
# Backward-looking analysis

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## ABSTRACT

We develop a new modelling approach combining micro and macro simulations to analyse distributional and stabilizing effects of a European Unemployment Benefit System (EUBS). We run counterfactual simulations based on micro data for the period 1995 to 2013 to estimate net contributions for different variants of EUBS across European member states. Our micro estimates are then used to feed the macro-econometric model in order to obtain counterfactual evolutions of income and unemployment. These new income and employment series are finally simulated again at the micro level. We compare results before and after taking account of the macroeconomic feedback effects and analyse the difference that the feedback effects make.

JEL-Codes: F550, H230, J650.

Keywords: European fiscal integration, unemployment insurance, automatic stabilizers.

# 1. INTRODUCTION

This paper reports the results of a detailed exercise that models the potential impacts of alternative variants of a European unemployment benefit system if such a system had been in operation in the period 1995-2013 across the EA19/EU27 Member States.

In the *microeconomic* analysis, we simulate a sample of repeated cross-sections for each member state using micro data from the EU Statistics on Income and Living Conditions (EU-SILC) in combination with the EUROMOD microsimulation model. We perform detailed imputations from the EU Labour Force Survey (EU-LFS) to determine the eligibility of individuals under the rules of each variant of the system, and hence determine the flows of contributions into the European fund and payments out of the fund, given the actual unemployment experience of each country. The results for transfers to and from the fund are then used to carry out *macroeconomic* analysis using the E3ME macroeconometric model to estimate the extent to which operation of such a system would have promoted macroeconomic stabilization. Finally, the macroeconomic consequences for short-term unemployment in the counterfactual (the hypothetical case where the European system would have been in operation) are simulated at the micro level to examine the extent to which microeconomic consequences and net transfers to and from the fund are affected by the macroeconomic stabilization feedback.

The EUBS variants can be grouped into *equivalent* and *genuine* systems. While the equivalent systems involve financial transfers between the supranational fund and the member state governments, the genuine systems establish direct transfers to unemployed citizens. A further difference between equivalent and genuine systems is that the former are only activated once certain thresholds defined by changes in the short-term unemployment rate are passed, while the latter are permanently in place.

The economic effects of the EUBS are compared to the actual history as observed over the period 1995-2013. In the simulations, the baseline is represented by the actual legislation of national unemployment benefit systems, while in the counterfactual different variants of the EUBS are simulated. This implies that the total stabilization effects derived in our analysis stem from different channels. First, the EUBS differs from national UI systems in various dimensions such as replacement rate, benefit duration and eligibility condition. The first stabilization channel is thus due to a (potentially) higher countercyclicality of the EUBS vis-à-vis national UI systems because of *greater coverage or benefit generosity*. Second, the establishment of a common EUBS effectively means that national UI systems are first harmonized such that they fulfill minimum requirements as defined by the conditions of the EUBS and subsequently centralized. Centralization gives rise to *inter-country smoothing* effects. Consider a fiscal union consisting of two countries A and B that centralize their UI systems. If the union is hit by asymmetric unemployment shocks, contributions to the centralized UI system are less volatile than those to the national UI systems. Third, most of the simulated EUBS variants can issue debt which gives rise to *intertemporal smoothing* gains. In sum, all three channels contribute to the macroeconomic stabilization effects derived in this paper.[1] In the absence of financing or other institutional constraints (which may be a strong assumption if either financial markets charge a premium for borrowing or Fiscal Compact rules are binding), national UI systems could in principle effect intertemporal smoothing; inter-country smoothing effects constitute the added value of a common European unemployment benefit system.

[1] Dolls et al. (2016) propose a formal decomposition of the stabilization effects of a European unemployment benefit system and distinguish between the effect of harmonization, inter-country and intertemporal smoothing. Smoothing results derived in their paper are reported in Appendix A.6. See also Fatás (1998) and Forni and Reichlin (1999) on potential insurance effects in EMU.

The paper is structured as follows. In section 2, the methodological approach in the micro and macro level analysis and the interaction between the two is presented. Section 3 describes in detail the 18 simulated EUBS variants and how they are operationalized in the empirical analysis. Section 4 reports results before and after taking account of the macroeconomic feedback effects. Section 5 concludes.

# 2. DATA AND METHODOLOGY

In this section, we present the empirical approach taken in the micro and macro modelling as well as the link between the micro and macro simulations. The micro data approach to simulate a European unemployment insurance system which we adopt in this paper has been proposed by Dolls et al. (2016).

## 2.1. Analysis at the micro level

We rely on representative household micro data for the European member states using EUROMOD, a static tax-benefit calculator for the European Union. EUROMOD is mainly based on cross-sectional micro data from the EU Statistics on Income and Living Conditions (EU-SILC) released by Eurostat (Eurostat 2012) which we combine with micro data from the EU Labour Force Survey (EU-LFS).[2] The key advantage of our approach in the present context is that we exploit both detailed household income and labour market information contained in EUROMOD and the EU-SILC as well as information on changing labour market patterns over time contained in the LFS. We are thus able to account for heterogeneity in various characteristics of the populations in the European member states.

In our simulation experiment, we introduce different variants of European unemployment benefits systems (EUBS) and ask what would have happened if such systems had been introduced in 1995. The analysis is conducted both for the EA19 and the EU27 member states.[3] As there are neither panel data nor repeated cross-sectional data available containing both income distributions and labour market conditions for all European member states over the period 1995-2013, we construct a series of reweighted cross-sections for the period of analysis which precisely replicates changes in labour market conditions (unemployment rate, share of short- and long-term unemployed, size and composition of the labour force) over time.[4] Our baseline input data is from EU-SILC 2008, the most recent data available with the version of EUROMOD used. For each member state, these data are first reweighted to reflect labour market conditions as observed in 1995 and then reweighted subsequently for each year of the analysis.

From the EU-LFS, we impute changes in (un)employment rates, size of the labour force, shares of short- and long-term unemployment, and coverage rates of national unemployment insurance systems for 18 gender-age-education strata (male/female, three age groups, three education levels) on an annual basis. We simulate (un)employment changes over time for each of the 18 socio-demographic subgroups so that our series of reweighted cross-sections precisely matches these dimensions both at

[2] Sutherland and Figari (2013) provide more detailed information on EUROMOD, the underlying input data and validation. The EU-LFS, conducted by the national statistical institutes across Europe and processed by Eurostat, is a representative household survey covering the years from 1983 onwards. It is the most important source for labour market statistics in the EU. Cf. http://ec.europa.eu/eurostat/web/microdata/european-union-labour-force-survey for further information.

[3] Note that Croatia was not included in the sample because the EUROMOD version used in this paper did not yet include Croatia.

[4] See Immervoll et al. (2006), Bargain et al. (2012) and Dolls et al. (2012) for further applications of the reweighting approach. Similar imputations from the LFS to EUROMOD input data have been conducted by Navicke et al. (2014) and Salgado et al. (2014).

the subgroup and aggregate level. Earnings growth is imputed from the AMECO-database in order to account for changes in the tax base of the European and national unemployment benefit systems. These imputations ensure that our reweighted micro data are consistent with aggregate statistics in each year of our simulation period (see Technical Appendix A.1 for further information). The analysis at the subgroup level allows us to examine individual heterogeneity within each member state showing to what extent different socio-demographic groups would gain from the introduction of a European unemployment benefit system in terms of coverage.[5]

In the first-round micro-level simulations, we simulate for each year and for each member state the total amount of benefits and contributions paid from/into the different EUBS. As the EUBS and national unemployment insurance systems coexist in case of the genuine EUBS (as explained further below in section 3), we also simulate benefits paid to the short-term unemployed by national UI systems as well as contributions paid to the national systems. In addition, we simulate benefits from and contributions to national UI systems in the baseline, i.e. in the non-EUBS scenario, according to actual national UI legislation over the simulation period. The simulated net benefits are subsequently fed into the macro-econometric model E3ME (see sections 2.2 and 2.3). In a second-round, the counterfactual macro-environment due to the presence of a EUBS is simulated again at the micro-level in order to compare results before and after taking account of the macroeconomic feedback effects (section 4.3).

Our analysis is based on the following simplifying assumptions. We do not simulate individual behavioral responses which could follow the introduction of a European unemployment benefit system, e.g. potential migration responses, changes in hours worked or different patterns of entries and exits to the labour force.[6] We also abstract from potential moral hazard of national governments and administrations which could have adverse labour market effects. In the light of these assumptions, our results obtained before feeding our results into the macro model E3ME should be interpreted as 'first-round' effects of a European unemployment benefit system. After simulating counterfactual unemployment and short-term unemployment series produced by E3ME, we obtain 'second-round' results which additionally reflect whole-economy effects of a European unemployment benefit system. Moreover, we run our simulations as if the EA19/EU27 had existed from 1995 onwards as it would complicate the interpretation of our results if we included new member states only after joining the EA/EU.

## 2.2. Analysis at the macro level

The effect of the EUBS is to provide income from a supranational fund to (depending on the details of the design of the system) households or the government of a country that is experiencing an increase in short-term unemployment. The means of financing the supranational fund depends on the details of the design of the system in each variant (whether by government contributions, by employers' and workers' contributions, and/or by borrowing). While the overall scale of macroeconomic impact during the period of higher unemployment is determined by the size of the transfer from the EUBS to the country, the precise impact depends on whose income is boosted, how they respond, and the subsequent consequences.

[5] Note that the LFS does not contain income distribution information. This implies that we cannot account for changes in the income distribution over time which prevents us from analyzing within-country distributional effects of the different EUBS variants.

[6] Bargain et al. (2013) account for labour supply behavior after the introduction of a European tax and transfer system. They find that labour supply responses are marginal and do not alter their main results.

### 2.2.1 Whose income is boosted when the transfer occurs?

Under an equivalent EUBS, the transfer from the supranational fund is paid to the Member State government. Although it is envisaged that the transfer would be earmarked for passive unemployment protection, we assume that the unemployment benefit payments that the Member State makes to claimants would be the same as under present arrangements with no EUBS[7]. Hence, it is the Member State government[8] whose net income is boosted relative to the non-EUBS counterfactual. We discuss below the rule to be adopted for what the government does with this income.

Under a genuine EUBS, the position is more complicated, since it depends on the extent to which the EUBS arrangements represent an improvement on the national system that would be in operation in the counterfactual. Under the variants and in those Member States where benefits in the EUBS world are more generous, there is a net improvement in the incomes of the unemployed: the nature of the financing of that net improvement depends on the details of the EUBS. In the macroeconomic modelling, it is assumed that the entire marginal increase in the unemployment benefit income of the unemployed is spent (added to household final consumption), which seems to be a more reasonable approach than to assume that their spending and saving behaviour is the same as that of the average household. To the extent that the EUBS replaces the national system, the main impact on Member State government budgets is to remove both the element of social protection contributions that is now diverted to the EUBS fund and the payment of unemployment benefit that now comes from the EUBS fund: the effect should therefore be to smooth the time profile of the budget deficit (because both contributions and payments are sensitive to the economic cycle).

### 2.2.2 How governments respond

In the simulations, we adjust the fiscal policy of central government to reflect the first-round effects of EUBS contributions and receipts, and treat the monetary policy of the monetary authority (the ECB in the case of countries in the Eurozone; national central banks in the case of other countries) as endogenous.

We adopt the rule that *fiscal policy* is adjusted so that the annual budget deficit is unchanged in the simulations with the EUBS compared with the non-EUBS benchmark. Consequently, in those variants in which the effect of the EUBS is to transfer income to or from governments (that is, under equivalent systems), the effect is to make fiscal policy looser or tighter by the amount of the net transfer received or paid. The interpretation is that, in the non-EUBS case, during a recession the national government has been forced to tighten fiscal policy to contain the budget deficit, while under the EUBS the scale of such tightening is less. Similarly, for Member States and periods when, under equivalent systems, net contributions are being made into the EUBS fund, we assume that the stance of fiscal policy is (slightly) tighter in order to finance the regular contributions.

The alternative would be to assume that the funding made available under the EUBS is used to reduce the budget deficit and repay government debt, and that the contributions

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[7] This would not be the case if, in a non-EUBS world, the austerity package introduced by a government at a time of economic shock included measures to curb entitlement to unemployment benefit. In that case, the cushion to austerity provided by the EUBS could be used to avoid the need for such measures, so that the EUBS has the effect of boosting the income of unemployment claimants relative to the counterfactual. However, given that such measures would be only a small part of the overall austerity package, it is unlikely that accounting for this effect would make much difference to the modelling results.

[8] Strictly speaking, it is the Member State's unemployment benefit fund that sees the improvement in net income, but for modelling purposes we treat this as the same as improvement in the government's net income.

are financed by increasing debt. If 'Ricardian equivalence', were assumed, private sector actors would adjust their spending behaviour and offset any debt-financed fiscal stimulus. Broadly speaking, therefore, the stimulus to the economy arising from the transfers to government made under the EUBS would be similar whether the income is used to loosen fiscal policy or repay debt (either the government spends the income or the private sector increases its spending in anticipation of lower taxes in future). However, in the context of a recession during which access to credit is likely to be constrained, at least for some actors, it seems unlikely that any Ricardian equivalence effect would be strong (or, to put it another way, that governments would be content to rely upon such an effect to stimulate economic activity). We have therefore preferred to adjust fiscal policy rather than government borrowing and debt.

The macroeconomic impact of changes to fiscal policy is likely to vary depending on which instrument of fiscal policy is used: government investment spending (which typically bears the brunt of the fiscal adjustment forced on governments by a recession, because it is easier to defer investment than to cut current spending) has a high construction content and hence a smaller import content (both intra-EU and extra-EU) than current spending or the private spending that would result from changes to tax rates: its domestic multiplier impact is therefore typically higher, and trade spillover effects are smaller. Conversely, changes in income tax that stimulate household spending will be subject to leakages reflecting both saving and the higher import content of consumers' expenditure.

In order to allow comparison between the impact of the equivalent and genuine systems to focus on the design features of each variant rather than the different multiplier effects of fiscal and private spending, in the macroeconomic results presented here the EUBS net effect on a country's income is implemented as a direct boost to household spending, in a similar manner to the way that genuine systems are modelled. This could be interpreted as, approximately, a decision by member state governments to improve the generosity of their national systems so that, when payments are triggered, the additional income is directed towards households with unemployed adults.

To the extent that, during a recession, the impact of the EUBS is to stimulate economic activity compared with the non-EUBS case, there could be an offsetting effect if monetary policy is tightened (because inflation is higher than it otherwise would have been), and exchange rate effects would follow from this. We have therefore implemented a Taylor-type rule for monetary authorities and an uncovered interest parity rule for the exchange rate of their currency.

### 2.2.3 Other features of the macroeconomic modelling

We note here other features of the E3ME model that are relevant to interpreting what effects the macroeconomic modelling does and does not capture. Annex A.5 gives a brief technical description.

#### *Aggregation*

Macroeconomic aggregates are understood to be the sum of the corresponding values for individual heterogeneous households, workers, firms or other agents (e.g. government entities). The properties observed for the aggregates are therefore some kind of weighted average of the (unobserved) properties of the individuals, and the stability over time of any aggregate relationships in the modelling depends not only on the stability of the underlying individual relationships but also on the effects of any changes in composition (for example, a shift over time towards a larger share of older individuals, or a reduction in the importance of heavy industry in production). Where data permit, E3ME addresses some of these issues through explicit disaggregation, principally by distinguishing expenditure on some 70 products and production and employment in some 70 industries. But any aggregate relationship (whether for an industry or, for some variables such as household consumption, the whole population) is understood as an

empirical regularity whose properties and stability over time is a matter for empirical investigation.

***The labour market***

Separate employment functions are estimated for each industry in each country. The specification follows the work of Lee, Pesaran and Pierse (1990), motivated by the theoretical optimisation problem for firms to minimise costs for a given level of output, but also incorporates insights from the work on growth theory developed by Scott (1989). Employment is determined as a function of real output, real wage costs, hours-worked, the oil import price (used as a proxy for energy prices) and measures of technological progress (which depend on investment). For the present study, the key points are that the elasticity of employment with respect to output is less than 1.0 (and considerably less for manufacturing industries), and that increases in the cost of labour faced by employers (brought about, for example, by higher social contributions to finance unemployment insurance) act to curb employment. Both of these have the effect in the simulations reported below that the proportional impact of the EUBS on employment is less than its impact on GDP.

Wage rates respond to the pressure of demand in the labour market (represented by the unemployment rate) and to the generosity of the benefit regime. In the present study, both of these have the effect of raising wages relative to the baseline in periods when the impact of recession is mitigated.

Population trends are entered as assumptions in E3ME and the migration of workers is not modelled. In the context of the present study, this means that, to the extent that improvements in labour market conditions would deter outmigration and increase the size of the labour force (offsetting some of the positive impact on unemployment rates), this effect is not captured.

***Spillover effects***

The principal spillover effect captured in E3ME is mediated via trade: expansion of demand in one country leads to an increase in imports and hence higher output and employment in the countries whose industries supply the imported products. Spillover effects are (proportionately) larger for spending in smaller countries where imports account for a larger share of domestic demand.

***Hysteresis effects***

Longer-term GDP growth is E3ME is affected by investment (though improvements to labour productivity and to trade non-price competitiveness). Consequently, a period of depressed investment produces a permanent reduction in the level of GDP and there is no tendency in the model for that loss to be recovered.

Hysteresis effects on labour quality and supply are not modelled, however, and so the potential benefit of curbing the deterioration of skills associated with spells of unemployment is not captured.

***Product markets***

E3ME's price equations include a positive response to the pressure of demand. To the extent that prices were frozen rather than cut during the recession, there may be scope for prices not to rise, at least initially, in response to the boost to activity associated with the EUBS, and this effect is not captured by the model.

***Expectations***

E3ME assumes that agents form expectations on the basis of observed indicators, rather than by looking forward. To the extent that the EUBS has the effect of improving forward-looking expectations, raising the expected inflation rate and thus lowering the real interest rate, household consumption may be stimulated, and this may be of particular relevance at a time when nominal interest rates cannot be reduced further to achieve the same effect through monetary policy. This effect is not captured in E3ME.

Similarly, the expectation of inflation that is used in E3ME to determine the spot exchange rate is based on an extrapolation of the current inflation rate. If forward-looking expectations of inflation are higher than this as a result of the EUBS, purchasing power parity arguments suggest that the exchange rate would have a tendency to depreciate, giving an additional boost to activity through competitiveness effects, and the model would not capture this effect.

***Financial markets***

E3ME assumes that money is created endogenously by banks in response to profitable lending opportunities, but the spread between banks' lending rates and the short-term rate set by the central bank is not modelled. There are no financial frictions. Consequently, any tendency for spreads to be reduced in a recession by the counter-cyclical effect of the EUBS and for this to be transmitted in lower effective borrowing rates will not be captured by the model.

***Potential crowding out of private risk sharing***

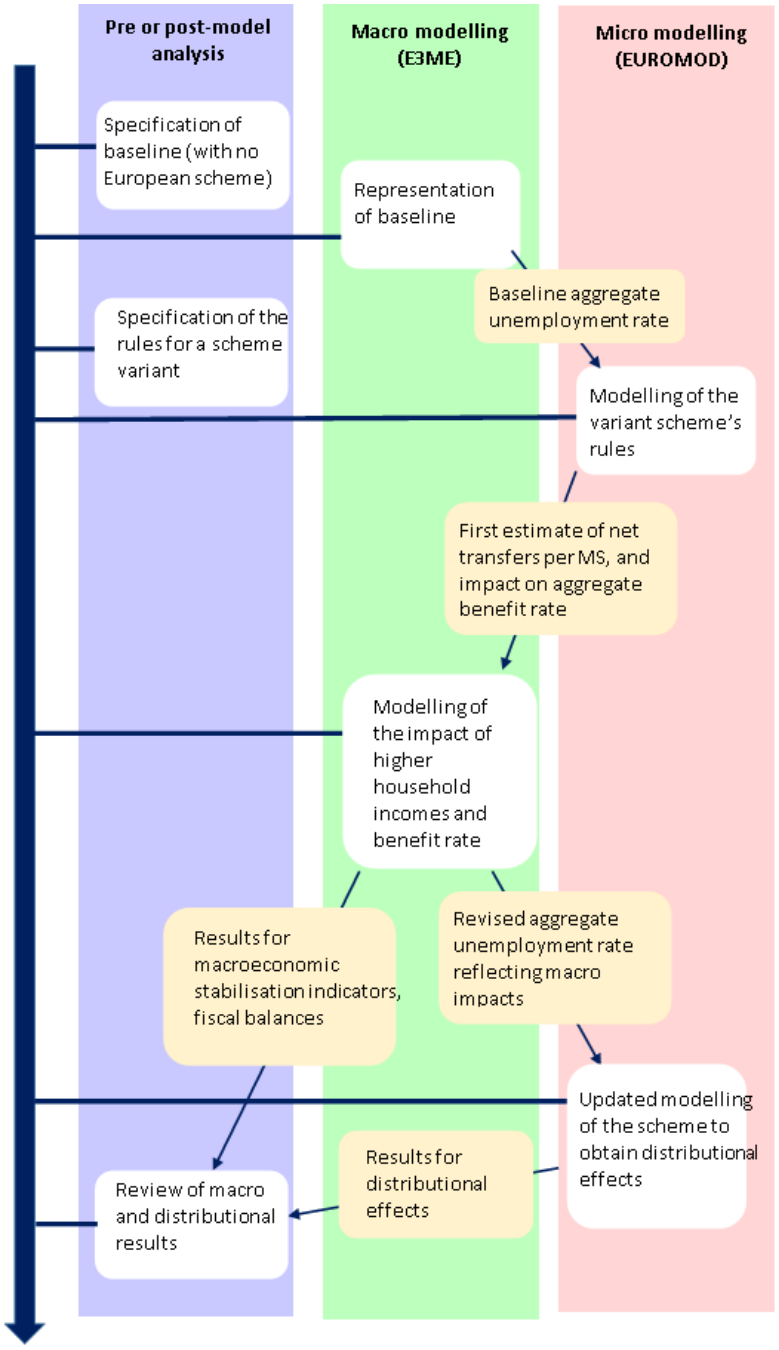
There is no modelling of behavioural responses with respect to private risk-sharing behaviour. Some forms of private risk-sharing (cross-border ownership of assets) are unlikely to be affected by the presence of an EUBS. Werning and Farhi (2012) find that the provision of market risk-sharing is sub-optimal even under the hypothesis of complete financial markets: opportunities for individuals to purchase, for example, comprehensive private unemployment insurance at a reasonable premium may not be available. Any system (whether national or pan-European) of public unemployment insurance could in principle allow households to hold smaller balances of precautionary savings, but the latter method of adequate protection against unemployment shocks is costly for individuals compared with an insurance system.

With the exception of the labour migration effect, most of the effects noted above that E3ME does not capture are in a positive direction with respect to the stabilization impact of the EUBS, suggesting that the E3ME results may be conservative in their representation of stabilization effects (the scale of any underestimate depending on the importance of the effects that are not captured).

## 2.3. Interaction between micro and macro simulations

Figure 1 shows the design for the interaction between the micro and macro simulations.

**Figure 1. The design for the interactions between the micro and macro simulations**



# 3. EUBS VARIANTS

In this section, we present the 18 variants that are simulated in the backward-looking analysis. For a comprehensive exposition of the different variants and their rationale, we refer to Annex 3 of the first Interim Report. In particular, this section clarifies how the variants are operationalized in the micro-simulations.

The variants can be grouped into *equivalent* and *genuine* European unemployment benefit systems. While the equivalent systems involve financial transfers between the supranational fund and the member state governments, the genuine systems establish direct transfers to unemployed citizens. This implies that national unemployment insurance (UI) systems stay in place under equivalent EUBS, but are (partly or fully) replaced by genuine EUBS depending on the design of the EUBS and the national UI system. However, financial transfers of the equivalent EUBS to national governments are intended to support unemployment benefit spending so that in effect the unemployed are the (indirect) recipients of the transfers. Tables 1 and 2 provide an overview of the four equivalent and the 14 genuine EUBS, respectively.

In the four equivalent systems, transfers are activated once a certain trigger is pulled (contingent benefits), whereas unemployment benefits paid under the genuine systems are non-contingent. The indicator chosen for determining the trigger is the short-term unemployment rate. Under variant 1 ("stormy day"), benefits are activated if the short-term unemployment rate in year t and country i is 1 percentage point higher than the average short-term unemployment rate in country i over the previous ten-year period. Note that in our empirical analysis t refers to years rather than quarters as specified in the Interim Report. The reason is that the simulations are run on a yearly basis. Under variants 2 and 3 ("rainy day with debt" and "rainy day without debt"), the increase in short-term unemployment must be larger than 0.1 percentage point, while under variant 4 ("reinsurance of national UBS"), the respective threshold is 2 percentage points. Other features that differentiate the four equivalent systems are the presence of *experience rating*, the presence of *claw-back* mechanism, and the possibility for the supranational fund to issue *debt*.

On the benefit side, once the trigger is pulled, country i receives a transfer that amounts to the sum of the benefits that would accrue if unemployment benefits were paid to the short-term unemployed according to the parameters of variant 5 of the genuine systems (see below for further information on the genuine systems).

On the financing side, countries contribute x per cent of their GDP every year as a basic pay-in rule. Countries stop their contribution payments when their cumulative net contributions exceed z per cent of EA19/EU27 GDP and restart contributing to the EUBS once the net balance drops below z per cent.[9] In the simulations, x equals 0.1 and z is set to 0.5 as suggested in the Interim Report. If experience rating or claw-back are applied, x is multiplied by a coefficient that accounts for the number of times the equivalent system was activated for a given country during the last 10 years (t-10, …, t-1). Under experience rating, the coefficient is equal to $1 + 0.1 * F_{i,(t-10,\ldots,t-1)}$. It ranges between 1 and 2 with the maximum value of 2 applied when the trigger has been pulled continuously from t-10 to t-1. The claw-back is applied in year t when the cumulative net deficit of a country vis-à-vis the EUBS has been larger than 1 per cent of GDP in the previous 3 years (t-3, t-2 and t-1). In that case, the coefficient is set to 2. Note that all equivalent systems contain either experience rating or claw-back or both. Formally, the pay-in formula for equivalent systems is defined as follows:

[9] Note that in our simulations, cumulative net contributions are added up over time without any weighting factor. An alternative would be to consider the present value of the cumulative intertemporal flow of pay-ins and benefits. The main rationale for the unweighted adding up is that the EUBS is designed as an insurance mechanism rather than a loan-based system.

$$Pay - in = x * \ GDP_{i,t} * \left(1 + 0.1 * F_{i,(t-10,\dots,t-1)}\right). \quad (1)$$

In two of the equivalent systems, variants 3 and 4, the supranational fund cannot issue debt. If the net balance of the EUBS is negative in a given year t and there are no reserves left in the fund, member states have to make an extra payment proportional to their GDP to balance the fund.

**Table 1. Overview of the equivalent systems**

| | **V1/18**<br>**Stormy day** | **V2/18**<br>**Rainy day with debt** | **V3/18**<br>**Rainy day without debt** | **V4/18**<br>**Reinsurance of national UBS** |
|---|---|---|---|---|
| Trigger | $UR_{t,i} - \overline{UR}_{i,t-10\ \dots\ t-1} > 1\ pp$ | $UR_{t,i} - \overline{UR}_{i,t-10\dots\ t-1} > 0.1\ pp$ | $UR_{t,i} - \overline{UR}_{i,t-10\ \dots\ t-1} > 0.1\ pp$ | $UR_{t,i} - \overline{UR}_{i,t-10,\dots,t-1} > 2\ pp$ |
| Experience rating | No | yes | yes | yes |
| Claw-back | Yes | yes | yes | no |
| Debt-issuing possibility | Yes | yes | no | no |

*Source*: Authors' re-elaboration based on ToR.

The 14 genuine systems can be differentiated according to the following criteria: a *basic or top-up system* (options 5, 7-18 vs. option 6), the *duration* of the benefits (options 7 and 8), the *replacement rate* of the benefits (options 9 and 10), the *eligibility* criteria (options 11 and 12), *capping* (options 13 and 14), *cyclical variability* (option 15), the presence of *experience rating* (option 16), the presence of a *claw-bac*k mechanism (option 17), and the possibility for the supranational fund to issue debt (option 18). Variant 5 is the baseline variant as all other genuine systems differ from it only by one dimension.

First, we present the financing side of the genuine systems. The genuine EUBS are financed by social insurance contributions of employees and employers rather than by direct contributions of the member states as in the equivalent systems. The basic pay-in formula excluding experience rating and claw-back reads as follows:

$$Pay - in = x * \ gross\ wage. \quad (2)$$

x is the revenue-neutral contribution rate being uniform across member states and balancing the supranational fund at the EA19/EU27 level over the period 1995-2013.[10] Experience rating is present in all genuine systems except variant 16. It implies that in each year the revenue-neutral contribution rate is multiplied by the ratio of the 10-year moving average national short-term unemployment rate to the 10-year moving average EA19/EU27 short-term unemployment rate:

$$Pay - in = x * \ gross\ wage * \left(\frac{\overline{UR}_{i_{t-10,\dots,t-1}}}{\overline{UR}_{EU_{t-10,\dots,t-1}}}\right) \quad (3)$$

As suggested in the Interim Report, claw-back payments are made by member state governments rather than by employers and employees. They amount to an annual contribution of 0.2 per cent of GDP if cumulative net benefits of a country have been above 1 per cent of GDP in three consecutive years. Claw-back is present in all genuine systems except variant 17. Moreover, all genuine systems except variant 18 can issue debt. As in the no-debt variants 3 and 4, member states have to make an extra-payment

[10] Note that, practically, the revenue-neutral contribution rate can only be calculated with hindsight once the total amount of benefit payments as well as the tax base is known.

proportional to their GDP to balance the fund if the net balance of the supranational fund is negative in a given year.

**Table 2. Overview of the genuine systems**

| | Basic or top-up | Duration | Replacement rate | Eligibility | Capping | Cyclical variability | Experience rating | Claw-back | Debt |
|---|---|---|---|---|---|---|---|---|---|
| **V5/18** | basic | M3-M12 | 50% | 3M out of 12M | 150% | no | yes | yes | yes |
| **V6/18** | top-up | M3-M12 | 50% | 3M out of 12M | 150% | no | yes | yes | yes |
| **V7/18** | basic | M0-M12 | 50% | 3M out of 12M | 150% | no | yes | yes | yes |
| **V8/18** | basic | M3-M6 | 50% | 3M out of 12M | 150% | no | yes | yes | yes |
| **V9/18** | basic | M3-M12 | 35% | 3M out of 12M | 150% | no | yes | yes | yes |
| **V10/18** | basic | M3-M12 | 60% | 3M out of 12M | 150% | no | yes | yes | yes |
| **V11/18** | basic | M3-M12 | 50% | 6M out of 12M | 150% | no | yes | yes | yes |
| **V12/18** | basic | M3-M12 | 50% | 9M out of 12M | 150% | no | yes | yes | yes |
| **V13/18** | basic | M3-M12 | 50% | 3M out of 12M | 100% | no | yes | yes | yes |
| **V14/18** | basic | M3-M12 | 50% | 3M out of 12M | 50% | no | yes | yes | yes |
| **V15/18** | basic | M3-M12 | 50% | 3M out of 12M | 150% | yes | yes | yes | yes |
| **V16/18** | basic | M3-M12 | 50% | 3M out of 12M | 150% | no | no | yes | yes |
| **V17/18** | basic | M3-M12 | 50% | 3M out of 12M | 150% | no | yes | no | yes |
| **V18/18** | basic | M3-M12 | 50% | 3M out of 12M | 150% | no | yes | yes | no |

*Source*: Authors' re-elaboration based on ToR.

On the benefit side, a first important distinction among the genuine systems refers to the interaction between national UI systems and the EUBS, i.e. whether the unemployment benefits paid out by the EUBS are topped up by national UI benefits or vice versa. Basic systems (partly or fully) replace national UI systems as the supranational fund pays out the unemployment benefit according to the rules defined in Table 2. For example, in the baseline variant 5 benefits are paid from the 4$^{th}$ up to the 12$^{th}$ month of unemployment if the worker has worked 3 (full-time equivalent) months out of the last 12 months before job loss. The replacement rate is 50 per cent of the last gross monthly wage and benefits are capped at 150 per cent of the average national gross wage. The unemployment benefit paid by the EUBS can be topped up by national UI benefits. All genuine systems except variant 6 are basic systems. In contrast, variant 6 is called top-up system as national UI benefits may be topped up by the EUBS so that a certain generosity level is achieved. More precisely, the EUBS under variant 6 guarantees every eligible unemployed person an unemployment benefit calculated according to the rules of variant 5. As under the equivalent systems, national UI systems remain in place. However,

benefits from the EUBS are only paid if the national unemployment benefit falls short of the guaranteed benefit.[11]

In order to simulate the interaction of the EUBS and national UI systems under the genuine systems, we construct a national UI calculator that contains the most important policy rules of national UI systems such as replacement rates and the duration of unemployment benefit payments over the period 1995-13. As there is no information on the length of the contribution period prior to unemployment, coverage rates of national UI systems which reflect the stringency of the eligibility conditions are imputed from the EU-LFS.[12] In the simulation of the basic systems (variants 5 and 7-18), we assume that national UI systems indeed top up the EMU-UI system if the former is more generous than the latter so that no unemployed citizen would be worse off after the introduction of the EUBS. If, for example, the replacement rate of national UI is 60 per cent of gross income in a given country and the replacement rate of the EUBS 50 per cent, we assume that the replacement rate of the EUBS is topped up by 10 percentage points such that the overall replacement rate is still 60 per cent. Correspondingly, in the simulation of the top-up system (variant 6), we assume that actual national UI regulations of the years 1995-2013 apply and that national unemployment benefits are topped up by the EUBS if national unemployment benefits are lower than the benefit paid under variant 5.

Variants 7 and 8 correspond to variant 5 in all dimensions except the duration of unemployment benefit payments which is set to 12 (3) months in variant 7 (8). In our simulations, the length of individual unemployment spells is imputed from the EU-LFS as outlined in section 2.1. Variants 9 and 10 have different replacement rates than variant 5, namely 35% and 60%, respectively. Variants 11 and 12 have more stringent eligibility conditions than variant 5. In these variants, the required contribution period to be eligible for unemployment benefits from the supranational fund is 6 (9) months out of 12 months.[13] As mentioned above, the EU-LFS does not contain information on previous contribution periods before job loss. Therefore, the computation of coverage rates of the EUBS consists of two steps. In a first step, for each member state and each year of the simulation period the share of short-term unemployed for each of the 18 socio-demographic groups defined in section 2.1 is imputed from the LFS. In a second step, based on pre-crisis EU-SILC data from 2007 we calculate the share of employees per socio-demographic group that fulfills the respective eligibility condition (3M out of 12M, 6M out of 12M, 9M out of 12M) and assume that the same share of short-term unemployed per subgroup is eligible to the EUBS (see Appendix A.2 for further information on the estimation of coverage rates of the EUBS). Hence, our simulations are based on the assumption that the (unobserved) working histories of the short-term unemployed (i.e. of those unemployed who lost their job within the last year) are comparable to those of employees with similar socio-demographic characteristics.

Variants 13 and 14 differ from variant 5 as the maximum benefit paid by the EUBS is capped at lower levels, namely at 100 per cent and 50 per cent of the average national gross wage, respectively. Variant 15 corresponds to variant 5 except for its cyclical variability. In this variant, the benefit duration in year t is extended by 6 months if the short-term unemployment rate in t-1 has been 3 percentage points higher than its 10-

[11] As discussed in the first Interim Report, such a top-up system would give rise to incentives for national governments to fully cut back national unemployment benefits. Therefore, variant 6 should not be understood as a policy alternative, but rather as an illustration to what extent national UI systems meet the requirements of variant 5.

[12] Detailed policy rules of national UI systems are collected from country chapters of the OECD series `Benefits and Wages´ (http://www.oecd.org/social/benefits-and-wages.htm) and from the EU's MISSOC-Comparative Tables Database (http://ec.europa.eu/social/main.jsp?langId=en&catId=815).

[13] Note that in the interim report, the eligibility conditions under variants 10 and 11 are classified as 3M out of 6M and 12M out of 24M. As eligibility is assessed based on yearly data, the requirements have been changed as shown in Table 2.

year moving average. Variants 16-18 are characterized by different rules on the financing side. Variant 16 excludes experience rating, variant 17 claw-back and variant 18 debt issuance of the supranational fund.

# 4. RESULTS

## 4.1. Simulations at the micro-level: 'First-round' effects

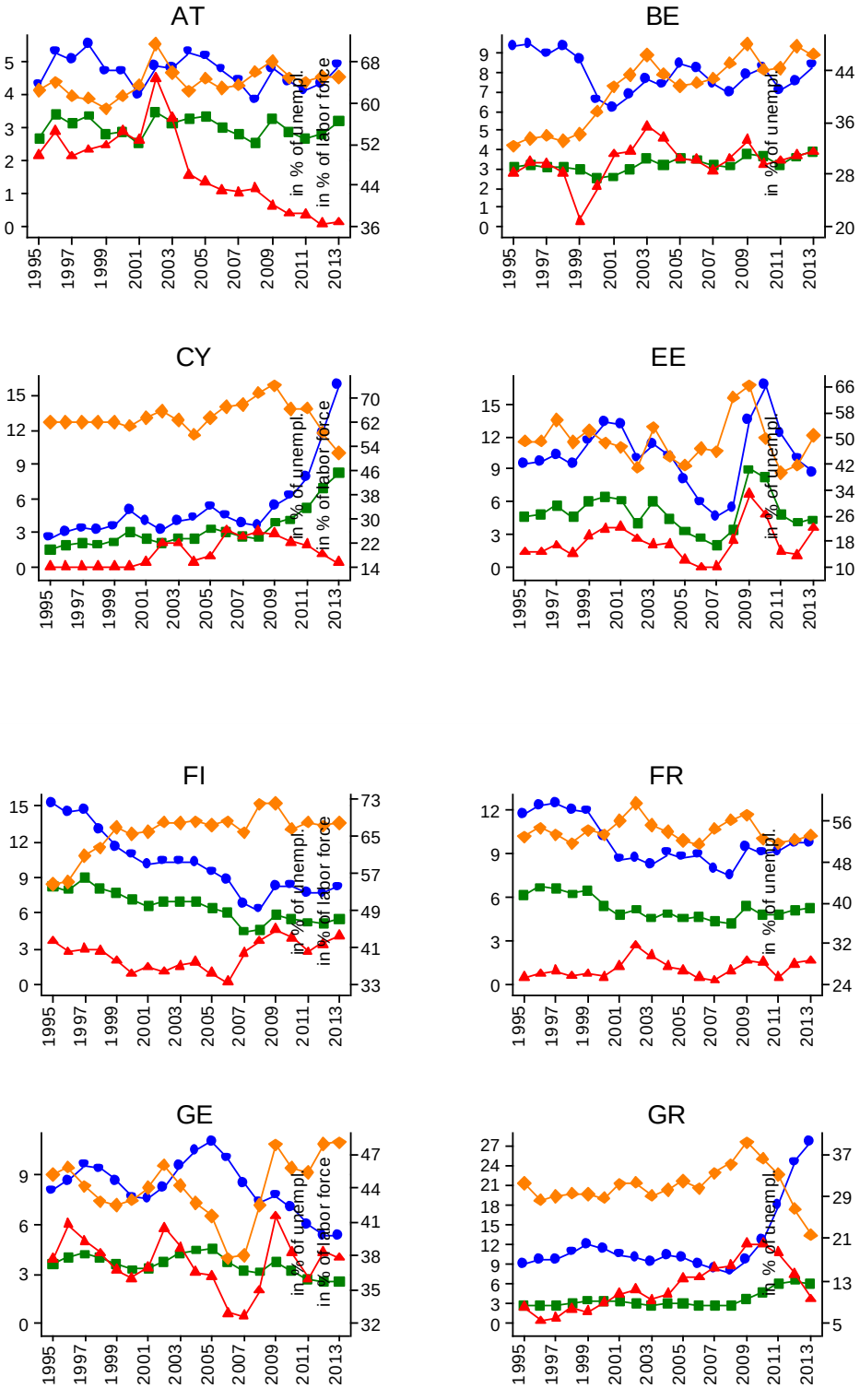
### 4.1.1 Coverage

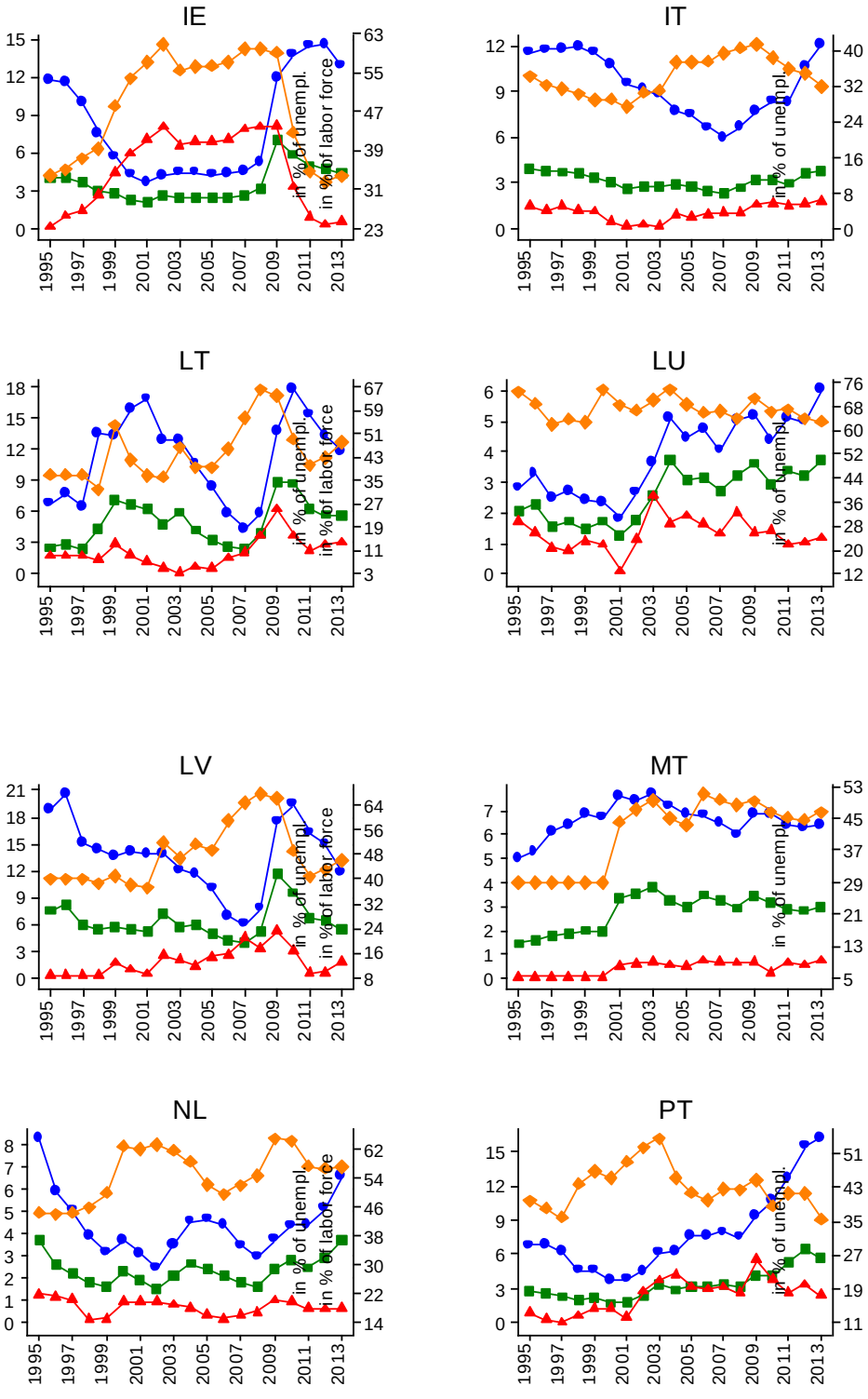
Figure 2 provides descriptive statistics on unemployment rates (blue line) and coverage rates of EUBS variant 7 (green and orange lines) and national UI systems (red line) for EA19 member states over the period 1995-2013.[14] Figure A.4-1 in Appendix A.4 shows corresponding time series for member states outside the euro area. Coverage is measured as the number of short-term unemployed receiving unemployment benefits relative to the total labour force (green line) as well as relative to the total number of unemployed (orange and red lines). Figures 2 and A.4-1 indicate that the share of short-term unemployed receiving benefits under EUBS variant 7 relative to the total labour force closely follows trends in overall unemployment. However, coverage rates of EUBS variant 7 measured as the number of short-term unemployed receiving unemployment benefits relative to the total number of unemployed (short-term and long-term unemployed) often diverge from unemployment rates in times of rising or falling unemployment. This pattern can be observed for Germany in the early 2000s and after 2007 or for Greece, Ireland and Spain during the recent crisis period, for instance. The reason is that the share of non-eligible long-term unemployed usually goes up (down) in prolonged recessions (upswings).

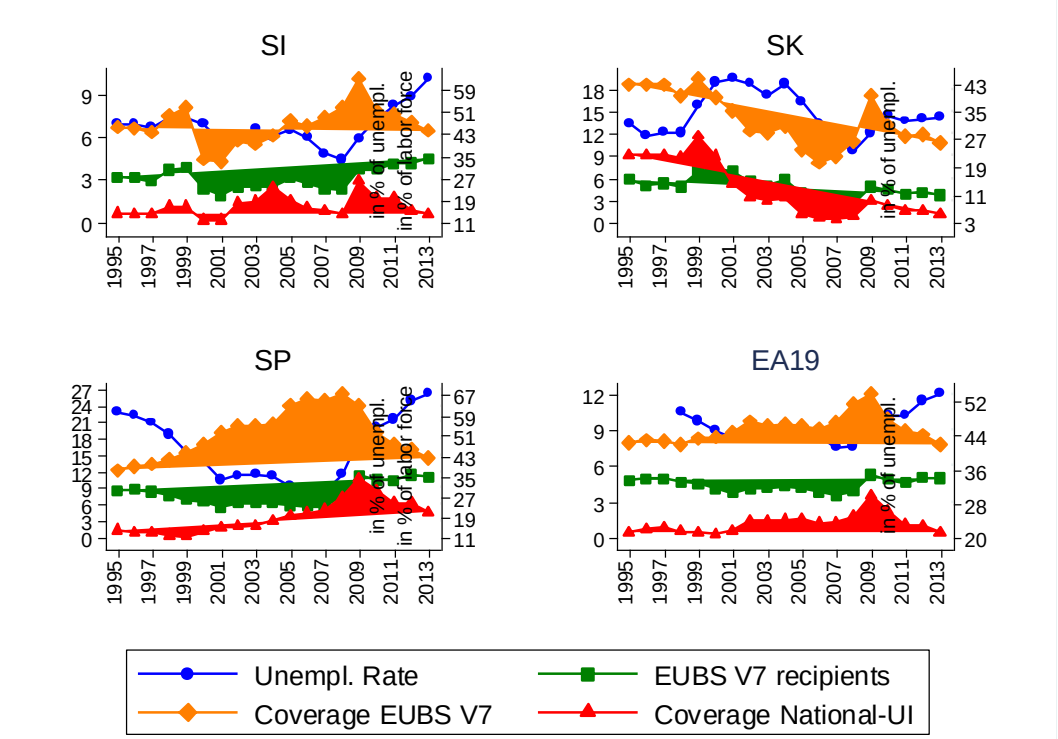
Figure 2 shows further that coverage rates of EUBS variant 7 (orange lines) over the period 1995-2013 differ substantially across EA19 member states ranging from an average of 31 per cent in Greece to 67 per cent in Luxembourg. With an average of 34 per cent (70 per cent) Bulgaria (Denmark) has the lowest (highest) coverage rate of EUBS variant 7 among member states outside the euro area (Figure A.4-1). These cross-country differences can be explained by different shares of short-term unemployment relative to total unemployment as well as different shares of eligible short-term unemployed. The higher the fraction of short-term unemployed among all unemployed, the higher the fraction of those who are potentially eligible to unemployment benefits paid under the EUBS. Finally, Figures 2 and A.4-1 point to a significant coverage gap between EUBS variant 7 and national UI systems revealed by a comparison of the orange and red lines. Coverage rates of EUBS variant 7 are substantially higher than those of national UI systems. While both follow a common trend over time, differences in coverage *levels* are clearly visible for all member states both inside and outside the euro area.

[14] EUBS variant 7 is chosen as a benchmark for national UI systems as it is the only variant where unemployment benefits are paid for 12 months starting with the first month of the unemployment spell. Below, we compare coverage rates of EUBS variants 5, 7, 8, 11 and 12. These variants differ in the length of benefit duration (3 months in variant 8; 9 months in variants 5, 11 and 12; 12 months in variant 7) as well as the stringency of the eligibility criteria. The ratio of the qualifying period to the reference period is 25 per cent in variants 5, 7 and 8; 50 per cent in variant 11; 75 per cent in variant 12.

**Figure 2. Unemployment and coverage rates of EUBS variant 7 and national UI systems**




IE
IT
LT
LU
LV
MT
NL
PT
in % of unempl.
in % of labor force

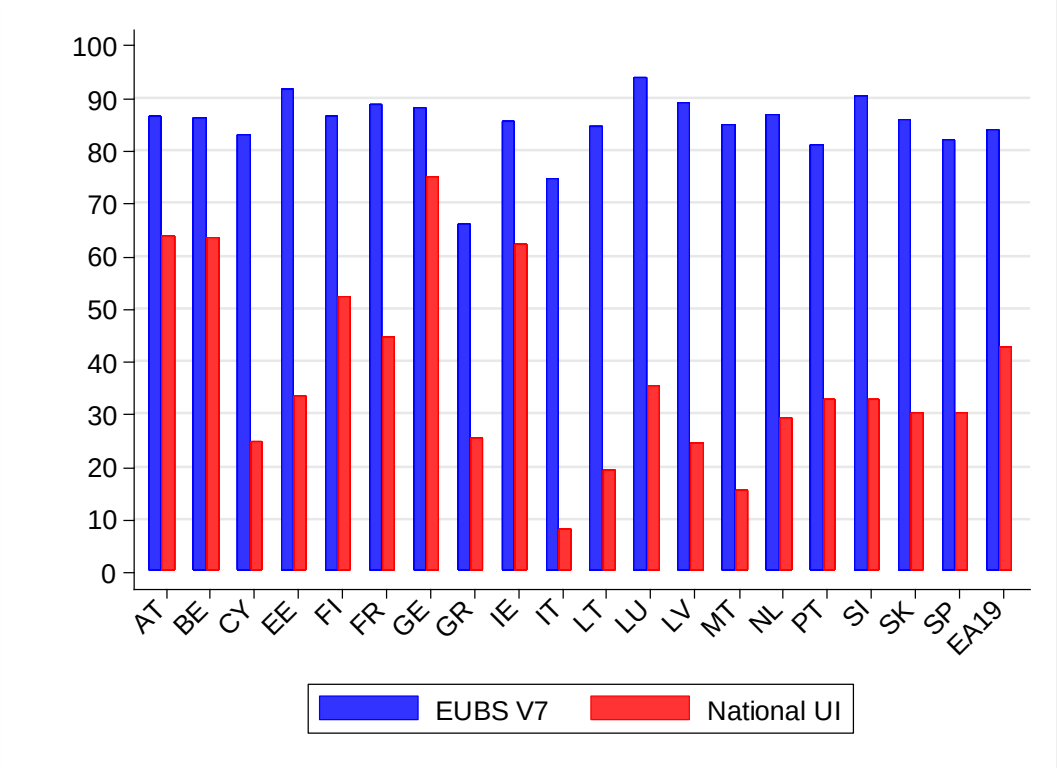



*Note*: Unemployment rates and EUBS V7 recipients measured in per cent of the labour force. Coverage EUBS V7 and coverage national UI calculated as number of short-term unemployed receiving unemployment benefits relative to all (short-term and long-term) unemployed. Coverage national UI includes UI benefits and assistance as reflected in the LFS. If coverage information is missing in the LFS for a given member state in one year, it is imputed from the closest country-year cell available.

