΔC_k and ΔC_{EU} in monthly EUR. *Source*: Own calculations based on EU-SILC and EUROMOD.

Table A.3: Validation of estimated net tax functions

	AT			**BE**			**BG**			**CY**			**CZ**		
	EM	Predicted	%-error	EM	Predicted	%-error	EM	Predicted	%-error	EM	Predicted	%-error	EM	Predicted	%-erro
Mean	3058	3058	0.00	2822	2822	0.00	474	474	0.00	3264	3264	0.00	1049	1049	0.00
D1	1294	1277	-1.32	1057	1059	0.26	160	159	-1.10	1370	1368	-0.16	416	419	0.75
D2	1503	1522	1.25	1385	1400	1.12	210	214	1.61	1745	1754	0.51	576	577	0.13
D3	1879	1892	0.68	1872	1854	-0.97	268	267	-0.29	2099	2095	-0.23	712	711	-0.08
D4	2149	2143	-0.28	2052	2056	0.20	322	323	0.40	2376	2360	-0.66	804	798	-0.65
D5	2419	2410	-0.36	2323	2327	0.17	375	374	-0.42	2713	2717	0.14	882	883	0.08
D6	2763	2749	-0.51	2733	2723	-0.39	425	426	0.36	3057	3065	0.25	993	992	-0.14
D7	3081	3085	0.12	3157	3154	-0.10	506	503	-0.53	3450	3460	0.30	1107	1110	0.28
D8	3819	3823	0.11	3609	3607	-0.07	580	581	0.08	3950	3962	0.31	1265	1263	-0.23
D9	4655	4660	0.11	4057	4059	0.05	700	698	-0.24	4766	4744	-0.46	1472	1474	0.14
D10	7029	7030	0.02	5980	5986	0.10	1195	1197	0.15	7124	7126	0.03	2268	2268	0.02
D-ratio	5.43	5.51	1.36	5.66	5.65	-0.15	7.45	7.55	1.26	5.20	5.21	0.18	5.46	5.42	-0.73
Gini	0.322	0.318	-1.24	0.303	0.301	-0.83	0.341	0.337	-1.08	0.287	0.284	-1.14	0.286	0.282	-1.08
R2		0.987	0.987		0.991	0.991		0.973	0.973		0.953	0.953		0.983	0.983
N	4021	4021	4021	4347	4347	4347	2645	2645	2645	2280	2280	2280	7084	7084	7084

	DE			**DK**			**EE**			**GR**			**ES**		
	EM	Predicted	%-error	EM	Predicted	%-error	EM	Predicted	%-error	EM	Predicted	%-error	EM	Predicted	%-erro
Mean	2673	2673	0.00	3394	3394	0.00	975	975	0.00	2138	2138	0.00	2397	2397	0.00
D1	1251	1242	-0.65	1348	1336	-0.94	233	232	-0.68	550	569	3.52	834	858	2.82
D2	1257	1240	-1.32	1307	1311	0.24	403	408	1.04	1047	1060	1.30	1273	1265	-0.61
D3	1439	1475	2.46	1813	1842	1.56	540	540	-0.02	1285	1267	-1.38	1540	1538	-0.18
D4	1782	1759	-1.26	2240	2264	1.05	643	649	0.83	1447	1436	-0.81	1737	1744	0.39
D5	2090	2071	-0.89	2645	2626	-0.71	794	784	-1.27	1675	1666	-0.49	2043	2017	-1.32
D6	2455	2463	0.31	3222	3199	-0.70	901	902	0.09	1967	1955	-0.64	2266	2262	-0.17
D7	2815	2827	0.43	3856	3878	0.55	1074	1071	-0.29	2244	2262	0.78	2610	2597	-0.52
D8	3320	3323	0.10	4451	4448	-0.09	1238	1240	0.15	2636	2615	-0.81	2985	2990	0.17
D9	4035	4052	0.42	5156	5110	-0.89	1539	1541	0.18	3193	3206	0.41	3575	3580	0.16
D10	6286	6276	-0.15	7911	7939	0.35	2387	2386	0.00	5348	5355	0.14	5106	5119	0.26
D-ratio	5.03	5.05	0.50	5.87	5.94	1.30	10.23	10.30	0.68	9.73	9.41	-3.26	6.12	5.97	-2.48
Gini	0.333	0.328	-1.72	0.333	0.331	-0.68	0.349	0.347	-0.47	0.360	0.347	-3.57	0.301	0.295	-2.12
R2		0.973	0.973		0.986	0.986		0.985	0.985		0.948	0.948		0.949	0.949
N	8397	8397	8397	4092	4092	4092	3376	3376	3376	4123	4123	4123	8986	8986	8986