*Sources*: EU-LFS, EU-SILC and own calculations based on EUROMOD.

Figures 3 and A.4-2 compare average coverage rates of EUBS variant 7 and national UI systems which are now measured as the number of short-term unemployed receiving unemployment benefits relative to the total number of short-term unemployed. By definition, these coverage rates are higher than those presented in Figures 2 and A.4-1 as they exclude the long-term unemployed in the denominator. Differences in coverage of EUBS variant 7 across member states still exist due to different shares of eligible short-term unemployed. In most member states, more than 80 per cent of the short-term unemployed are covered by EUBS variant 7. Only in Greece and Italy (as well as in Poland and Romania among the non-euro area member states), coverage rates are below 80 per cent which is due to a relatively large fraction of non-eligible self-employed or farmer in these member states. Largest coverage gaps between EUBS variant 7 and national UI systems exist in Italy, Lithuania, Latvia, and Malta, all above 60 percentage points. Smallest gaps are found for Austria, Belgium, Germany and Ireland, all below 30 percentage points. Among the member states outside the euro area, the largest coverage gap is found for Bulgaria (above 60 percentage points). Smallest gaps are found for Denmark and Sweden (below 40 per cent).

**Figure 3. Average coverage gaps between EUBS V7 and national UI systems, 1995-2013**



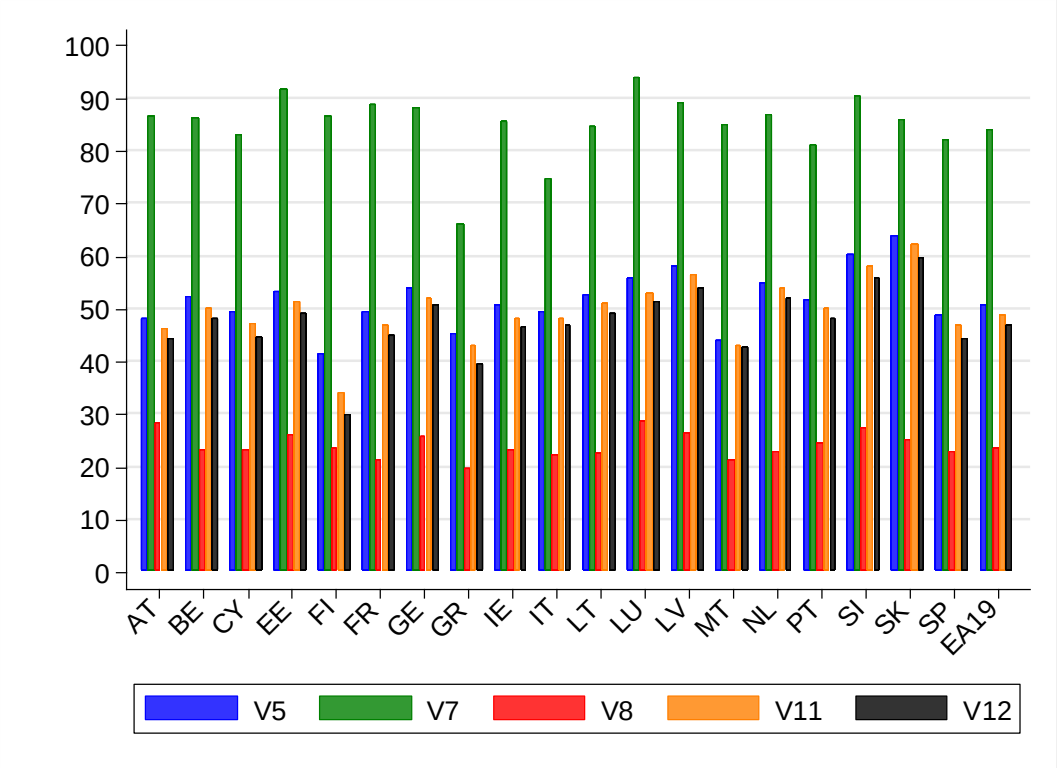

*Note*: Coverage rates of EUBS variant 7 and national UI systems calculated as number of UI recipients relative to total number short-term unemployed.

*Sources*: EU-LFS, EU-SILC and own calculations based on EUROMOD.

Figures 4 and A.4-3 compare coverage rates of EUBS variants 5, 7, 8, 11 and 12. These variants differ in terms of benefit duration (M3-M12 in variants 5, 11 and 12, M0-M12 in variant 7, M3-6 in variant 8) and stringency of the eligibility condition (3M out of 12M in variants 5, 7 and 8, 6M out of 12M in variant 11 and 9M out of 12M in variant 12). Both figures reveal that differences in coverage rates across variants are mainly driven by different benefit durations (variants 5,7 and 8) and only to a smaller extent by different eligibility conditions (variants 5, 11 and 12).[15] A waiting period in the first 3 months of the unemployment spell reduces coverage rates on average by more than 30 percentage points (variant 7 vs. variant 5), while the difference in coverage rates between the variants with the least and most stringent eligibility condition (variant 5 vs. variant 12) is on average 4 percentage points (see Appendix A.2).

[15] Recall that in our simulations, information on the length of individual unemployment spells and hence benefit duration is directly imputed from the LFS and not based on any modelling assumptions. Information on previous contribution periods of the short-term unemployed before job loss is not available in the LFS. As explained in Section 3 and Appendix A.2, we calculate the share of employees in various socio-demographic groups that fulfill the eligibility criteria using SILC data (i.e. we compute "potential coverage rates"). These potential coverage rates are then applied for the short-term unemployed that are in the same socio-demographic group. Our simulations are hence based on the assumption that the (unobserved) working histories of the short-term unemployed are comparable to those of employees with similar socio-demographic characteristics.

**Figure 4. Average coverage rates of EUBS variants 5, 7, 8, 11 and 12, 1995-2013**




*Note*: Coverage rates of EUBS variants 5, 7, 8, 11 and 12 calculated as number of UI recipients relative to total number short-term unemployed.

*Sources*: EU-LFS, EU-SILC and own calculations based on EUROMOD.

Turning next to within-country heterogeneity, Figure A.2-1 in Appendix A.2 shows that the share of short-term unemployed is highest among the young and high-skilled in most countries. This implies that the share of unemployed that is potentially eligible to the EUBS is highest among these socio-demographic groups. Comparing coverage rates for EUBS variant 7 and national UI systems, Figure A.2-2 in Appendix A.2 reveals that in most member states the young indeed tend to gain most in terms of coverage.

### 4.1.2 Budgetary effects and financial flows

In this section, we present the budgetary effects and financial flows of the 18 variants that are simulated in the backward-looking analysis. Note that these are so-called 'first-round' effects that are calculated before macroeconomic feedback effects are taken into account. We first present results for the equivalent and then for the genuine systems.

#### Equivalent systems

Figures 5 and A.4-4 (Appendix A.4) provide an overview of the accumulated net contributions for the four equivalent systems in 2013, the last year of the simulation period. Figure 5 summarizes results for EA19 member states whereas Figure A.4-4 shows accumulated net contributions if the EUBS had been introduced in the EU-27 member states. Figures 6 and A.4-7 present the sequence of net contributions over the entire simulation period.

If accumulated net contributions in 2013 are larger than zero, the total amount of contributions paid into the supranational fund over the period 1995-2013 exceeds the total amount of benefits received. Vice versa, if the total amount of benefits received by a member state is larger than the total amount of contributions paid, accumulated net contributions are negative. Note that for a given euro area member state, net contributions under variants 1 and 2 depend on the number of member states participating in the EUBS only if the threshold z is reached which relates to EA19/EU27 GDP (see section 3). The other parameters such as the trigger activating benefit payments and the coefficient used for experience rating and claw-back are country-specific. Another reason why net contributions in variants 3 and 4 can depend on the number of member states participating in the EUBS is the no-debt constraint in these variants. As explained in section 3, member states need to make extra-payments proportional to their GDP-share in order to balance the supranational fund if the overall balance turns negative. The GDP-share, in turn, depends on the number of participating member states.

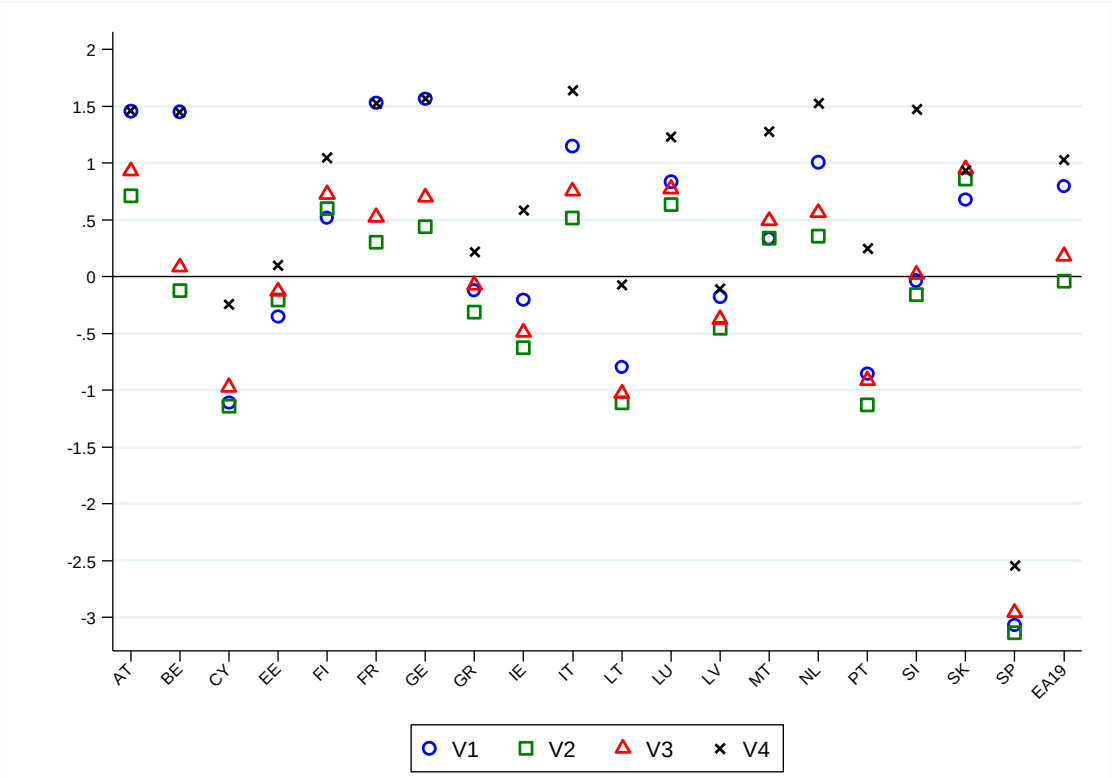
Figure 5 shows that accumulated net contributions in 2013 at the EA19-level range between 0 and 1 per cent of GDP. In absolute terms, the balances amount to roughly 102 billion euros in variant 4, 79 billion euros in variant 1, 18 billion euros in variant 3 and -4 billion euro in variant 2. A similar picture emerges if the equivalent systems are simulated for the EU-27 as can be seen in Figure A.4-4. Accumulated net contributions in 2013 at the EU-27-level range between -0.2 and 1.1 per cent of GDP which corresponds to surpluses of approximately 142 billion euros in variant 4 and 94 billion euros in variant 1, a balanced budget in variant 3 and a deficit of 20 billion euros in variant 2.

Which characteristics of the four variants are the main drivers? The difference in accumulated net contributions between variants 2 and 3 which are identical in all dimensions except the no-debt constraint in variant 3 is due to the extra-payments of member states in those years in which the net balance of the supranational fund turns negative. The large surpluses built up in variants 1 and 4 are due to the relatively high thresholds of the trigger. In variant 1 (4), unemployment benefits are triggered if the short-term unemployment rate in member state i exceeds its 10-year moving average by 1 (2) percentage points. The threshold of 0.1 percentage points is much smaller in variants 2 and 3. This implies that in variants 1 and 4, some member states continuously contribute to the supranational fund but do not receive any benefits. This is true for Austria, Belgium, France and Germany (see Figure 5). Italy, Luxembourg, Malta, the Netherlands and Slovenia (as well as among the non-euro area member states Bulgaria, Czech Republic and Romania) receive transfers in EUBS variant 1, but not in variant 4. As a consequence, in variant 4 there are only four member states that end up as a net recipient in 2013, namely Cyprus, Latvia, Lithuania and Spain.[16]

Figures 5 and A.4-4 further show that some member states are net contributors (recipients) in all four equivalent systems, while for a few member states the sign of the overall net position depends on the variant. Among the EA19 member states, Austria, Finland, France, Germany, Italy, Luxembourg, Malta, the Netherlands and Slovakia are net contributors in all four equivalent systems. Cyprus, Latvia, Lithuania and Spain are net recipients in all four equivalent systems. Among the non-euro area member states, the Czech Republic, Denmark, Hungary and Romania are net contributors in all equivalent systems, while there is no net recipient in all equivalent systems.

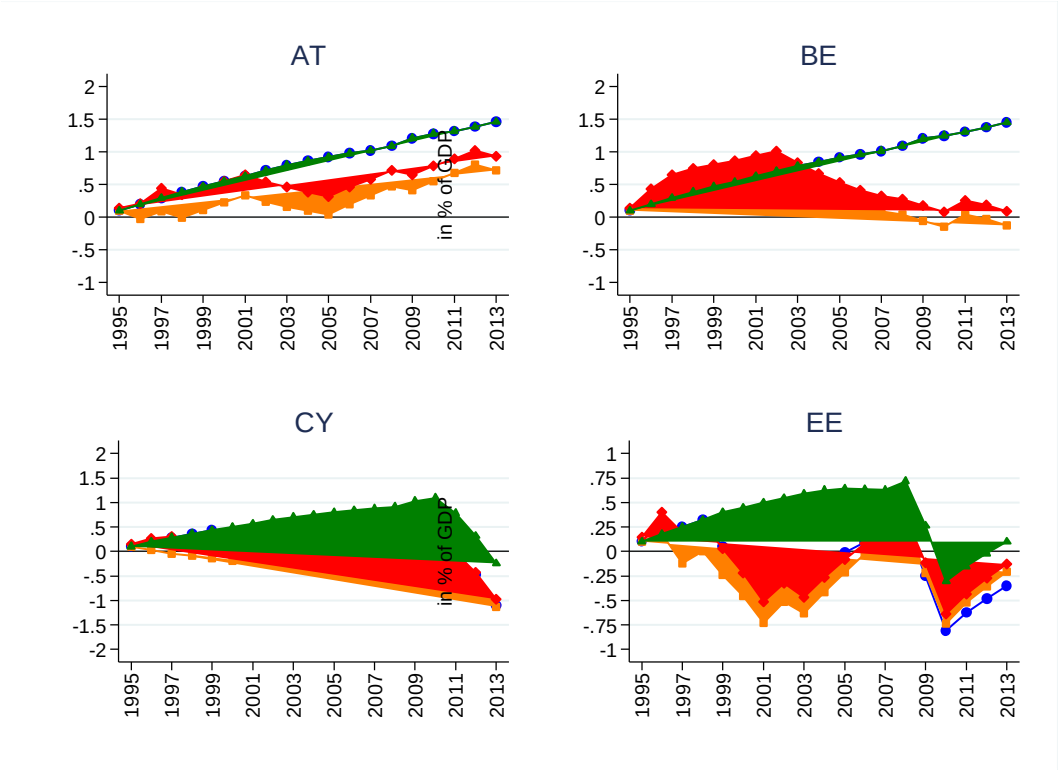
[16] Table A.3-1 in Appendix A.3 shows in which years the triggers are pulled.

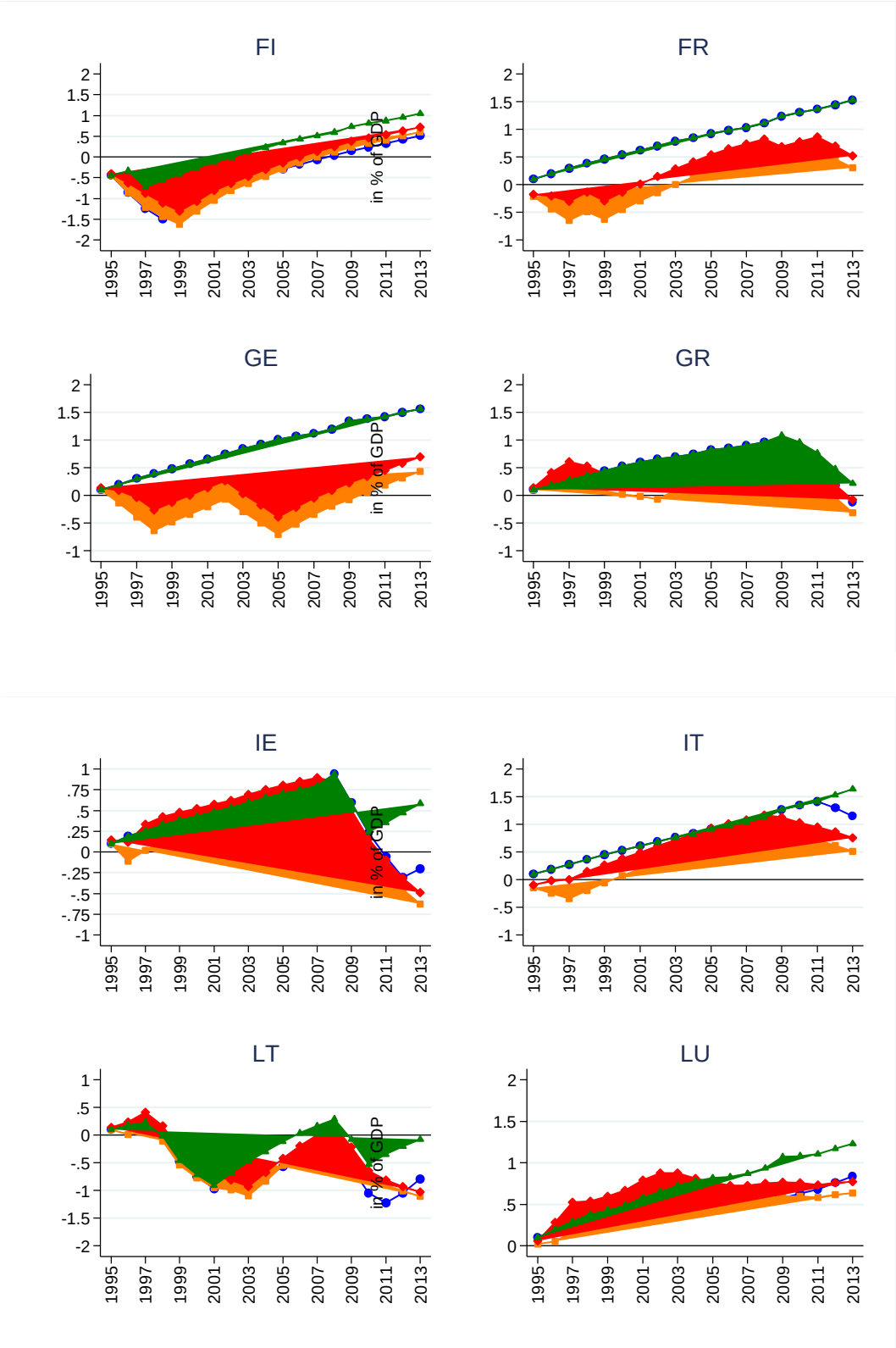
**Figure 5. Accumulated net contributions in 2013 in per cent of 2013 GDP: Equivalent systems**

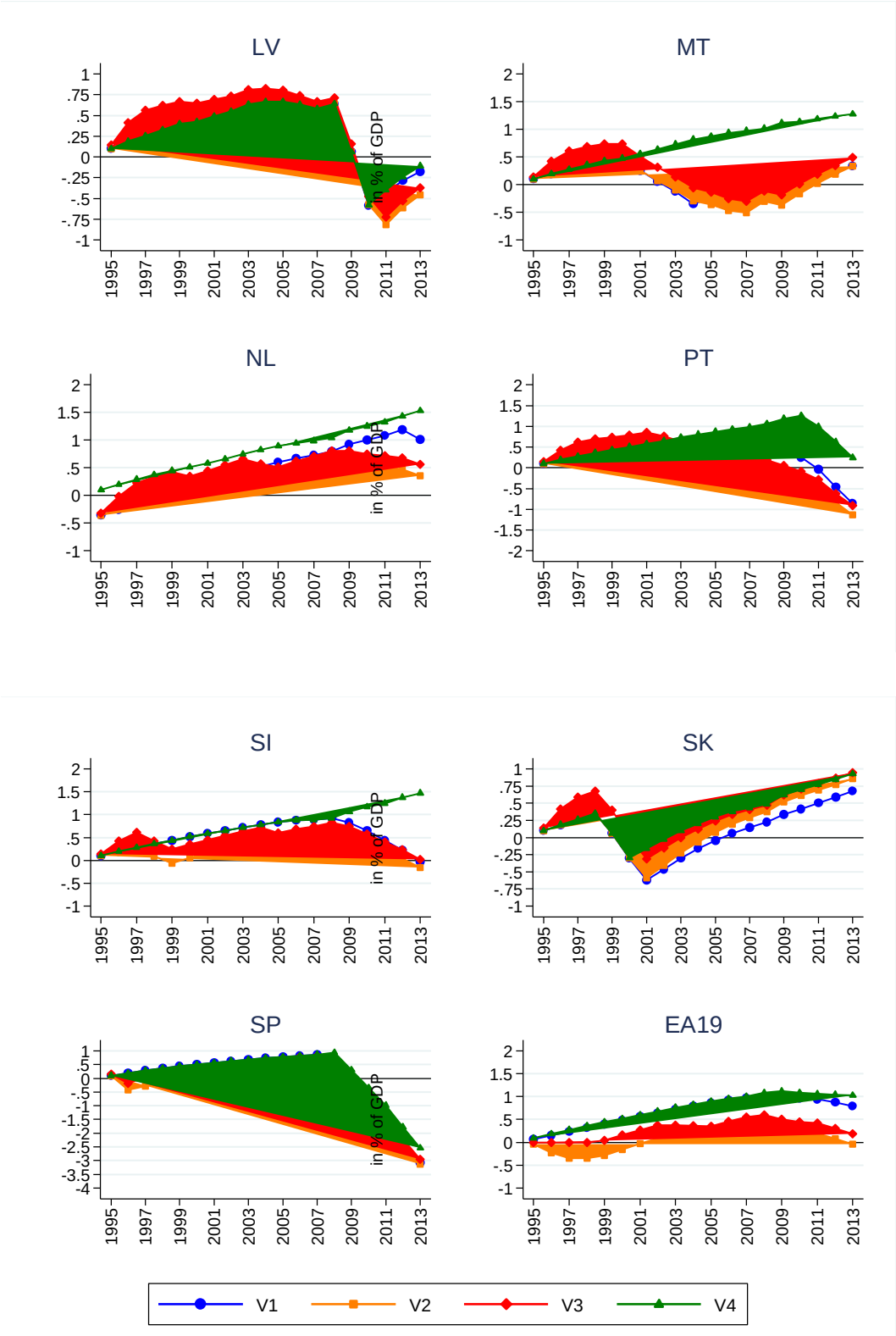



*Note*: Net contributions=Contr.–Benefits.
*Sources*: EU-LFS + own calculations based on EUROMOD.

**Figure 6. Cumulative net contributions: Equivalent systems**




FI
FR
GE
GR
IE
IT
LT
LU
in % of GDP



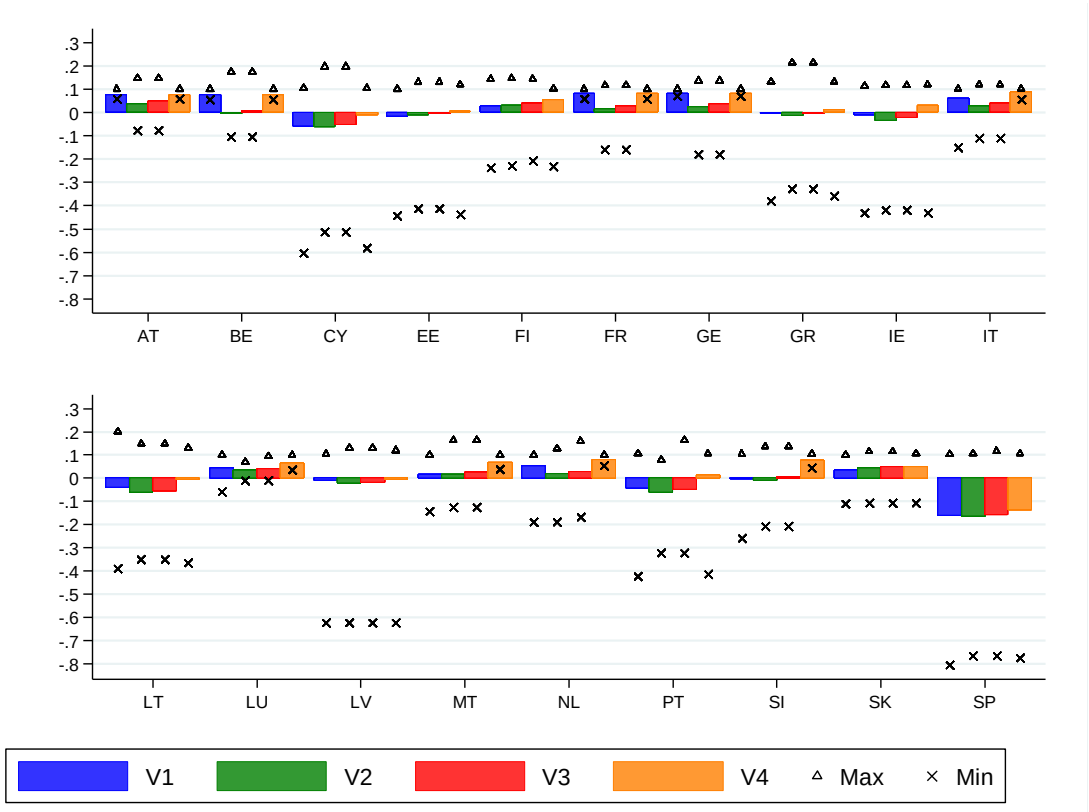

*Note:* Cumulative net contributions in % of GDP of year t. Net contributions = Contributions – Benefits.

*Sources*: EU-LFS and own calculations based on EUROMOD.

While it is clear that any insurance system will end up with net contributors and net recipients ex-post, an important question is whether member states see themselves in a

*permanent* net contributor or net recipient position over the long period of time that is analyzed in this paper, despite the design features that are intended to mitigate this risk. Figures 6 and 7 for the EA19 member states and Figures A.4-5 and A.4-7 for the EU-27 member states shed light on this question. Figures 6 and A.4-7 present cumulative net contributions for each year of the simulation period. Figures 7 and A.4-5 show average yearly net contributions over the period 1995-2013 as well as minimum and maximum net contributions, all expressed in per cent of 2013 GDP. An important finding is that in variants 2 and 3 no member state is in a permanent net contributor or recipient position, while a few member states are permanent net contributors in variants 1 or 4. As discussed above, in these variants the trigger is pulled less often than in variants 2 and 3. Our results suggest that a member state usually becomes a net recipient when the trigger is pulled and a net contributor otherwise. Take Germany and Spain as an example. Germany ends up as a net contributor in 2013 in all four equivalent systems, while the opposite is true for Spain. In certain sub-periods, however, Germany is a net recipient (1996-1998 and 2003-2005 in variants 2 and 3) and Spain a net contributor (1996 to 2008 in all four variants) as exemplified in Figure 6.

**Figure 7. Average yearly net contributions (1995-2013) in per cent of 2013 GDP: Equivalent systems**




*Note*: Net contributions=Contr.–Benefits.
*Sources*: LFS + own calculations based on EUROMOD.

Figures A.3-1 and A.4-6 in the Appendix show the evolution of overall contributions and benefits for the equivalent systems at the EA-19 and EU-27-level over the period 1995-2013. The figures illustrate that especially in variants 1 and 4, the supranational fund accumulates a significant amount of reserves in the first 14 years of the simulation period and that benefits are paid mainly during the crisis period starting in 2008/2009. In variants 3 and 4, the trigger is pulled more often. Due to the no-debt constraint in variant 3, member states are obliged to make extra payments in the early phase of the simulation period (1995-1998 in Figure A.3-1, 1995-1997 in Figure A.4-6) in order to comply with the balanced budget rule. From 2009-2013, overall unemployment benefit

payments exceed the pay-ins. In these years, the supranational fund uses the buffer built up in previous years.

Finally, Figures A.3-3 (EA19) and A.4-9 (EU27) illustrate the evolution of the experience rating / claw-back coefficient (left-hand side) and resulting pay-ins (right-hand side) for the equivalent systems. Recall from section 3 that that the pay-in formula for the equivalent systems is defined as

$$Pay - in = x * \ GDP_{i,t} * \left(1 + 0.1 * F_{i,(t-10,\dots,t-1)}\right).$$

The experience rating/claw-back coefficient takes values between 1 and 2 depending on the number of times benefits have been triggered in the previous 10-year period and on whether the claw-back has been activated. In the latter case, it takes the value of 2. The contribution rate x is set to 0.1 per cent. Contributions stop once the net balance of member state i vis-à-vis the supranational fund exceeds the threshold of 0.5 per cent of EA19/EU-27 GDP and start again when the balance drops below the threshold. Here, we summarize the main findings from Figures A.3-3 and A.4-9.

Variant 1 represented by the blue line is the only equivalent system that does not include experience rating. This implies that the coefficient is either 1 or 2 and correspondingly, annual pay-ins amount to either 0.1 or 0.2 per cent of GDP. Due to the relatively large threshold of 1 percentage point that must be reached in order to activate benefits, the claw-back applies only in two EA19 member states, namely in Finland (2000 and 2001) and in Lithuania (2013). As a consequence, the Finnish (Lithuanian) pay-ins amount to 0.2 per cent of GDP in these years. In all other EA19 member states, yearly pay-ins amount to 0.1 per cent of GDP. As is shown in Figure A.4-9 for the EU-27, the claw-back is applied in Poland from 2005-2007 as well.

Variant 2 represented by the red line includes both claw-back and experience rating. Due to the lower threshold, benefits are activated more often than in variant 1. As a consequence, experience rating drives up the coefficient and thus also the pay-ins for several member states as can be seen by the stepwise increase of the coefficient (left-hand side) and the pay-ins (right-hand side) in Figures A.3-3 and A.4-9. There are three EA19 and one EU27 member states where the coefficient reaches its maximum value of 2 due to the claw-back (Finland, Poland) or experience rating (Luxembourg, Portugal).

Variant 3 represented by the green line corresponds to variant 2 in terms of the trigger, experience rating and claw-back, but does not have a debt issuing capacity. If the balance of the supranational fund becomes negative, member states need to make an extra-payment according to their GDP-share to balance the fund. In the EA19, this is the case from 1995-1998 as can be seen by the stark increase in pay-ins in these years which occur without any corresponding jumps in the experience rating / claw-back coefficient. The amount of extra-payments corresponds to the difference in pay-ins between variants 2 and 3 in these years. Finland is an interesting case study since it is the only EA19 member state where the coefficients in variants 2 and 3 differ. In variant 3, the claw-back is applied in 2001 only while in variant 2 it is applied form 2000-2003. The reason is that in variant 3 the extra-payments postpone the activation of the claw-back by one year. If the EUBS is adopted by the EU27 member states, extra-payments are due form 1995-1997 and in 2013 (Figure A.4-9).

Variant 4 represented by the orange line is the equivalent system with the highest threshold for the trigger (2 percentage points). It includes experience rating, but neither claw-back nor debt-issuance capacity. Benefits are paid only in a few member states and as a consequence, the compensating effect of experience rating is smaller than in variants 2 and 3. The same reasoning also holds for the extra-payments. The supranational fund accumulates a buffer which suffices to cover benefit payments so that no extra-payments are needed.

**Genuine systems**

Next, we turn to the 14 genuine systems. Recall from section 3 that in contrast to the equivalent systems, unemployment benefits under genuine EUBS are paid directly to the unemployed without any triggers at the macro level. A further difference to the equivalent systems is that the experience rating coefficient which is calculated as the ratio of the 10-year moving-average short-term unemployment rate in member state i to the 10-year moving-average short-term unemployment rate in the EA19/EU27 does not exclusively depend on country-specific circumstances, but also on the economic conditions in the other participating member states. Contribution payments further depend on the revenue-neutral contribution rate x of a given variant that balances the supranational fund at the EA19 / EU27-level over the period 1995-2013 (see formula 3 in section 3).

Revenue-neutral contribution rates for each genuine system are shown in Table 3. If the EA19 member states participate in the EUBS, contribution rates range from 0.35 per cent in variant 8 to 1.36 per cent in variant 7. They only differ slightly if the EUBS is adopted by the EU27 member states. Note that variants 16-18 have the same revenue-neutral contribution rate x as variant 5 as they differ from variant 5 only in terms of financing rules.[17] The fact that pay-ins into the supranational fund depend on the contribution rate x as well as on the experience rating coefficient (except for variant 16 that does not include experience rating) implies that in all genuine systems the pay-ins of a given member state and thus also its net contributions do depend on the number of member states participating in the EUBS.

**Table 3. Revenue-neutral contribution rates x, in per cent of employment income**

| Variant | EA19 | EU27 |
|---|---|---|
| V5 | 0.84 | 0.82 |
| V6 | 0.44 | 0.50 |
| V7 | 1.36 | 1.34 |
| V8 | 0.35 | 0.36 |
| V9 | 0.59 | 0.58 |
| V10 | 1.01 | 0.99 |
| V11 | 0.81 | 0.80 |
| V12 | 0.78 | 0.77 |
| V13 | 0.84 | 0.82 |
| V14 | 0.80 | 0.78 |
| V15 | 0.87 | 0.84 |
| V16 | 0.84 | 0.82 |
| V17 | 0.84 | 0.82 |
| V18 | 0.84 | 0.82 |

*Note*: Revenue-neutral contribution rates in per cent of employment income without experience rating and claw-back. They balance the supranational fund at the EA19 / EU27-level over the period 1995-2013.

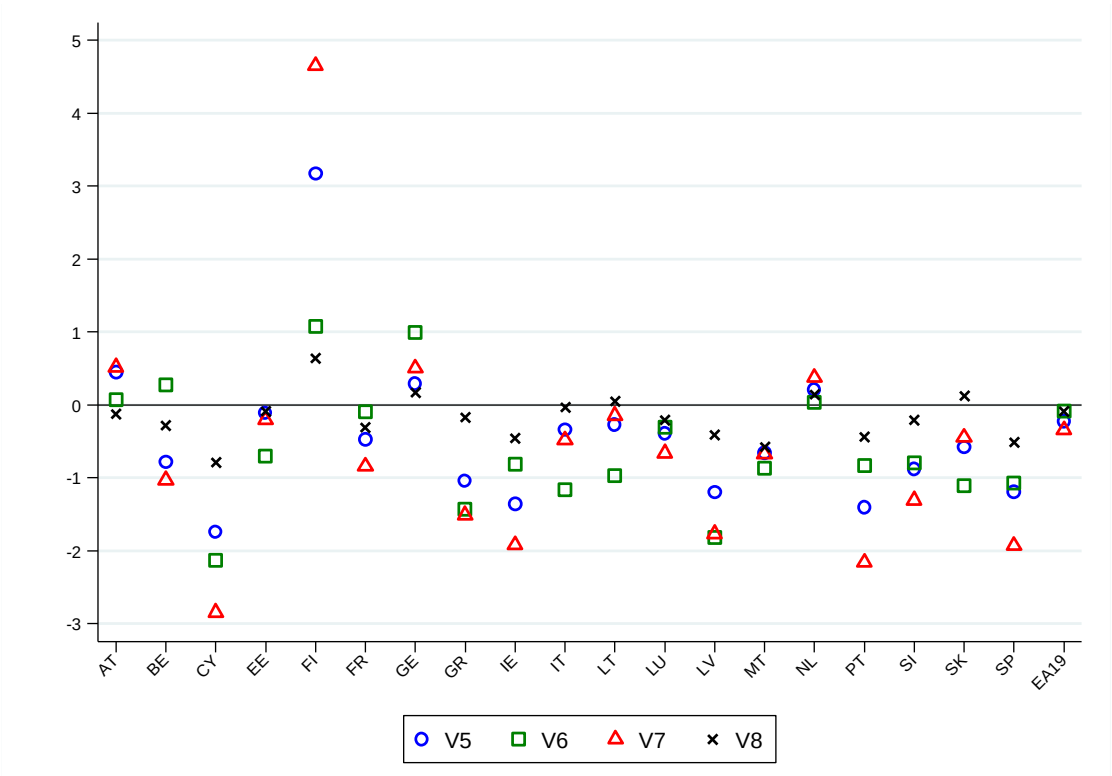
As in our analysis of the equivalent systems, we start with an overview of accumulated net contributions in 2013 in per cent of 2013 GDP as shown in Figure 8 for the EA19 member states and in Figure A.4-4 for the EU-27 member states. At EA19-level, accumulated net contributions in 2013 are in a range from -0.34 to 0.07 per cent of GDP

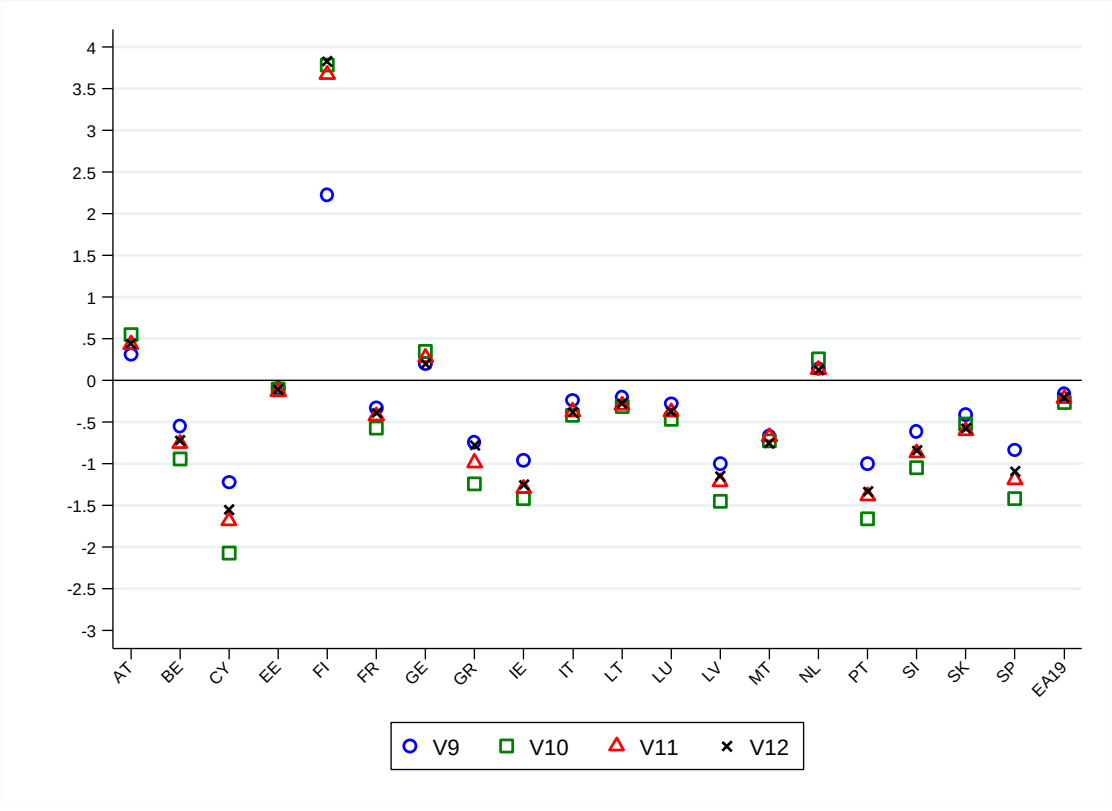
[17] The revenue-neutral contribution rate x is calculated as follows: x = Sum of benefits paid by the supranational fund over the period 1995-2013 / total tax base over the period 1995-2013.

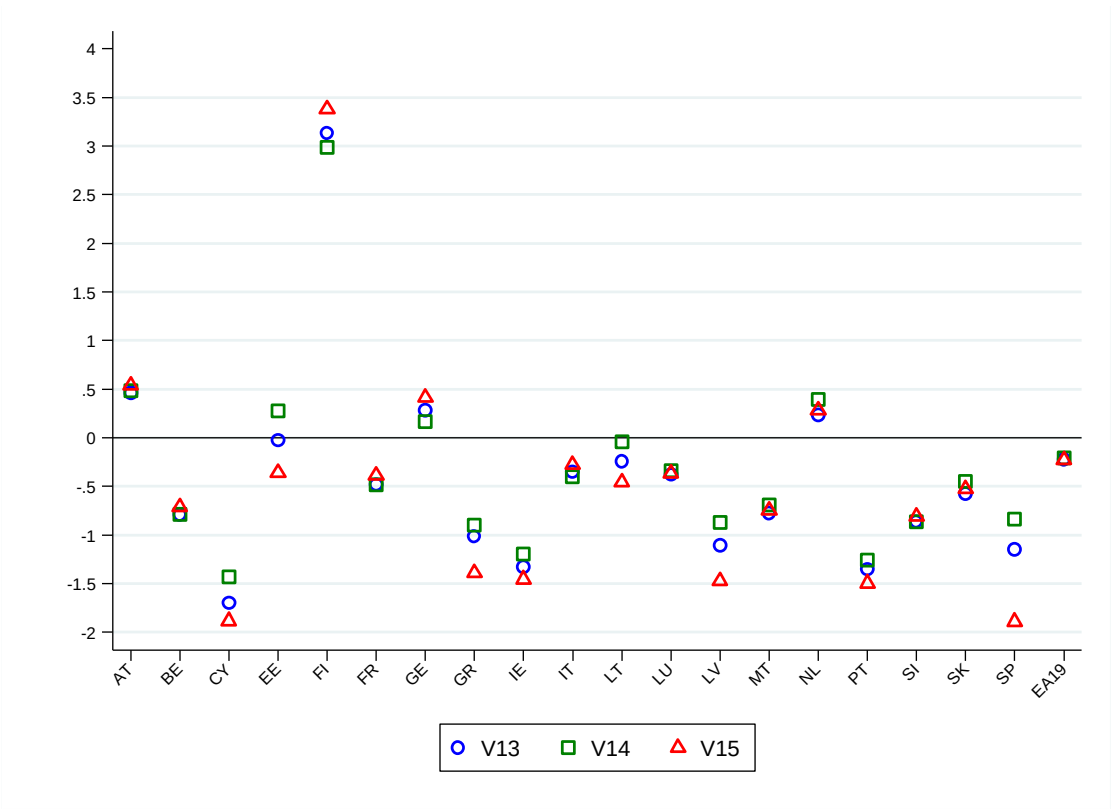
across variants. At EU27-level, the range is -0.28 to 0.07 per cent of GDP and thus slightly smaller. In all variants except variants 16 and 18 which do not include experience rating and debt issuance possibility, the supranational fund's balance in 2013, the last year of the simulation period, is negative, albeit by a relatively small amount. In absolute terms, the fund's balance ranges between -34 to 7 billion euros (-37 to 9 billion euros) if the EUBS are adopted by the EA19 (EU27) member states.

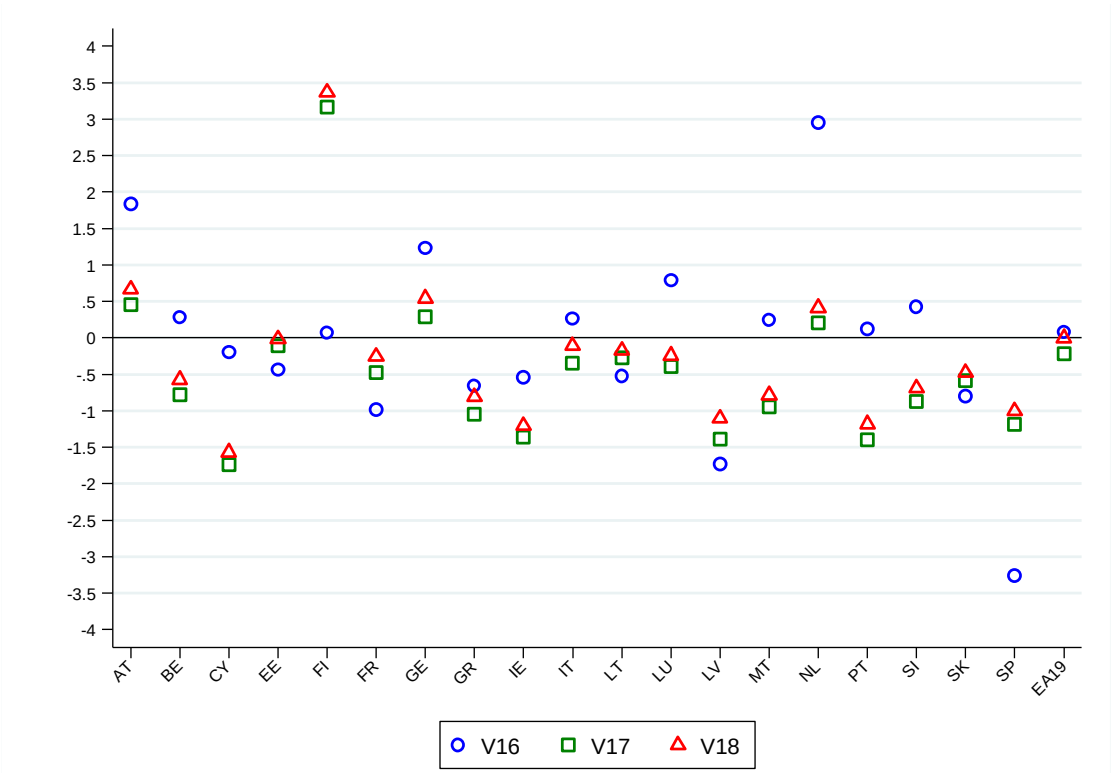
Figures 8 and A.4-4 show that those variants with relatively generous transfers or without experience rating/claw-back tend to produce largest redistributive effects across member states. With accumulated net contributions amounting to 4.7 per cent of the Finnish GDP in 2013, variant 7 comes with the largest surplus of a member state vis-à-vis the supranational fund. The largest deficit accrues for Spain in variant 16. It amounts to 3.3 per cent of Spanish GDP. Figures 8 and A.4-4 reveal that a few member states are net contributors (recipients) in all 14 genuine systems while for some member states, the sign of the net position at the end of the simulation period in 2013 depends on the variant.

**Figure 8. Accumulated net contributions in 2013 in per cent of 2013 GDP: Genuine systems**




4
3.5
3
2.5
2
1.5
1
.5
0
-.5
-1
-1.5
-2
-2.5
-3
AT
BE
CY
EE
FI
FR
GE
GR
IE
IT
LT
LU
LV
MT
NL
PT
SI
SK
SP
EA19
V9
V10
V11
V12


4
3.5
3
2.5
2
1.5
1
.5
0
-.5
-1
-1.5
-2
AT
BE
CY
EE
FI
FR
GE
GR
IE
IT
LT
LU
LV
MT
NL
PT
SI
SK
SP
EA19
V13
V14
V15




*Note*: Net contributions= Contr. –Benefits.
*Sources*: EU-LFS + own calculations based on EUROMOD.

As in the analysis of the equivalent systems, we ask next whether member states are permanent net contributors or recipients. Figures 9 (EA19) and A.4-8 (EU27) present the sequence of net contributions over the entire simulation period. Figures 10 and A.4-5 show average yearly net contributions over the period 1995-2013 as well as minimum and maximum net contributions, all expressed in per cent of 2013-GDP. These figures show that in all variants, the majority of member states is not in a permanent net contributor or recipient position. Some member states that end up as net recipients in 2013 are net contributors or in an almost balanced position until the outbreak of the financial and economic crisis in 2008/2009. As can be seen in Figure 9, this is the case for Estonia, Ireland, Latvia, Lithuania and Spain in most of the genuine systems. Member states that end up as net contributors in 2013 such as Germany or the Netherlands would have been in a net recipient position over several years. In most genuine systems, Germany's net position turns from net recipient to net contributor only after 2009. Similarly, in most variants the Netherlands is a net recipient until the early 2000s and becomes a net contributor afterwards.

Figures A.3-2 (EA19) and A.4-6 (EU27) in the Appendix describe the overall evolution of contributions and benefits at the EA19 and EU27-level, respectively. With the exception of variant 18 (no debt), the various variants of the EUBS accumulate deficits in the early phase of the simulation period. Starting in the early 2000s, most EUBS variants run surpluses that reduce the accrued deficit. Deficits start growing again from 2009 onwards.

Finally, Figures A.3-4 (EA19) and A.4-10 (EU27) illustrate the evolution of short-term unemployment rates of a given member state vis-à-vis the EA19/EU27 average and the respective 10-year moving averages (left-hand side of the graphs) as well as resulting experience rating coefficients and pay-ins (right-hand side) for selected genuine systems. These are those variants that differ in terms of financing conditions, i.e. baseline variant 5, variant 16 (no experience rating), variant 17 (no claw-back) and variant 18 (no debt

issuance). Recall from section 3 that that the pay-in formula for the genuine systems including experience rating is defined as

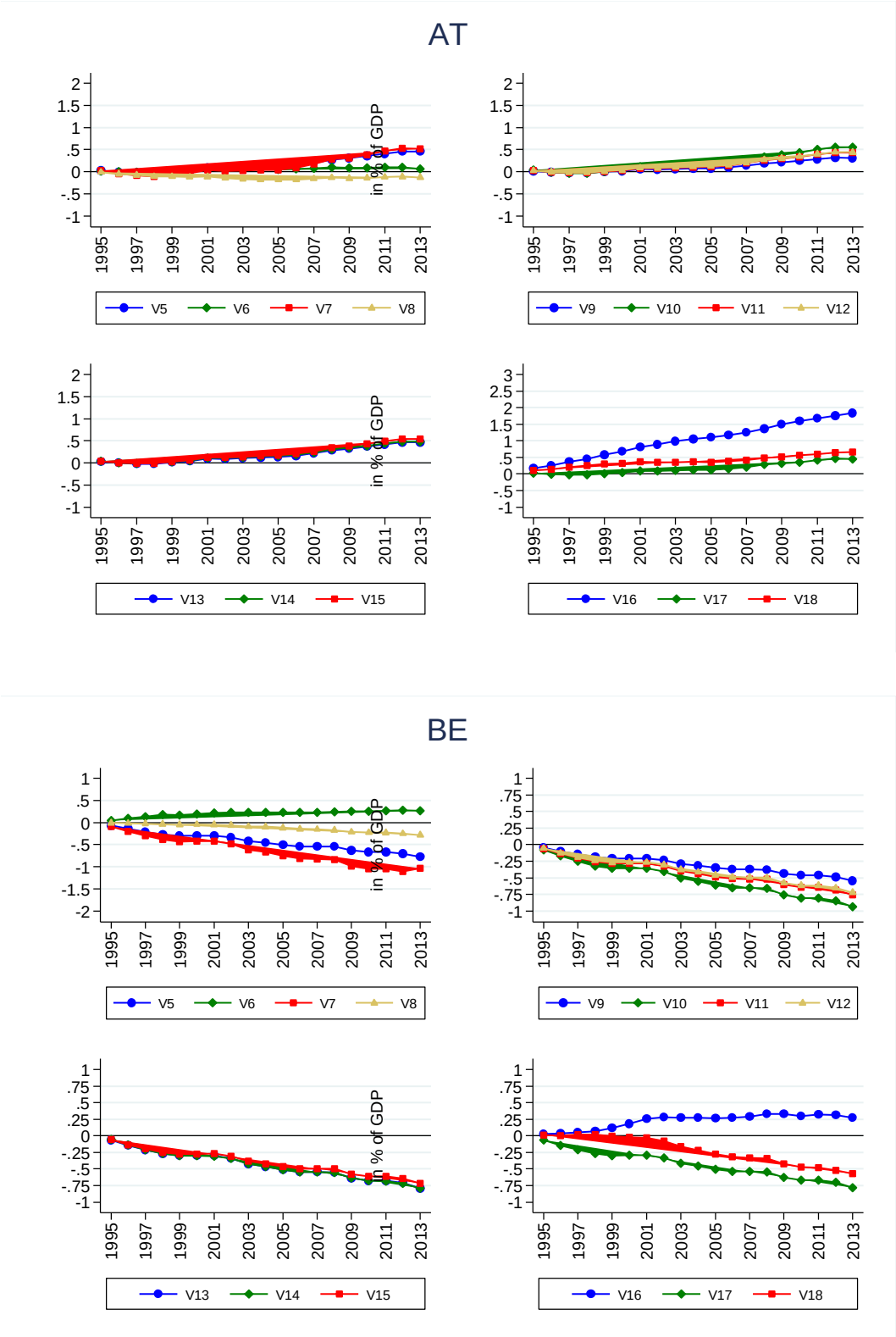
$$Pay - in = x * \ gross\ wage * (\frac{\overline{UR}_{i_{t-10,\dots,t-1}}}{\overline{UR}_{EU_{t-10,\dots,t-1}}}).$$

x is the revenue-neutral contribution rate of a given variant as reported in Table 3. It is multiplied by the gross wage (yielding the basic pay-in) and the experience rating coefficient which is updated every 3 years. Total pay-ins are obtained after adding to the individual-level contributions potential payments that are paid by member states directly (due to claw-back and no-debt constraint). Claw-back payments are due when a member state has accumulated net benefits of more than 1 per cent of its GDP in three consecutive years. They amount to 0.2 per cent of GDP. As in variants 3 and 4, variant 18 does not contain a debt capacity so that member states are obliged to make extra-payments if the supranational fund's balance turns negative.

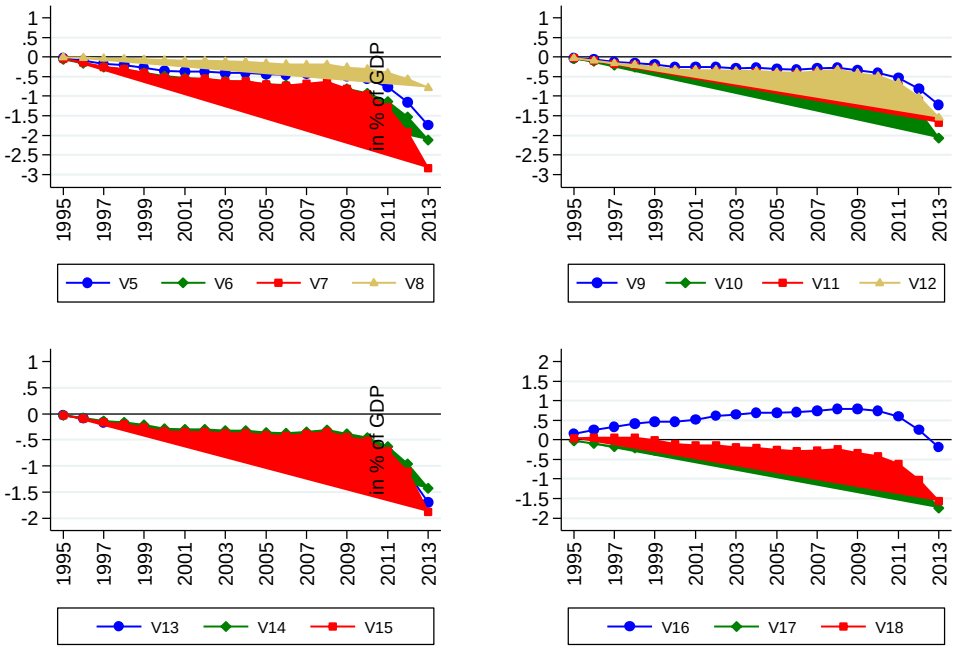
Figure A.3-4 shows that in a few member states, the 10-year moving average short-term unemployment rate is permanently above (below) the EA-19 10-year moving average. As a consequence, for these member states pay-ins in variant 16 (excluding experience rating) are permanently below (above) those in variant 5. In variant 5, the claw-back is activated in two member states, namely in Latvia in 2013 and in Malta in 2007/2008. In these two member states, the pay-in in the respective years is 0.2 per cent higher than in variant 17 which is identical to variant 5 except that it does not contain claw-back. The claw-back is activated more frequently in variant 16 which does not contain experience rating as a 'compensating' mechanism. It is activated in Latvia (2001, 2005, 2012, 2013), Slovakia (2004, 2005) and Spain (2001, 2002, 2012, 2013). In variant 18, the no-debt constraint requires member states to make extra-payments from 1995-1999 and in 2013. These extra-payments increase net contributions and make the claw-back less important than in the other variants.

A similar picture emerges if the EUBS is adopted by the EU-27 member states (Figure A.4-10). The claw-back additionally comes into play in Poland (2006 in variant 5, 2004-2007 in variant 16). In Spain, it is activated in 2000, 2001, 2012 and 2013 (variant 16). Extra-payments in variant 18 are due in the first four years of the simulation period (1995-1998) as well as in 2013.

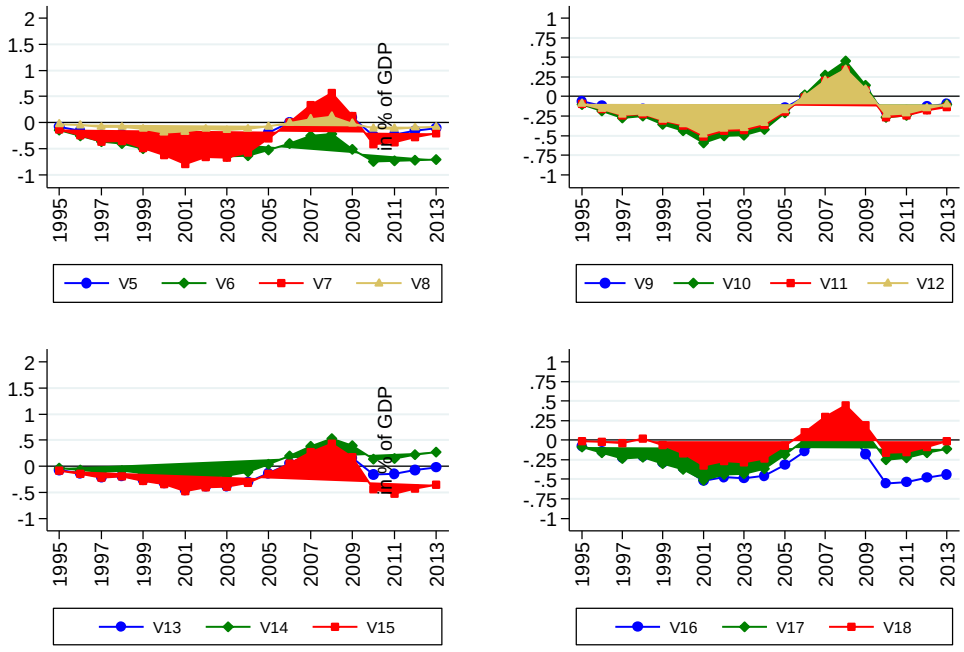
**Figure 9. Cumulative net contributions: Genuine systems**



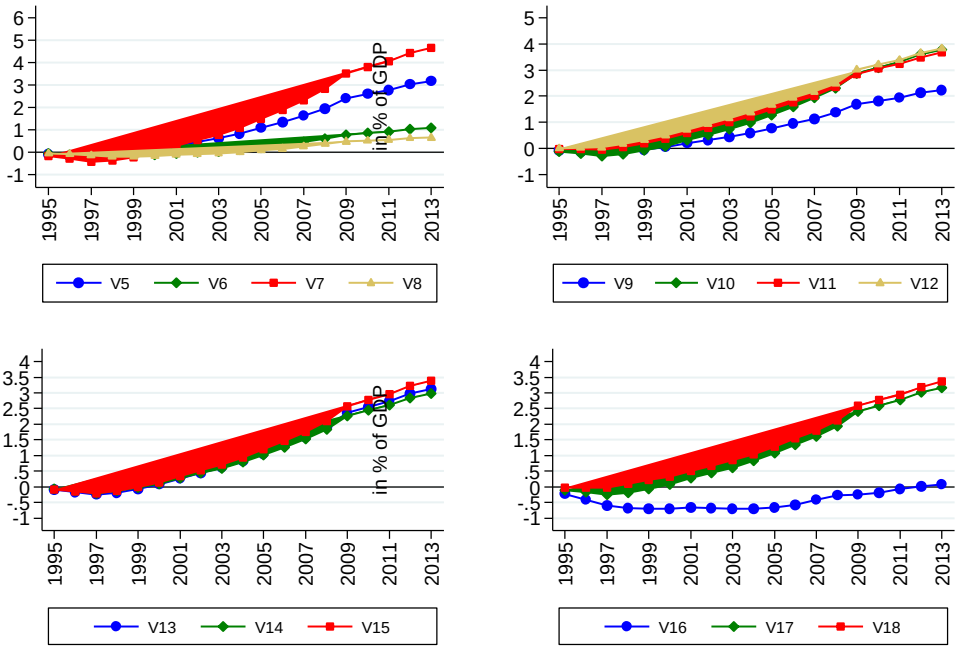
## CY


in % of GDP
V5 V6 V7 V8
V9 V10 V11 V12
V13 V14 V15
V16 V17 V18

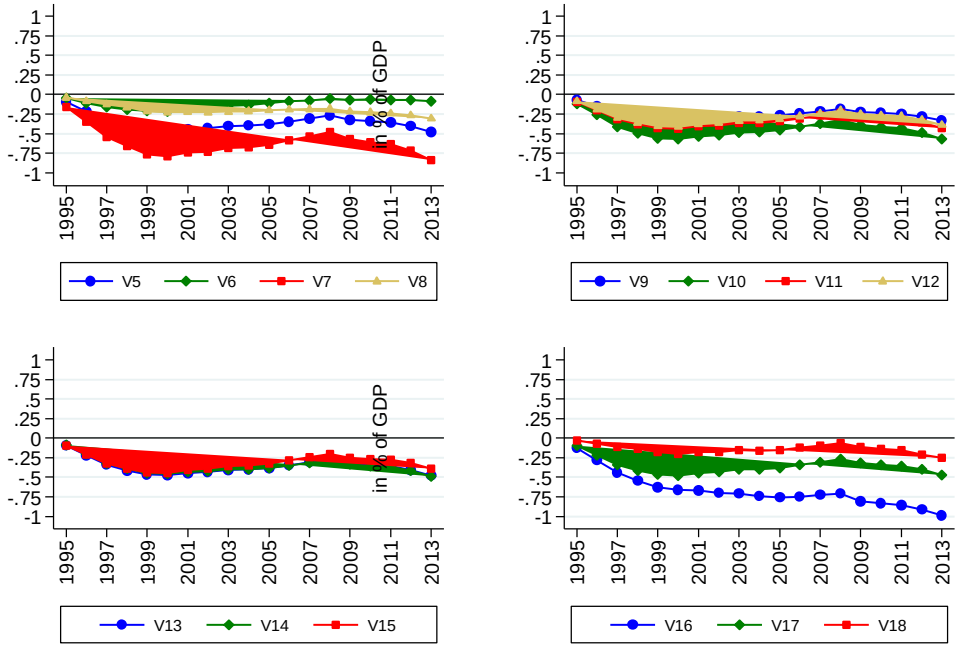
## EE

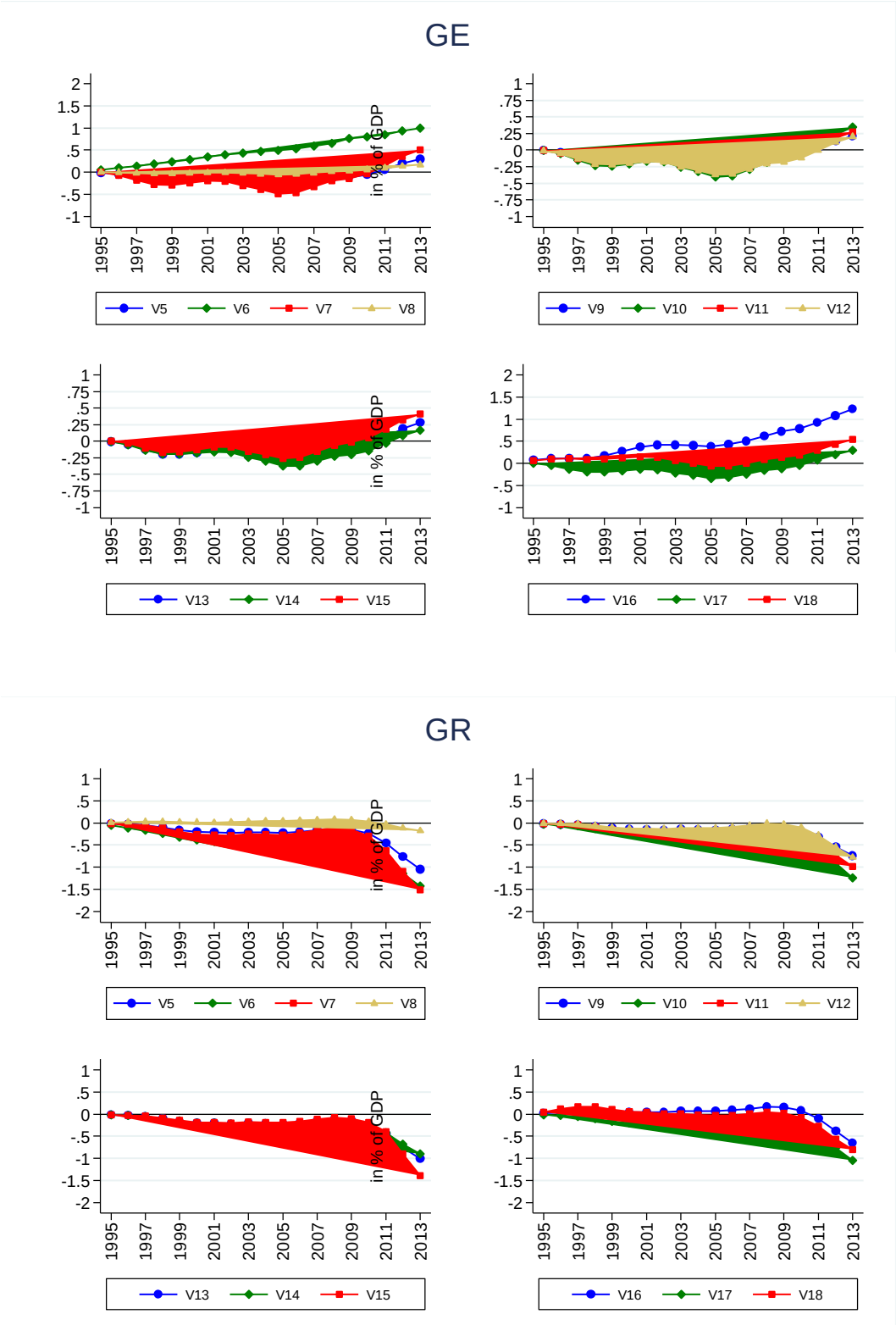

in % of GDP
V5 V6 V7 V8
V9 V10 V11 V12
V13 V14 V15
V16 V17 V18

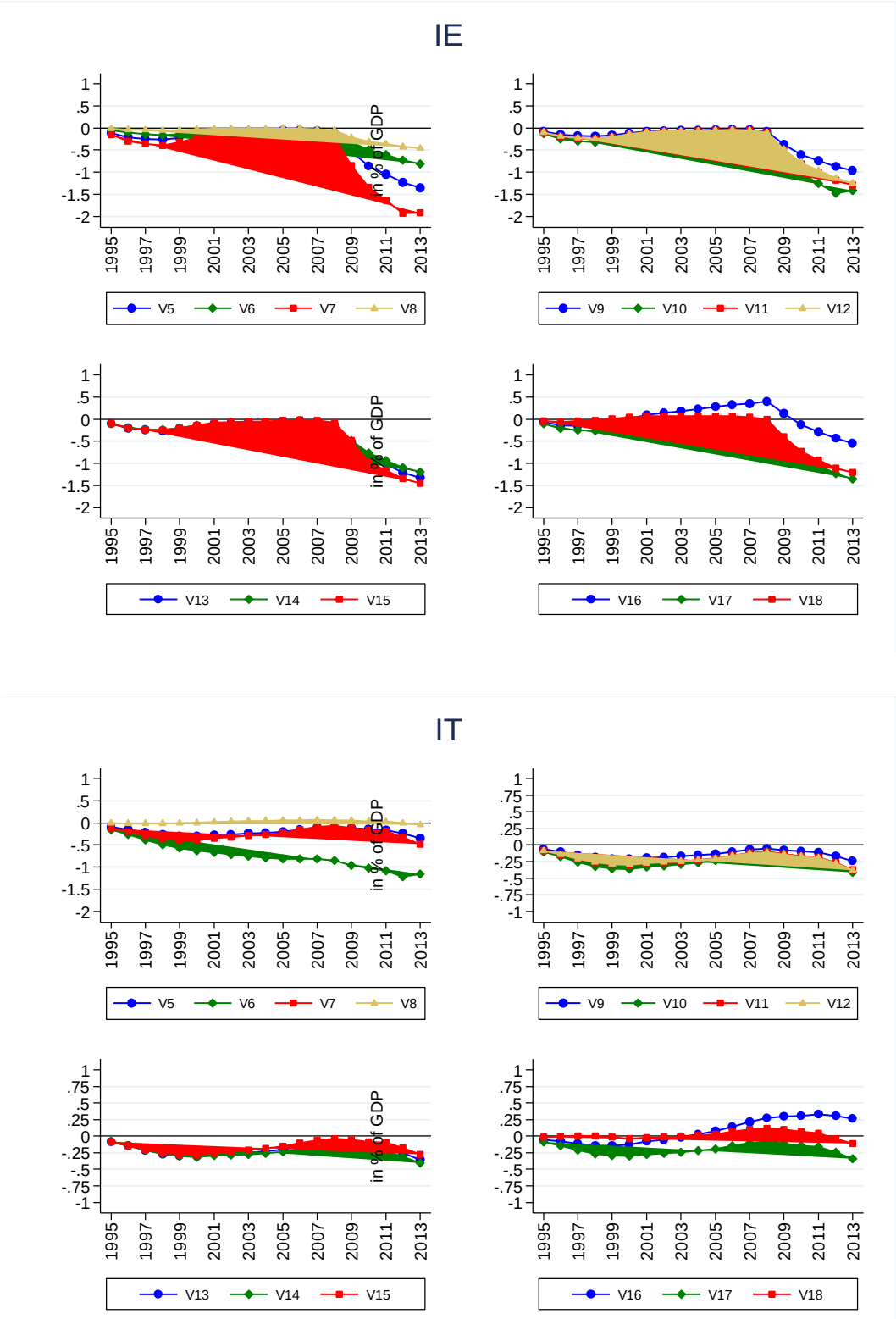
## FI

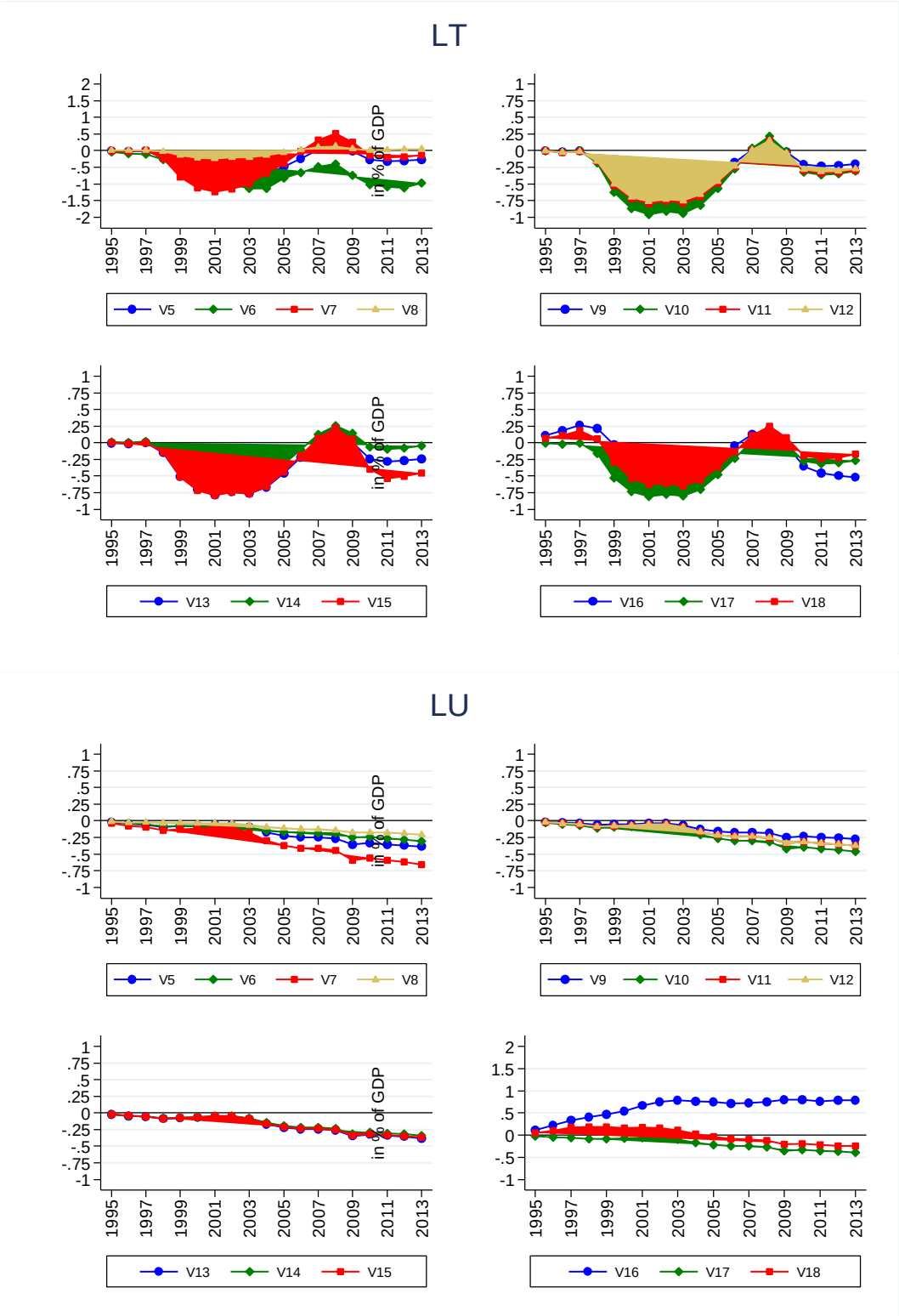

in% of GDP
V5 V6 V7 V8
V9 V10 V11 V12
in % of GDP
V13 V14 V15
V16 V17 V18

## FR

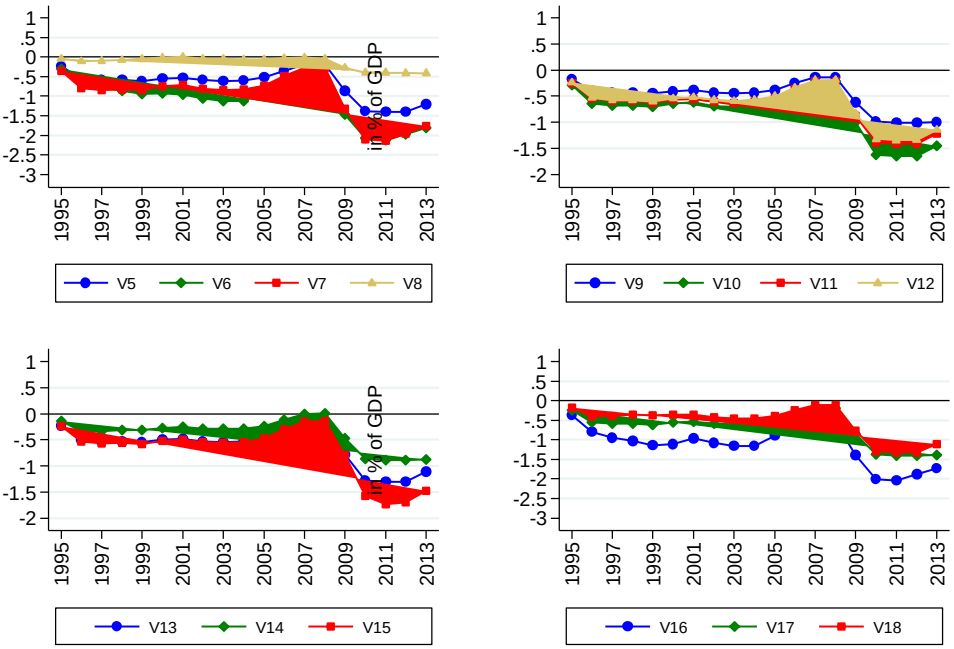

in % of GDP
V5 V6 V7 V8
V9 V10 V11 V12
in % of GDP
V13 V14 V15
V16 V17 V18


GE
in % of GDP
V5 V6 V7 V8
V9 V10 V11 V12
V13 V14 V15
V16 V17 V18
GR
in % of GDP
V5 V6 V7 V8
V9 V10 V11 V12
V13 V14 V15
V16 V17 V18

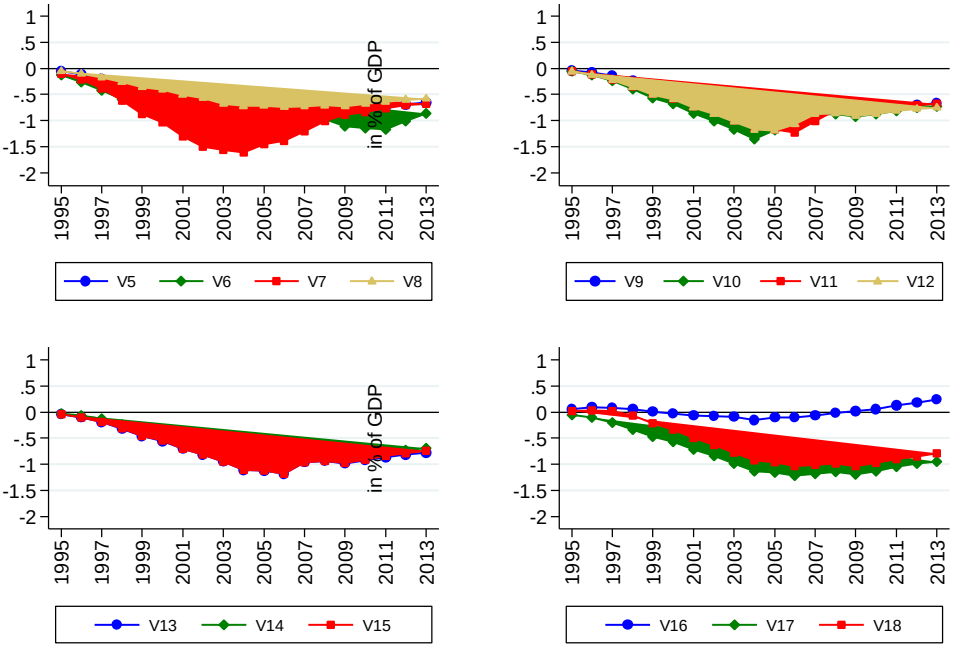

IE
in % of GDP
V5 V6 V7 V8
V9 V10 V11 V12
V13 V14 V15
V16 V17 V18
IT
in % of GDP
V5 V6 V7 V8
V9 V10 V11 V12
V13 V14 V15
V16 V17 V18


LT
in % of GDP
V5
V6
V7
V8
V9
V10
V11
V12
V13
V14
V15
V16
V17
V18
LU
in % of GDP
V5
V6
V7
V8
V9
V10
V11
V12
V13
V14
V15
V16
V17
V18

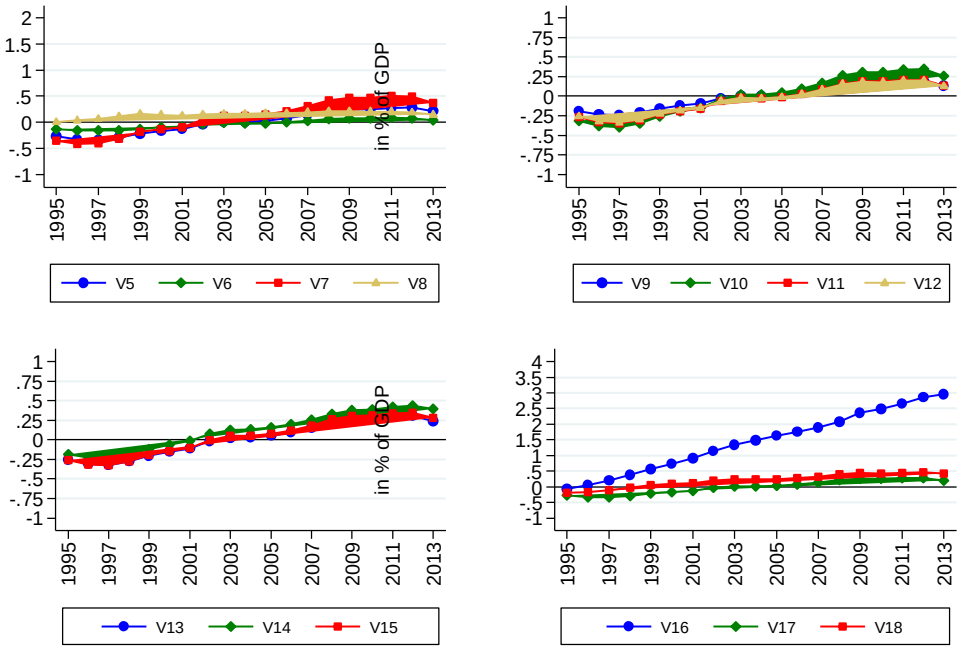
## LV


in % of GDP
V5 V6 V7 V8
V9 V10 V11 V12
V13 V14 V15
V16 V17 V18

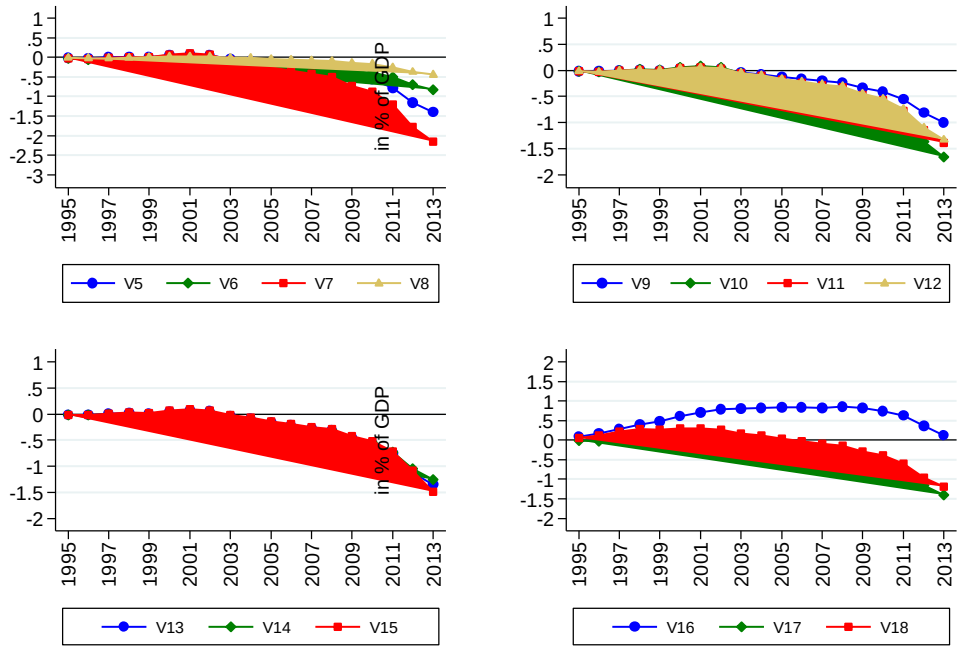
## MT

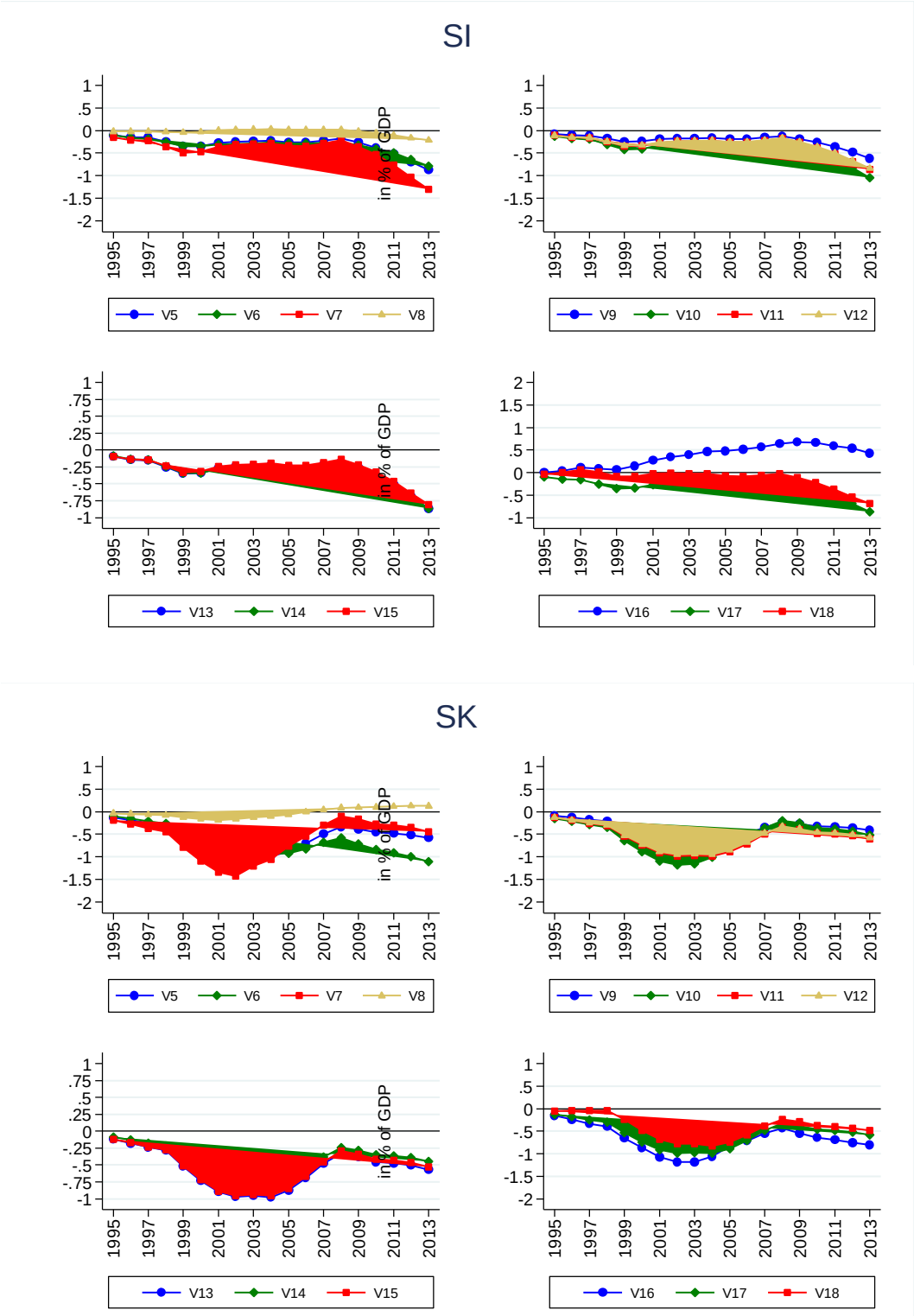

in % of GDP
V5 V6 V7 V8
V9 V10 V11 V12
V13 V14 V15
V16 V17 V18

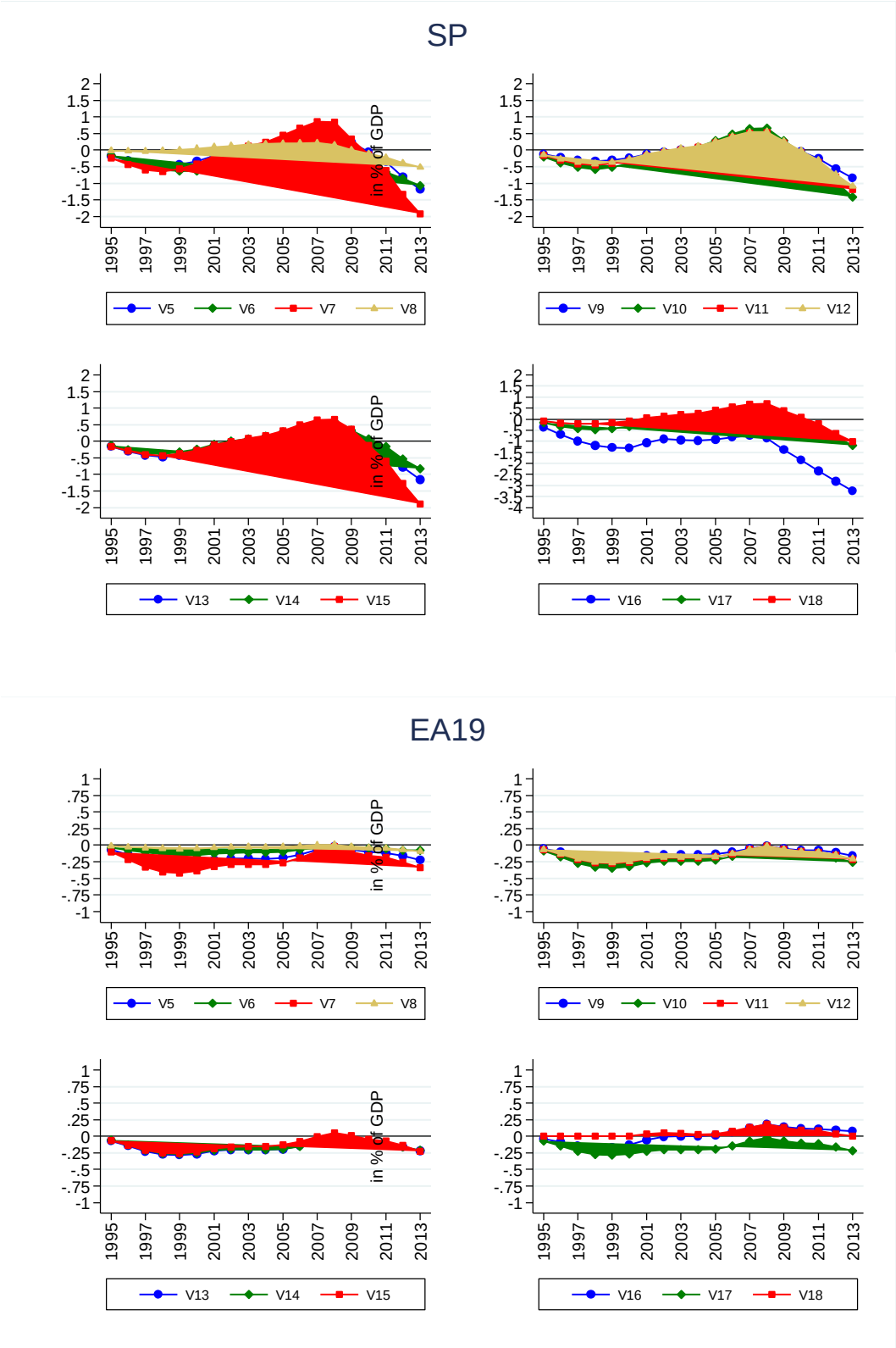
## NL


in % of GDP
V5 V6 V7 V8
V9 V10 V11 V12
V13 V14 V15
V16 V17 V18

## PT


in % of GDP
V5 V6 V7 V8
V9 V10 V11 V12
V13 V14 V15
V16 V17 V18

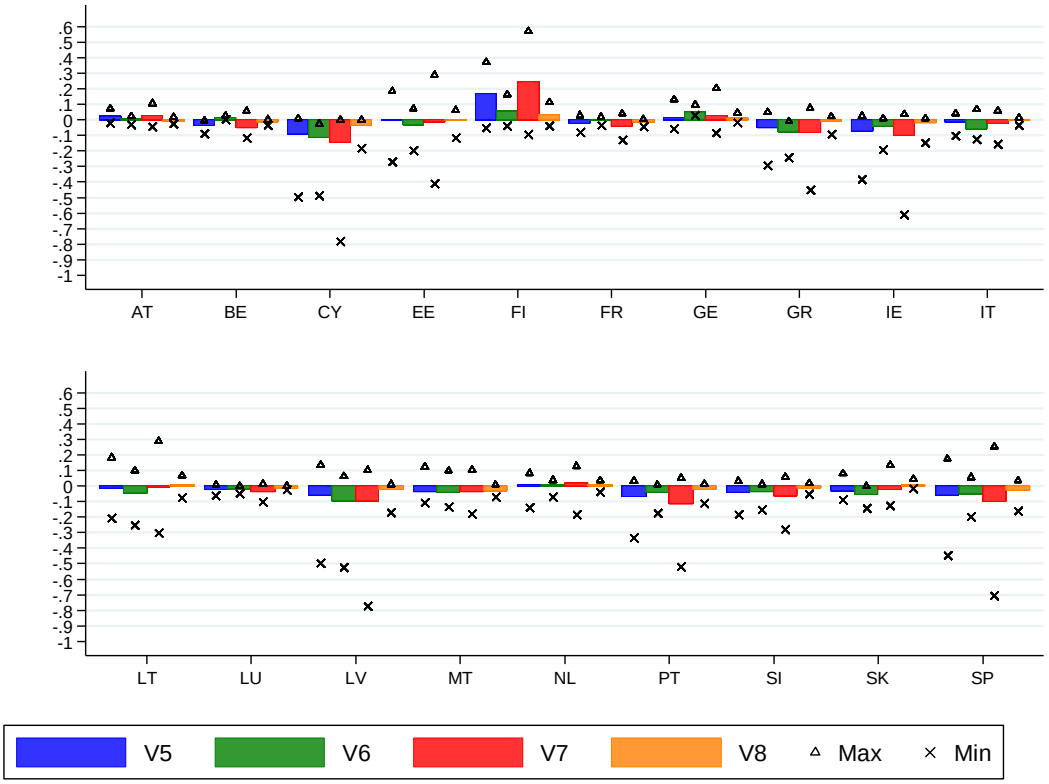

SI
in % of GDP
V5 V6 V7 V8
V9 V10 V11 V12
V13 V14 V15
V16 V17 V18
SK
in % of GDP
V5 V6 V7 V8
V9 V10 V11 V12
V13 V14 V15
V16 V17 V18

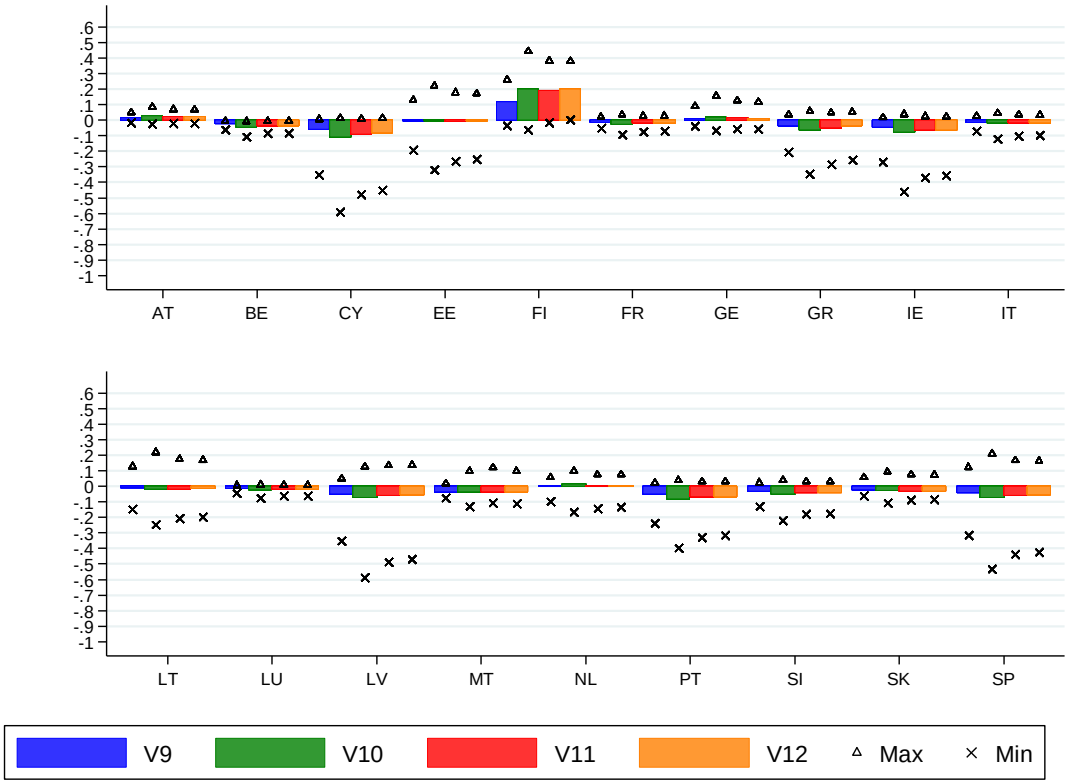


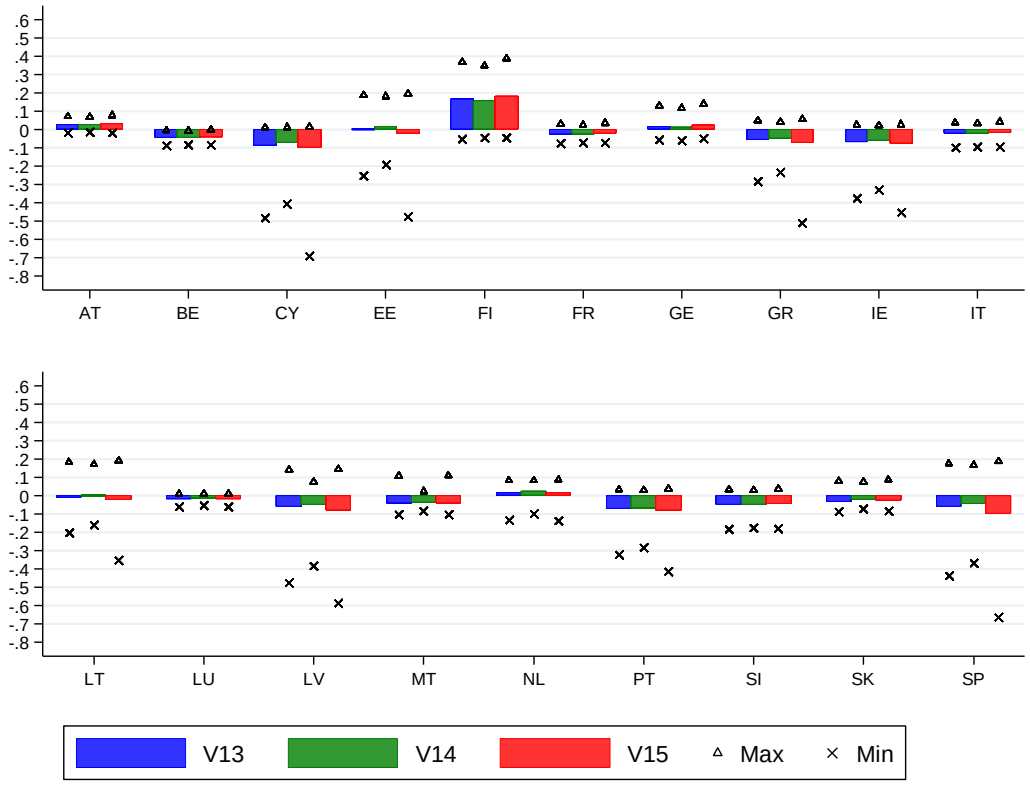

*Note*: Cumulative net contributions in % of GDP of year t. Net contributions = Contributions – Benefits.