	FI			**FR**			**HU**			**IE**			**IT**		
	EM	Predicted	%-error	EM	Predicted	%-error	EM	Predicted	%-error	EM	Predicted	%-error	EM	Predicted	%-erro
Mean	2854	2854	0.00	2610	2610	0.00	722	722	0.00	4422	4422	0.00	2714	2714	0.00
D1	1018	1015	-0.25	1171	1131	-3.40	330	333	0.96	1760	1753	-0.39	918	967	5.28
D2	1202	1207	0.42	1425	1409	-1.15	446	443	-0.56	1963	1951	-0.62	1396	1403	0.53
D3	1689	1697	0.43	1560	1608	3.07	491	489	-0.30	2546	2599	2.08	1737	1708	-1.68
D4	1969	1976	0.33	1776	1832	3.13	552	552	0.04	3129	3152	0.73	2011	2000	-0.58
D5	2293	2288	-0.21	2121	2113	-0.40	639	634	-0.82	3524	3512	-0.33	2220	2222	0.10
D6	2764	2753	-0.40	2484	2482	-0.07	672	673	0.26	4256	4216	-0.93	2539	2524	-0.60
D7	3197	3195	-0.06	2801	2791	-0.36	742	747	0.70	4862	4839	-0.46	2879	2889	0.33
D8	3682	3679	-0.08	3194	3183	-0.37	854	853	-0.19	5600	5574	-0.47	3318	3297	-0.65
D9	4299	4296	-0.09	3904	3891	-0.35	1001	1005	0.42	6613	6636	0.35	3985	3981	-0.09
D10	6434	6443	0.13	5673	5672	-0.02	1496	1493	-0.25	9996	10016	0.20	6139	6152	0.22
D-ratio	6.32	6.35	0.38	4.85	5.02	3.50	4.53	4.48	-1.19	5.68	5.71	0.59	6.68	6.36	-4.81
Gini	0.321	0.318	-1.11	0.306	0.299	-2.10	0.293	0.282	-3.88	0.314	0.312	-0.80	0.327	0.314	-3.88
R2		0.984	0.984		0.964	0.964		0.973	0.973		0.986	0.986		0.945	0.945
N	7741	7741	7741	7243	7243	7243	5841	5841	5841	2941	2941	2941	13687	13687	13687

Table A.4: Validation of estimated net tax functions (ctd.)

	LT EM	Predicted	%-error	LU EM	Predicted	%-error	LV EM	Predicted	%-error	MT EM	Predicted	%-error	NL EM	Predicted	%-error
Mean	770	770	0.00	5105	5105	0.00	892	892	0.00	1944	1944	0.00	3125	3125	0.00
D1	181	183	1.33	2438	2388	-2.04	181	181	-0.31	705	712	1.06	973	972	-0.14
D2	309	310	0.13	2903	2941	1.29	311	319	2.48	988	985	-0.31	1249	1232	-1.37
D3	421	420	-0.23	3271	3286	0.44	435	436	0.11	1211	1211	0.02	1715	1723	0.42
D4	523	514	-1.63	3877	3906	0.73	518	519	0.22	1444	1453	0.61	2130	2137	0.36
D5	598	600	0.38	4186	4189	0.08	631	631	0.03	1605	1603	-0.13	2588	2603	0.56
D6	704	702	-0.35	4724	4708	-0.34	795	785	-1.26	1852	1844	-0.47	3000	3009	0.30
D7	811	817	0.69	5311	5300	-0.21	918	912	-0.63	2148	2128	-0.95	3444	3431	-0.37
D8	982	981	-0.11	6102	6095	-0.12	1132	1135	0.28	2449	2460	0.43	3938	3937	-0.02
D9	1172	1178	0.51	7188	7183	-0.07	1452	1455	0.16	2845	2848	0.12	4628	4630	0.03
D10	2002	1999	-0.18	11069	11076	0.06	2548	2549	0.06	4209	4213	0.10	7588	7580	-0.10
D-ratio	11.07	10.90	-1.49	4.54	4.64	2.15	14.06	14.11	0.36	5.97	5.92	-0.95	7.79	7.80	0.04
Gini	0.366	0.361	-1.30	0.284	0.282	-0.82	0.404	0.400	-1.07	0.294	0.293	-0.50	0.331	0.330	-0.40
R2		0.980	0.980		0.986	0.986		0.975	0.975		0.971	0.971		0.988	0.988
N	3036	3036	3036	2851	2851	2851	3408	3408	3408	2429	2429	2429	7374	7374	7374