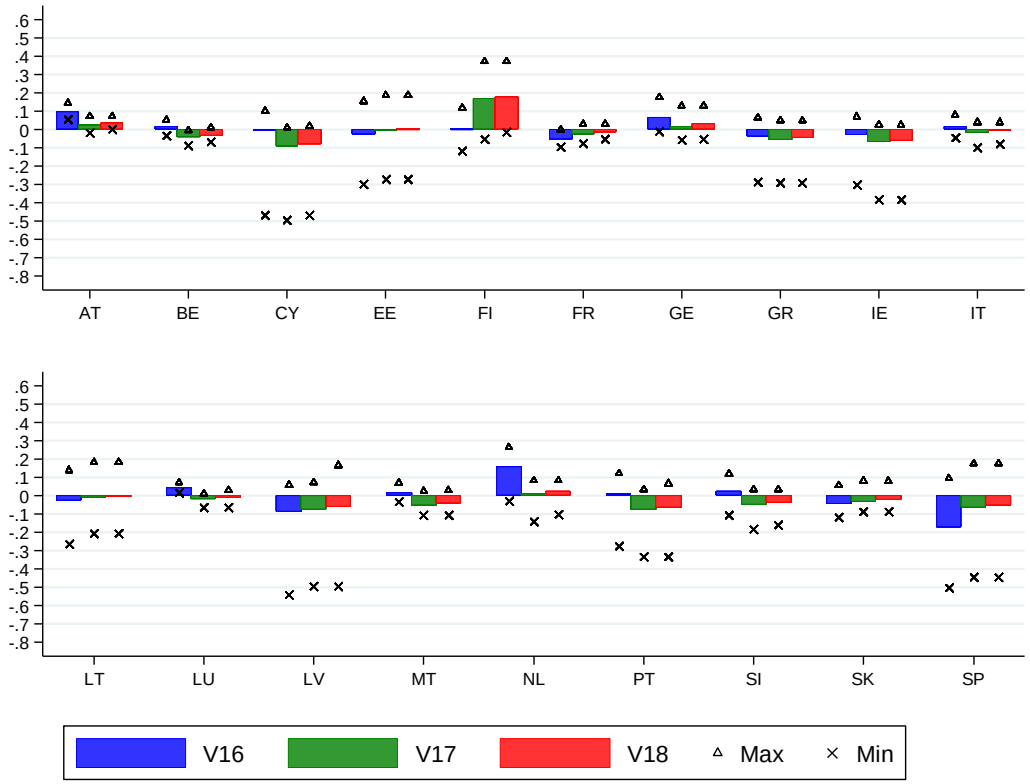
*Sources*: EU-LFS and own calculations based on EUROMOD.

**Figure 10. Average yearly net contributions (1995-2013) in per cent of 2013 GDP: Genuine systems**






*Note*: Net contributions=Contr.–Benefits.
*Sources*: LFS + own calculations based on EUROMOD.

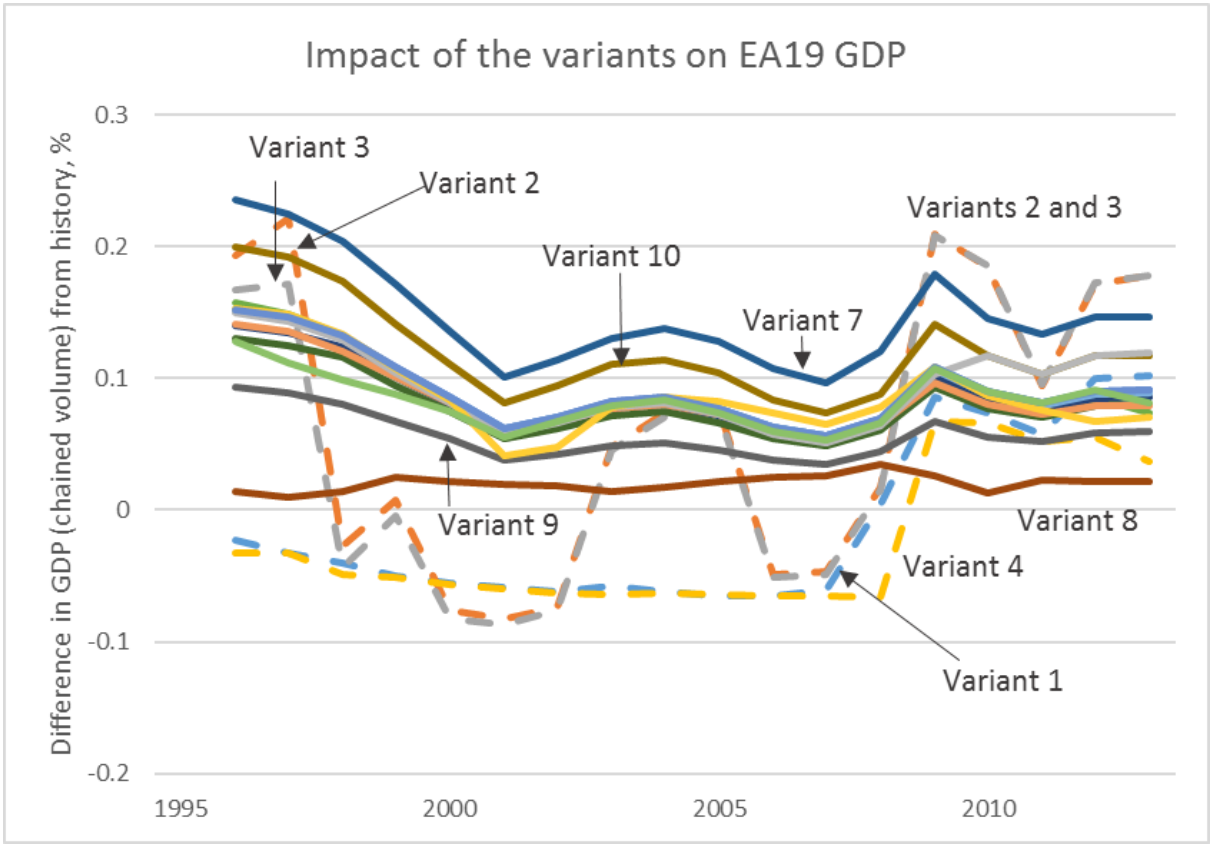
## 4.2. Macroeconomic effects

The results reported in this section are the results of the macroeconomic modelling using E3ME. In what follows, the term 'non-EUBS 'baseline' is used to refer to the position without the EUBS: that is, the actual history over 1995-2013.

### 4.2.1 Impacts on the Eurozone as a whole

The analysis has been carried out both for a system that includes only the (present) Eurozone members, EA19, and for a system that includes all the EU27 countries. The differences between the two cases are small, and the presentation of results that follows focuses on the EA19 case.

**Figure 11. Impact of the variants on EA19 GDP**




*Note*: Equivalent system variants are shown with dotted lines, and genuine system variants with solid lines.

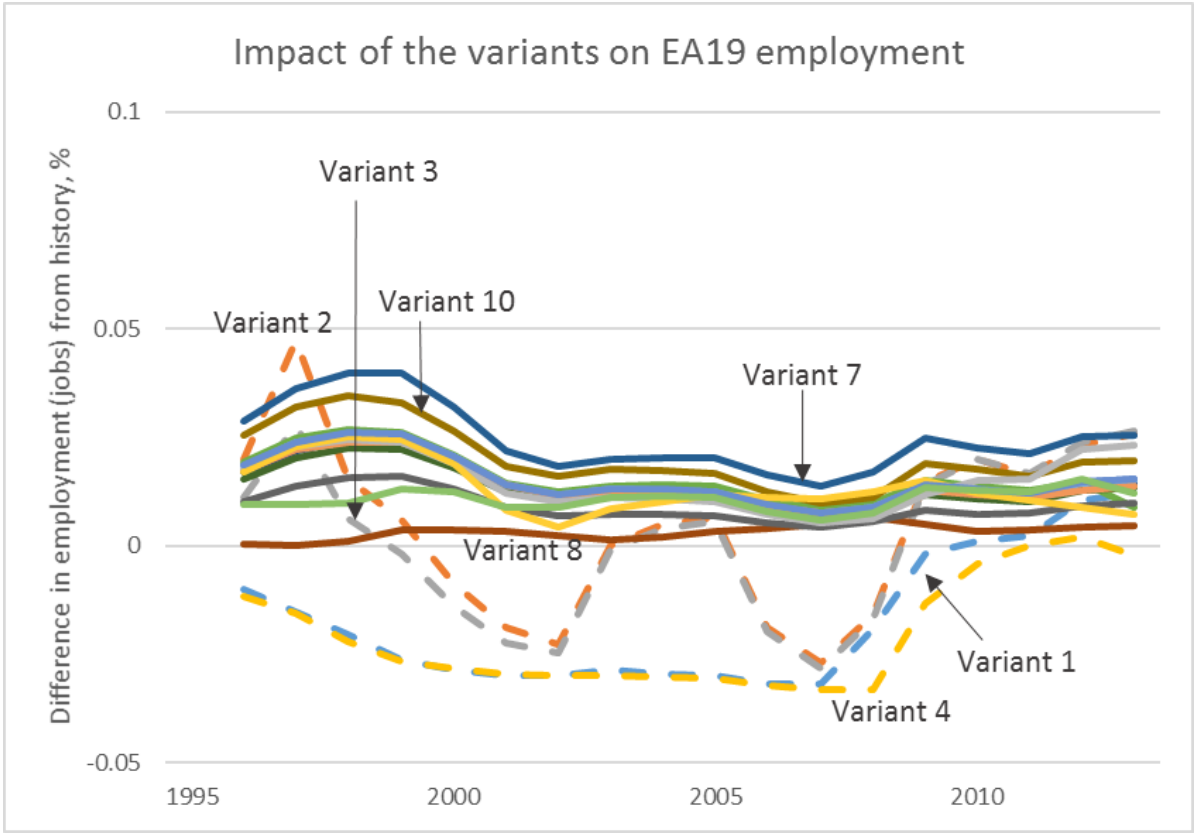
Figure 11 shows the impact on GDP relative to the non-EUBS baseline, of each of 18 variants. In overall scale the differences (less than 0.5% in any year) are consistent with the broad magnitude of net transfers under the EUBS. The overall profile of impacts (high in 1996 and high again in 2009) reflects the time profile of short-term unemployment. The different profiles of the variants reflect the differences in the profile of net transfers calculated in the micro modelling (reflecting the different rules of the variants). Variants 1 and 4, which have the higher thresholds for triggering payments under the equivalent systems, only have a positive impact on GDP during the post-2007 severe recession. Variants 2 and 3, with their lower thresholds, have a positive impact more frequently and have the largest positive impact during the post-2007 recession. Their impact is very similar, since they differ only to the extent that the no-borrowing constraint in variant 3 takes effect (requiring additional contributions when the fund would otherwise be unable to meet its obligations). Of the genuine systems, the largest (smallest) positive impact is for variant 7 (variant 8), which has the longest (shortest) duration of benefit. The second-largest (second-smallest) impact is for variant 10 (variant 9) which has the

highest (lowest) replacement rate. There is little difference among the impacts of the other genuine systems.

For the purpose of macroeconomic stabilization, the equivalent systems have a stronger stabilization effect because they are designed to pay out only in periods of macroeconomic downturns, whereas the net contributions and GDP impacts of the genuine systems is smoother because they are paying out continually to those who are eligible. For the genuine systems, the stabilization effect is generally in line with the generosity of the system: a more generous system raises larger contributions during macroeconomic upswings and pays out larger benefits during a downturn.

As noted in section 4.1.2, the equivalent systems generate a small net surplus for the EUBS by 2013, whereas the genuine systems mostly generate a small net deficit. This is consistent with the pattern of GDP impacts shown in Figure 11: for the genuine systems there is a net positive impact on GDP over the whole period, whereas for the equivalent systems (and especially variants 1 and 4, which accumulate the largest surpluses) there is a negative impact on GDP in most years (reflecting the fact that the trigger is rarely pulled).

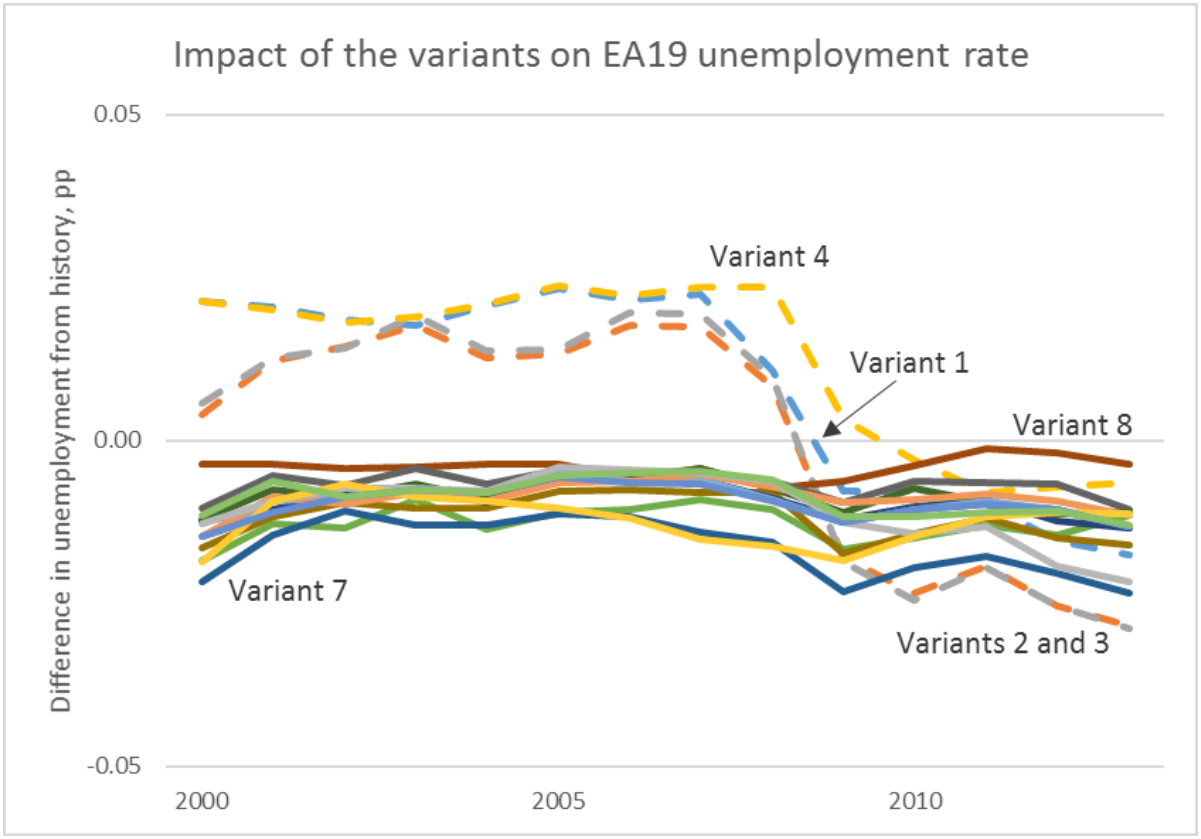
**Figure 12. Impact of the variants on EA19 employment**




*Note*: Equivalent system variants are shown with dotted lines, and genuine system variants with solid lines.

Figure 12 shows the impact on employment. The employment impacts are smaller than the GDP impacts, reflecting E3ME's properties (the elasticity of employment with respect to output varies across countries and sectors, but is less than 1.0 in all cases). The broad pattern of results is similar to those for GDP. Figure 13 shows the corresponding impact on unemployment, with similar patterns to the employment results but in the opposite direction.

**Figure 13. Impact of the variants on the EA19 unemployment rate**




*Note*: Equivalent system variants are shown with dotted lines, and genuine system variants with solid lines.

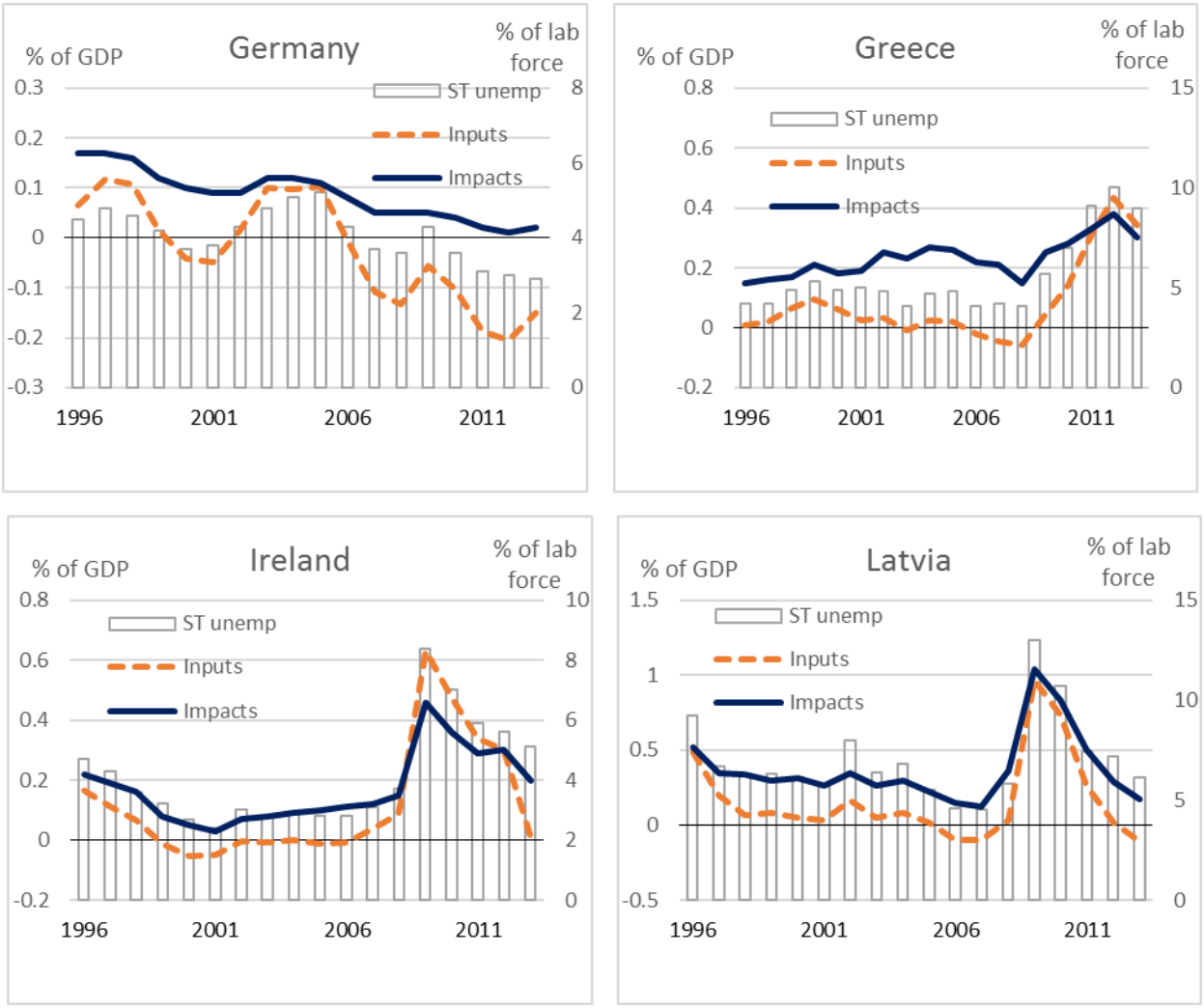
### 4.2.2 Impacts on particular countries

Clearly, in the presence of asymmetric shocks the impact of the EUBS in relation to GDP and other macroeconomic indicators will be larger for particular countries than for the Eurozone area as a whole.

Figure 14 presents the time profile of net contributions and GDP impacts of variant 7 (the most generous variant) for a selection of countries including one (Germany) in which short-term unemployment was higher at the beginning of the period and three (Greece, Ireland and Latvia) where short-term unemployment rose sharply during the Great Recession.

In each chart in Figure 14, the close relationship between changes in net receipts (benefit payments less contributions) from the EUBS and changes in short-term unemployment. In the case of Germany, net receipts become negative in the latter years reflecting the fall in short-term unemployment, whereas in the three other countries net receipts rise sharply at the beginning of the Great Recession, when short-term unemployment spiked, and then fall away as short-term unemployment rates fell back. The GDP impacts are typically somewhat larger than the net receipts, reflecting spillover effects (activity boosted by exports to other countries whose domestic spending has been stimulated by net receipts from the EUBS) and Eurozone-wide multiplier effects in years when the EUBS runs a deficit (either by running down reserves or by borrowing). There are also multiplier effects associated with the transfer of income from those in employment and their employers (who make the contributions) and the unemployed, because of the assumption that the marginal propensity to consume of the unemployed is higher.

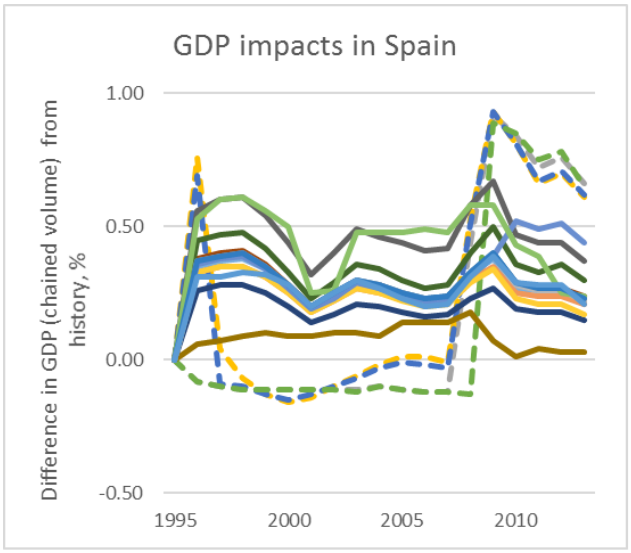
**Figure 14. Net contributions and GDP impacts under variant 7 in selected countries**

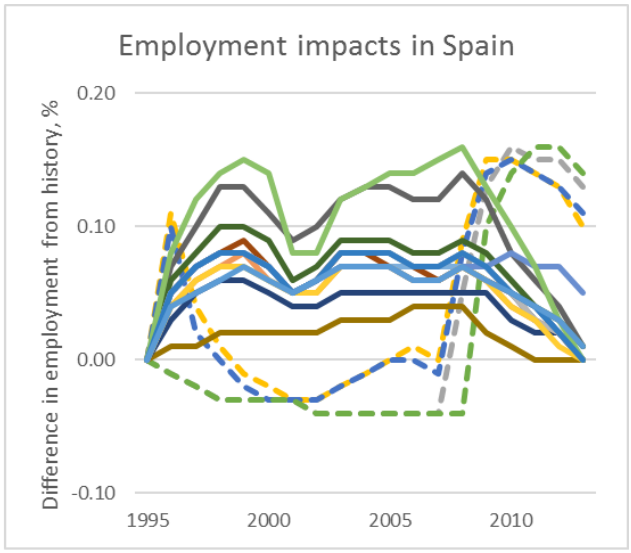



*Note*: 'Inputs' shows net receipts under the EUBS (the outcome of the EUROMOD first-round analysis) as a percent of GDP, measured on the left-hand axis. 'Impacts' shows the GDP impact results of the macroeconomic modelling with E3ME, also measured on the left-hand axis. 'ST unemp' shows the historical short-term unemployment rates (which are the key determinant of changes in benefit payments and hence of changes in net receipts), measured on the right-hand axis.

Figures 15-17 show the results of all the variants for Spain, Ireland and Greece, as illustrations of particular Eurozone countries where the impacts are larger, reflecting the greater scale of the economic crisis in those countries. In Spain the peak impact is about 0.9% of GDP in 2009 for equivalent systems which kick in in that year, while in Ireland it is 0.6%. In Greece the peak impact is later (reflecting the timing of the increase in short-term unemployment) and about 0.4% of GDP.

**Figure 15. Impact of the variants on Spain**



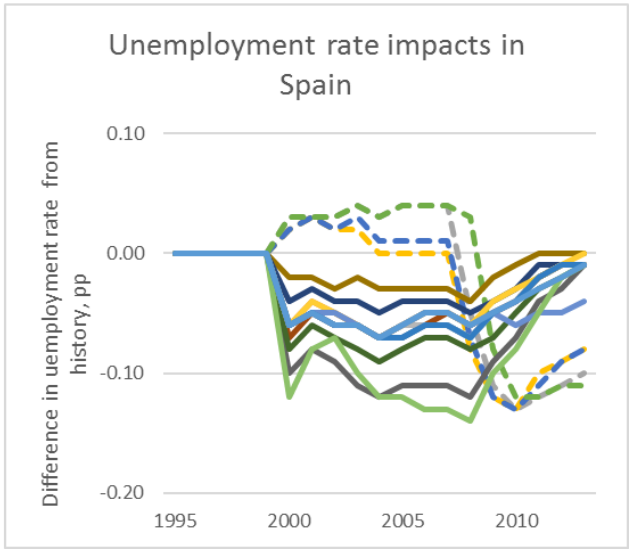
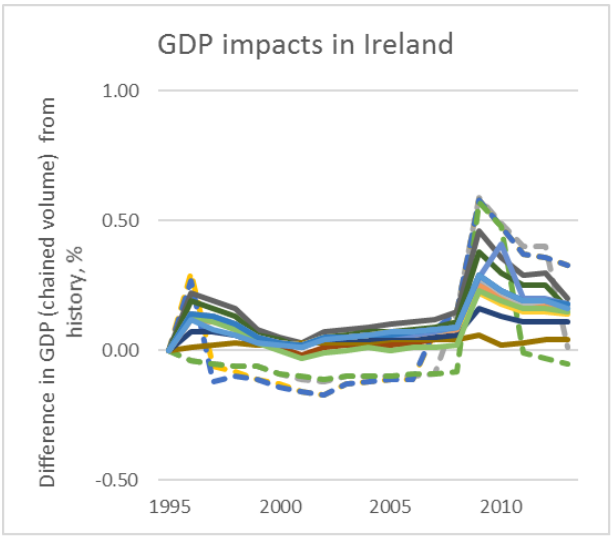



**Figure 16. Impact of the variants on Ireland**



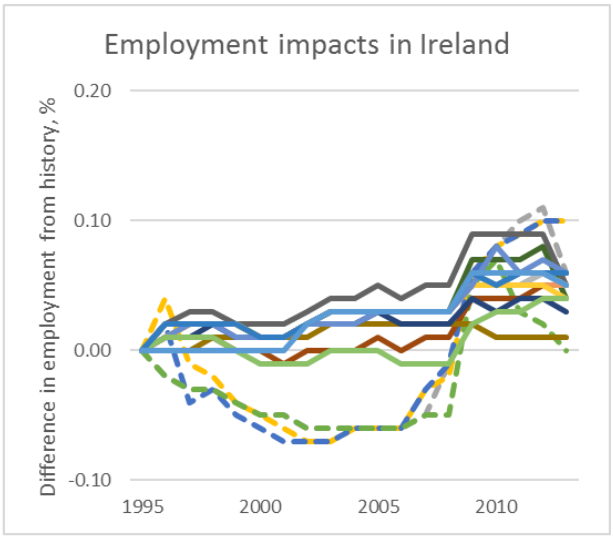
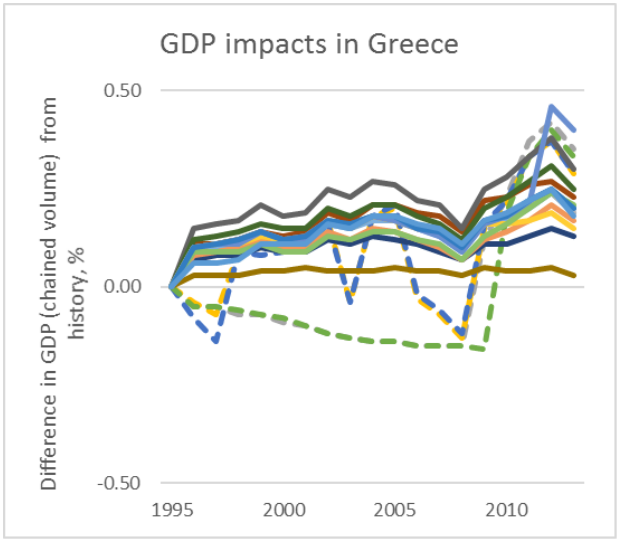
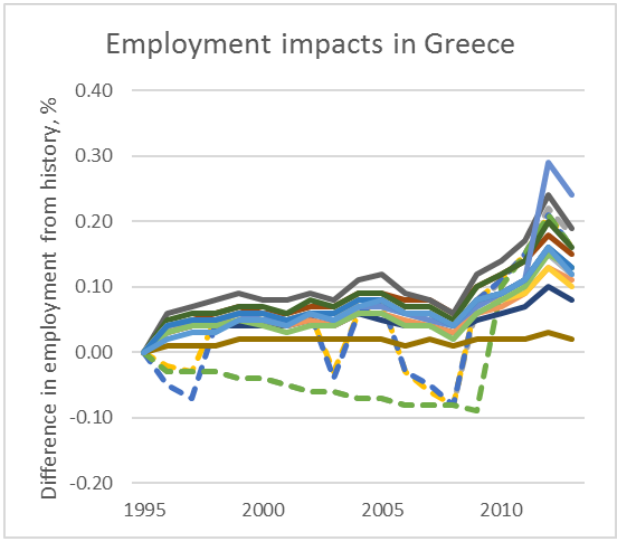




**Figure 17. Impact of the variants on Greece**



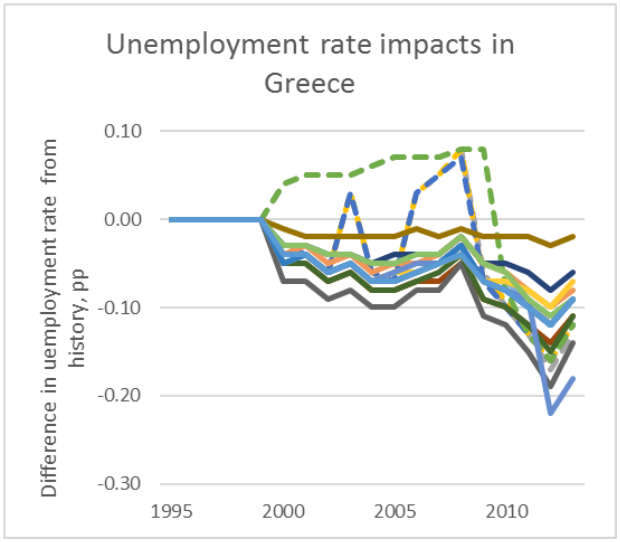



Table 4 presents summary results across the EA19 and the 18 variants. For each variant the tables show:

- the total net transfer by each country into the EUBS, aggregated over the entire historical period and expressed as a percentage of (nominal) GDP over that period
- the year in which the highest value of transfer received from the EUBS (as a percentage of GDP) occurs, according to the first-round effects (if #N/A is shown then the country never receives a positive transfer in the micro simulation)
- the size of the largest transfer received in that year (as a percentage of GDP)
- the year in which the largest boost to (nominal) GDP in the macro simulation occurs
- the size of the boost to (nominal) GDP in that year (as a percentage of the baseline value)
- the change, compared with the baseline, in the standard deviation of the growth of real GDP over the whole period, as a measure of the macro stabilization impact of the policy

The final item in this list, the stabilization indicator, is to be interpreted as follows: If the standard deviation of real GDP growth in the baseline for a particular country took the value 1.5 then, if the series were normally distributed, the annual GDP growth rate would lie approximately within 3 pp (= 2 x 1.5) of the mean growth rate over the period in 95% of cases. If the stabilization indicator shows a value of -0.3, this means that the standard deviation of growth rates in the simulation is 0.3 pp smaller than in the baseline, or 1.2 (1.5-0.3) in the present example, so that the volatility of growth rates has been reduced as a result of the EUBS.

The following findings emerge:

- it is fairly common across countries for the year with the largest impact on GDP also to be the year when the largest receipt from the EUBS occurs; this is particularly the case for countries in which the largest benefit payment received is relatively large (as a share of GDP) compared with the other countries, and for smaller countries: Cyprus, Greece, Ireland, Lithuania, Latvia, Malta, Portugal and Slovenia

- in cases where the largest GDP impact is felt in the same year as the largest EUBS transfer (as a percentage of GDP), the GDP impact is often slightly larger: Keynesian multiplier effects including spillovers in the form of exports and imports account for this

- spillover effects are also evident in the fact that the largest GDP impact is sometimes found to occur in 2009 in countries in which this is not the year of the largest EUBS contribution: they benefit from the general alleviation of the recession in that year arising from EUBS transfers

- the EUBS variants make a contribution towards greater stabilization, as evidenced by the reduction in each country's standard deviation of the time series of GDP growth (in the cases where the effect is large enough to register at the level of one decimal place in the statistic)

**Table 4. Summary results by variant and Eurozone country**

| | Variant 1 | | | | | | Variant 2 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Inputs to macro modelling | | | Macro results | | | Inputs to macro modelling | | | Macro results | | |
| | Net EUBS receipts, 1995-2013 | Highest annual benefit received | | Highest annual boost to GDP | | Change from baseline in standard deviation of GDP growth (1995-2013) | Net EUBS receipts, 1995-2013 | Highest annual benefit received | | Highest annual boost to GDP | | Change from baseline in standard deviation of GDP growth (1995-2013) |
| | % of GDP (1995-2013) | Year | % GDP | Year | % of baseline GDP | | % of GDP (1995-2013) | Year | % GDP | Year | % of baseline GDP | |
| Austria | -0.1 | #N/A | 0.0 | 1996 | -0.1 | 0.0 | 0.0 | 1996 | 0.1 | 1998 | 0.4 | -0.1 |
| Belgium | -0.1 | #N/A | 0.0 | 1996 | 0.0 | 0.0 | 0.0 | 2003 | 0.1 | 2013 | 0.3 | 0.0 |
| Cyprus | 0.1 | 2013 | 0.6 | 2013 | 0.6 | -0.2 | 0.0 | 2013 | 0.6 | 2013 | 0.7 | -0.2 |
| Estonia | 0.0 | 2009 | 0.6 | 2009 | 0.6 | -0.1 | 0.0 | 2009 | 0.5 | 2010 | 0.6 | -0.1 |
| Finland | 0.0 | 1995 | 0.4 | 1997 | 0.6 | 0.1 | 0.0 | 1995 | 0.4 | 1997 | 0.7 | 0.1 |
| France | -0.1 | #N/A | 0.0 | 1996 | 0.0 | 0.0 | 0.0 | 1996 | 0.2 | 1997 | 0.8 | -0.1 |
| Germany | -0.1 | #N/A | 0.0 | 1996 | 0.0 | 0.0 | 0.0 | 1997 | 0.3 | 1997 | 0.4 | 0.0 |
| Greece | 0.0 | 2012 | 0.4 | 2012 | 0.5 | -0.1 | 0.0 | 2012 | 0.3 | 2012 | 0.5 | -0.1 |
| Ireland | 0.0 | 2009 | 0.4 | 2009 | 0.6 | -0.1 | 0.0 | 2009 | 0.4 | 2009 | 0.6 | -0.1 |
| Italy | -0.1 | 2013 | 0.2 | 2013 | 0.3 | 0.0 | 0.0 | 1995 | 0.1 | 1997 | 0.3 | 0.0 |
| Lithuania | 0.0 | 2010 | 0.5 | 2010 | 0.5 | -0.1 | 0.1 | 1999 | 0.5 | 1999 | 0.5 | -0.1 |
| Luxembourg | -0.1 | 2009 | 0.1 | 2009 | 0.1 | 0.0 | 0.0 | 2004 | 0.0 | 2009 | 0.1 | 0.0 |
| Latvia | 0.0 | 2009 | 0.8 | 2009 | 0.8 | -0.2 | 0.1 | 2009 | 0.8 | 2009 | 0.8 | -0.2 |
| Malta | -0.1 | 2003 | 0.2 | 2003 | 0.2 | 0.0 | 0.0 | 2002 | 0.2 | 2003 | 0.3 | 0.0 |
| Netherlands | -0.1 | 2013 | 0.2 | 2013 | 0.2 | 0.0 | 0.0 | 1995 | 0.4 | 2013 | 0.3 | 0.0 |
| Portugal | 0.1 | 2012 | 0.4 | 2012 | 0.6 | 0.0 | 0.1 | 2012 | 0.3 | 2013 | 0.6 | 0.0 |
| Slovenia | 0.0 | 2013 | 0.3 | 2013 | 0.3 | -0.1 | 0.0 | 2013 | 0.2 | 1999 | 0.3 | -0.1 |
| Slovakia | -0.1 | 2000 | 0.4 | 2000 | 0.5 | 0.0 | -0.1 | 2000 | 0.3 | 2000 | 0.5 | 0.0 |
| Spain | 0.2 | 2013 | 0.8 | 2012 | 1.6 | 0.0 | 0.2 | 2012 | 0.8 | 2012 | 1.6 | -0.2 |

| | Variant 3 | | | | | | | Variant 4 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Inputs to macro modelling | | | Macro results | | | | Inputs to macro modelling | | | Macro results | | |
| | Net EUBS receipts, 1995-2013 | Highest annual benefit received | | Highest annual boost to GDP | | Change from baseline in standard deviation of GDP growth (1995-2013) | | Net EUBS receipts, 1995-2013 | Highest annual benefit received | | Highest annual boost to GDP | | Change from baseline in standard deviation of GDP growth (1995-2013) |
| | % of GDP (1995-2013) | Year | % GDP | Year | % of baseline GDP | | | % of GDP (1995-2013) | Year | % GDP | Year | % of baseline GDP | |
| Austria | -0.1 | 1998 | 0.1 | 1998 | 0.3 | -0.1 | | -0.1 | #N/A | 0.0 | 1996 | -0.1 | 0.0 |
| Belgium | 0.0 | 2003 | 0.1 | 2013 | 0.3 | 0.0 | | -0.1 | #N/A | 0.0 | 1996 | 0.0 | 0.0 |
| Cyprus | 0.0 | 2013 | 0.5 | 2013 | 0.7 | -0.2 | | 0.0 | 2013 | 0.6 | 2013 | 0.6 | -0.2 |
| Estonia | 0.0 | 2009 | 0.5 | 2010 | 0.6 | -0.1 | | 0.0 | 2009 | 0.6 | 2009 | 0.6 | -0.1 |
| Finland | 0.0 | 1995 | 0.4 | 1997 | 0.6 | 0.1 | | -0.1 | 1997 | 0.4 | 1997 | 0.5 | 0.0 |
| France | 0.0 | 1995 | 0.2 | 2013 | 0.8 | -0.1 | | -0.1 | #N/A | 0.0 | 1996 | 0.0 | 0.0 |
| Germany | -0.1 | 2003 | 0.2 | 1997 | 0.4 | 0.0 | | -0.1 | #N/A | 0.0 | 1996 | 0.0 | 0.0 |
| Greece | 0.0 | 2012 | 0.3 | 2012 | 0.5 | -0.1 | | 0.0 | 2012 | 0.3 | 2012 | 0.5 | -0.1 |
| Ireland | 0.0 | 2009 | 0.4 | 2009 | 0.6 | -0.1 | | 0.0 | 2009 | 0.4 | 2009 | 0.6 | -0.1 |
| Italy | 0.0 | 1995 | 0.1 | 2013 | 0.3 | 0.0 | | -0.1 | #N/A | 0.0 | 1996 | -0.1 | 0.0 |
| Lithuania | 0.1 | 1999 | 0.5 | 1999 | 0.5 | -0.1 | | 0.0 | 2010 | 0.5 | 2010 | 0.5 | -0.1 |
| Luxembourg | -0.1 | 2004 | 0.0 | 2013 | 0.1 | 0.0 | | -0.1 | 2004 | 0.1 | 2004 | 0.1 | 0.0 |
| Latvia | 0.1 | 2009 | 0.8 | 2009 | 0.8 | -0.2 | | 0.0 | 2009 | 0.8 | 2009 | 0.8 | -0.2 |
| Malta | 0.0 | 2002 | 0.2 | 2003 | 0.2 | 0.0 | | -0.1 | #N/A | 0.0 | 2010 | 0.0 | 0.0 |
| Netherlands | 0.0 | 1995 | 0.3 | 2013 | 0.3 | 0.0 | | -0.1 | #N/A | 0.0 | 1996 | -0.1 | 0.0 |
| Portugal | 0.1 | 2012 | 0.3 | 2012 | 0.6 | 0.0 | | 0.0 | 2012 | 0.4 | 2013 | 0.5 | 0.0 |
| Slovenia | 0.0 | 2013 | 0.2 | 1998 | 0.3 | -0.1 | | -0.1 | #N/A | 0.0 | 2009 | 0.0 | 0.0 |
| Slovakia | -0.1 | 2000 | 0.3 | 2000 | 0.5 | 0.0 | | -0.1 | 2000 | 0.4 | 2000 | 0.4 | 0.0 |
| Spain | 0.2 | 2012 | 0.8 | 2012 | 1.6 | -0.2 | | 0.2 | 2012 | 0.8 | 2012 | 1.5 | 0.0 |

| | Variant 5 | | | | | | Variant 6 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Inputs to macro modelling | | | Macro results | | | Inputs to macro modelling | | | Macro results | | |
| | Net EUBS receipts, 1995-2013 | Highest annual benefit received | | Highest annual boost to GDP | | Change from baseline in standard deviation of GDP growth (1995-2013) | Net EUBS receipts, 1995-2013 | Highest annual benefit received | | Highest annual boost to GDP | | Change from baseline in standard deviation of GDP growth (1995-2013) |
| | % of GDP (1995-2013) | Year | % GDP | Year | % of baseline GDP | | % of GDP (1995-2013) | Year | % GDP | Year | % of baseline GDP | |
| Austria | 0.0 | 1996 | 0.0 | 2013 | 0.2 | 0.0 | 0.0 | 2013 | 0.0 | 2013 | 0.2 | 0.0 |
| Belgium | 0.1 | 2013 | 0.1 | 2002 | 0.1 | 0.0 | 0.0 | #N/A | 0.0 | 1999 | 0.1 | 0.0 |
| Cyprus | 0.1 | 2013 | 0.5 | 2013 | 0.5 | -0.1 | 0.1 | 2013 | 0.5 | 2013 | 0.6 | -0.1 |
| Estonia | 0.0 | 2010 | 0.4 | 2009 | 0.4 | 0.0 | 0.0 | 2009 | 0.2 | 2009 | 0.5 | -0.1 |
| Finland | -0.2 | 1995 | 0.1 | 1996 | 0.2 | 0.0 | -0.1 | 1997 | 0.0 | 1997 | 0.3 | 0.0 |
| France | 0.0 | 1997 | 0.1 | 2000 | 0.5 | 0.0 | 0.0 | 1996 | 0.0 | 2000 | 0.4 | 0.0 |
| Germany | 0.0 | 2005 | 0.1 | 2005 | 0.2 | 0.0 | -0.1 | #N/A | 0.0 | 1997 | 0.1 | 0.0 |
| Greece | 0.1 | 2012 | 0.3 | 2012 | 0.4 | 0.0 | 0.1 | 2012 | 0.2 | 2012 | 0.4 | 0.0 |
| Ireland | 0.1 | 2009 | 0.4 | 2009 | 0.3 | 0.0 | 0.0 | 2009 | 0.2 | 2009 | 0.3 | 0.0 |
| Italy | 0.0 | 2013 | 0.1 | 1997 | 0.2 | 0.0 | 0.1 | 1995 | 0.1 | 1997 | 0.2 | 0.0 |
| Lithuania | 0.0 | 2010 | 0.3 | 2010 | 0.4 | 0.0 | 0.1 | 2010 | 0.3 | 2010 | 0.4 | 0.0 |
| Luxembourg | 0.0 | 2004 | 0.1 | 2009 | 0.2 | 0.0 | 0.0 | 2009 | 0.1 | 2013 | 0.1 | 0.0 |
| Latvia | 0.1 | 2009 | 0.6 | 2009 | 0.7 | -0.1 | 0.2 | 2009 | 0.6 | 2009 | 0.8 | -0.1 |
| Malta | 0.1 | 2004 | 0.1 | 2004 | 0.3 | 0.0 | 0.1 | 2004 | 0.2 | 2003 | 0.3 | 0.0 |
| Netherlands | 0.0 | 1995 | 0.3 | 2013 | 0.1 | 0.0 | 0.0 | 1995 | 0.1 | 2013 | 0.1 | 0.0 |
| Portugal | 0.1 | 2012 | 0.3 | 2012 | 0.3 | 0.0 | 0.0 | 2012 | 0.2 | 2012 | 0.3 | 0.0 |
| Slovenia | 0.1 | 2013 | 0.2 | 1999 | 0.2 | 0.0 | 0.0 | 2013 | 0.1 | 1999 | 0.2 | 0.0 |
| Slovakia | 0.1 | 2000 | 0.3 | 2001 | 0.3 | 0.0 | 0.1 | 2001 | 0.2 | 2000 | 0.3 | 0.0 |
| Spain | 0.1 | 2012 | 0.5 | 2009 | 0.8 | 0.0 | 0.0 | 2012 | 0.2 | 2009 | 0.7 | 0.0 |

| | Variant 7 | | | | | | | Variant 8 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Inputs to macro modelling | | | Macro results | | | | Inputs to macro modelling | | | Macro results | | |
| | Net EUBS receipts, 1995-2013 | Highest annual benefit received | | Highest annual boost to GDP | | Change from baseline in standard deviation of GDP growth (1995-2013) | | Net EUBS receipts, 1995-2013 | Highest annual benefit received | | Highest annual boost to GDP | | Change from baseline in standard deviation of GDP growth (1995-2013) |
| | % of GDP (1995-2013) | Year | % GDP | Year | % of baseline GDP | | | % of GDP (1995-2013) | Year | % GDP | Year | % of baseline GDP | |
| Austria | 0.0 | 1996 | 0.1 | 2013 | 0.3 | 0.0 | | 0.0 | 1996 | 0.0 | 2013 | 0.1 | 0.0 |
| Belgium | 0.1 | 2013 | 0.1 | 2002 | 0.2 | 0.0 | | 0.0 | 2009 | 0.0 | 2007 | 0.0 | 0.0 |
| Cyprus | 0.1 | 2013 | 0.8 | 2013 | 0.8 | -0.2 | | 0.0 | 2013 | 0.2 | 2013 | 0.2 | 0.0 |
| Estonia | 0.0 | 2009 | 0.6 | 2009 | 0.7 | -0.1 | | 0.0 | 2009 | 0.2 | 2009 | 0.1 | 0.0 |
| Finland | -0.3 | 1995 | 0.1 | 1997 | 0.4 | 0.0 | | 0.0 | 1997 | 0.1 | 1999 | 0.1 | 0.0 |
| France | 0.1 | 1997 | 0.2 | 2000 | 0.8 | 0.0 | | 0.0 | 1999 | 0.1 | 2013 | 0.1 | 0.0 |
| Germany | 0.0 | 2005 | 0.1 | 2004 | 0.2 | 0.0 | | 0.0 | 2004 | 0.0 | 2012 | 0.0 | 0.0 |
| Greece | 0.1 | 2012 | 0.4 | 2012 | 0.6 | 0.0 | | 0.0 | 2012 | 0.1 | 2012 | 0.1 | 0.0 |
| Ireland | 0.1 | 2009 | 0.6 | 2009 | 0.6 | -0.1 | | 0.0 | 2009 | 0.2 | 2009 | 0.1 | 0.0 |
| Italy | 0.0 | 2013 | 0.2 | 2013 | 0.3 | 0.0 | | 0.0 | 2013 | 0.0 | 2012 | 0.1 | 0.0 |
| Lithuania | 0.0 | 2010 | 0.4 | 2010 | 0.6 | -0.1 | | 0.0 | 2009 | 0.1 | 2000 | 0.1 | 0.0 |
| Luxembourg | 0.1 | 2004 | 0.1 | 2009 | 0.2 | 0.0 | | 0.0 | 2004 | 0.0 | 2013 | 0.1 | 0.0 |
| Latvia | 0.2 | 2009 | 1.0 | 2009 | 1.0 | -0.2 | | 0.0 | 2009 | 0.2 | 2009 | 0.2 | 0.0 |
| Malta | 0.1 | 2001 | 0.2 | 2003 | 0.4 | 0.0 | | 0.0 | 2003 | 0.1 | 2003 | 0.1 | 0.0 |
| Netherlands | 0.0 | 1995 | 0.3 | 2013 | 0.2 | 0.0 | | 0.0 | 2013 | 0.0 | 2012 | 0.1 | 0.0 |
| Portugal | 0.1 | 2012 | 0.5 | 2012 | 0.5 | 0.0 | | 0.0 | 2012 | 0.1 | 1996 | 0.1 | 0.0 |
| Slovenia | 0.1 | 2013 | 0.3 | 1999 | 0.3 | 0.0 | | 0.0 | 2012 | 0.1 | 2008 | 0.1 | 0.0 |
| Slovakia | 0.1 | 2000 | 0.4 | 2000 | 0.4 | 0.0 | | 0.0 | 2000 | 0.1 | 1997 | 0.0 | 0.0 |
| Spain | 0.1 | 2012 | 0.7 | 2009 | 1.3 | 0.0 | | 0.0 | 2012 | 0.2 | 2008 | 0.3 | 0.0 |

| | Variant 9 | | | | | | | Variant 10 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Inputs to macro modelling | | | Macro results | | | | Inputs to macro modelling | | | Macro results | | |
| | Net EUBS receipts, 1995-2013 | Highest annual benefit received | | Highest annual boost to GDP | | Change from baseline in standard deviation of GDP growth (1995-2013) | | Net EUBS receipts, 1995-2013 | Highest annual benefit received | | Highest annual boost to GDP | | Change from baseline in standard deviation of GDP growth (1995-2013) |
| | % of GDP (1995-2013) | Year | % GDP | Year | % of baseline GDP | | | % of GDP (1995-2013) | Year | % GDP | Year | % of baseline GDP | |
| Austria | 0.0 | 1996 | 0.0 | 2013 | 0.1 | 0.0 | | 0.0 | 1996 | 0.0 | 1998 | 0.2 | 0.0 |
| Belgium | 0.0 | 2013 | 0.1 | 2002 | 0.1 | 0.0 | | 0.1 | 2013 | 0.1 | 2003 | 0.2 | 0.0 |
| Cyprus | 0.0 | 2013 | 0.4 | 2013 | 0.4 | -0.1 | | 0.1 | 2013 | 0.6 | 2013 | 0.6 | -0.1 |
| Estonia | 0.0 | 2010 | 0.3 | 2009 | 0.3 | 0.0 | | 0.0 | 2010 | 0.4 | 2009 | 0.6 | -0.1 |
| Finland | -0.1 | 1995 | 0.1 | 1996 | 0.1 | 0.0 | | -0.2 | 1995 | 0.1 | 1996 | 0.3 | 0.0 |
| France | 0.0 | 1997 | 0.1 | 2000 | 0.3 | 0.0 | | 0.0 | 1997 | 0.1 | 2000 | 0.5 | 0.0 |
| Germany | 0.0 | 2005 | 0.1 | 2000 | 0.1 | 0.0 | | 0.0 | 2005 | 0.1 | 2004 | 0.2 | 0.0 |
| Greece | 0.0 | 2012 | 0.2 | 2012 | 0.2 | 0.0 | | 0.1 | 2012 | 0.3 | 2012 | 0.5 | 0.0 |
| Ireland | 0.1 | 2009 | 0.3 | 2009 | 0.2 | 0.0 | | 0.1 | 2009 | 0.5 | 2009 | 0.4 | 0.0 |
| Italy | 0.0 | 2013 | 0.1 | 1997 | 0.2 | 0.0 | | 0.0 | 2013 | 0.1 | 1997 | 0.3 | 0.0 |
| Lithuania | 0.0 | 2010 | 0.2 | 2010 | 0.2 | 0.0 | | 0.0 | 2010 | 0.3 | 2010 | 0.5 | -0.1 |
| Luxembourg | 0.0 | 2004 | 0.1 | 2009 | 0.1 | 0.0 | | 0.0 | 2004 | 0.1 | 2009 | 0.2 | 0.0 |
| Latvia | 0.1 | 2009 | 0.4 | 2009 | 0.5 | -0.1 | | 0.1 | 2009 | 0.8 | 2009 | 0.8 | -0.1 |
| Malta | 0.0 | 2004 | 0.1 | 2004 | 0.2 | 0.0 | | 0.1 | 2004 | 0.2 | 2004 | 0.3 | 0.0 |
| Netherlands | 0.0 | 1995 | 0.2 | 2013 | 0.1 | 0.0 | | 0.0 | 1995 | 0.3 | 2013 | 0.2 | 0.0 |
| Portugal | 0.1 | 2012 | 0.2 | 2012 | 0.2 | 0.0 | | 0.1 | 2012 | 0.4 | 2012 | 0.4 | 0.0 |
| Slovenia | 0.0 | 2013 | 0.1 | 1999 | 0.2 | 0.0 | | 0.1 | 2013 | 0.2 | 1999 | 0.3 | 0.0 |
| Slovakia | 0.0 | 2000 | 0.2 | 2001 | 0.2 | 0.0 | | 0.1 | 2000 | 0.4 | 2000 | 0.4 | 0.0 |
| Spain | 0.1 | 2012 | 0.3 | 2009 | 0.5 | 0.0 | | 0.1 | 2012 | 0.6 | 2009 | 0.9 | 0.0 |

| | Variant 11 | | | | | | | Variant 12 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Inputs to macro modelling | | | Macro results | | | | Inputs to macro modelling | | | Macro results | | |
| | Net EUBS receipts, 1995-2013 | Highest annual benefit received | | Highest annual boost to GDP | | Change from baseline in standard deviation of GDP growth (1995-2013) | | Net EUBS receipts, 1995-2013 | Highest annual benefit received | | Highest annual boost to GDP | | Change from baseline in standard deviation of GDP growth (1995-2013) |
| | % of GDP (1995-2013) | Year | % GDP | Year | % of baseline GDP | | | % of GDP (1995-2013) | Year | % GDP | Year | % of baseline GDP | |
| Austria | 0.0 | 1996 | 0.0 | 2013 | 0.2 | 0.0 | | 0.0 | 1996 | 0.0 | 2013 | 0.1 | 0.0 |
| Belgium | 0.1 | 2013 | 0.1 | 2005 | 0.1 | 0.0 | | 0.0 | 2013 | 0.1 | 2002 | 0.1 | 0.0 |
| Cyprus | 0.1 | 2013 | 0.5 | 2013 | 0.5 | -0.1 | | 0.0 | 2013 | 0.5 | 2013 | 0.5 | -0.1 |
| Estonia | 0.0 | 2010 | 0.4 | 2009 | 0.4 | 0.0 | | 0.0 | 2010 | 0.3 | 2009 | 0.4 | 0.0 |
| Finland | -0.2 | 1995 | 0.0 | 1996 | 0.2 | 0.0 | | -0.3 | #N/A | 0.0 | 1996 | 0.1 | 0.0 |
| France | 0.0 | 1997 | 0.1 | 2000 | 0.4 | 0.0 | | 0.0 | 1997 | 0.1 | 2000 | 0.4 | 0.0 |
| Germany | 0.0 | 1997 | 0.1 | 2004 | 0.1 | 0.0 | | 0.0 | 1997 | 0.1 | 2003 | 0.1 | 0.0 |
| Greece | 0.1 | 2012 | 0.3 | 2012 | 0.3 | 0.0 | | 0.0 | 2012 | 0.2 | 2012 | 0.3 | 0.0 |
| Ireland | 0.1 | 2009 | 0.4 | 2009 | 0.3 | 0.0 | | 0.1 | 2009 | 0.4 | 2009 | 0.3 | 0.0 |
| Italy | 0.0 | 2013 | 0.1 | 1997 | 0.2 | 0.0 | | 0.0 | 2013 | 0.1 | 1997 | 0.2 | 0.0 |
| Lithuania | 0.0 | 2010 | 0.3 | 2010 | 0.4 | 0.0 | | 0.0 | 2010 | 0.3 | 2010 | 0.3 | 0.0 |
| Luxembourg | 0.0 | 2004 | 0.1 | 2009 | 0.1 | 0.0 | | 0.0 | 2004 | 0.1 | 2009 | 0.1 | 0.0 |
| Latvia | 0.1 | 2009 | 0.6 | 2009 | 0.7 | -0.1 | | 0.1 | 2009 | 0.6 | 2009 | 0.6 | -0.1 |
| Malta | 0.1 | 2004 | 0.1 | 2004 | 0.3 | 0.0 | | 0.1 | 2004 | 0.1 | 2004 | 0.3 | 0.0 |
| Netherlands | 0.0 | 1995 | 0.3 | 2004 | 0.1 | 0.0 | | 0.0 | 1995 | 0.2 | 2013 | 0.1 | 0.0 |
| Portugal | 0.1 | 2012 | 0.3 | 2012 | 0.3 | 0.0 | | 0.1 | 2012 | 0.3 | 2012 | 0.3 | 0.0 |
| Slovenia | 0.1 | 2013 | 0.2 | 1999 | 0.2 | 0.0 | | 0.1 | 2013 | 0.2 | 2013 | 0.2 | 0.0 |
| Slovakia | 0.1 | 2000 | 0.3 | 2001 | 0.3 | 0.0 | | 0.0 | 2000 | 0.3 | 2000 | 0.2 | 0.0 |
| Spain | 0.1 | 2012 | 0.5 | 2009 | 0.7 | 0.0 | | 0.1 | 2012 | 0.4 | 2009 | 0.7 | 0.0 |

| | **Variant 13** | | | | | | | **Variant 14** | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Inputs to macro modelling | | | Macro results | | | | Inputs to macro modelling | | | Macro results | | |
| | Net EUBS receipts, 1995-2013 | Highest annual benefit received | | Highest annual boost to GDP | | Change from baseline in standard deviation of GDP growth (1995-2013) | | Net EUBS receipts, 1995-2013 | Highest annual benefit received | | Highest annual boost to GDP | | Change from baseline in standard deviation of GDP growth (1995-2013) |
| | % of GDP (1995-2013) | Year | % GDP | Year | % of baseline GDP | | | % of GDP (1995-2013) | Year | % GDP | Year | % of baseline GDP | |
| Austria | 0.0 | 1996 | 0.0 | 2013 | 0.2 | 0.0 | | 0.0 | 1996 | 0.0 | 2013 | 0.1 | 0.0 |
| Belgium | 0.1 | 2013 | 0.1 | 2002 | 0.1 | 0.0 | | 0.1 | 2013 | 0.1 | 2003 | 0.1 | 0.0 |
| Cyprus | 0.1 | 2013 | 0.5 | 2013 | 0.5 | -0.1 | | 0.0 | 2013 | 0.4 | 2013 | 0.4 | -0.1 |
| Estonia | 0.0 | 2010 | 0.3 | 2009 | 0.4 | 0.0 | | 0.0 | 2010 | 0.3 | 2009 | 0.3 | 0.0 |
| Finland | -0.2 | 1995 | 0.1 | 1996 | 0.2 | 0.0 | | -0.2 | 1997 | 0.1 | 1996 | 0.2 | 0.0 |
| France | 0.0 | 1997 | 0.1 | 2000 | 0.5 | 0.0 | | 0.0 | 1997 | 0.1 | 2000 | 0.4 | 0.0 |
| Germany | 0.0 | 2005 | 0.1 | 2003 | 0.1 | 0.0 | | 0.0 | 2005 | 0.1 | 2003 | 0.1 | 0.0 |
| Greece | 0.1 | 2012 | 0.3 | 2012 | 0.4 | 0.0 | | 0.0 | 2012 | 0.2 | 2002 | 0.3 | 0.0 |
| Ireland | 0.1 | 2009 | 0.4 | 2009 | 0.3 | 0.0 | | 0.1 | 2009 | 0.3 | 2009 | 0.3 | 0.0 |
| Italy | 0.0 | 2013 | 0.1 | 1997 | 0.2 | 0.0 | | 0.0 | 2013 | 0.1 | 1997 | 0.2 | 0.0 |
| Lithuania | 0.0 | 2010 | 0.3 | 2010 | 0.4 | 0.0 | | 0.0 | 2010 | 0.2 | 2010 | 0.3 | 0.0 |
| Luxembourg | 0.0 | 2004 | 0.1 | 2009 | 0.2 | 0.0 | | 0.0 | 2004 | 0.1 | 2009 | 0.1 | 0.0 |
| Latvia | 0.1 | 2009 | 0.6 | 2009 | 0.6 | -0.1 | | 0.1 | 2009 | 0.5 | 2009 | 0.5 | -0.1 |
| Malta | 0.1 | 2004 | 0.1 | 2004 | 0.3 | 0.0 | | 0.0 | 2004 | 0.1 | 2004 | 0.2 | 0.0 |
| Netherlands | 0.0 | 1995 | 0.2 | 2004 | 0.1 | 0.0 | | 0.0 | 1995 | 0.2 | 2013 | 0.1 | 0.0 |
| Portugal | 0.1 | 2012 | 0.3 | 2012 | 0.3 | 0.0 | | 0.1 | 2012 | 0.3 | 2012 | 0.3 | 0.0 |
| Slovenia | 0.1 | 2013 | 0.2 | 1999 | 0.2 | 0.0 | | 0.1 | 2013 | 0.2 | 1999 | 0.2 | 0.0 |
| Slovakia | 0.1 | 2000 | 0.3 | 2001 | 0.3 | 0.0 | | 0.0 | 2000 | 0.3 | 2001 | 0.3 | 0.0 |
| Spain | 0.1 | 2012 | 0.5 | 2009 | 0.7 | 0.0 | | 0.1 | 2012 | 0.4 | 2009 | 0.6 | 0.0 |

| | Variant 15 | | | | | | | Variant 16 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Inputs to macro modelling | | | Macro results | | | | Inputs to macro modelling | | | Macro results | | |
| | Net EUBS receipts, 1995-2013 | Highest annual benefit received | | Highest annual boost to GDP | | Change from baseline in standard deviation of GDP growth (1995-2013) | | Net EUBS receipts, 1995-2013 | Highest annual benefit received | | Highest annual boost to GDP | | Change from baseline in standard deviation of GDP growth (1995-2013) |
| | % of GDP (1995-2013) | Year | % GDP | Year | % of baseline GDP | | | % of GDP (1995-2013) | Year | % GDP | Year | % of baseline GDP | |
| Austria | 0.0 | 1996 | 0.0 | 2013 | 0.2 | 0.0 | | -0.1 | #N/A | 0.0 | 2013 | 0.1 | 0.0 |
| Belgium | 0.1 | 2013 | 0.1 | 2002 | 0.1 | 0.0 | | 0.0 | 2013 | 0.0 | 1999 | 0.1 | 0.0 |
| Cyprus | 0.1 | 2013 | 0.7 | 2013 | 0.7 | -0.1 | | 0.0 | 2013 | 0.5 | 2013 | 0.5 | -0.1 |
| Estonia | 0.0 | 2010 | 0.6 | 2010 | 0.7 | -0.1 | | 0.0 | 2010 | 0.4 | 2009 | 0.5 | 0.0 |
| Finland | -0.2 | 1995 | 0.1 | 1996 | 0.2 | 0.0 | | 0.0 | 1995 | 0.2 | 1997 | 0.3 | 0.0 |
| France | 0.0 | 1997 | 0.1 | 2000 | 0.5 | 0.0 | | 0.1 | 1997 | 0.2 | 2000 | 0.5 | 0.0 |
| Germany | 0.0 | 2005 | 0.1 | 2003 | 0.1 | 0.0 | | -0.1 | 2005 | 0.0 | 1996 | 0.1 | 0.0 |
| Greece | 0.1 | 2012 | 0.5 | 2012 | 0.6 | 0.0 | | 0.0 | 2012 | 0.3 | 2012 | 0.4 | 0.0 |
| Ireland | 0.1 | 2010 | 0.5 | 2010 | 0.5 | 0.0 | | 0.0 | 2009 | 0.3 | 2009 | 0.3 | 0.0 |
| Italy | 0.0 | 2013 | 0.1 | 1997 | 0.2 | 0.0 | | 0.0 | 1995 | 0.1 | 1997 | 0.2 | 0.0 |
| Lithuania | 0.0 | 2010 | 0.5 | 2010 | 0.6 | 0.0 | | 0.1 | 2010 | 0.3 | 2010 | 0.4 | 0.0 |
| Luxembourg | 0.0 | 2004 | 0.1 | 2009 | 0.2 | 0.0 | | -0.1 | #N/A | 0.0 | 1998 | 0.1 | 0.0 |
| Latvia | 0.1 | 2010 | 0.8 | 2010 | 0.8 | -0.1 | | 0.2 | 2009 | 0.7 | 2009 | 0.7 | -0.1 |
| Malta | 0.1 | 2004 | 0.1 | 2004 | 0.3 | 0.0 | | 0.0 | 2004 | 0.1 | 2004 | 0.2 | 0.0 |
| Netherlands | 0.0 | 1995 | 0.3 | 2013 | 0.1 | 0.0 | | -0.2 | 1995 | 0.1 | 1996 | -0.1 | 0.0 |
| Portugal | 0.1 | 2013 | 0.4 | 2013 | 0.4 | 0.0 | | 0.0 | 2012 | 0.3 | 2012 | 0.3 | 0.0 |
| Slovenia | 0.1 | 2013 | 0.2 | 1999 | 0.2 | 0.0 | | 0.0 | 2013 | 0.1 | 1999 | 0.2 | 0.0 |
| Slovakia | 0.1 | 2000 | 0.3 | 2001 | 0.3 | 0.0 | | 0.1 | 2000 | 0.3 | 2001 | 0.3 | 0.0 |
| Spain | 0.1 | 2012 | 0.7 | 2012 | 1.1 | 0.0 | | 0.2 | 2009 | 0.5 | 2009 | 1.1 | 0.0 |

| | Variant 17 | | | | | | | Variant 18 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Inputs to macro modelling | | | Macro results | | | | Inputs to macro modelling | | | Macro results | | |
| | Net EUBS receipts, 1995-2013 | Highest annual benefit received | | Highest annual boost to GDP | | Change from baseline in standard deviation of GDP growth (1995-2013) | | Net EUBS receipts, 1995-2013 | Highest annual benefit received | | Highest annual boost to GDP | | Change from baseline in standard deviation of GDP growth (1995-2013) |
| | % of GDP (1995-2013) | Year | % GDP | Year | % of baseline GDP | | | % of GDP (1995-2013) | Year | % GDP | Year | % of baseline GDP | |
| Austria | 0.0 | 1996 | 0.0 | 2013 | 0.2 | 0.0 | | 0.0 | 2002 | 0.0 | 2013 | 0.1 | 0.0 |
| Belgium | 0.1 | 2013 | 0.1 | 2002 | 0.1 | 0.0 | | 0.0 | 2003 | 0.1 | 2002 | 0.1 | 0.0 |
| Cyprus | 0.1 | 2013 | 0.5 | 2013 | 0.5 | -0.1 | | 0.0 | 2013 | 0.5 | 2013 | 0.5 | -0.1 |
| Estonia | 0.0 | 2010 | 0.4 | 2009 | 0.4 | 0.0 | | 0.0 | 2010 | 0.4 | 2009 | 0.4 | -0.1 |
| Finland | -0.2 | 1995 | 0.1 | 1996 | 0.2 | 0.0 | | -0.2 | 1995 | 0.0 | 1996 | 0.2 | 0.0 |
| France | 0.0 | 1997 | 0.1 | 2000 | 0.5 | 0.0 | | 0.0 | 1997 | 0.1 | 2000 | 0.4 | 0.0 |
| Germany | 0.0 | 2005 | 0.1 | 2005 | 0.2 | 0.0 | | 0.0 | 2005 | 0.1 | 2004 | 0.1 | 0.0 |
| Greece | 0.1 | 2012 | 0.3 | 2012 | 0.4 | 0.0 | | 0.0 | 2012 | 0.3 | 2012 | 0.4 | 0.0 |
| Ireland | 0.1 | 2009 | 0.4 | 2009 | 0.3 | 0.0 | | 0.1 | 2009 | 0.4 | 2009 | 0.3 | 0.0 |
| Italy | 0.0 | 2013 | 0.1 | 1997 | 0.2 | 0.0 | | 0.0 | 2012 | 0.1 | 2012 | 0.2 | 0.0 |
| Lithuania | 0.0 | 2010 | 0.3 | 2010 | 0.4 | 0.0 | | 0.0 | 2010 | 0.3 | 2010 | 0.4 | 0.0 |
| Luxembourg | 0.0 | 2004 | 0.1 | 2009 | 0.2 | 0.0 | | 0.0 | 2004 | 0.1 | 2009 | 0.1 | 0.0 |
| Latvia | 0.1 | 2009 | 0.6 | 2009 | 0.7 | -0.1 | | 0.1 | 2009 | 0.6 | 2009 | 0.7 | -0.1 |
| Malta | 0.1 | 2004 | 0.1 | 2004 | 0.3 | 0.0 | | 0.1 | 2004 | 0.1 | 2004 | 0.3 | 0.0 |
| Netherlands | 0.0 | 1995 | 0.3 | 2013 | 0.1 | 0.0 | | 0.0 | 1995 | 0.2 | 2004 | 0.1 | 0.0 |
| Portugal | 0.1 | 2012 | 0.3 | 2012 | 0.3 | 0.0 | | 0.1 | 2012 | 0.3 | 2012 | 0.3 | 0.0 |
| Slovenia | 0.1 | 2013 | 0.2 | 1999 | 0.2 | 0.0 | | 0.1 | 2012 | 0.2 | 1999 | 0.2 | 0.0 |
| Slovakia | 0.1 | 2000 | 0.3 | 2001 | 0.3 | 0.0 | | 0.1 | 2000 | 0.3 | 2001 | 0.3 | 0.0 |
| Spain | 0.1 | 2012 | 0.5 | 2009 | 0.8 | 0.0 | | 0.1 | 2012 | 0.5 | 2009 | 0.7 | 0.0 |

### 4.2.3 Summary metrics by variant

Table 5 presents a set of indicators intended to summarise the key characteristics and impacts of the variants.

**Table 5. Summary metrics by variant**

| Variant | Gross cost (1) | Accumulated surplus/deficit in 2013 (2) | GDP impact in 2009 | | |
|---|---|---|---|---|---|
| | | | EA19 | Latvia (Country with largest impact) | |
| | % of whole period GDP | % of 2013 GDP | % above baseline | % above baseline level of GDP (3) | pp above baseline GDP growth rate (4) |
| **1** | 0.05 | 0.79 | 0.09 | 0.82 | 0.76 |
| **2** | 0.13 | -0.04 | 0.21 | 0.82 | 0.51 |
| **3** | 0.13 | 0.18 | 0.21 | 0.82 | 0.51 |
| **4** | 0.03 | 1.03 | 0.07 | 0.80 | 0.77 |
| **5** | 0.27 | -0.22 | 0.11 | 0.66 | 0.39 |
| **6** | 0.14 | -0.08 | 0.11 | 0.75 | 0.42 |
| **7** | 0.43 | -0.34 | 0.18 | 1.04 | 0.58 |
| **8** | 0.11 | -0.09 | 0.03 | 0.20 | 0.07 |
| **9** | 0.19 | -0.16 | 0.07 | 0.45 | 0.27 |
| **10** | 0.32 | -0.26 | 0.14 | 0.81 | 0.48 |
| **11** | 0.26 | -0.21 | 0.10 | 0.65 | 0.39 |
| **12** | 0.25 | -0.21 | 0.09 | 0.61 | 0.36 |
| **13** | 0.26 | -0.22 | 0.11 | 0.64 | 0.38 |
| **14** | 0.25 | -0.21 | 0.10 | 0.53 | 0.31 |
| **15** | 0.27 | -0.23 | 0.10 | 0.66 | 0.39 |
| **16** | 0.27 | 0.07 | 0.11 | 0.70 | 0.38 |
| **17** | 0.27 | -0.22 | 0.11 | 0.66 | 0.39 |
| **18** | 0.27 | 0.00 | 0.11 | 0.66 | 0.39 |

(1) The total value of benefits paid out over the whole period expressed as a proportion of total GDP over the whole period.

(2) The EUBS surplus or deficit that would have resulted in 2013, expressed as a percentage of EA19 GDP in 2013.

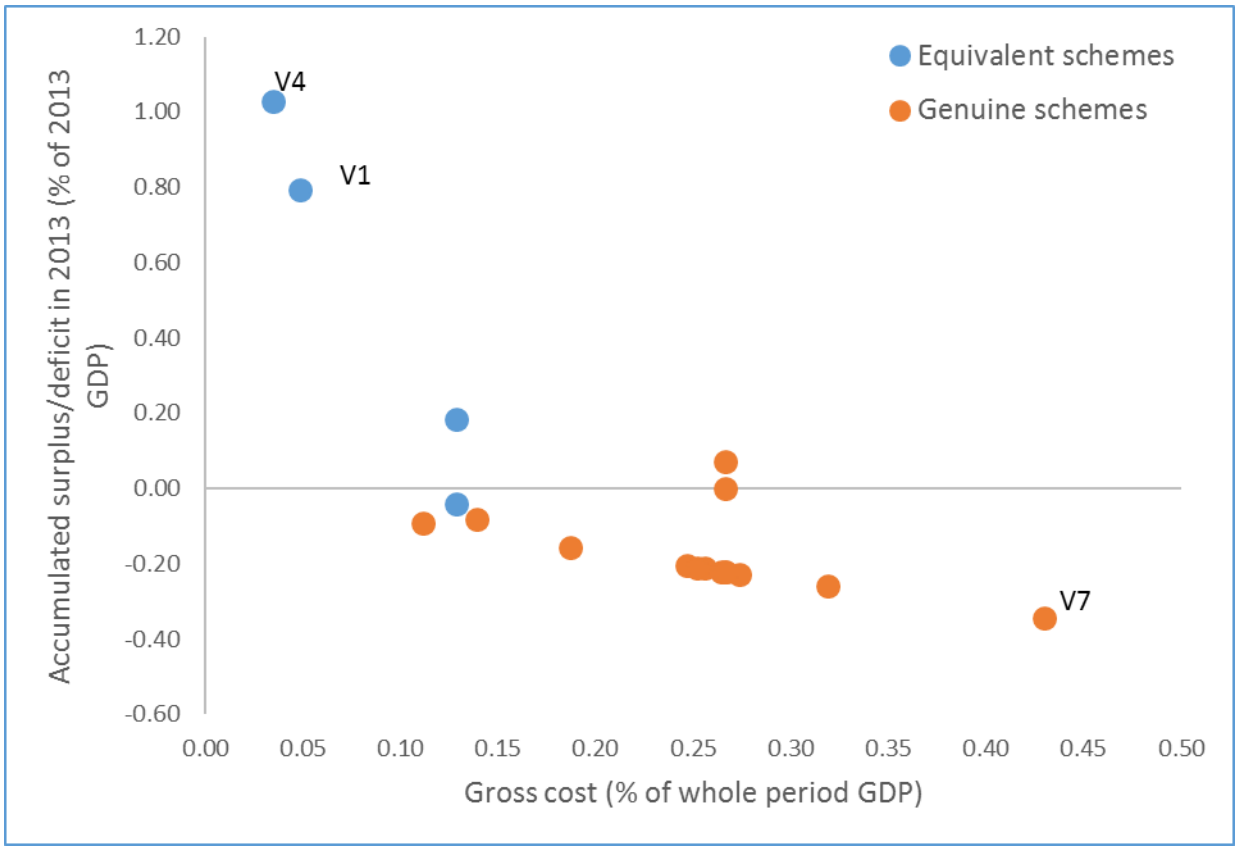
(3) The percentage difference between the level of GDP in the variant and the baseline (actual historical) value of GDP in 2009.

(4) The percentage points difference between GDP growth in 2009 in the variant and in the baseline (actual history).

The *scale* of the EUBS varies across the variants according to the generosity of its rules. A more generous system requires higher contributions to fund it, and pays out larger sums over the whole period. The 'gross cost' column of Table 5 is a measure of this scale: it shows the total value of benefits paid out over the whole period expressed as a ratio of the total value of Eurozone GDP over the same period. It can be seen that the equivalent schemes are smaller in scale than all but the least generous genuine schemes. Among the four equivalent schemes, variants 1 and 4 (which have a higher threshold of macroeconomic weakness before payment of benefits is triggered) are substantially smaller in scale because they pay out more rarely.

The *accumulated surplus / deficit* at the end of the period depends upon the operation of the rules that call for larger contributions when a country draws repeatedly on the fund or runs up a large deficit. These rules operate with a lag, and the more generous is the scheme the more likely it is that a deficit will not have been wholly cleared by the end of the period. Conversely, if a surplus is built up, it is run down only as pay-outs deplete it. Figure 18 shows that there is a broad correlation between the generosity (gross cost) of the scheme and the accumulated deficit.

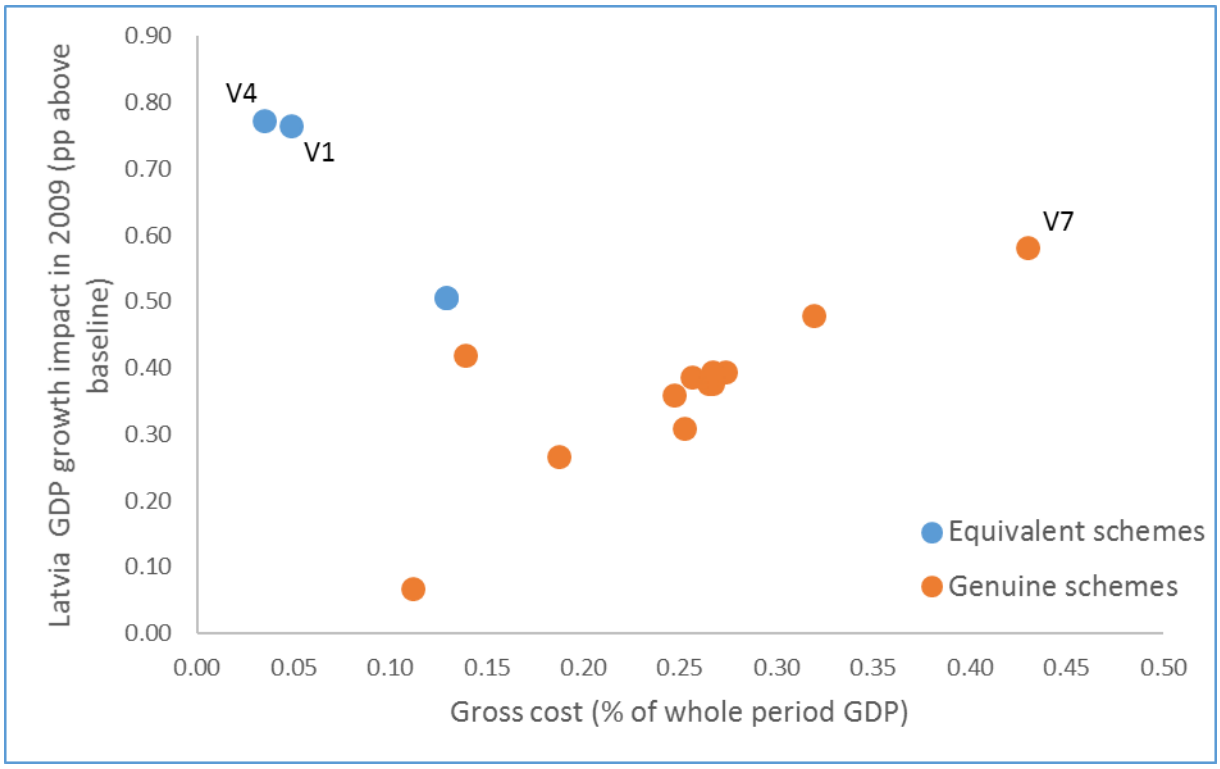
**Figure 18. The gross cost of each variant over 1995-2013 and the accumulated net contributions in 2013**




The *impact on the level of EA19 GDP* in the recession trough year depends on the scale of pay-outs in that year, and this is shown in the column entitled 'EA19'. In the case of the equivalent schemes, the key factor here is the number of countries that qualify for pay-outs, and so variants 2 and 3 (which have a lower threshold for payment to be triggered) have larger impacts.

As an indicator of the *stabilization effect*, the table shows the impact on GDP in the country that has the largest impact of the EUBS in 2009, namely Latvia. The table shows both the impact on the level of GDP in 2009 and the impact on the growth rate of GDP in 2009. Because the genuine schemes pay out to beneficiaries in every year, the scale of pay-outs is smoother than it is for the equivalent schemes which are focused on 'bad' macroeconomic years. Consequently, for the genuine schemes the impact on the level of GDP is larger than on the growth rate. Because Latvia's recession began in 2008, this effect is also evident for the two more generous equivalent schemes (variants 2 and 3), but in general the more tightly focused nature of the equivalent schemes means that they have a larger growth stabilization effect. Figure 19 shows that the two less generous equivalent scheme variants (which are the lowest gross-cost variants) have the largest impact on Lativa's growth rate in 2009.

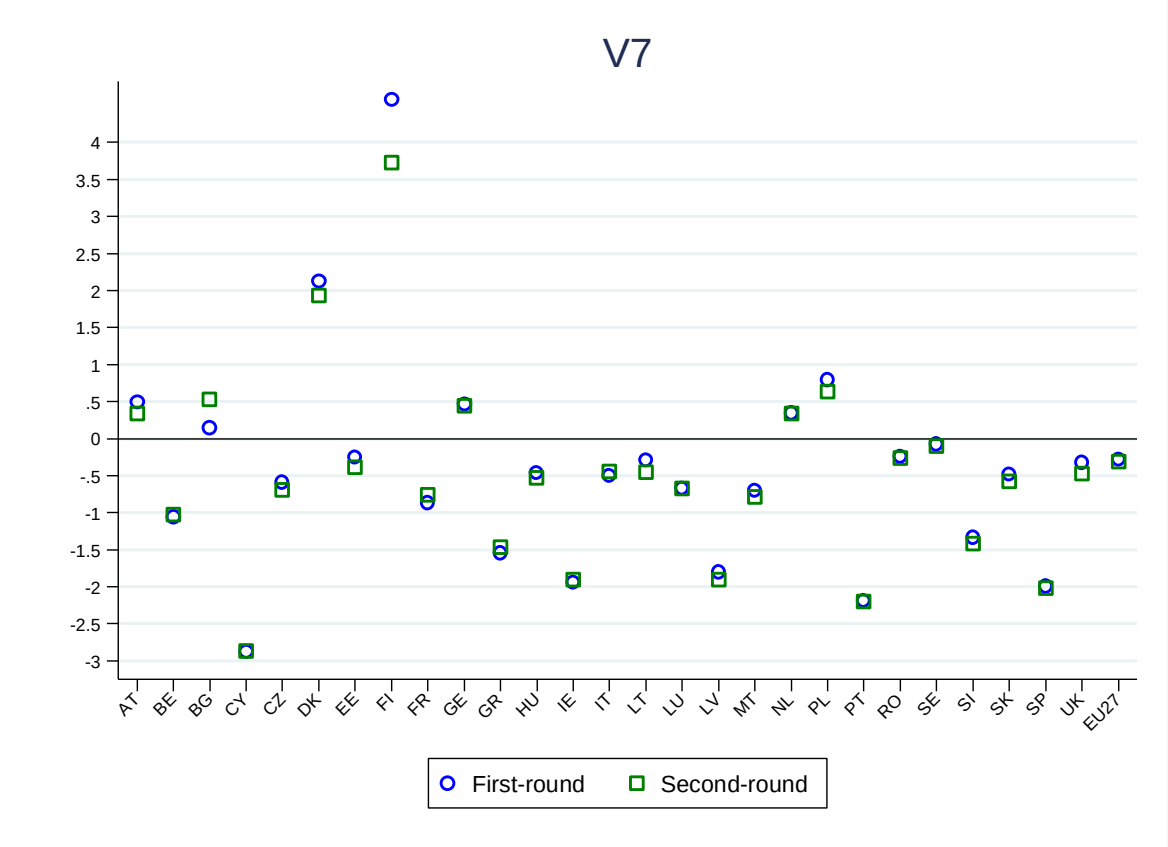
**Figure 19. The gross cost of each variant over 1995-2013 and the impact on Latvia's GDP growth in 2009**




## 4.3. Simulations at the micro-level: 'Second-round' effects

In this section, we present the 'second-round' results of the EUBS after the macro feedback response has been simulated at the micro level. We simulate the counterfactual macro environment as projected by E3ME resulting from the (hypothetical) implementation of the EUBS in 1995. That is, the second-round simulations are based on the counterfactual macro environment presented in the previous section. We then compare the cross-country distributional outcomes of the first and second-round simulations, i.e. before and after taking into account whole-economy effects.

**Figure 20. Accumulated net contributions in 2013 in per cent of 2013 GDP after taking into account macroeconomic feedback effects**




*Note*: Net contributions=Contr.–Benefits.
*Sources*: EU-LFS + own calculations based on EUROMOD.

Figure 20 shows accumulated net contributions in 2013 for variant 7 in the EU-27 scenario. The macro stabilization effect of the EUBS slightly reduces redistributive effects across countries. The countries that were identified as the largest net contributors in the first-round analysis continue to be the largest net contributors, but the size of their net contributions is smaller (with the exception of Bulgaria). For the net beneficiaries, we find that some countries have larger net contributions after the second-round (France, Greece, Ireland, Italy), while others end up with smaller net contributions (Czech Republic, Estonia, Hungary, Lithuania, Latvia, Malta, Slovenia, Slovakia and the UK).

At the EU-27 level the net deficit amounting to 0.3 per cent of EU-27 GDP after first-round simulations is almost unchanged after whole-economy effects have been taken into account. We find very similar results for the other variants. These findings suggest that the positive macroeconomic stabilization effects, rather small in absolute magnitude, have a negligible effect on the overall budget, but make redistributive effects across countries somewhat smaller.

# 5. Conclusions

In this paper, we have simulated 18 different variants of European unemployment benefit systems for the period 1995-2013. Each variant has been simulated in two scenarios. In a first scenario, it is assumed that the EUBS is adopted by the EA19 member states,

while in a second scenario, it is adopted by the EU27 member states. The variants can be grouped into *equivalent* and *genuine* systems. While the equivalent systems involve financial transfers between the supranational fund and the member state governments, the genuine systems establish direct transfers to unemployed citizens. In effect, financial transfers under the equivalent systems, once triggered, are earmarked for unemployment benefit spending so that equivalent and genuine systems are comparable in that regard.

Methodologically, we have established an interaction between the simulations at the micro and macro level. In a first step, the observed past history has been simulated at the micro level. For each variant and each year of the simulation period, the simulations yield net contributions to the EUBS at the member state level. These 'first-round' results can be interpreted as the direct effect of a EUBS before macro-feedback effects are taken into account. In a second step, the micro-level results are fed into the macro-econometric model E3ME. At this stage of the analysis, the macro impact of the different EUBS is estimated resulting in a counterfactual macro environment. In a third step, the counterfactual macro environment is simulated at the micro level in order to compare the cross-country distributional outcomes of the first and second-round simulations.

The main results of our analysis can be summarized as follows.

The first-round simulations at the micro level show that coverage rates of the simulated EUBS (measured as the number of short-term unemployed covered by the EUBS relative to the total number of short- and long-term unemployed) typically diverge from trends in overall unemployment in times of rising or falling unemployment. The reason is that the share of non-eligible long-term unemployed usually goes up (down) in prolonged recessions (upswings). One implication of this finding is that the simulated EUBS tend to achieve the highest stabilization effects at the beginning of economic crises when the share of short-term unemployment is relatively high, but that this effect phases out the longer the crises last. Our simulations reveal that coverage rates of the short-term unemployed (measured as the number of short-term unemployed covered by the EUBS relative to the total number of short-term unemployed) are higher than those of national UI systems. Largest coverage gains are achieved for those EUBS that have the longest benefit duration and the least stringent eligibility condition. For example, coverage rates of EUBS variant 7 are typically above 80 per cent which implies significant coverage gains of up to 60 percentage points in some member states.

In terms of budgetary effects, we find for the equivalent systems that in variants 2 and 3 no member state is in a permanent net contributor or recipient position, while a few member states are permanent net contributors in variants 1 or 4. The reason is that the trigger is pulled less often in variants 1 and 4 due to higher thresholds than in variants 2 and 3. For the genuine systems, we find a similar pattern as for variants 2 and 3. In most variants, there is no permanent contributor or recipient. That is, member states are typically net contributors in some years and net recipients in other years. Experience rating and claw-back mechanism effectively prevent the accumulation of excessive deficits.

The EUBS contributes to macroeconomic stabilization in the expected way, by supporting spending by households in times of recession (and notably at the beginning of a recession for the reason noted above). The scale of contribution to stabilization in relation to the level of EA19 GDP is less than 0.5% of GDP in any one year, in line with the scale of the transfers associated with higher short-term unemployment according to the rules of the system. While the main effect in each case is on the countries receiving the largest benefit payments, there are also trade spillover effects that mitigate the wider impacts of the effects of recession on any given country's domestic spending. Among the equivalent systems, the variants with higher thresholds for triggering payments take effect only occasionally, having a positive impact on GDP only during the post-2007

severe recession. This makes them cheaper and more targeted on the period of greatest macroeconomic need. Among the genuine systems, the largest variation arises in response to the sensitivity testing of the duration of benefit. The next-largest variation arises in response to the generosity of benefit in terms of the scale of the replacement rate.

The second-round simulations at the micro level reveal that the positive macro stabilization effects translate into slightly smaller redistributive effects across countries. The distributional effects across countries are small, however, and do not change the (accumulated) net budgetary position of member states at the end of the simulation period. Those member states that are net contributors (recipients) in the first-round analysis are still net contributors (recipients) after simulating the macro feedback-loop.

For any given Member State, the size of stabilisation impact is determined by the coverage and generosity of the EUBS (relative to the national scheme assumed to be in place otherwise). A more generous EUBS (longer duration of benefit, higher level of benefit) requires larger social contributions to be raised (reducing income and spending without much in the way of offsetting benefit receipts when unemployment is low) and pays out larger transfers (boosting income and spending when short-term unemployment is high). But the higher social contributions required to finance a more generous EUBS increase the tax wedge between the cost of labour faced by the employer and the wage income received by the worker, which makes the labour market less flexible (consistently through time, not just in the periods when macroeconomic stabilisation is needed).

For genuine systems, which pay directly to households, eligibility for benefit depends on prior work history as an employee, and so the coverage of the unemployed would be lower in countries in which self-employment is more important (for example, Greece and Italy)[18]

Because short-term unemployment is particularly prevalent among the young in most countries, the increase in the coverage of the short-term unemployed compared with existing national schemes is likely to be felt particularly in this group.

Equivalent systems, which focus on stabilising government budgets, only pay out when macroeconomic conditions are bad, whereas EUBS systems that operate like conventional unemployment insurance pay out in any year to any eligible individuals (of whom there will be a greater number when macroeconomic conditions are bad). Clearly, the *stabilisation* effect on government budgets is stronger for systems that are only responsive to macroeconomic downturns, and that is likely to translate into a broader *macroeconomic stabilisation* effect (depending on what the government chooses to do with its enhanced income in a downturn, and what view is taken on the economic impacts of those alternatives[19]). Systems that only pay out when macroeconomic conditions are particularly bad are relatively cheap because they pay out rarely, but they also tend to produce greater polarisation among countries with regard to financing: a smaller number of countries qualify for pay outs. But if the threshold is set too high, stabilization payments can fail to kick in even in quite a severe downturn.

For equivalent systems, the design feature that triggers payments only when *short-term* unemployment is high (relative to the country's own historical experience) focuses support in the early part of a recession. EUBS payments drop off sharply even if the

[18] This feature also affects national schemes, but differences in the extent of coverage of national schemes also reflect other differences in their eligibility rules.

[19] In particular, whether spending the income on government investment, consumption or transfers would give a larger boost to economic activity than paying off debt.

recession is prolonged because in that case, typically, the average duration of unemployment increases (so long-term unemployment becomes more important). A similar effect applies for the EUBS systems targeted at individuals (higher payments as the recession begins, and then lower payments as eligibility drops off even if unemployment stays high), but the contrast between the recession years and other years is less pronounced (because payments are less focused on the recession years).

As with any kind of insurance, ex post some countries suffer circumstances that lead them to be net claimants on the EUBS. Had the system been applied in the past, the countries that would have been net claimants are among those that experienced the worst recession following the 2007-08 crisis; these would not necessarily be the same countries that suffer recession in the future. Mechanisms that implement 'experience rating' (raising the contribution rate of countries that have a history of having a higher short-term unemployment rate than the average of participating countries) and 'clawback' (top-up contributions by the governments of countries that are high claimants in three consecutive years) largely achieve their purpose in limiting the scale of net transfers over the longer term.

If the system had operated across the current eurozone 19 Member States, between 1995 and 2013, Spain, Portugal and Cyprus would have built up deficits (that is, they would have been net recipients) over the period taken as a whole (generally in the range 0.5-2.0% of 2013 GDP) under all the alternative arrangements that were modelled. Systems that pay directly to households would have put most of the other countries also in deficit by 2013 (reflecting the timing of a severe recession coming towards the end of the period), while Austria, Finland, Germany and the Netherlands would have been net contributors. Systems that support government budgets would have had most countries as net contributors, and the more so if the rules for triggering pay-out had been set at the tightest level (i.e. payment only made in a severe recession).

If the system had operated across the current eurozone 19 Member States, between 1995 and 2013, the level of GDP would have been higher in 2009 (the trough of the recession) by up to (depending on the details of the system) 1% in Latvia, 0.9% in Spain, 0.6% in Ireland, and about 0.5% in Estonia, Ireland and Lithuania. For the eurozone 19 as a whole, GDP would have been up to 0.2% higher in 2009. While the system therefore would have made a contribution to stabilisation, the scale of the transfer under any of the alternatives that were modelled would not have been large enough in relation to GDP to offset a substantial part of the recession: unemployment benefit spending (or, more precisely, the *addition to existing national unemployment benefit schemes* that would be represented by the EUBS*)* is not a large enough lever to achieve that.

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# APPENDIX

## A.1 Reweighting procedure for modeling changes in (un)employment

In EUROMOD, the baseline household weights supplied with the national cross-sectional databases have been calculated to adjust for sample design and/or differential non-response. In our empirical analysis, we follow the approach taken by Immervoll et al. (2006), Bargain et al. (2012) and Dolls et al. (2012) and employ reweighting techniques to simulate a sample of repeated cross-sections for each EA19/EU27 member state over the period 1995-2013. We impute various labour force characteristics from the LFS micro data based on 18 age-gender-education strata. For each subgroup-year cell, these are number of people in the labour force, unemployment rates, shares of short- and long-term unemployed as well as coverage rates of national unemployment insurance systems. The 18 subgroups are defined according to the following socio-demographic characteristics:

- gender
- age (<30, 30-50, >50)
- education (low: not completed primary, primary and lower secondary; middle: upper secondary and post secondary; high: tertiary)

(Un)employment changes over the period of analysis are modeled at the subgroup level. An increase (a decrease) of the group-specific unemployment rate is computed by increasing the weights of the unemployed (employed) in each subgroup while the weights of the employed (unemployed) are decreased correspondingly, i.e., in effect a fraction of employed (unemployed) individuals is made unemployed (employed). Hence, the size and composition of the labour force in each reweighted cross-section matches the labour force as reflected in the LFS both at the subgroup and aggregate level. Growth in average earnings along the intensive margin, modeled in order to account for changes in the tax base, is imputed from the AMECO-database.

## A.2 Coverage rates of the EUBS and national UI systems

Appendix A.2 provides a detailed description how coverage rates of the EUBS and national UI systems are computed. Coverage rates of EUBS are derived in two steps. In a first step, we impute from the LFS for each member state and each year of the simulation period the share of short- and long-term unemployed in each of the 18 socio-demographic groups defined in Appendix A.1. The short-term unemployed are those unemployed who are eligible to the EUBS if they paid contributions to the EUBS for a sufficiently long time period before job loss.[20] Table A.2-1 shows average unemployment rates and average shares of short-term unemployed (among all unemployed) over the period 1995-2013 as reflected in the LFS:

**Table A.2-1. Average unemployment rates and average shares of short-term unemployed, 1995-2013**

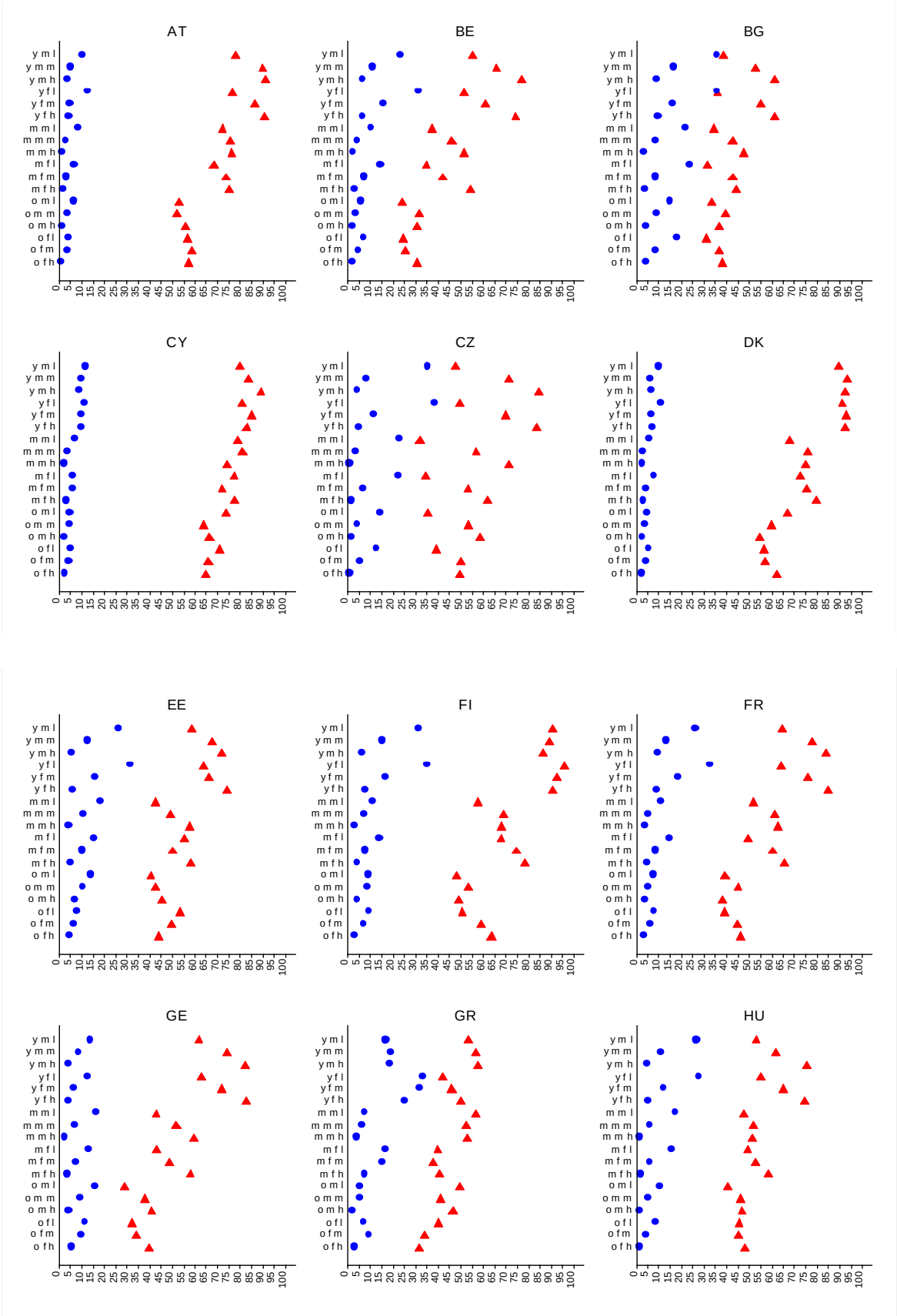
| CON | Average Unempl. Rate | Average share of short-term unempl. |
|---|---|---|
| AT | 4.6 | 73.5 |
| BE | 8.1 | 48.7 |
| BG | 12.2 | 43.2 |
| CY | 5.4 | 76.9 |
| CZ | 6.7 | 57.0 |
| DK | 5.5 | 78.0 |
| EE | 10.2 | 53.2 |
| FI | 9.5 | 73.2 |
| FR | 9.2 | 60.8 |
| GE | 8.3 | 49.8 |
| GR | 12.2 | 47.6 |
| HU | 8.3 | 53.0 |
| IE | 8.3 | 56.7 |
| IT | 9.2 | 44.6 |
| LT | 11.4 | 53.4 |
| LU | 3.8 | 72.0 |
| LV | 13.5 | 53.9 |
| MT | 6.6 | 48.7 |
| NL | 5.2 | 64.4 |
| PL | 13.1 | 54.2 |
| PT | 8.9 | 54.9 |
| RO | 6.9 | 52.5 |
| SE | 7.5 | 79.4 |
| SI | 6.8 | 51.5 |
| SK | 14.7 | 38.0 |
| SP | 15.4 | 62.4 |
| UK | 6.3 | 71.3 |

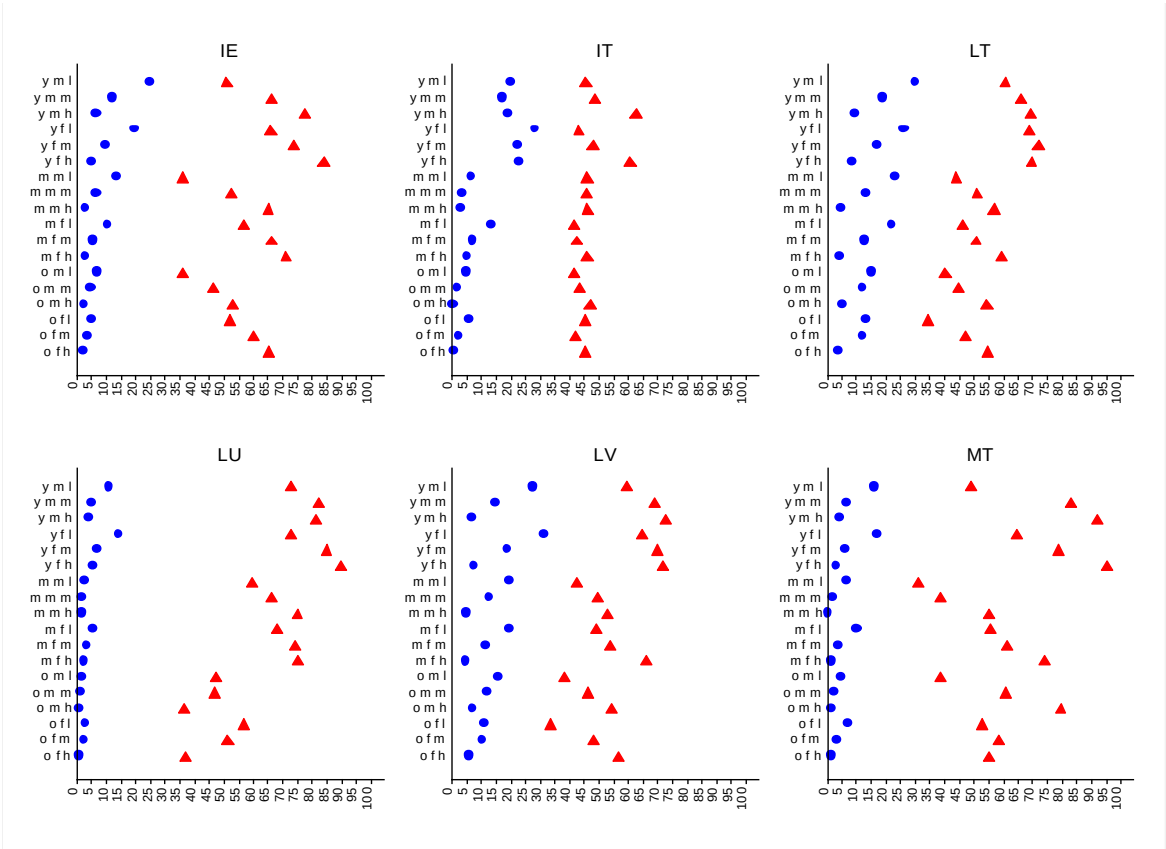
*Source*: EU-LFS.