	PL EM	Predicted	%-error	PT EM	Predicted	%-error	RO EM	Predicted	%-error	SE EM	Predicted	%-error	SI EM	Predicted	%-error
Mean	918	918	0.00	1824	1824	0.00	413	413	0.00	2909	2909	0.00	1942	1942	0.00
D1	345	340	-1.59	724	705	-2.60	155	153	-1.37	1055	1044	-1.11	711	704	-0.88
D2	430	438	1.79	884	894	1.16	143	143	0.41	1355	1345	-0.77	1085	1091	0.49
D3	548	555	1.26	973	996	2.33	219	219	-0.01	1769	1829	3.37	1254	1259	0.41
D4	630	630	0.01	1173	1172	-0.12	276	280	1.62	2068	2079	0.52	1521	1520	-0.09
D5	723	714	-1.24	1331	1341	0.76	325	323	-0.80	2496	2460	-1.42	1687	1681	-0.39
D6	818	813	-0.58	1598	1571	-1.67	380	379	-0.24	2904	2893	-0.39	1888	1894	0.31
D7	948	944	-0.48	1796	1795	-0.07	439	437	-0.42	3308	3318	0.28	2128	2135	0.33
D8	1123	1125	0.24	2229	2241	0.53	529	534	0.96	3782	3791	0.23	2404	2398	-0.26
D9	1368	1375	0.53	2751	2753	0.09	662	660	-0.36	4330	4305	-0.58	2769	2765	-0.14
D10	2247	2246	-0.04	4788	4779	-0.19	1007	1007	-0.02	6025	6031	0.10	3978	3979	0.02
D-ratio	6.51	6.62	1.58	6.62	6.78	2.47	6.50	6.59	1.37	5.71	5.78	1.22	5.60	5.65	0.91
Gini	0.343	0.333	-2.94	0.358	0.351	-1.94	0.363	0.358	-1.44	0.297	0.293	-1.34	0.287	0.282	-1.77
R2		0.934	0.934		0.952	0.952		0.961	0.961		0.986	0.986		0.974	0.974
N	10073	10073	10073	2696	2696	2696	4830	4830	4830	5197	5197	5197	7059	7059	7059

	SK EM	Predicted	%-error	UK EM	Predicted	%-error
Mean	933	933	0.00	3541	3541	0.00
D1	379	378	-0.23	1265	1277	0.93
D2	569	569	-0.01	1361	1378	1.20
D3	635	639	0.56	1802	1800	-0.07
D4	705	705	-0.10	2151	2132	-0.86
D5	789	790	0.07	2585	2598	0.50
D6	896	895	-0.13	3109	3118	0.29
D7	994	993	-0.15	3687	3690	0.10
D8	1107	1112	0.50	4438	4402	-0.80
D9	1329	1325	-0.28	5442	5425	-0.32
D10	1934	1933	-0.08	9572	9591	0.20
D-ratio	5.11	5.12	0.15	7.56	7.51	-0.72
Gini	0.276	0.273	-1.16	0.369	0.366	-0.64
R2		0.974	0.974		0.997	0.997
N	3926	3926	3926	16159	16159	16159

*Note: Column EM indicates monthly disposable income as calculated by EUROMOD, column Predicted the accordant values as predicted with the respective net tax function, estimated separately for each country using the same specification. Monthly disposable income is presented for gross income deciles D1-D10 at the household level. D-ratio is the D10/D1-ratio. R2 is the R-squared of the estimated net tax function, N the number of observations used in the calculations. The %-error is calculated as the mean of the absoulte value of the difference between the EM and the predicted amount in per cent of the mean of the EM amount: %-error={(1/N)*Σ(y_predicted - y_EM)}/{(1/N)*Σy_EM}*100.*

Table A.5: Main estimation output for European average tax functions

VARIABLES	(1) EU27	(2) EA17	(3) EA12	(4) EA-N	(5) EA-S
Employment income	0.462***	0.590***	0.579***	0.617***	0.402***
	(0.0166)	(0.0208)	(0.0222)	(0.0280)	(0.0301)
(Employment income)^2	2.551**	-6.370***	-7.048***	-15.52***	10.93***
	(1.172)	(1.553)	(1.653)	(2.186)	(2.813)
Capital income	-0.140	-0.251	-0.110	-0.787**	1.902***
	(0.175)	(0.207)	(0.217)	(0.309)	(0.349)
(Capital income)^2	123.1***	329.4***	312.2***	413.4***	-419.7**
	(27.78)	(44.74)	(46.98)	(102.4)	(174.1)
Priv. pension income	0.426	0.466	0.136	-1.529***	2.059***
	(0.260)	(0.366)	(0.385)	(0.492)	(0.657)
(Priv. pension income)^2	35.18	-111.9	87.08	1,873***	-2,869***
	(130.8)	(264.5)	(279.6)	(435.4)	(675.3)
Maint. costs	0.0193	0.741	0.892	2.244**	1.010
	(0.539)	(0.598)	(0.624)	(1.022)	(0.774)
(Maint. costs)^2	2,164***	2,964***	3,045***	1,765	4,772***
	(539.9)	(711.8)	(741.4)	(1,378)	(1,092)
N childr. age 0-2	-171.4***	-277.6***	-364.5***	-377.0***	-501.8***
	(20.44)	(31.30)	(34.51)	(54.31)	(38.31)
N childr. age 3-6	-139.3***	-247.8***	-361.1***	-322.2***	-506.4***
	(17.70)	(26.51)	(29.48)	(46.86)	(33.01)
N childr. age 7-12	20.05	-83.40***	-219.2***	-280.9***	-269.0***
	(14.83)	(24.07)	(26.94)	(41.61)	(29.81)
N childr. age 13-17	76.11***	-40.67*	-121.9***	-342.7***	-177.1***
	(14.50)	(23.22)	(26.27)	(42.59)	(29.62)
N childr. age 18+	68.01***	54.70**	-12.01	-411.6***	-1.273
	(13.33)	(22.24)	(25.35)	(44.09)	(27.75)
(N childr. age 0-2)^2	-64.48***	16.28	30.02**	78.27***	-11.89
	(10.29)	(14.29)	(15.29)	(22.82)	(16.74)
(N childr. age 3-6)^2	-8.043	50.58***	60.83***	47.79***	46.75***
	(7.522)	(10.02)	(10.62)	(13.61)	(12.42)
(N childr. age 7-12)^2	-17.00***	-4.518	5.990	-4.323	-38.91***
	(4.411)	(6.805)	(7.426)	(10.48)	(8.478)
(N childr. age 13-17)^2	-35.71***	-2.341	-0.905	34.08***	-9.212
	(5.056)	(7.398)	(8.467)	(12.51)	(9.206)
(N childr. age 18+)^2	5.123	11.92*	12.28*	117.6***	-53.57***
	(3.578)	(6.246)	(6.973)	(13.89)	(7.115)
N adults age 16-25	312.1***	230.1***	135.0***	-33.36	-121.0***
	(15.93)	(26.39)	(29.90)	(48.34)	(33.47)
N adults age 26-35	173.0***	117.0***	33.61	-187.2***	-93.47***
	(14.39)	(23.85)	(26.84)	(47.12)	(28.63)
N adults age 36-45	114.3***	124.1***	52.70*	-142.4***	-118.0***
	(15.24)	(24.63)	(27.85)	(48.42)	(29.78)
N adults age 46-55	198.9***	148.5***	54.55*	-113.6**	-166.4***