[20] An exception is variant 15 where the duration of unemployment benefits from the EUBS can be extended by 6 months under certain circumstances. In that case, a fraction of the long-term unemployed is covered as well.

Average unemployment rates and shares of short-term unemployed for the 18 socio-demographic groups of the labour force are shown in Figure A.2-1.

**Figure A.2-1. Average unemployment rates and average shares of short-term unemployed, 1995-2013**




IE
IT
LT
LU
LV
MT
y m l
y m m
y m h
y f l
y f m
y f h
m m l
m m m
m m h
m f l
m f m
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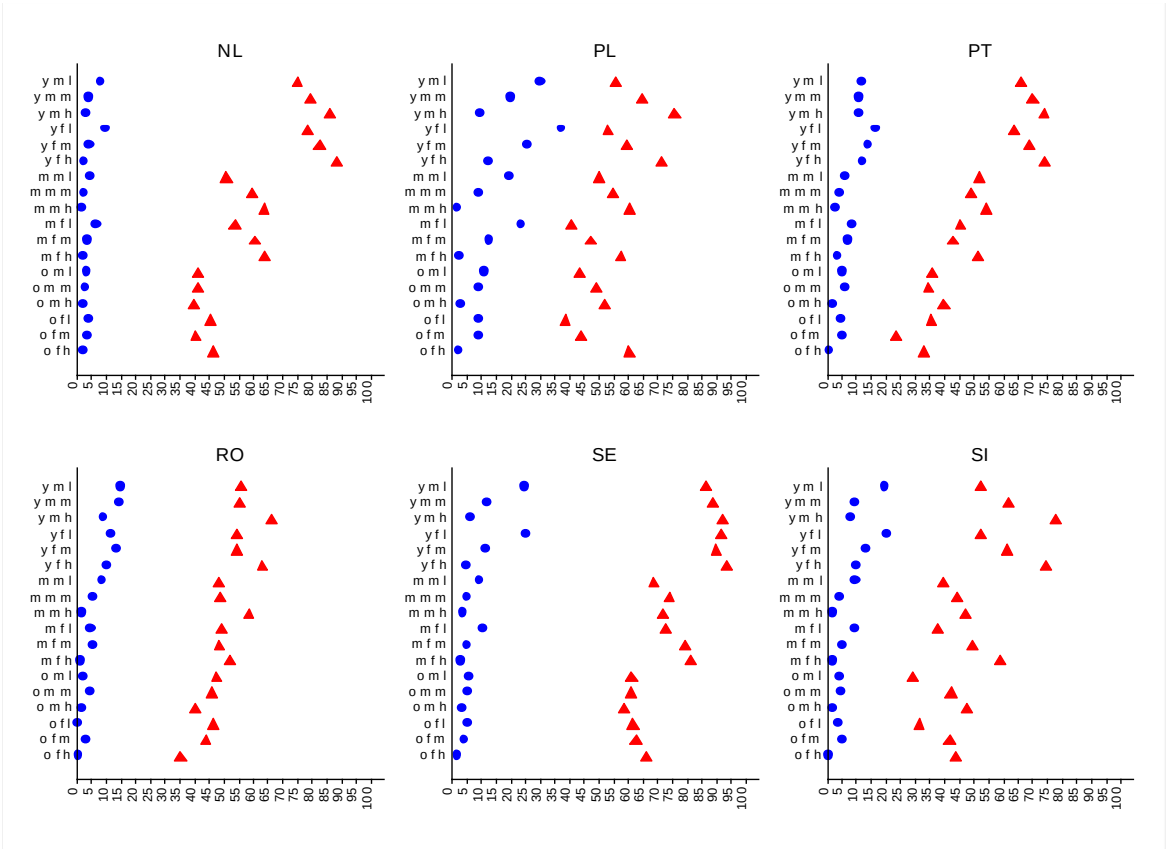
o m h
o f l
o f m
o f h
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100


NL
PL
PT
RO
SE
SI
y m l
y m m
y m h
y f l
y f m
y f h
m m l
m m m
m m h
m f l
m f m
m f h
o m l
o m m
o m h
o f l
o f m
o f h
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100


*Note*: First letter: age. y = young, m = middle-aged, o = old. Second letter: gender. m = male, f = female. Third letter: skill. l = low-skilled, m = medium-skilled, h = high-skilled. For example, y m l stands for "young/male/low-skilled".

*Source*: EU-LFS.

In a second step we calculate the share of employees that fulfils the respective eligibility condition of the various variants (3M out of 12M, 6M out of 12M, 9M out of 12M) based on 2007 SILC data as the LFS does not contain information on previous contribution periods before job loss. Precisely, the share is calculated for each of the 18 socio-demographic groups and aggregated for the total labour force. It reads as follows:

$$Share\ of\ employees\ that\ fulfill\ the\ elibility\ condition$$

$$= \frac{Number\ of\ employees\ that\ fulfill\ the\ eligibility\ condition}{Total\ number\ of\ employees, self-employed\ and\ farmer}$$

In our simulations, we assume that the same share of short-term unemployed per socio-demographic subgroup is eligible to and hence covered by the EUBS. Coverage rates (defined as the share of short-term unemployed covered by the EUBS) are reported in Table A.2-2 for each of the 3 eligibility conditions.

**Table A.2-2. Percent of short-term unemployed covered by the EUBS, 1995-2013**

| CON | 3M out of 12M | 6M out of 12M | 9M out of 12M |
|---|---|---|---|
| AT | 85.2 | 82.6 | 79.9 |
| BE | 86.1 | 84.2 | 82.2 |
| BG | 82.2 | 80.0 | 75.9 |
| CY | 82.8 | 80.5 | 76.7 |
| CZ | 82.6 | 81.0 | 79.0 |
| DE | 87.5 | 85.2 | 83.6 |
| DK | 88.4 | 87.0 | 84.7 |
| EE | 91.8 | 89.6 | 86.8 |
| EL | 63.2 | 61.5 | 57.8 |
| ES | 81.3 | 79.3 | 76.6 |
| FI | 84.9 | 71.6 | 66.7 |
| FR | 88.0 | 85.2 | 82.8 |
| HU | 84.7 | 81.8 | 78.3 |
| IE | 82.0 | 79.3 | 76.7 |
| IT | 73.5 | 72.5 | 71.1 |
| LT | 85.4 | 83.4 | 81.0 |
| LU | 92.2 | 89.6 | 87.8 |
| LV | 89.2 | 87.3 | 84.2 |
| MT | 84.9 | 83.3 | 82.8 |
| NL | 84.7 | 83.5 | 80.4 |
| PL | 65.0 | 63.0 | 60.6 |
| PT | 78.0 | 76.3 | 74.2 |
| RO | 71.4 | 70.8 | 70.2 |
| SE | 87.1 | 84.6 | 83.3 |
| SI | 90.5 | 89.0 | 87.1 |
| SK | 88.0 | 86.5 | 84.2 |
| UK | 85.6 | 85.6 | 85.6 |

*Source*: EU-SILC.

Coverage rates of national unemployment insurance systems can be directly inferred from the LFS. Table A.2-3 reports average coverage rates (defined as the share of short-term unemployed covered by national UI systems) over the period 1995-2013.

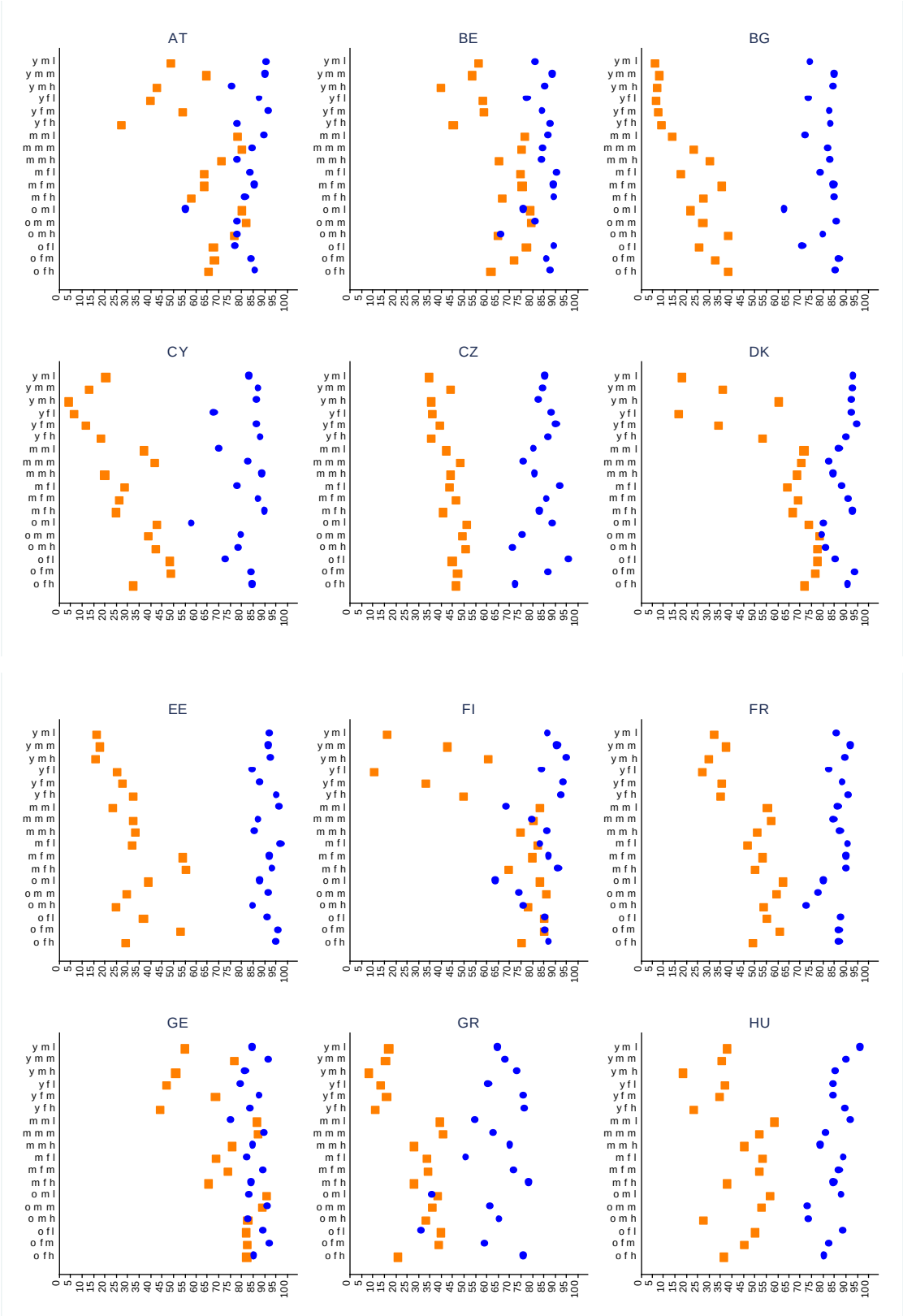
**Table A.2-3. Percent of short-term unemployed covered by national UI systems, 1995-2013**

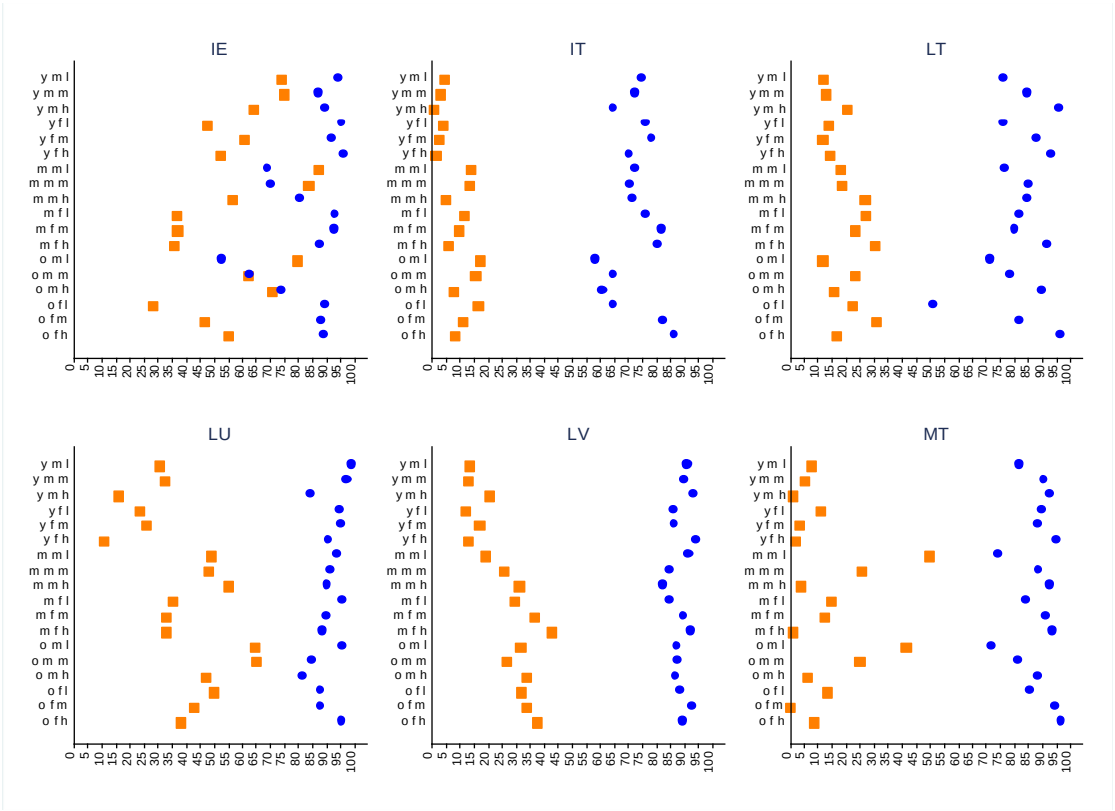
| CON | Average coverage rate |
|---|---|
| AT | 63.6 |
| BE | 63.3 |
| BG | 19.2 |
| CY | 24.5 |
| CZ | 44.4 |
| DK | 51.4 |
| EE | 33.1 |
| FI | 52.0 |
| FR | 44.3 |
| GE | 74.8 |
| GR | 25.1 |
| HU | 44.8 |
| IE | 62.2 |
| IT | 8.1 |
| LT | 19.2 |
| LU | 35.3 |
| LV | 24.3 |
| MT | 15.4 |
| NL | 29.3 |
| PL | 24.5 |
| PT | 32.7 |
| RO | 28.5 |
| SE | 44.3 |
| SI | 32.7 |
| SK | 30.0 |
| SP | 30.1 |
| UK | 34.7 |

*Source*: EU-LFS.

Figure A.2-2 presents coverage gains for the 18 socio-demographic groups defined above. For each group, it shows average coverage rates over the period 1995-2013 for EUBS variant 7 and national UI systems, respectively.

**Figure A.2-2. Average coverage rates of EUBS variant 7 and national UI systems, 1995-2013**




IE
IT
LT
LU
LV
MT
y m l
y m m
y m h
y f l
y f m
y f h
m m l
m m m
m m h
m f l
m f m
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o m m
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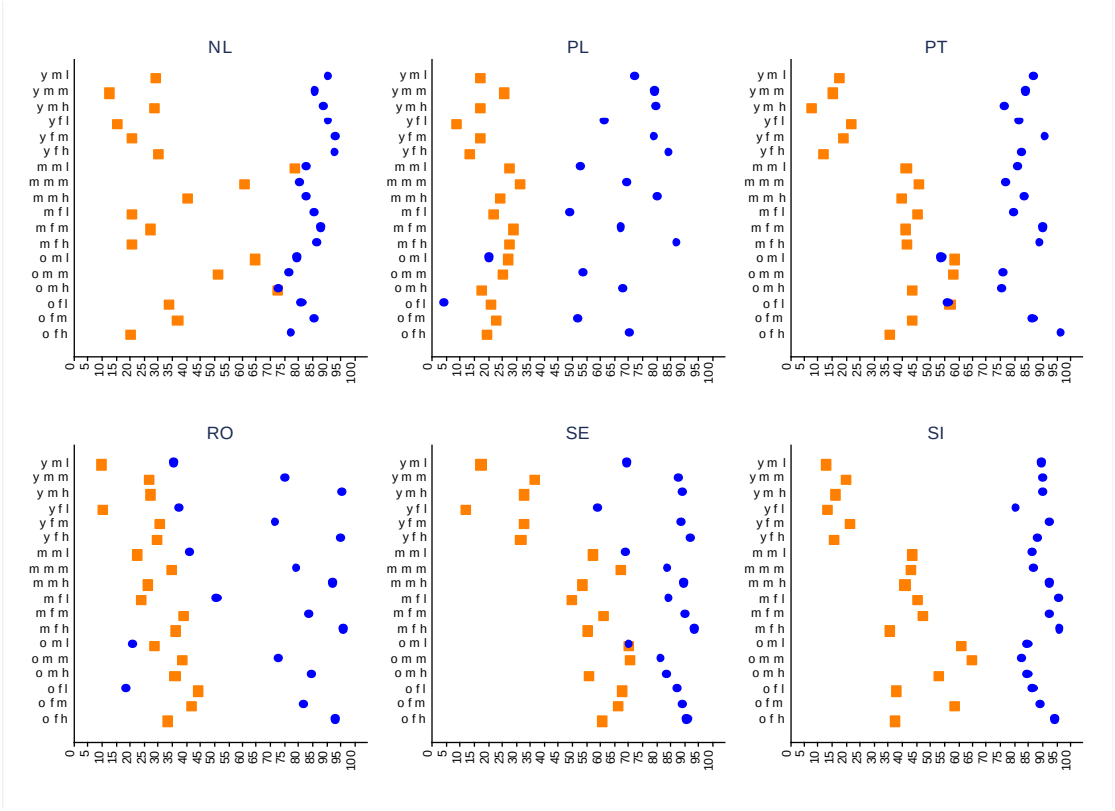
o f l
o f m
o f h
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100


NL
PL
PT
RO
SE
SI
y m l
y m m
y m h
y f l
y f m
y f h
m m l
m m m
m m h
m f l
m f m
m f h
o m l
o m m
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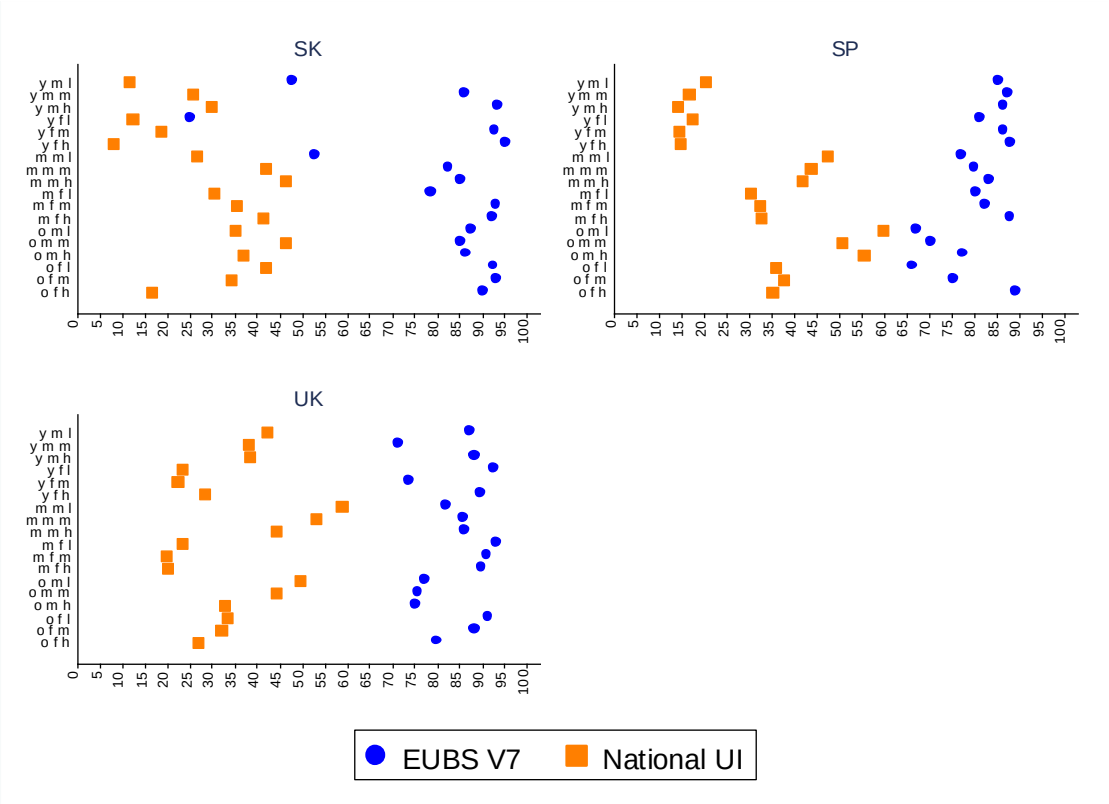
o f l
o f m
o f h
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100

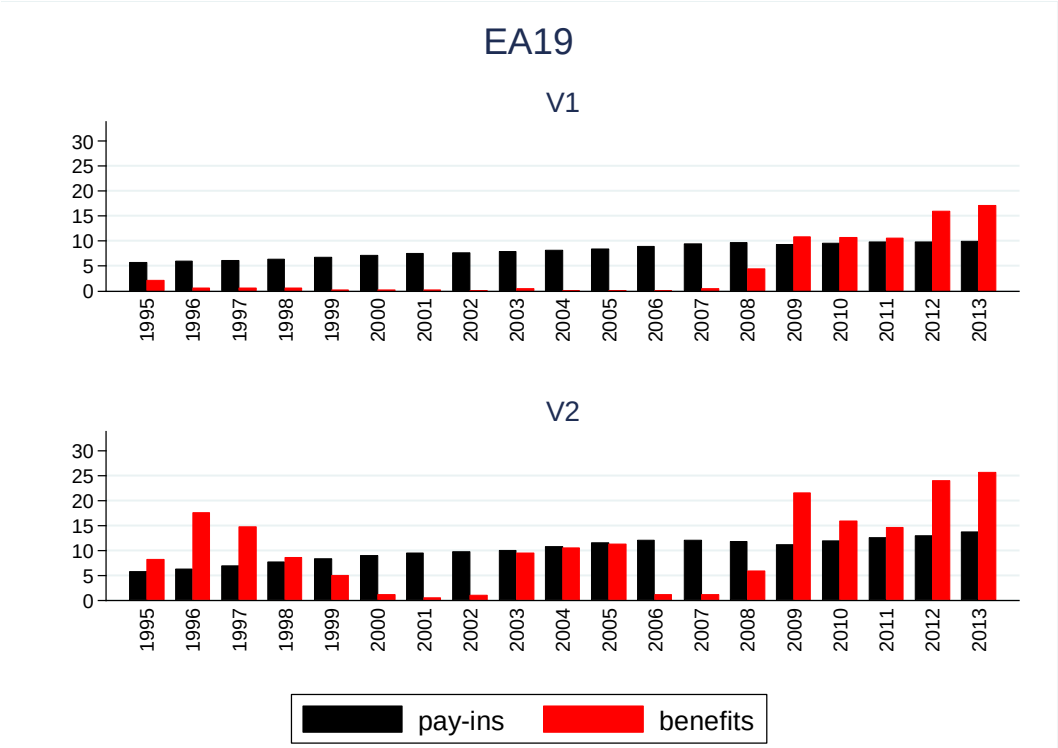



N*ote*: First letter: age. y = young, m = middle-aged, o = old. Second letter: gender. m = male, f = female. Third letter: skill. l = low-skilled, m = medium-skilld, h = high-skilled. For example, y m l stands for "young/male/low-skilled".

*Source*: EU-LFS.

## A.3 Additional results for EA19 member states

**Figure A.3-1. Overall pay-ins and benefits, 1995-2013: Equivalent systems**



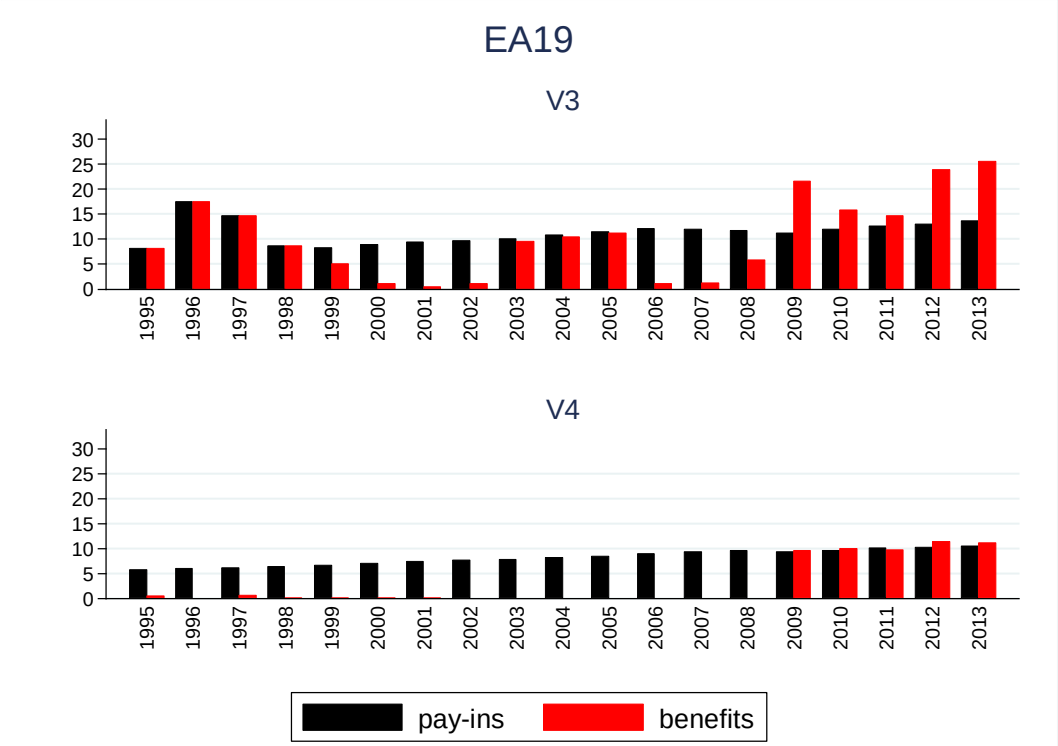
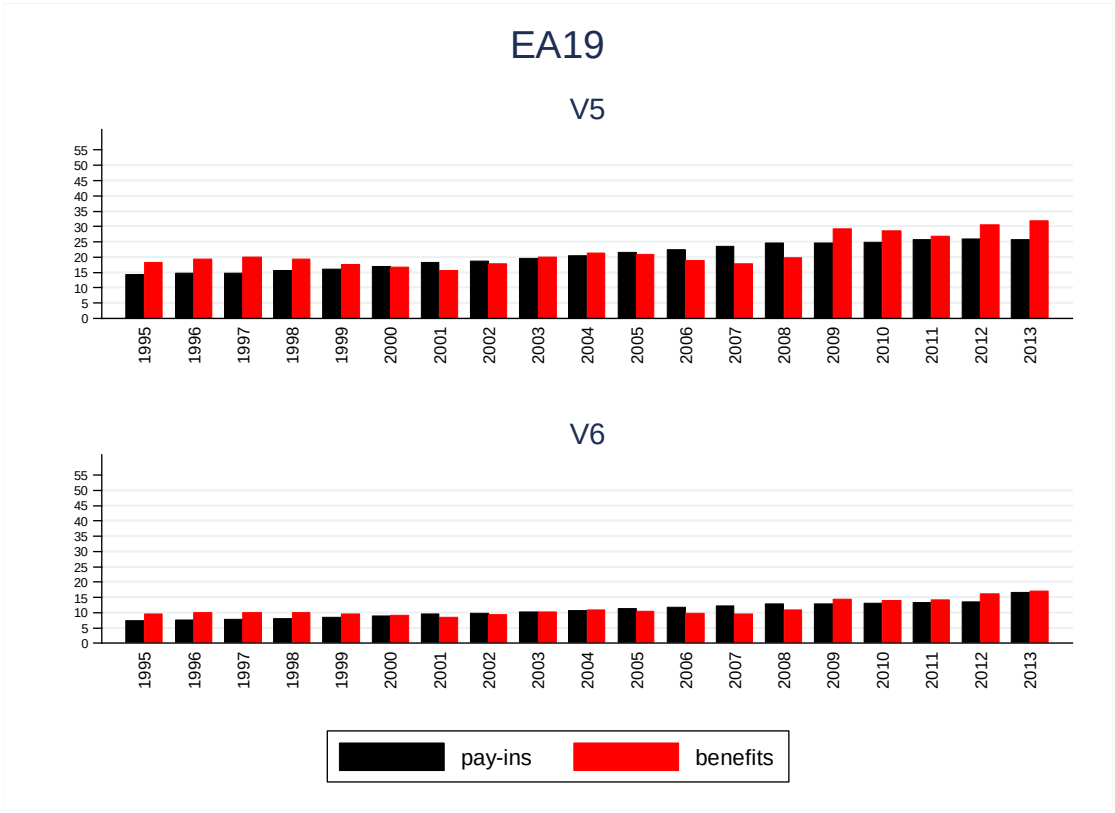
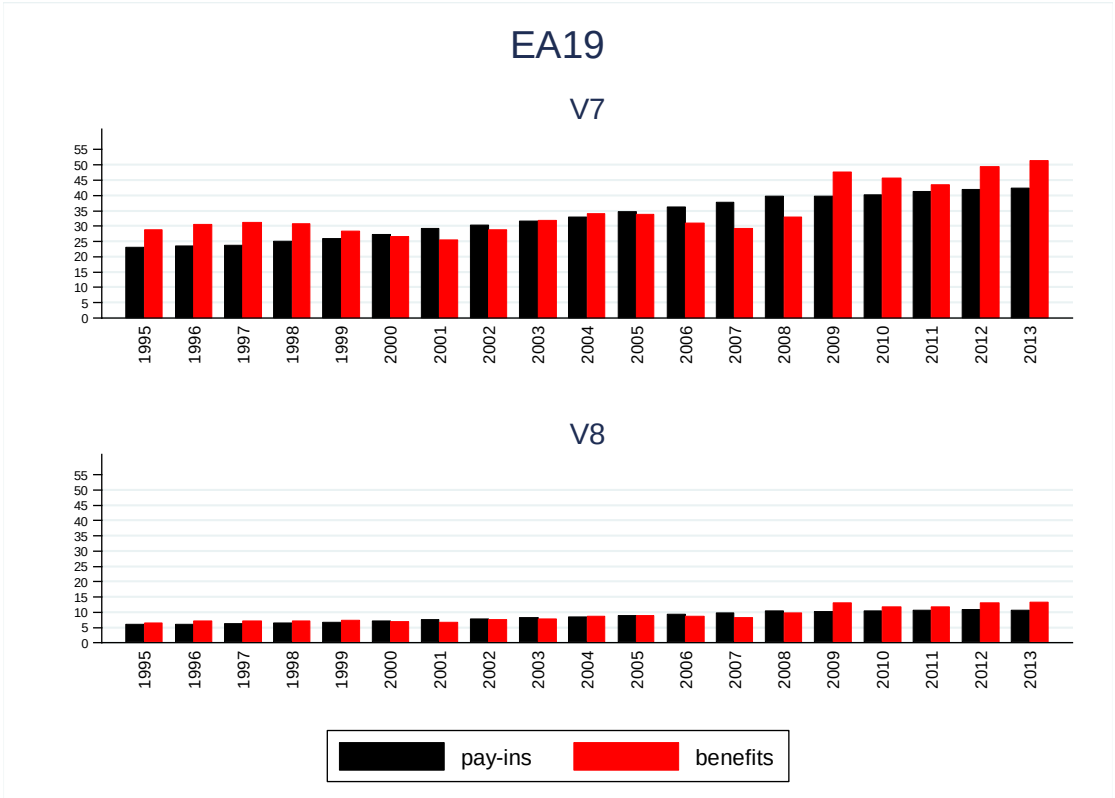
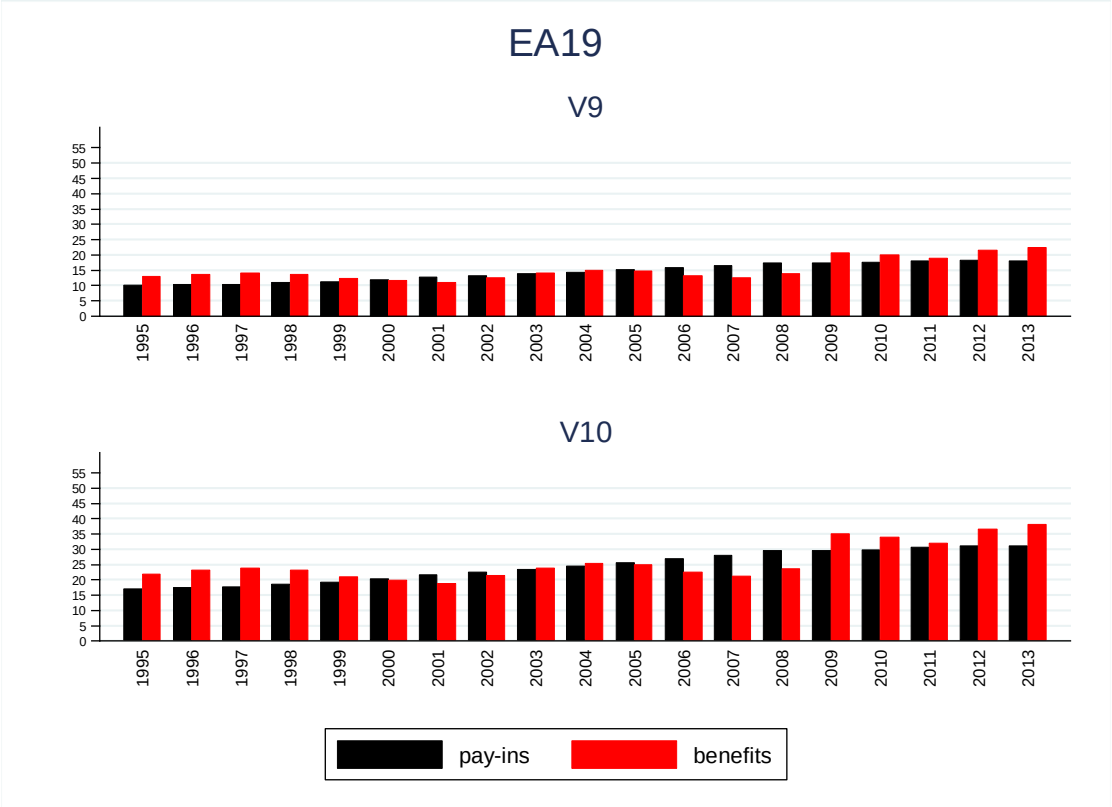
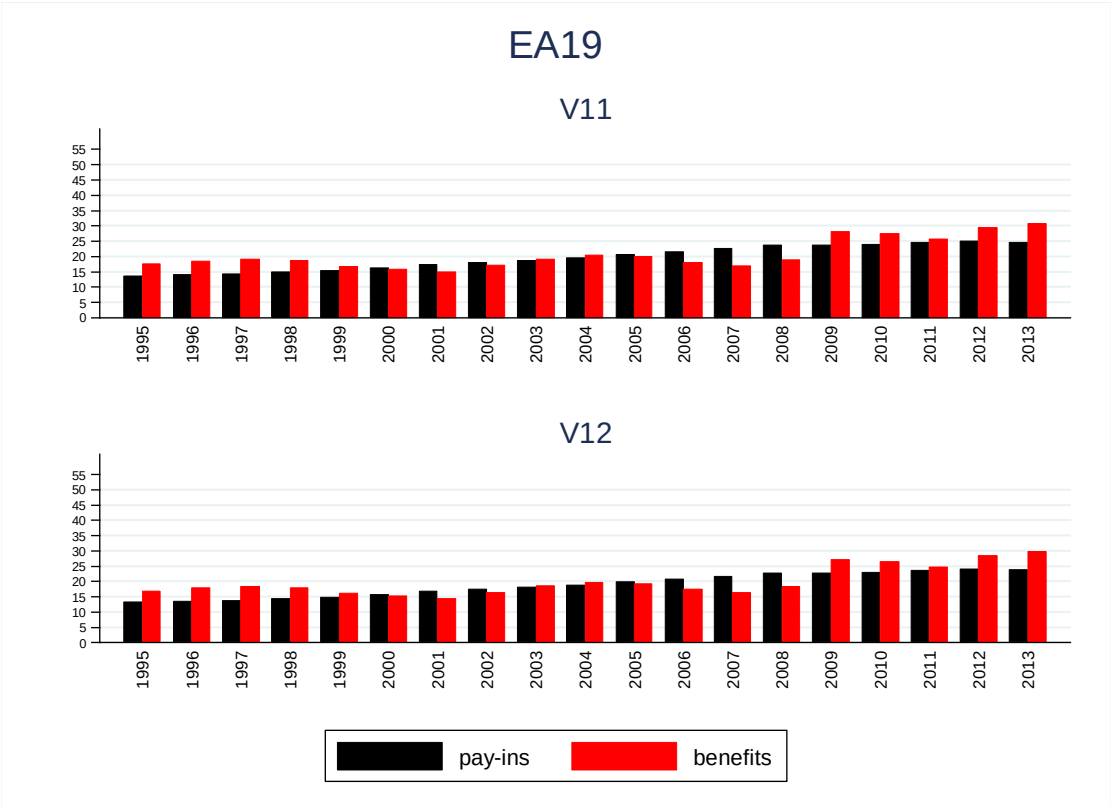



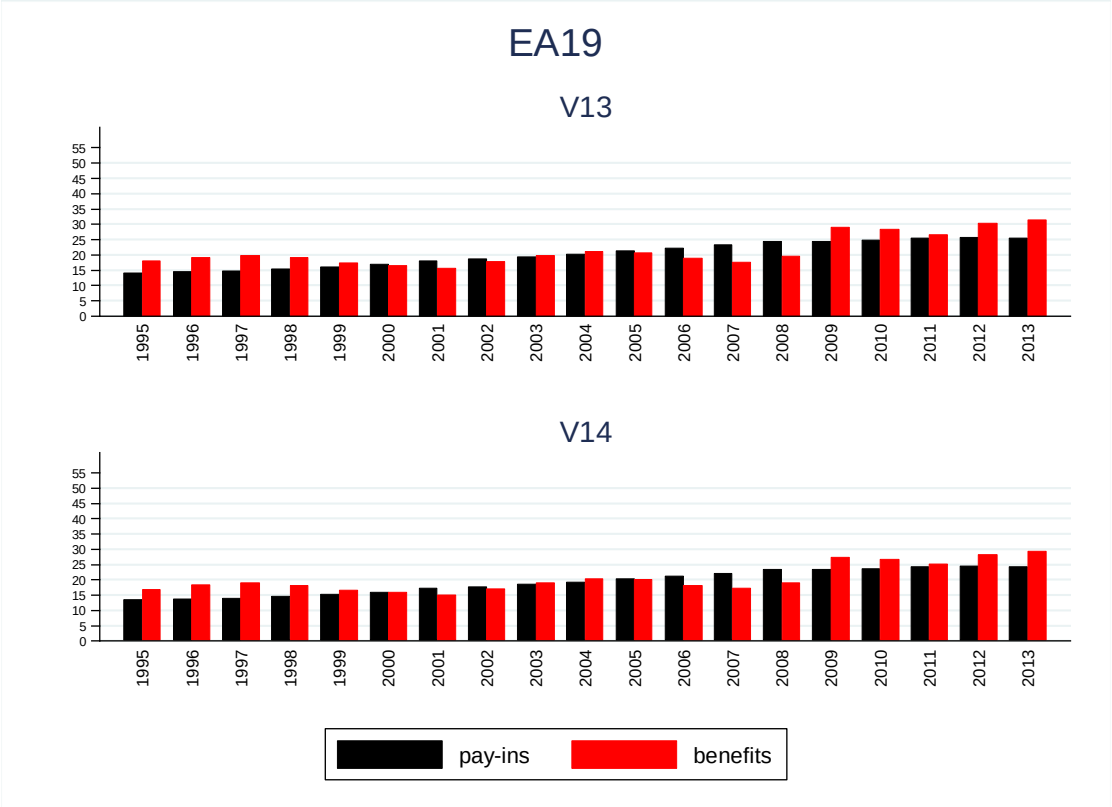
**Figure A.3-2. Overall pay-ins and benefits, 1995-2013: Genuine systems**

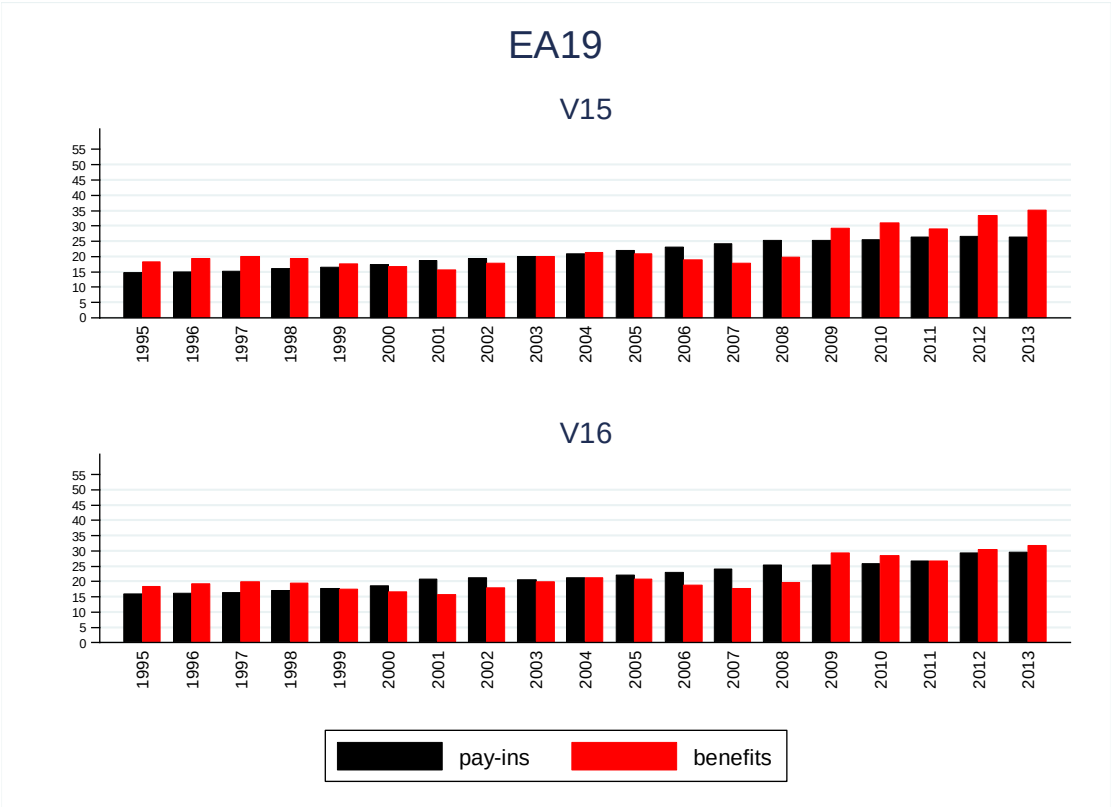



EA19
V9
V10
pay-ins
benefits


EA19
V11
V12
pay-ins
benefits


EA19
V13
V14
pay-ins
benefits


EA19
V15
V16
pay-ins
benefits

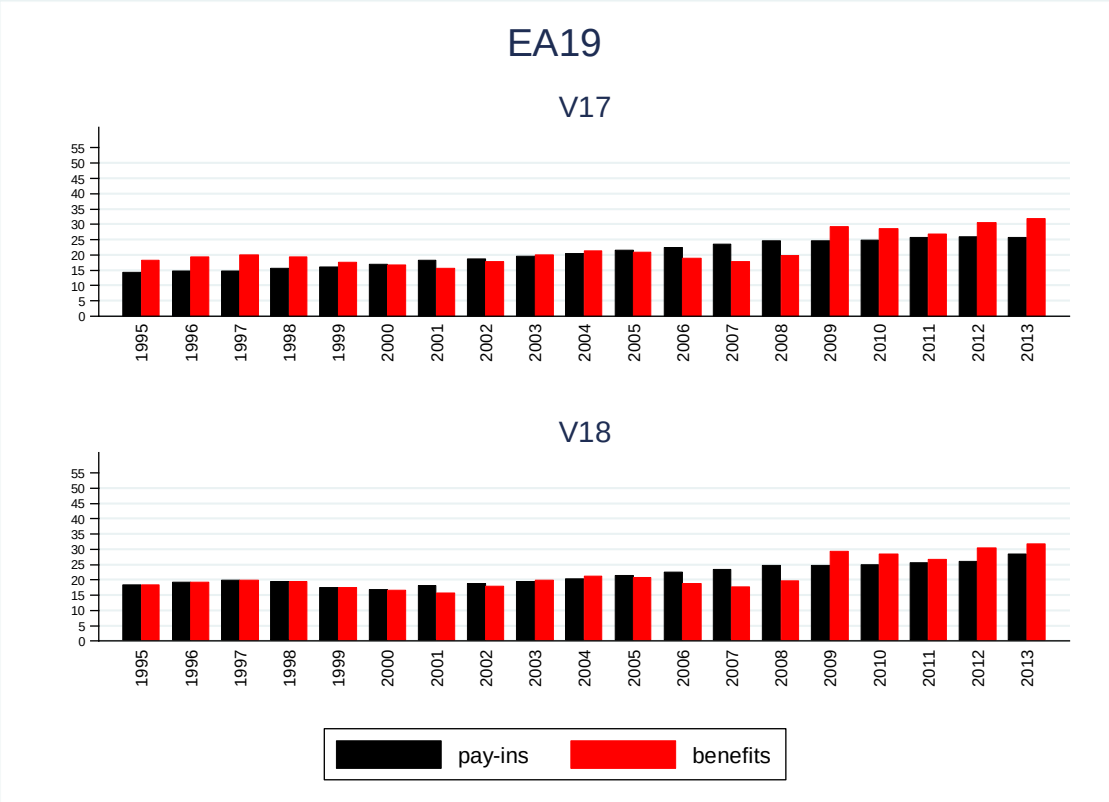
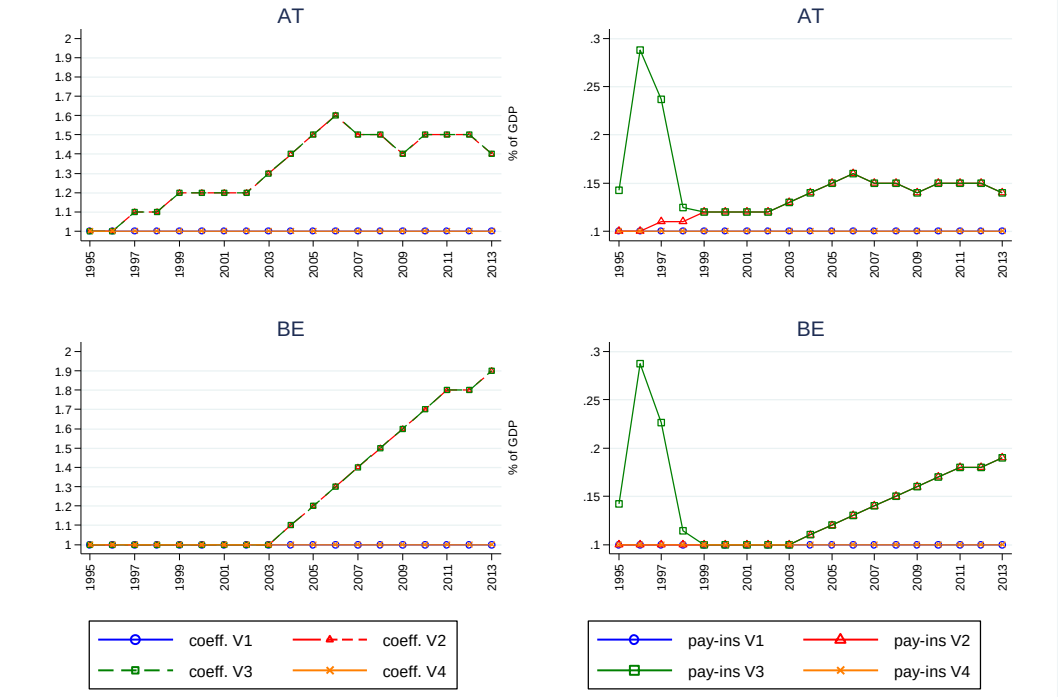
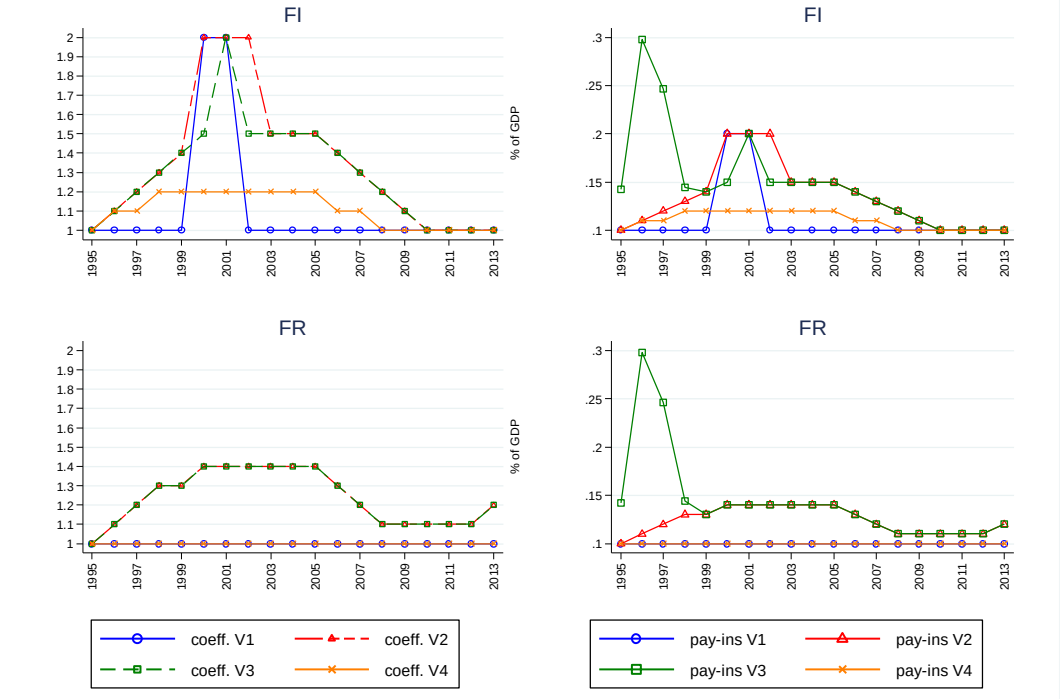