	(16.77)	(26.90)	(30.38)	(50.72)	(33.05)
N adults age 56-65	185.4***	86.00***	-19.85	-177.6***	-160.7***
	(19.46)	(30.03)	(33.72)	(54.48)	(36.46)
N adults age 66-75	217.4***	136.1***	64.78	-279.8***	-193.0***
	(30.85)	(44.90)	(49.31)	(83.33)	(49.52)
N adults age 76+	303.0***	221.1***	137.6**	-11.97	-143.0**
	(38.59)	(54.19)	(59.67)	(118.9)	(59.72)
(N adults age 16-25)^2	-53.68***	-48.66***	-44.33***	-63.97***	40.06***
	(5.570)	(9.496)	(10.11)	(13.41)	(12.07)
(N adults age 26-35)^2	20.98***	22.62***	12.02	39.11***	15.47*
	(4.234)	(6.977)	(7.559)	(10.45)	(8.176)
(N adults age 36-45)^2	38.23***	30.45***	18.14***	29.85***	37.56***
	(4.609)	(5.965)	(6.378)	(8.764)	(7.395)
(N adults age 46-55)^2	-0.990	-0.718	-5.303	14.32*	16.11**
	(4.768)	(6.237)	(6.692)	(8.566)	(7.610)
(N adults age 56-65)^2	-26.02***	-7.151	-7.121	5.142	-42.65***
	(6.353)	(7.890)	(8.438)	(11.48)	(9.152)
(N adults age 66-75)^2	-30.39*	29.99	40.99*	237.5***	52.68***
	(16.01)	(21.27)	(22.88)	(45.12)	(20.44)
(N adults age 76+)^2	-58.49**	-28.54	-2.931	128.7*	34.29
	(22.81)	(29.78)	(32.13)	(69.84)	(28.84)
N civil servants in hh	26.74***	-21.52***	-76.17***	-338.7***	-106.1***
	(5.055)	(6.924)	(7.623)	(17.46)	(7.335)
N disabled in hh	-78.69***	-343.9***	-341.8***	-395.0***	-265.6***
	(6.114)	(10.10)	(10.74)	(12.66)	(12.14)
N months in unempl. in hh	-4.351***	-19.75***	-19.54***	-13.69***	-15.04***
	(0.436)	(0.573)	(0.613)	(0.713)	(0.751)
N immigrants in hh	-40.55***	-2.518	-4.190	-45.08***	-0.344
	(3.820)	(4.688)	(4.967)	(8.379)	(5.001)
N women in hh	22.15***	14.82***	7.409*	-12.05**	-10.95**
	(2.981)	(3.813)	(4.067)	(5.133)	(4.601)
Hours worked hh-head	17.68***	7.852***	6.639***	10.05***	0.638
	(0.319)	(0.402)	(0.424)	(0.549)	(0.460)
Hours worked hh-head's partn.	4.471***	-4.605***	-7.082***	-11.62***	-4.367***
	(0.414)	(0.549)	(0.594)	(0.928)	(0.627)
Hh-head married	133.6***	80.65***	60.17***	4.085	17.34*
	(7.248)	(9.169)	(9.726)	(13.22)	(10.40)
Hh-head sep./divorced	14.55**	-8.382	-16.97**	-45.55***	47.47***
	(5.929)	(7.306)	(7.750)	(8.137)	(9.997)
Hh-head early ret.	-158.2***	-327.1***	-334.1***	-95.11***	-521.2***
	(11.85)	(13.93)	(14.77)	(18.30)	(16.17)
Hh-head inactive/unemp.	15.30**	13.18	24.85**	60.51***	-36.26***
	(7.764)	(9.375)	(9.858)	(11.88)	(10.87)
Hh-head student/other	55.58***	0.693	22.99*	99.64***	-26.88*
	(10.09)	(11.50)	(12.06)	(14.01)	(14.68)
Hh-head's partn. early ret.	-27.36***	78.02***	59.11***	48.77***	23.79*
	(9.287)	(11.62)	(12.38)	(17.27)	(14.02)

Hh-head's partn. inactive/unemp.	-267.5***	-393.8***	-455.4***	-530.3***	-408.5***
	(13.61)	(17.19)	(18.45)	(27.66)	(18.62)
Hh-head's partn. student/other	-57.14***	61.99***	45.02***	-126.0***	93.67***
	(8.230)	(10.36)	(11.61)	(15.71)	(13.13)
Hh is homeowner	146.5***	106.5***	70.60***	104.3***	36.78***
	(4.253)	(5.387)	(5.746)	(7.333)	(6.770)
Hours worked 1st add. hh-mem.	0.999***	1.682***	0.527*	3.486***	-0.868***
	(0.207)	(0.269)	(0.307)	(0.589)	(0.289)
1st add. hh-mem. married	-85.93***	17.41	41.19	-110.7***	124.4***
	(17.25)	(24.01)	(26.22)	(42.16)	(26.98)
1st add. hh-mem. sep./divorced	-128.4***	-19.45	76.58***	194.8***	16.08
	(15.74)	(22.60)	(24.71)	(64.73)	(23.63)
1st add. hh-mem. early ret.	-111.4***	-376.3***	-436.0***	-106.9	-456.4***
	(31.63)	(45.79)	(50.22)	(84.09)	(53.16)
1st add. hh-mem. inactive/unemp.	-111.9***	-256.2***	-212.4***	143.8*	-300.4***
	(30.18)	(43.47)	(47.72)	(75.11)	(51.04)
1st add. hh-mem. student/other	-170.3***	-369.7***	-301.1***	143.3**	-324.5***
	(28.21)	(40.98)	(45.09)	(70.87)	(48.93)
...					
+ up to 4th additional household member					
+ all demographic variables interacted with all income variables					
...					
Constant	-886.2***	-477.5***	-248.6***	-46.84	95.72
	(40.72)	(54.43)	(58.97)	(76.65)	(67.34)
Obs.	155,842	93,477	74,407	31,880	36,735
$R2$	0.981	0.965	0.970	0.987	0.979

Note: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. EU27 indicates the estimated model for 27 member states of the EU; EA17 for the current 17 member states of the euro area; EA12 for the 12 founding members of the euro area and EA-N (EA-S) for a hypothetical "North" ("South") euro area as defined in the text. *Source*: Own calculations based on EU-SILC and EUROMOD.