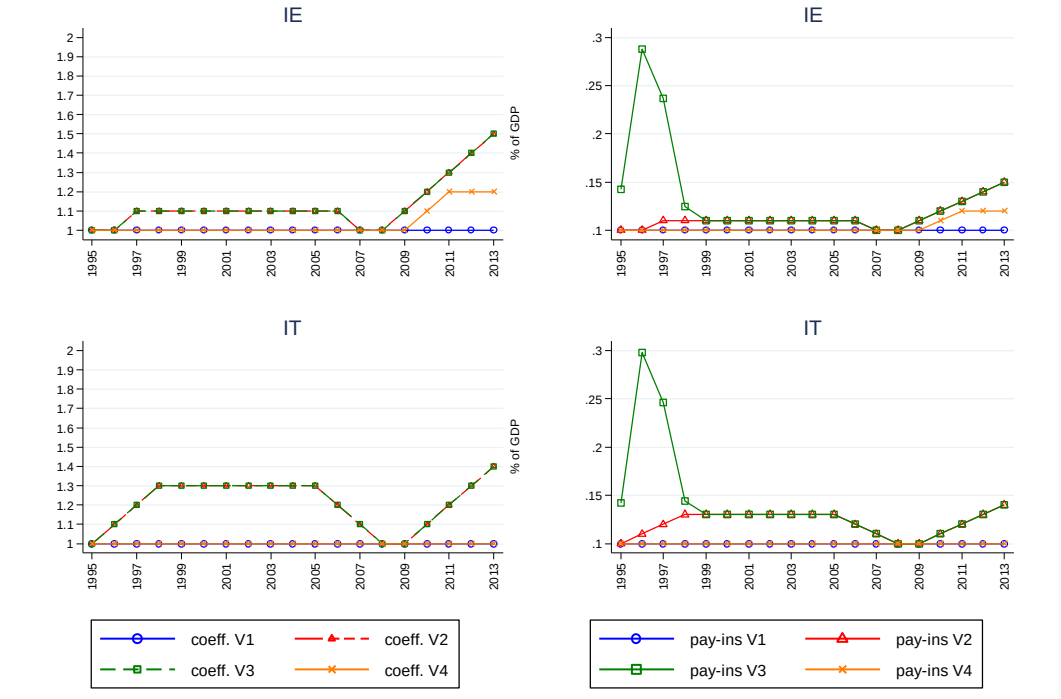

**Figure A.3-3. Experience rating and pay-ins: Equivalent systems**

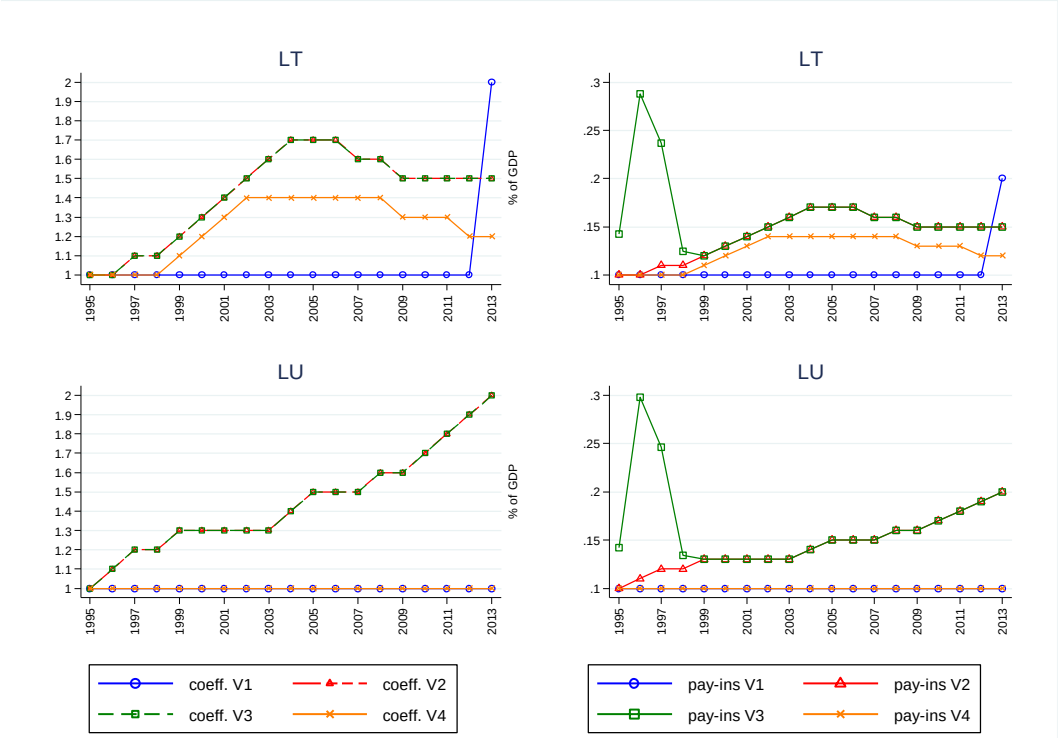


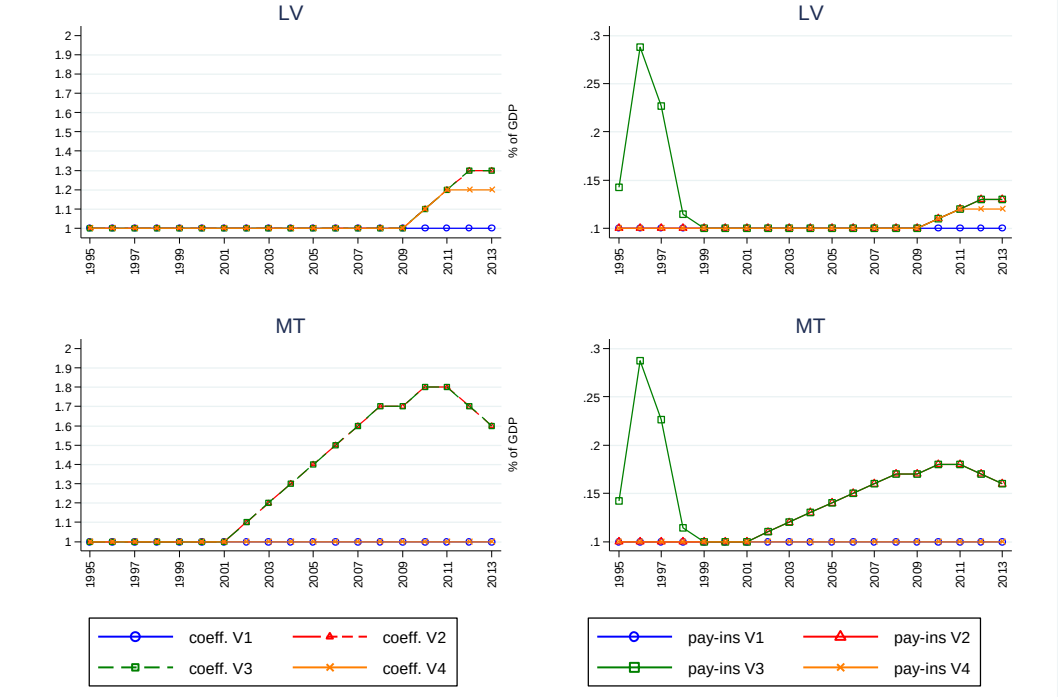

CY
EE
% of GDP
coeff. V1
coeff. V2
coeff. V3
coeff. V4
pay-ins V1
pay-ins V2
pay-ins V3
pay-ins V4

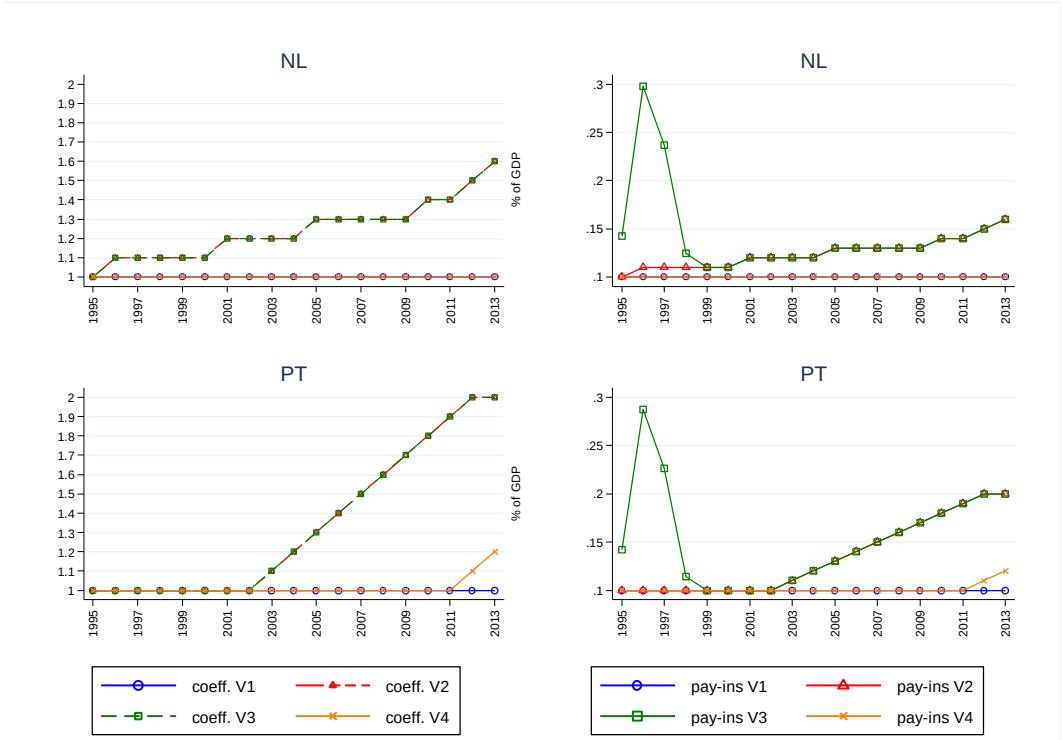

FI
FR
% of GDP
coeff. V1
coeff. V2
coeff. V3
coeff. V4
pay-ins V1
pay-ins V2
pay-ins V3
pay-ins V4


GE
GE
GR
GR
% of GDP
coeff. V1
coeff. V2
coeff. V3
coeff. V4
pay-ins V1
pay-ins V2
pay-ins V3
pay-ins V4


IE
IE
IT
IT
% of GDP
coeff. V1
coeff. V2
coeff. V3
coeff. V4
pay-ins V1
pay-ins V2
pay-ins V3
pay-ins V4


LT
LT
LU
LU
% of GDP
coeff. V1
coeff. V2
coeff. V3
coeff. V4
pay-ins V1
pay-ins V2
pay-ins V3
pay-ins V4


LV
LV
MT
MT
% of GDP
coeff. V1
coeff. V2
coeff. V3
coeff. V4
pay-ins V1
pay-ins V2
pay-ins V3
pay-ins V4


NL
NL
PT
PT
% of GDP
coeff. V1
coeff. V2
coeff. V3
coeff. V4
pay-ins V1
pay-ins V2
pay-ins V3
pay-ins V4

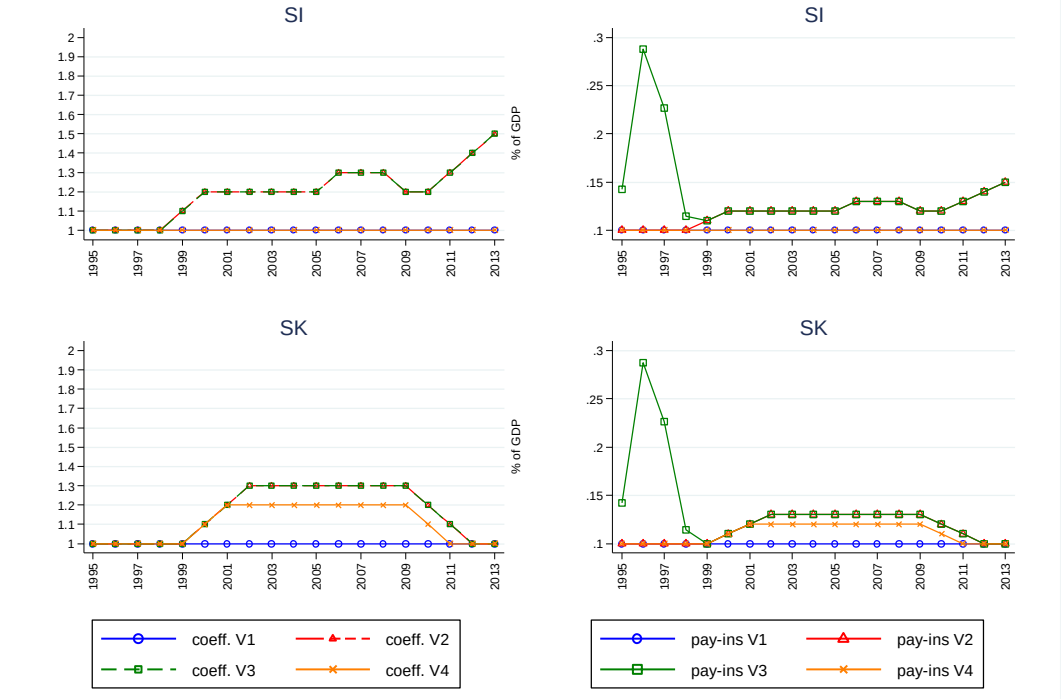
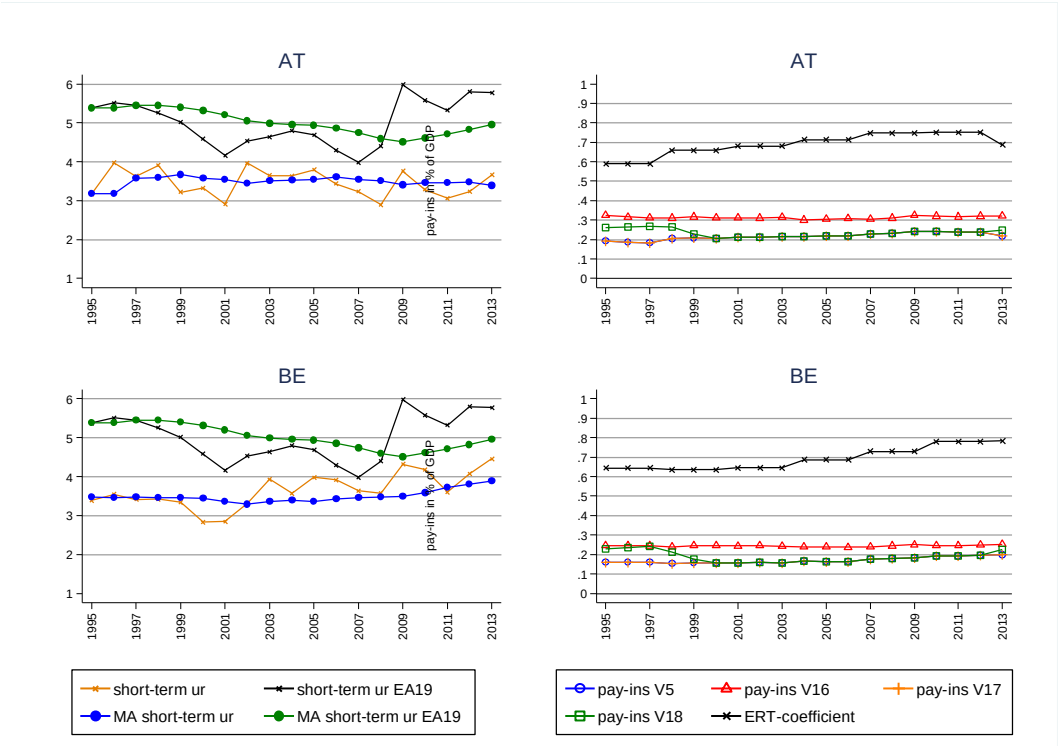
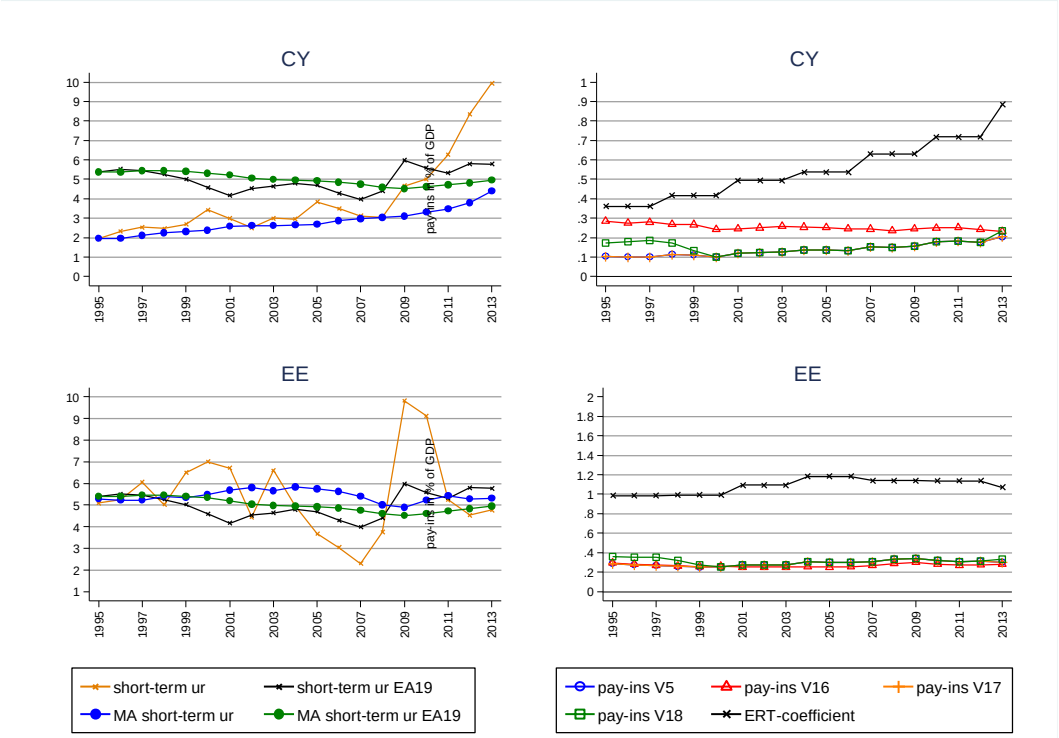
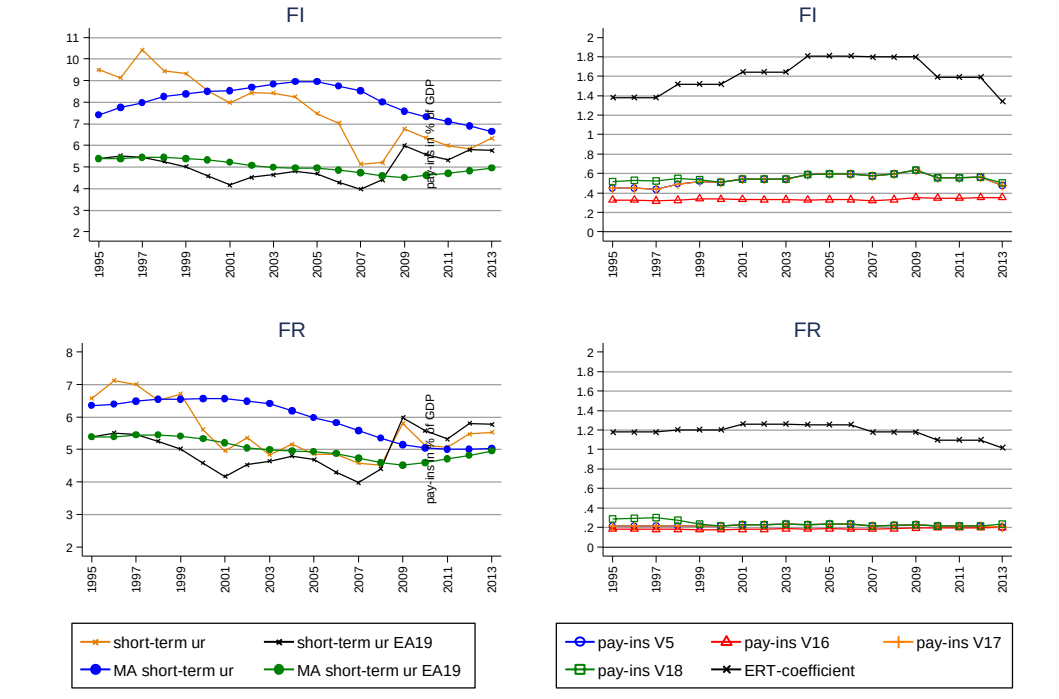
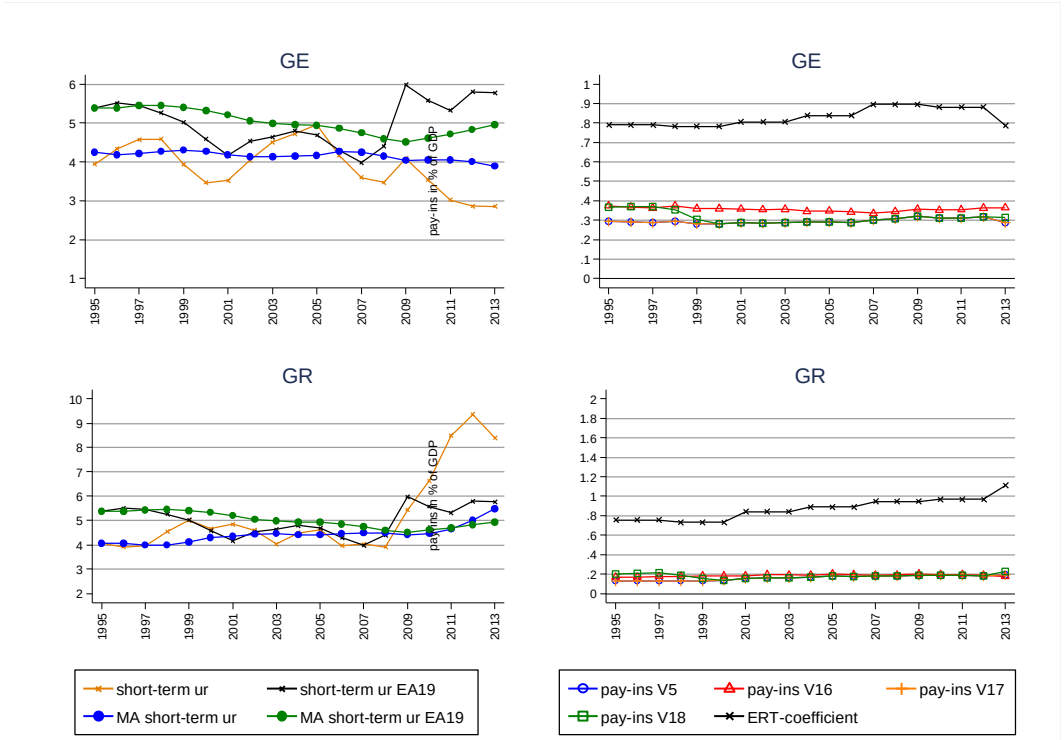

SI
SI
SK
SK
% of GDP
coeff. V1
coeff. V2
coeff. V3
coeff. V4
pay-ins V1
pay-ins V2
pay-ins V3
pay-ins V4

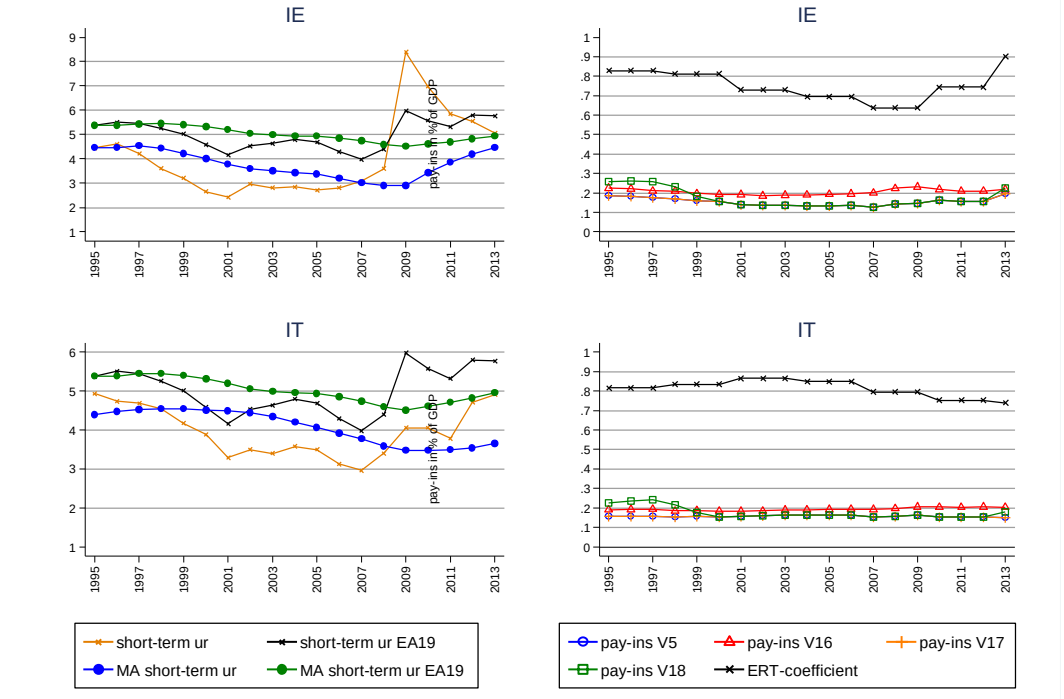

**Figure A.3-4. Experience rating and pay-ins: Genuine systems**

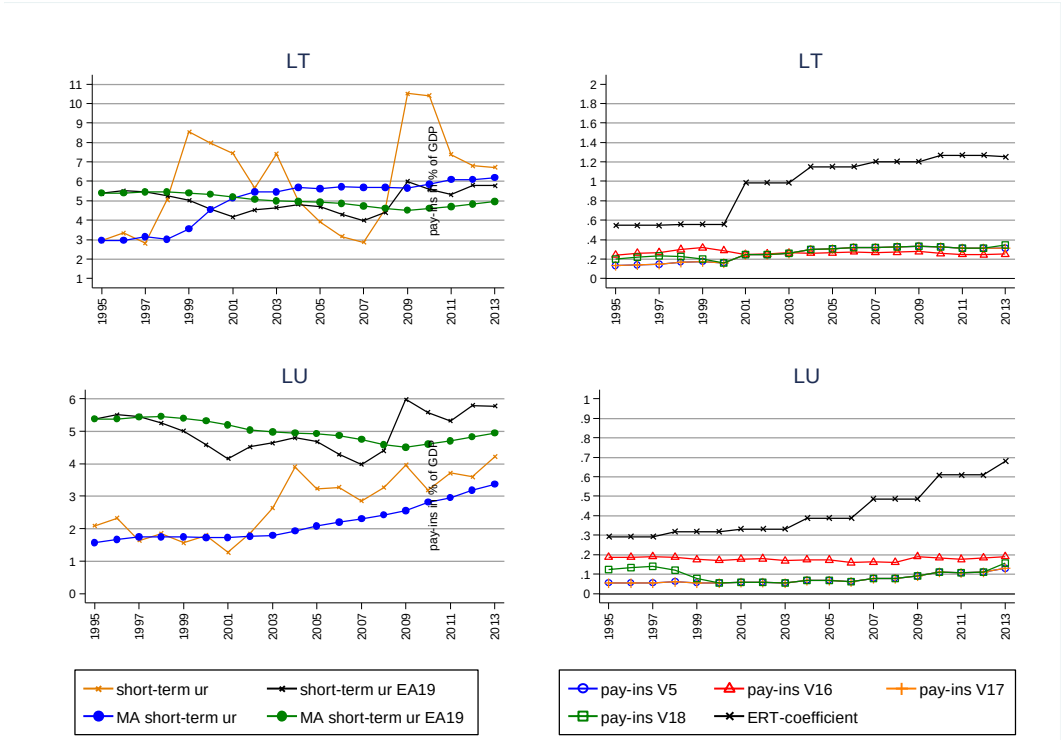


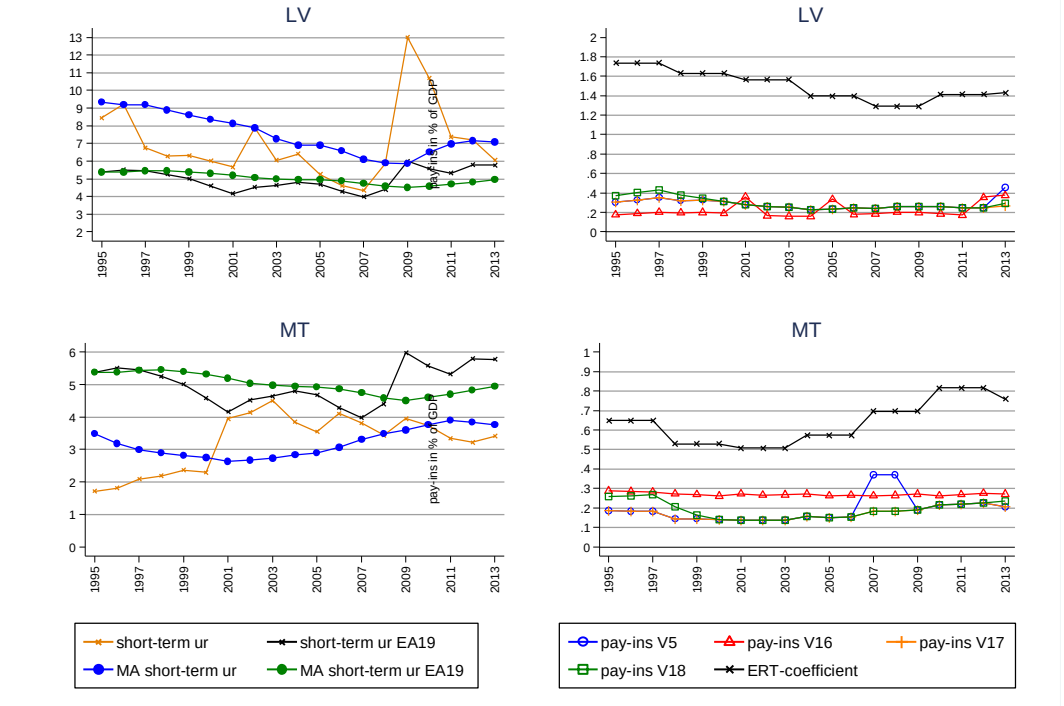

CY
pay-ins in % of GDP
CY
EE
pay-ins in % of GDP
EE
short-term ur
short-term ur EA19
MA short-term ur
MA short-term ur EA19
pay-ins V5
pay-ins V16
pay-ins V17
pay-ins V18
ERT-coefficient

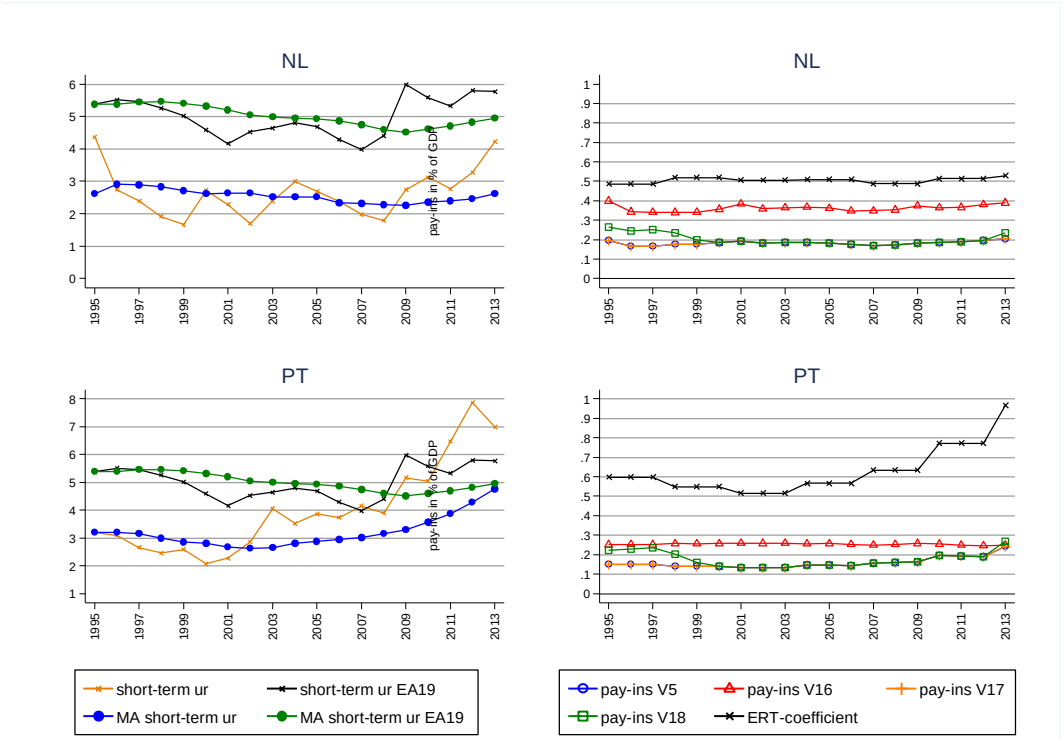

FI
pay-ins in % of GDP
FI
FR
pay-ins in % of GDP
FR
short-term ur
short-term ur EA19
MA short-term ur
MA short-term ur EA19
pay-ins V5
pay-ins V16
pay-ins V17
pay-ins V18
ERT-coefficient

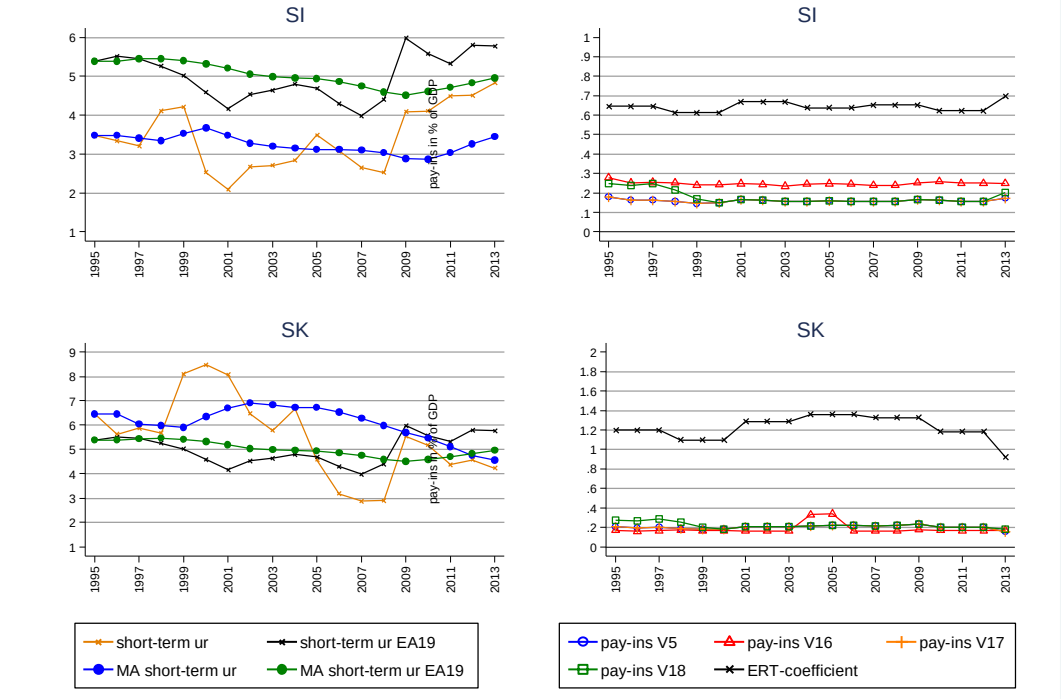

GE
GE
GR
GR
pay-ins in % of GDP
short-term ur
short-term ur EA19
MA short-term ur
MA short-term ur EA19
pay-ins V5
pay-ins V16
pay-ins V17
pay-ins V18
ERT-coefficient


IE
IE
IT
IT
pay-ins in % of GDP
short-term ur
short-term ur EA19
MA short-term ur
MA short-term ur EA19
pay-ins V5
pay-ins V16
pay-ins V17
pay-ins V18
ERT-coefficient


LT
LT
LU
LU
pay-ins in % of GDP
short-term ur
short-term ur EA19
MA short-term ur
MA short-term ur EA19
pay-ins V5
pay-ins V16
pay-ins V17
pay-ins V18
ERT-coefficient


LV
LV
MT
MT
pay-ins in % of GDP
short-term ur
short-term ur EA19
MA short-term ur
MA short-term ur EA19
pay-ins V5
pay-ins V16
pay-ins V17
pay-ins V18
ERT-coefficient


NL
NL
PT
PT
pay-ins in % of GDP
short-term ur
short-term ur EA19
MA short-term ur
MA short-term ur EA19
pay-ins V5
pay-ins V16
pay-ins V17
pay-ins V18
ERT-coefficient


SI
SI
SK
SK
pay-ins in % of GDP
short-term ur
short-term ur EA19
MA short-term ur
MA short-term ur EA19
pay-ins V5
pay-ins V16
pay-ins V17
pay-ins V18
ERT-coefficient

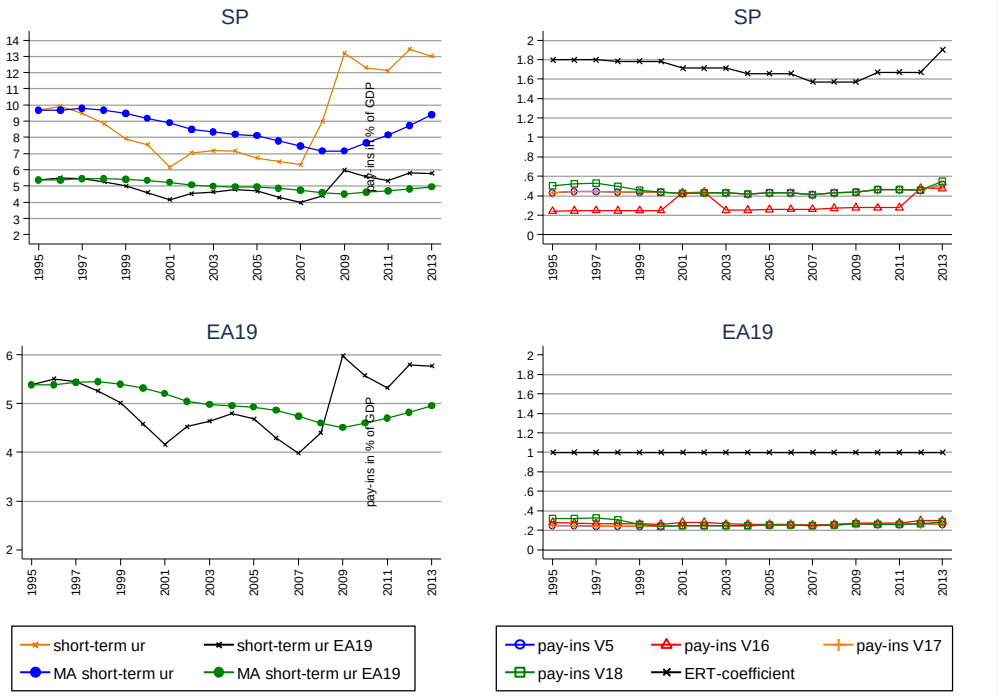

SP
SP
EA19
EA19
pay-ins in % of GDP
pay-ins in % of GDP
short-term ur
short-term ur EA19
MA short-term ur
MA short-term ur EA19
pay-ins V5
pay-ins V16
pay-ins V17
pay-ins V18
ERT-coefficient

**Table A.3-1. Years the trigger is pulled**

| | 1995 | | | 1996 | | | 1997 | | | 1998 | | | 1999 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | V1 | V2/V3 | V4 | V1 | V2/V3 | V4 | V1 | V2/V3 | V4 | V1 | V2/V3 | V4 | V1 | V2/V3 | V4 |
| AT | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| BE | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| BG | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 |
| CY | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 |
| CZ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0 |
| DK | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| EE | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 0 |
| FI | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 0 |
| FR | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| GE | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| GR | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 |
| HU | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| IE | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| IT | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| LT | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 |
| LU | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| LV | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MT | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NL | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| PL | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| PT | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| RO | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 |
| SE | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| SI | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 |
| SK | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 |
| SP | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| UK | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| | 2000 | | | 2001 | | | 2002 | | | 2003 | | | 2004 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | V1 | V2/V3 | V4 | V1 | V2/V3 | V4 | V1 | V2/V3 | V4 | V1 | V2/V3 | V4 | V1 | V2/V3 | V4 |
| AT | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 |
| BE | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 |
| BG | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| CY | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 |
| CZ | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| DK | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| EE | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| FI | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| FR | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| GE | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 |
| GR | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| HU | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| IE | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| IT | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| LT | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| LU | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 0 |
| LV | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MT | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 0 |
| NL | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| PL | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 0 |
| PT | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 1 | 0 |
| RO | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| SE | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| SI | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| SK | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| SP | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| UK | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

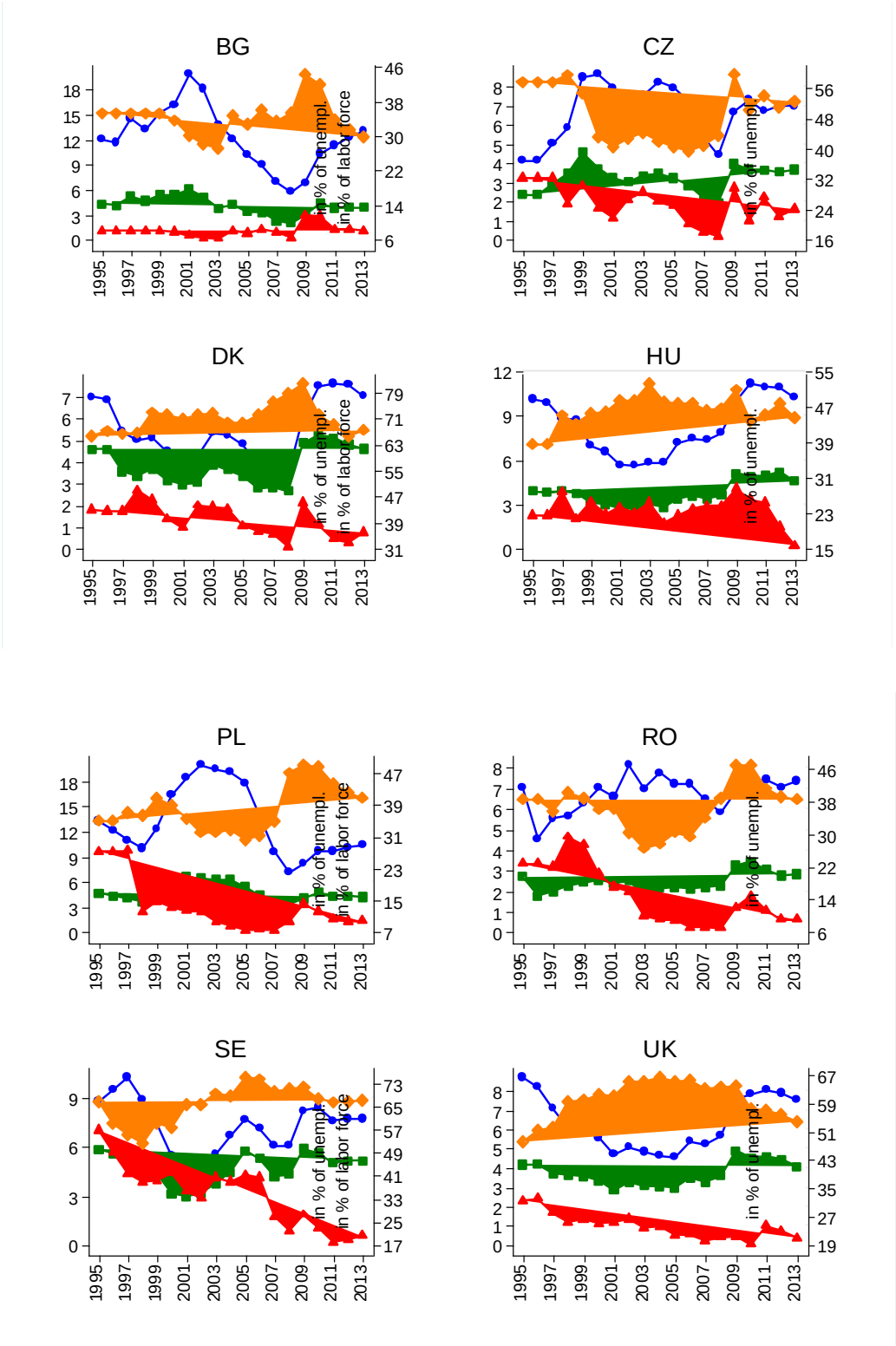
| | 2005 | | | 2006 | | | 2007 | | | 2008 | | | 2009 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | V1 | V2/V3 | V4 | V1 | V2/V3 | V4 | V1 | V2/V3 | V4 | V1 | V2/V3 | V4 | V1 | V2/V3 | V4 |
| AT | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| BE | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 |
| BG | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| CY | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 0 |
| CZ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 |
| DK | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 |
| EE | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 |
| FI | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| FR | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| GE | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| GR | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 |
| HU | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 1 |
| IE | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 |
| IT | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| LT | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 |
| LU | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0 |
| LV | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 |
| MT | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| NL | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| PL | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| PT | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0 |
| RO | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 0 |
| SE | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 1 |
| SI | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 |
| SK | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| SP | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 1 | 1 |
| UK | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 |

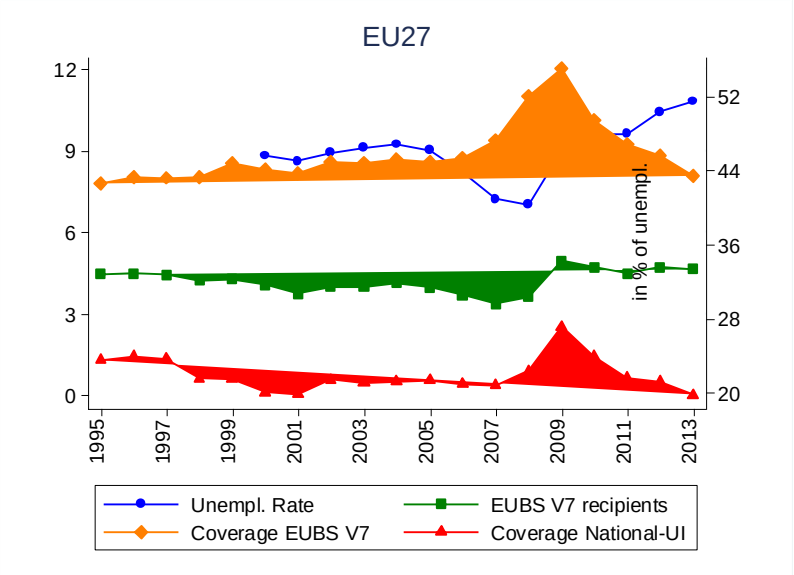
| | 2010 | 2011 | 2012 | 2013 |
|---|---|---|---|---|

| | V1 | V2/V3 | V4 | V1 | V2/V3 | V4 | V1 | V2/V3 | V4 | V1 | V2/V3 | V4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AT | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| BE | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 |
| BG | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 |
| CY | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| CZ | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 |
| DK | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 1 | 0 |
| EE | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| FI | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| FR | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 |
| GE | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| GR | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| HU | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 1 | 0 |
| IE | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 1 | 0 |
| IT | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 0 |
| LT | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 |
| LU | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 |
| LV | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MT | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NL | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0 |
| PL | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| PT | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| RO | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 |
| SE | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 |
| SI | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 0 |
| SK | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| SP | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| UK | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 |

## A.4 Results for EU-27 member states

**Figure A.4-1. Unemployment and coverage rates in EU member states outside the EA**

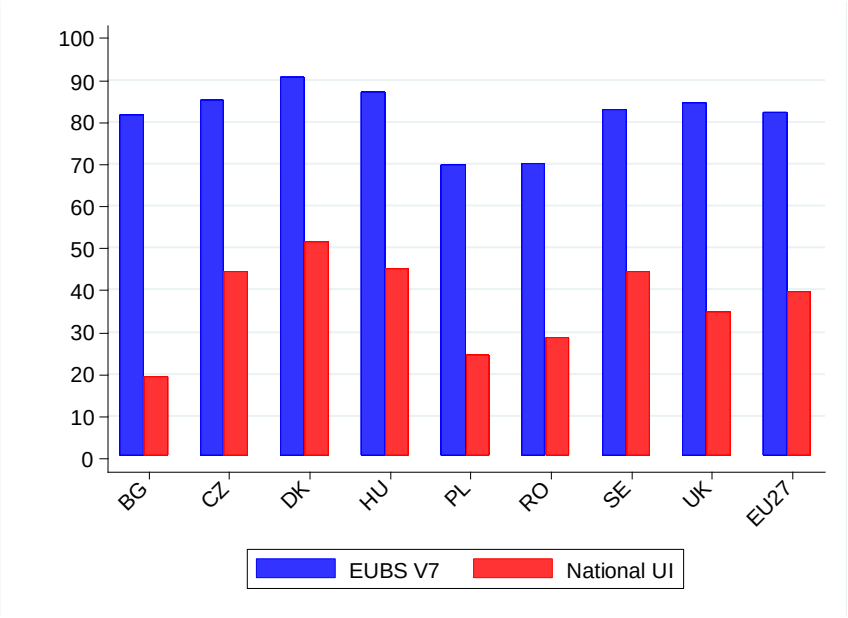





*Note:* Unemployment rates and EUBS V7 recipients measured in per cent of the labour force. Coverage EUBS V7 and coverage national UI calculated as number of short-term unemployed receiving unemployment benefits relative to all (short-term and long-term) unemployed. Coverage national UI includes UI benefits and assistance as reflected in the LFS. If coverage information is missing in the LFS for a given member state in one year, it is imputed from the closest country-year cell available.

*Sources*: EU-LFS, EU-SILC and own calculations based on EUROMOD.

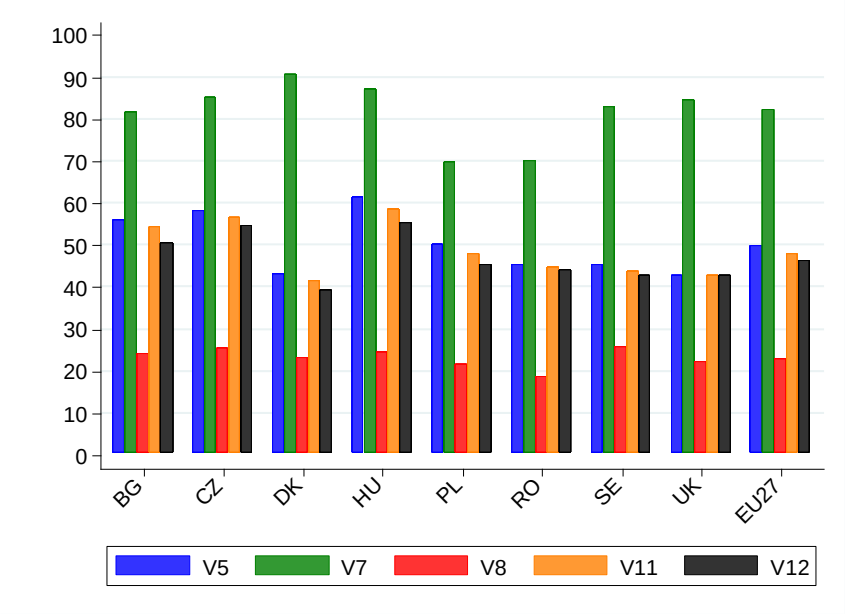
**Figure A.4-2. Average coverage gaps between EUBS V7 and national UI systems, 1995-2013**




*Note*: Coverage rates of EUBS variant 7 and national UI systems calculated as number of UI recipients relative to total number short-term unemployed.

*Sources*: EU-LFS, EU-SILC and own calculations based on EUROMOD.

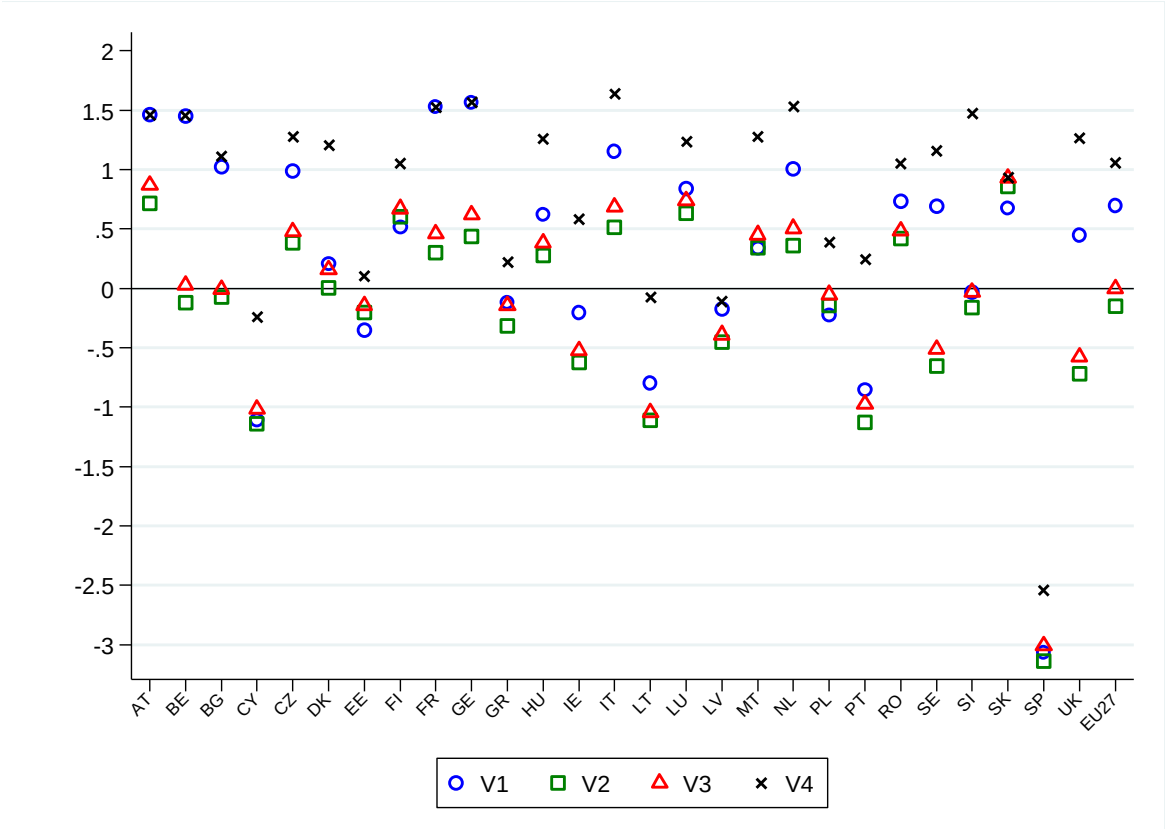
**Figure A.4-3. Average coverage gaps between EUBS V7 and national UI systems, 1995-2013**

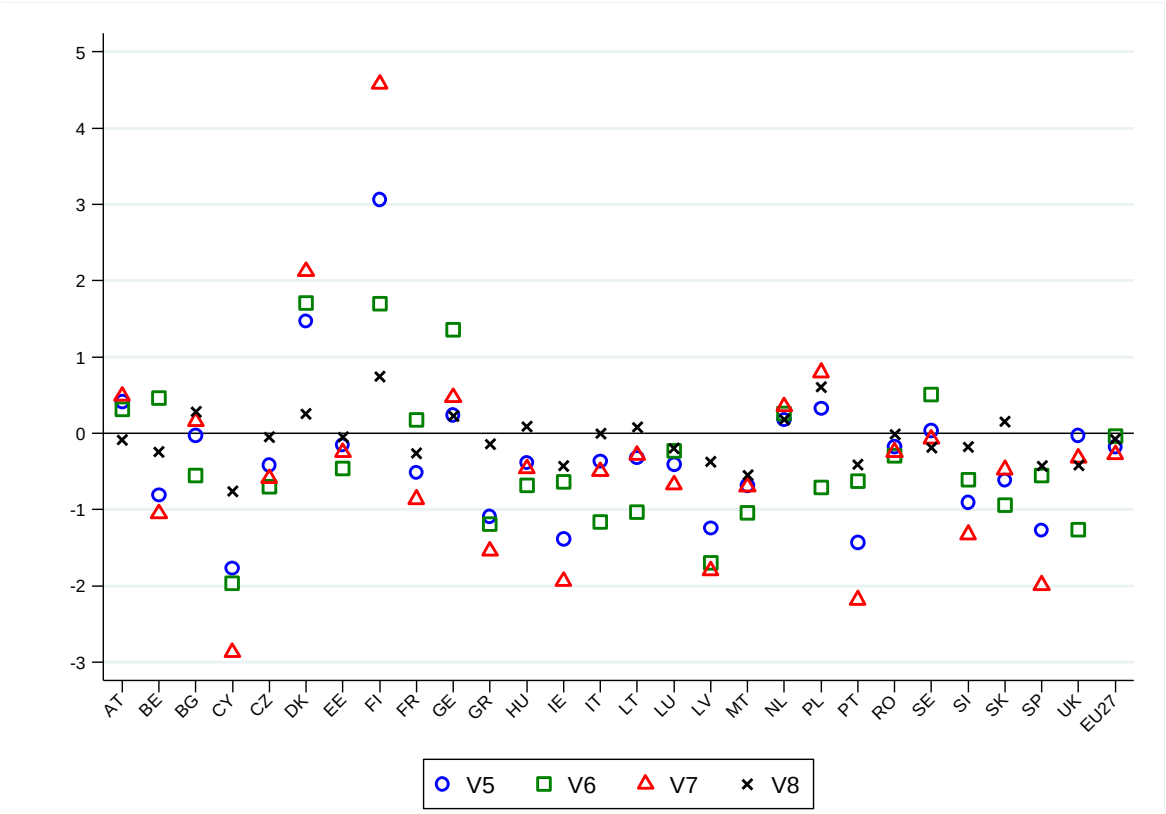


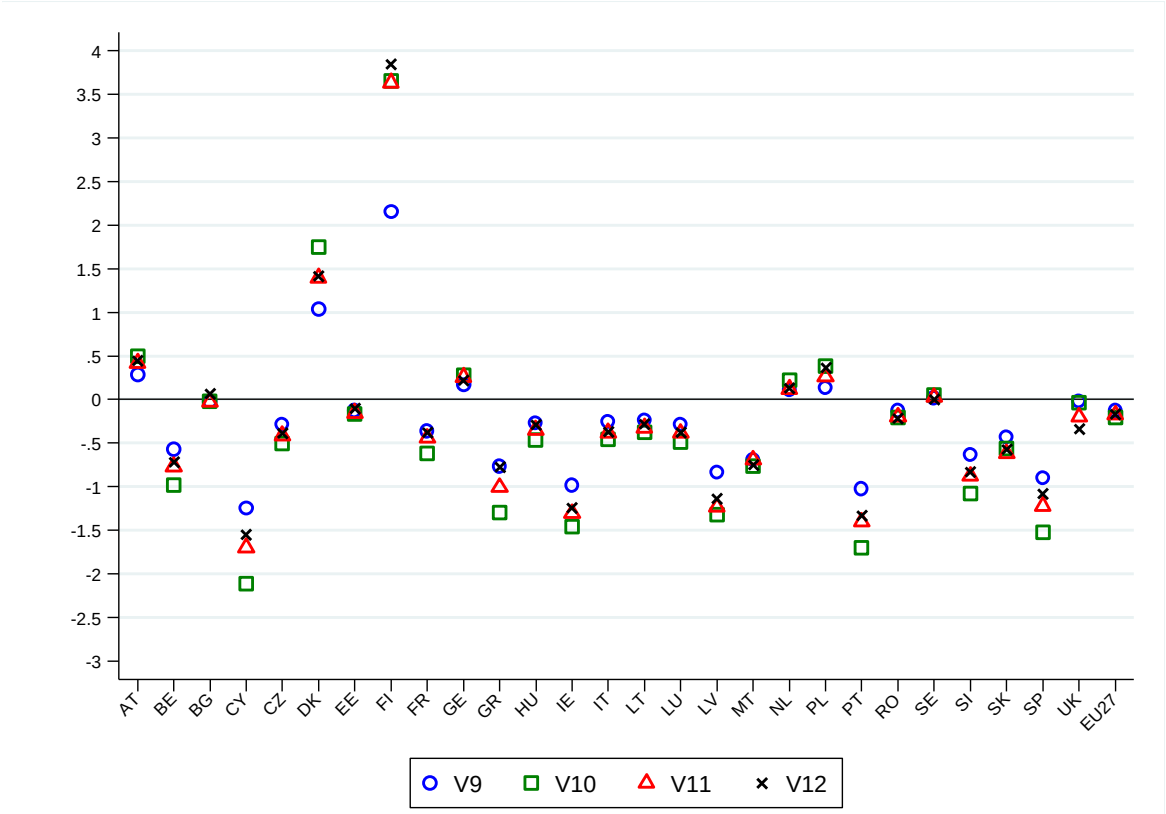

*Note*: Coverage rates of EUBS variants 5, 7, 8, 11 and 12 calculated as number of UI recipients relative to total number short-term unemployed.

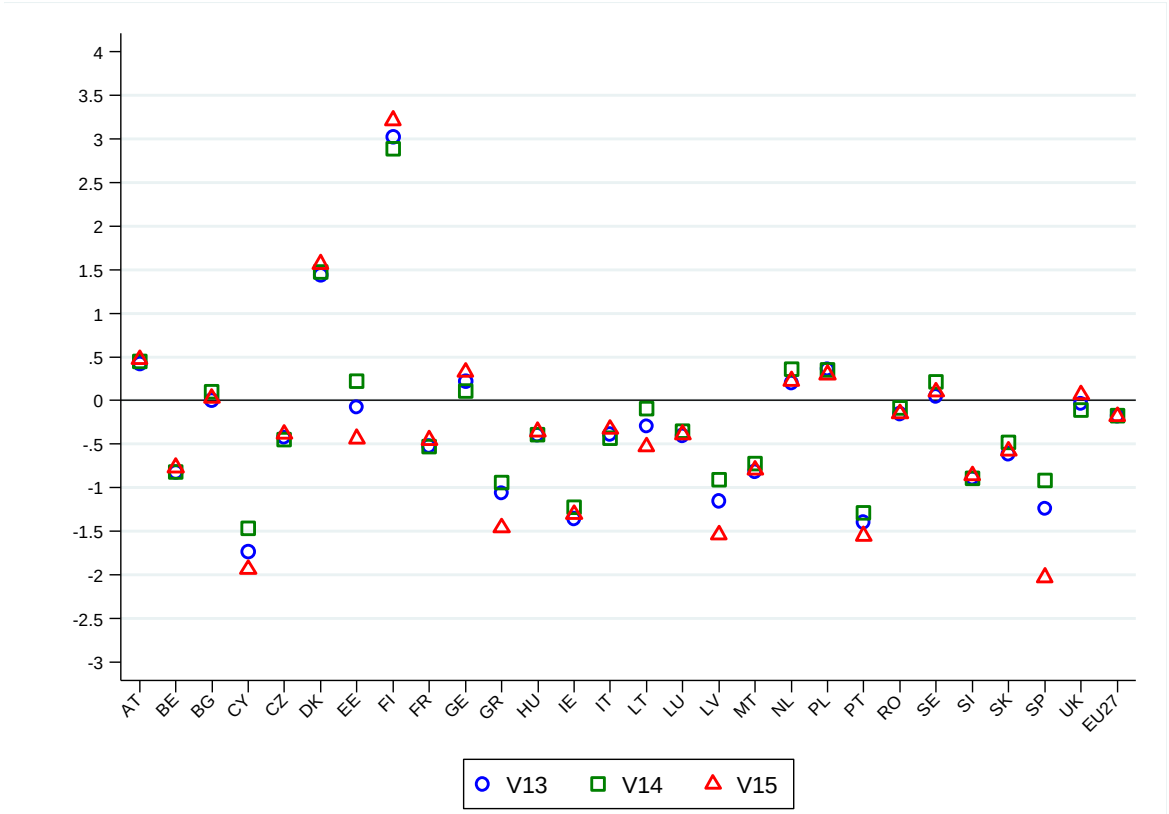
*Sources*: EU-LFS, EU-SILC and own calculations based on EUROMOD.

**Figure A.4-4. Accumulated net contributions in 2013 in per cent of 2013 GDP**




5
4
3
2
1
0
-1
-2
-3
AT BE BG CY CZ DK EE FI FR GE GR HU IE IT LT LU LV MT NL PL PT RO SE SI SK SP UK EU27
V5 V6 V7 V8


4
3.5
3
2.5
2
1.5
1
.5
0
-.5
-1
-1.5
-2
-2.5
-3
AT BE BG CY CZ DK EE FI FR GE GR HU IE IT LT LU LV MT NL PL PT RO SE SI SK SP UK EU27
V9 V10 V11 V12


4
3.5
3
2.5
2
1.5
1
.5
0
-.5
-1
-1.5
-2
-2.5
-3
AT BE BG CY CZ DK EE FI FR GE GR HU IE IT LT LU LV MT NL PL PT RO SE SI SK SP UK EU27
V13
V14
V15

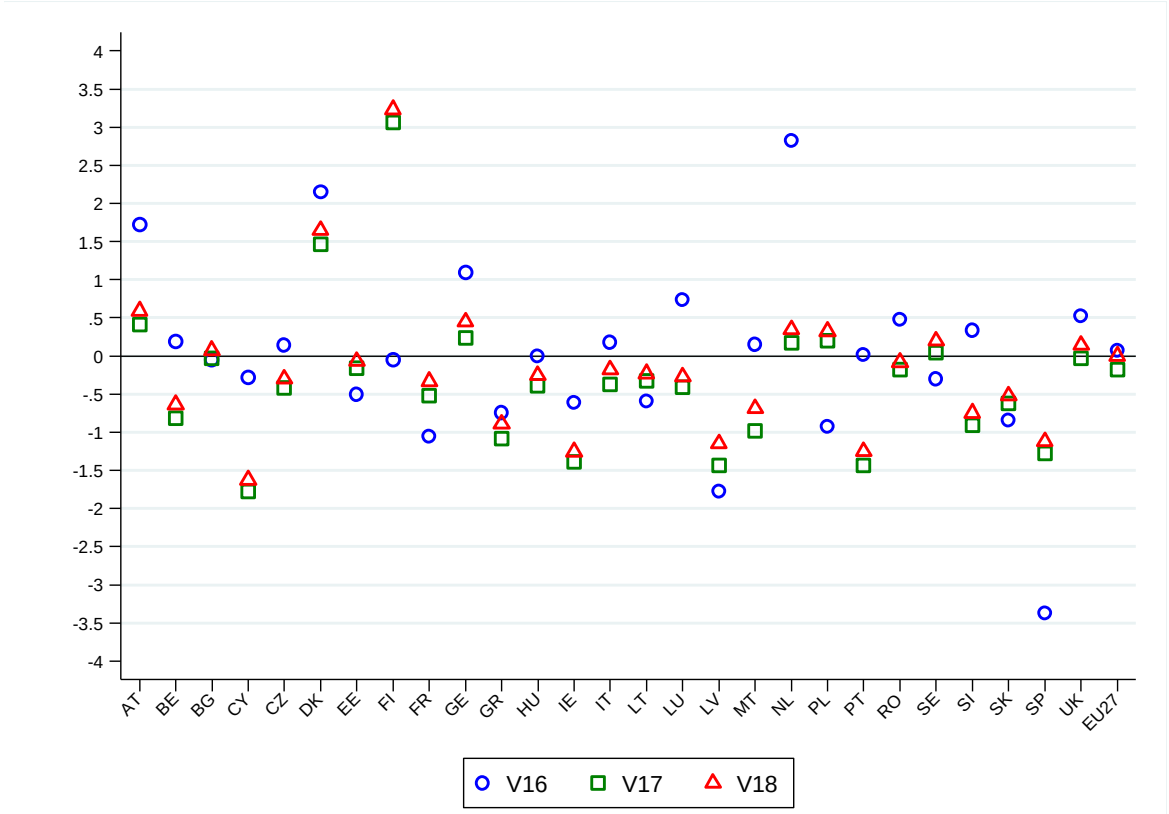
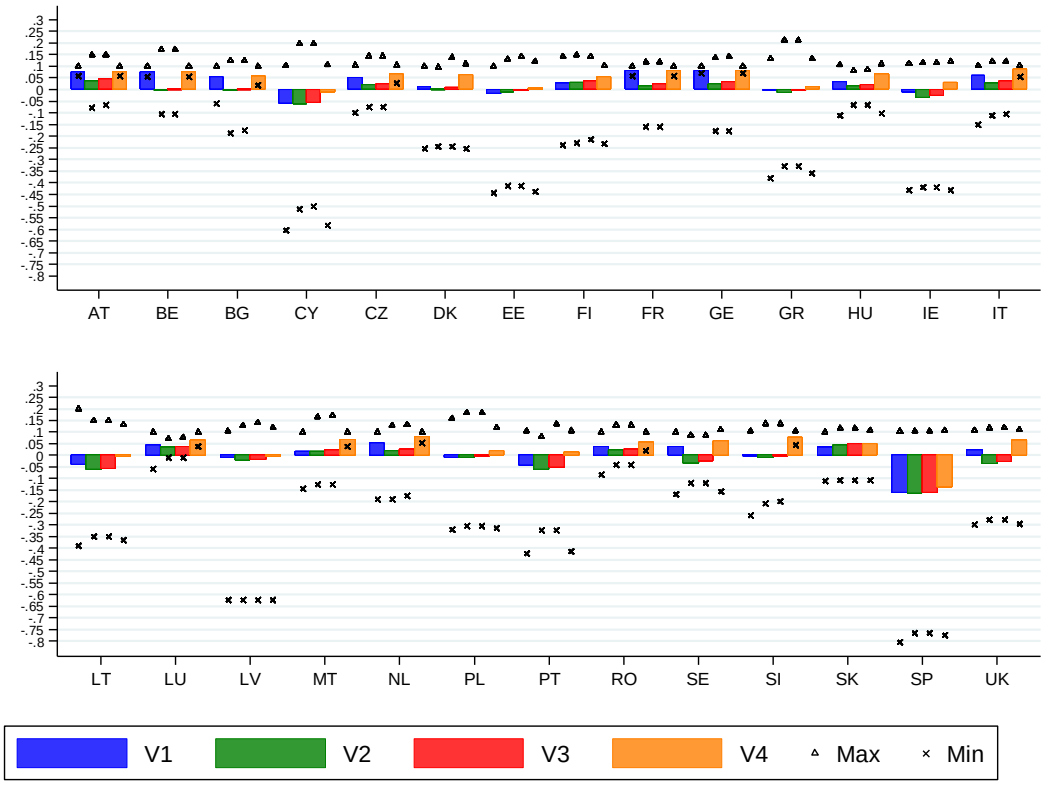
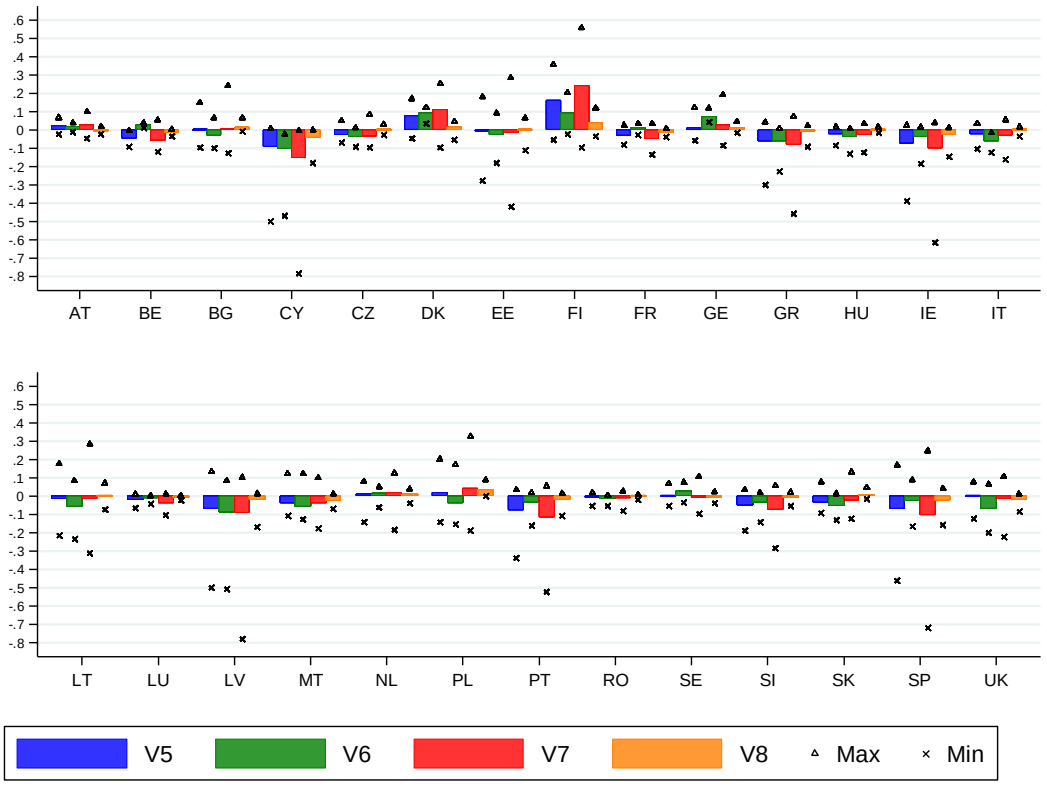
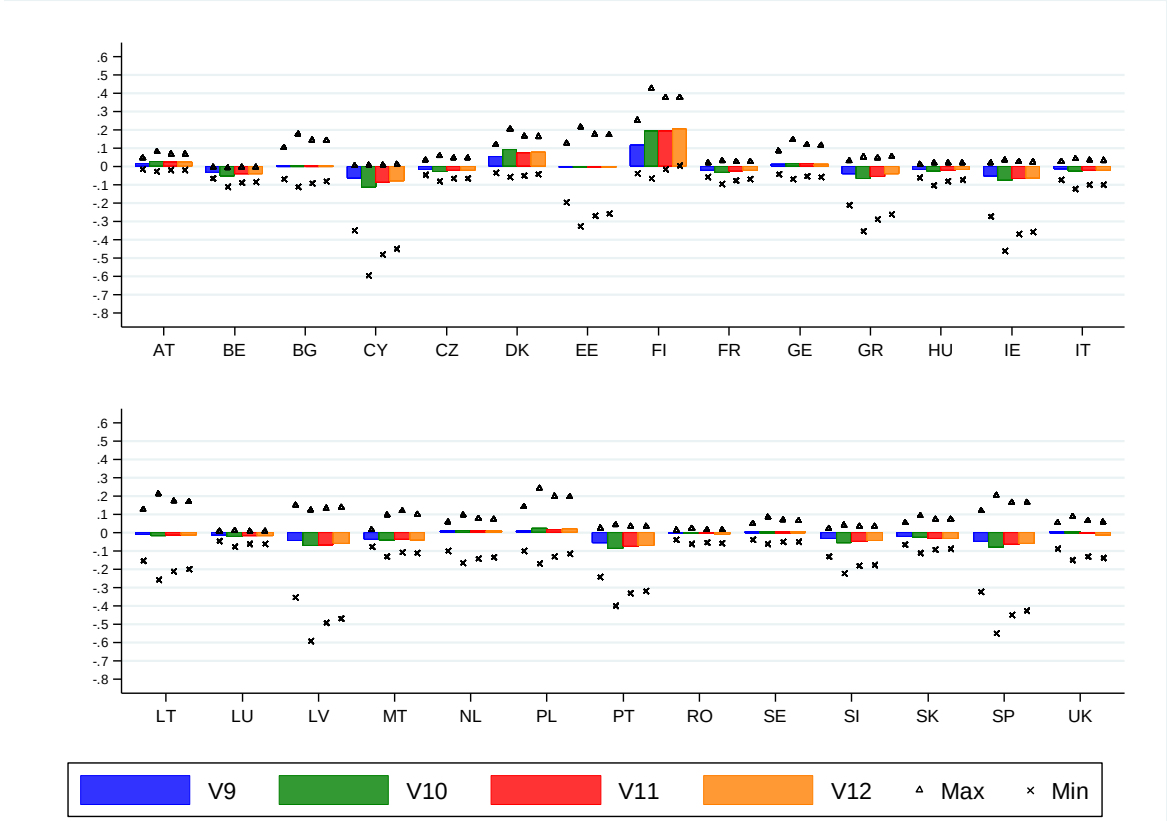
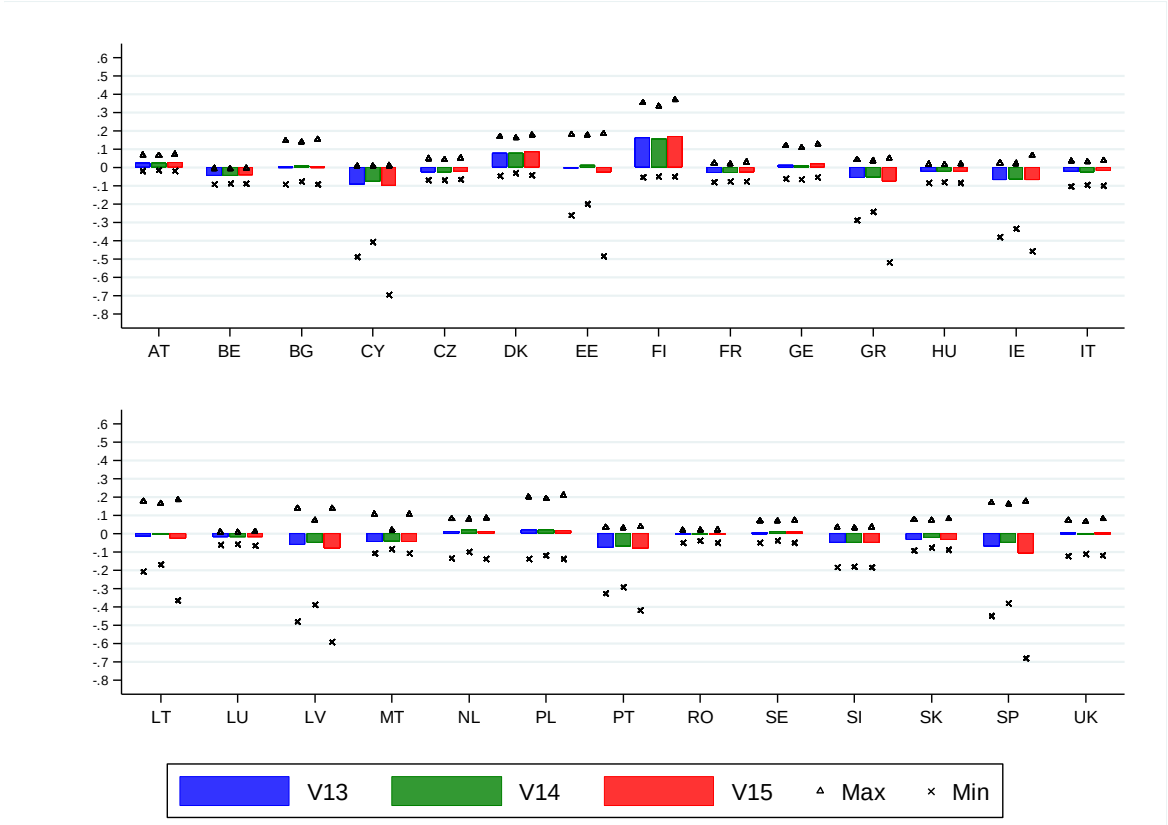

4
3.5
3
2.5
2
1.5
1
.5
0
-.5
-1
-1.5
-2
-2.5
-3
-3.5
-4
AT BE BG CY CZ DK EE FI FR GE GR HU IE IT LT LU LV MT NL PL PT RO SE SI SK SP UK EU27
V16
V17
V18

**Figure A.4-5. Average yearly net contributions (1995-2013) in per cent of 2013 GDP**




.6
.5
.4
.3
.2
.1
0
-.1
-.2
-.3
-.4
-.5
-.6
-.7
-.8
AT BE BG CY CZ DK EE FI FR GE GR HU IE IT
LT LU LV MT NL PL PT RO SE SI SK SP UK
V9
V10
V11
V12
Max
Min


.6
.5
.4
.3
.2
.1
0
-.1
-.2
-.3
-.4
-.5
-.6
-.7
-.8
AT BE BG CY CZ DK EE FI FR GE GR HU IE IT
LT LU LV MT NL PL PT RO SE SI SK SP UK
V13
V14
V15
Max
Min

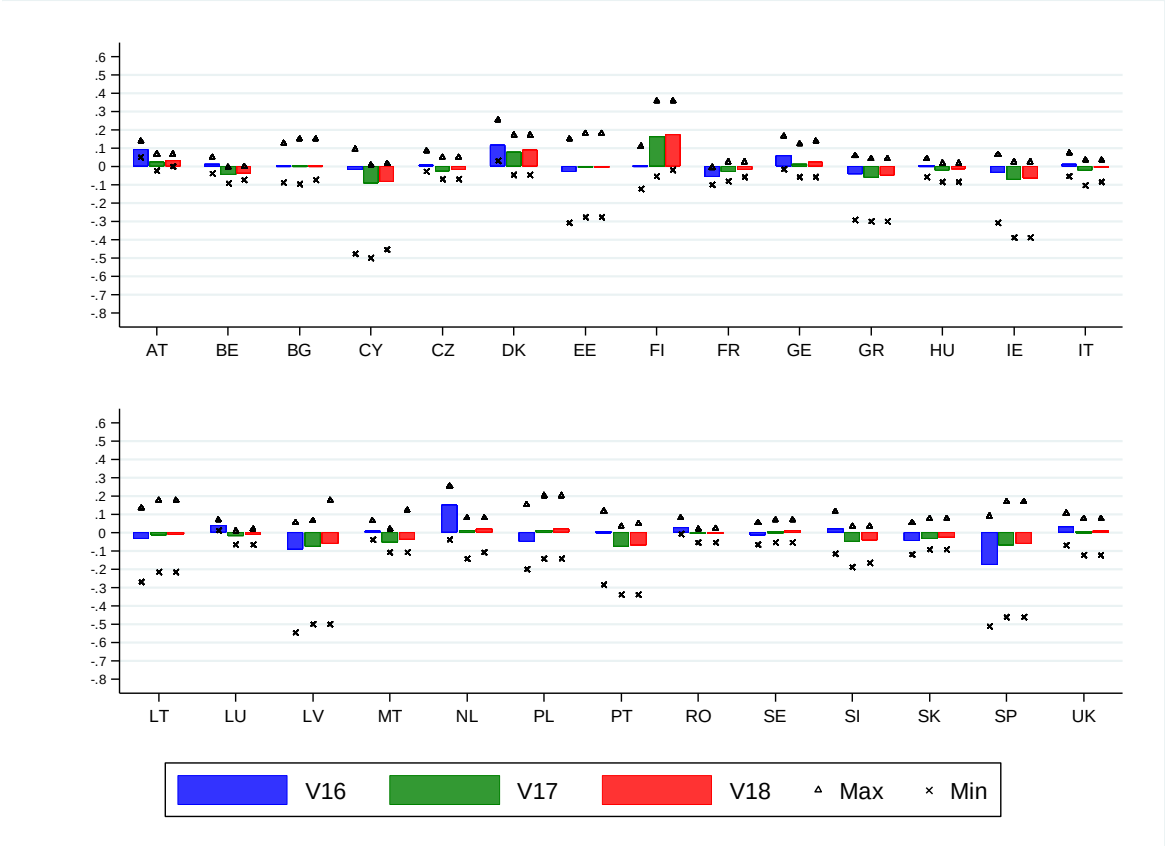
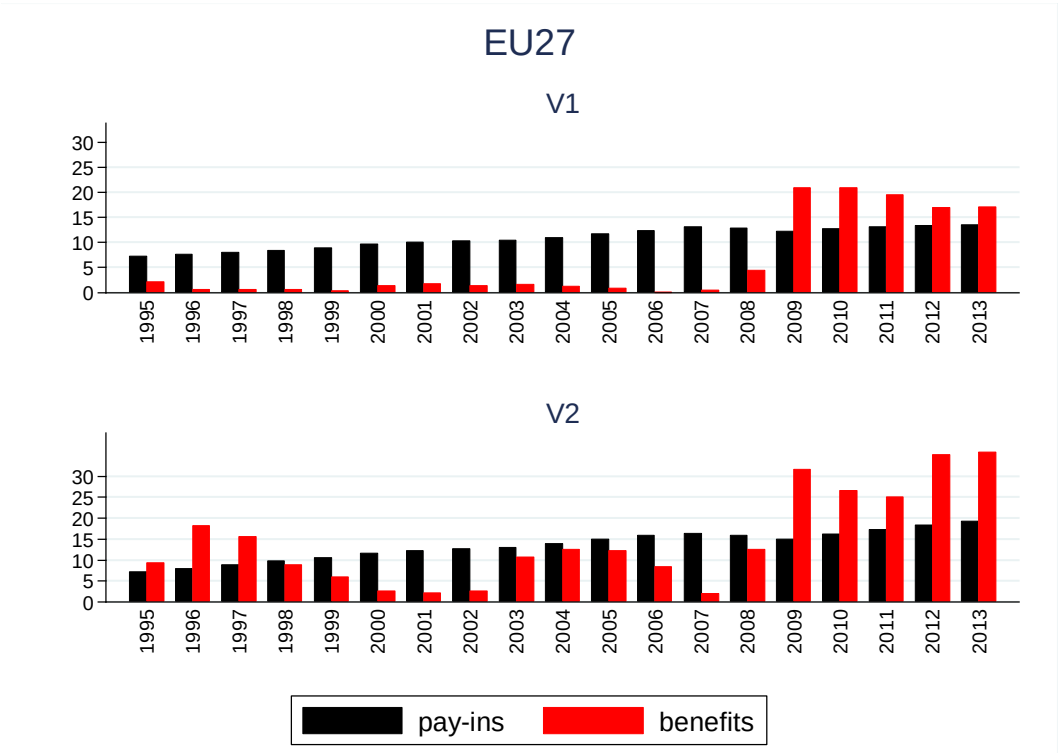
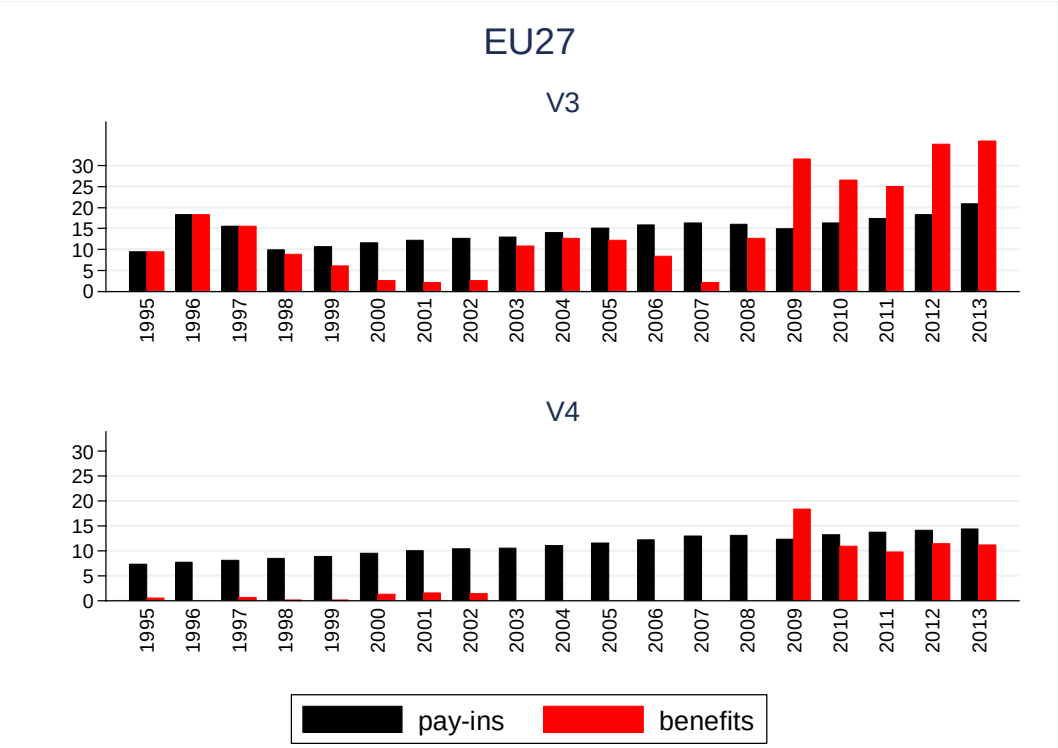
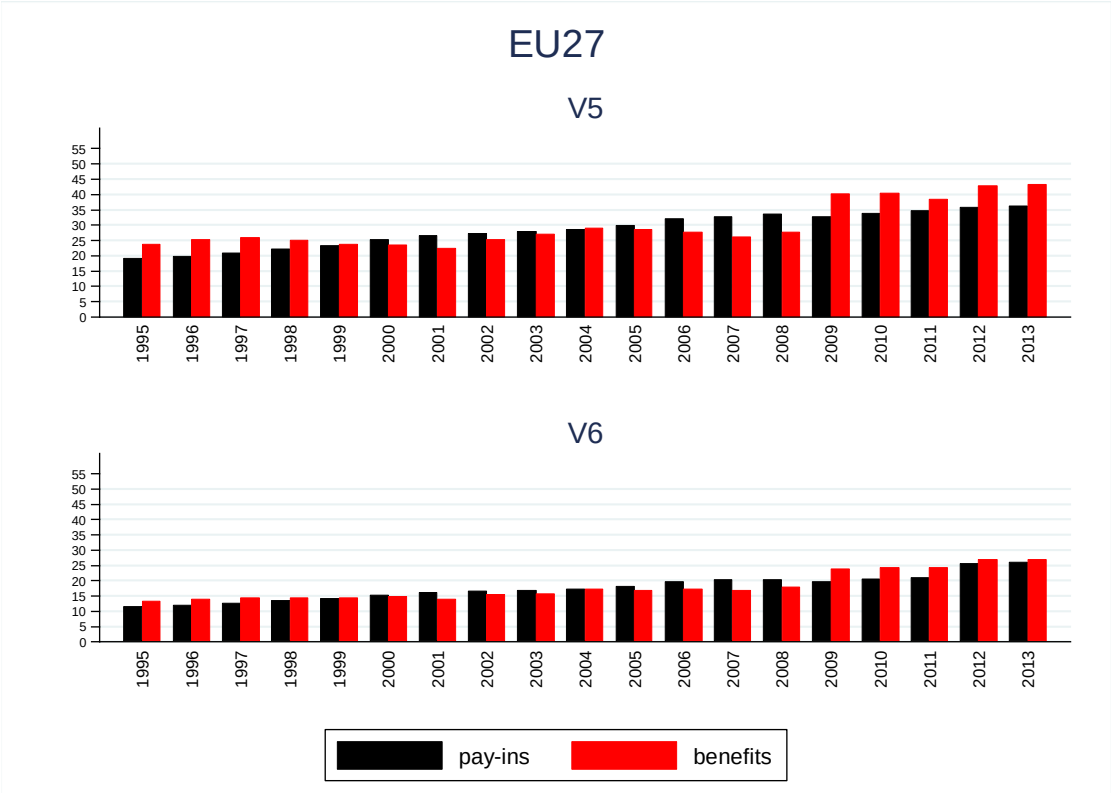
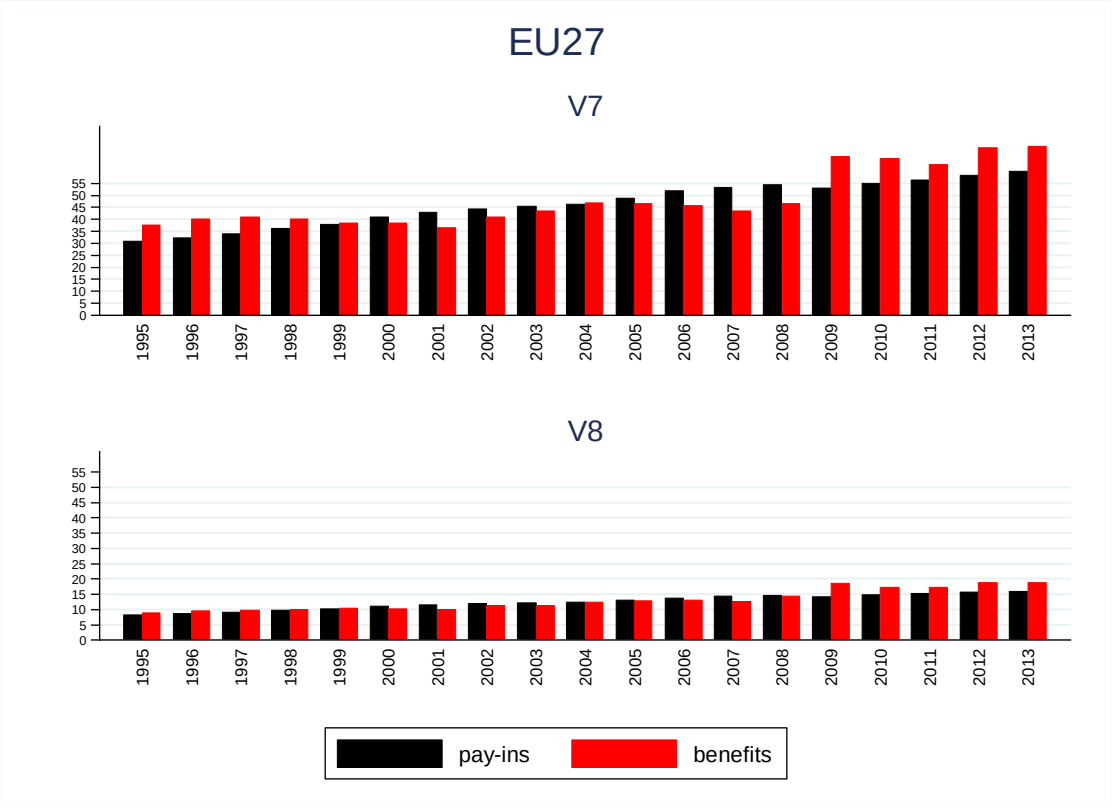


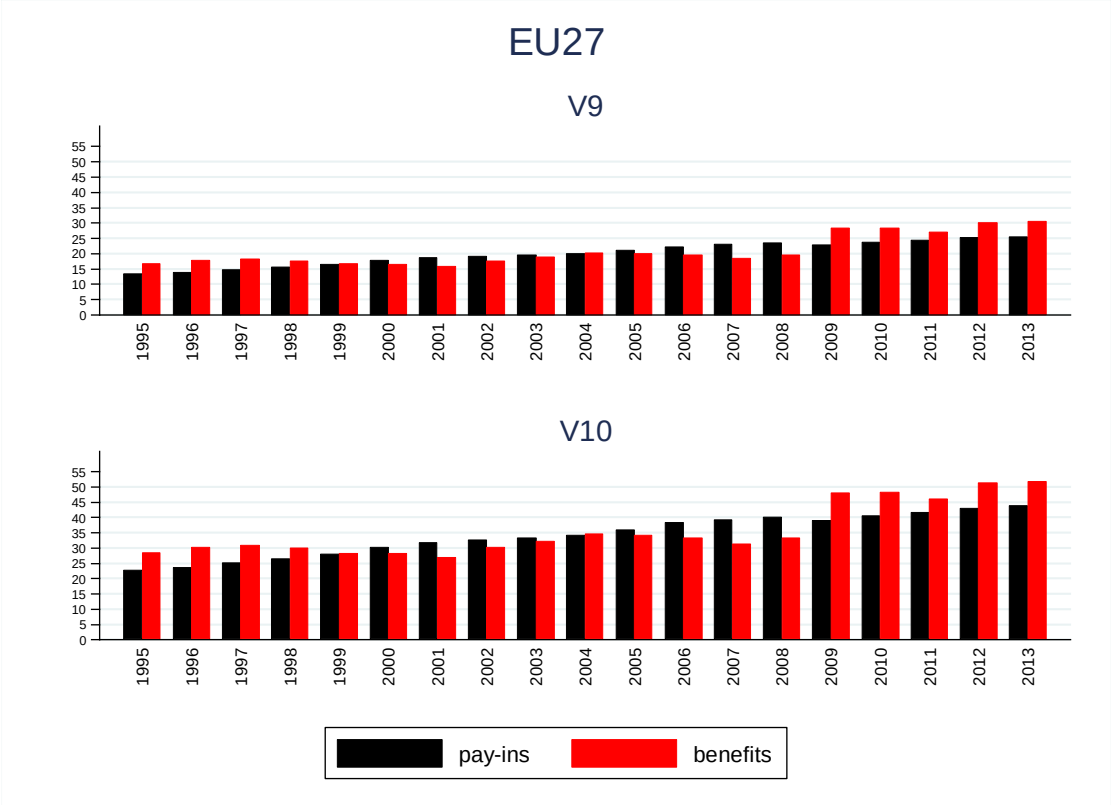

**Figure A.4-6. Overall pay-ins and benefits, 1995-2013**

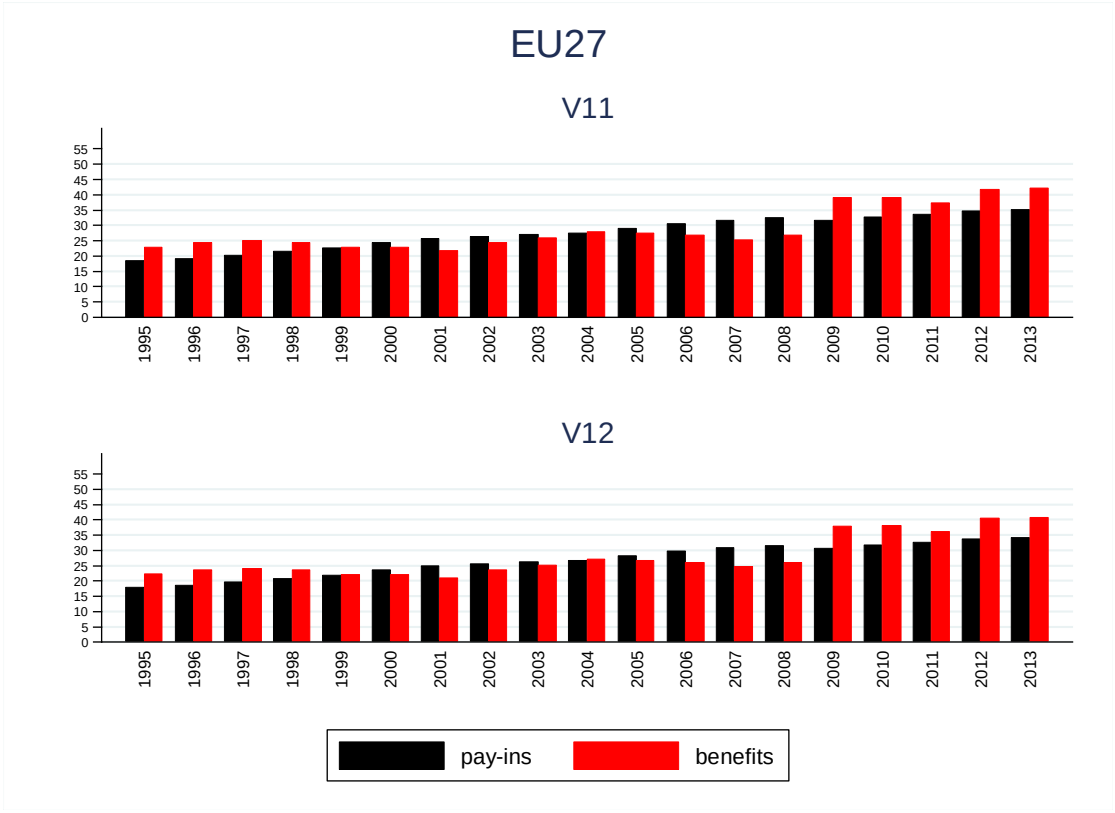


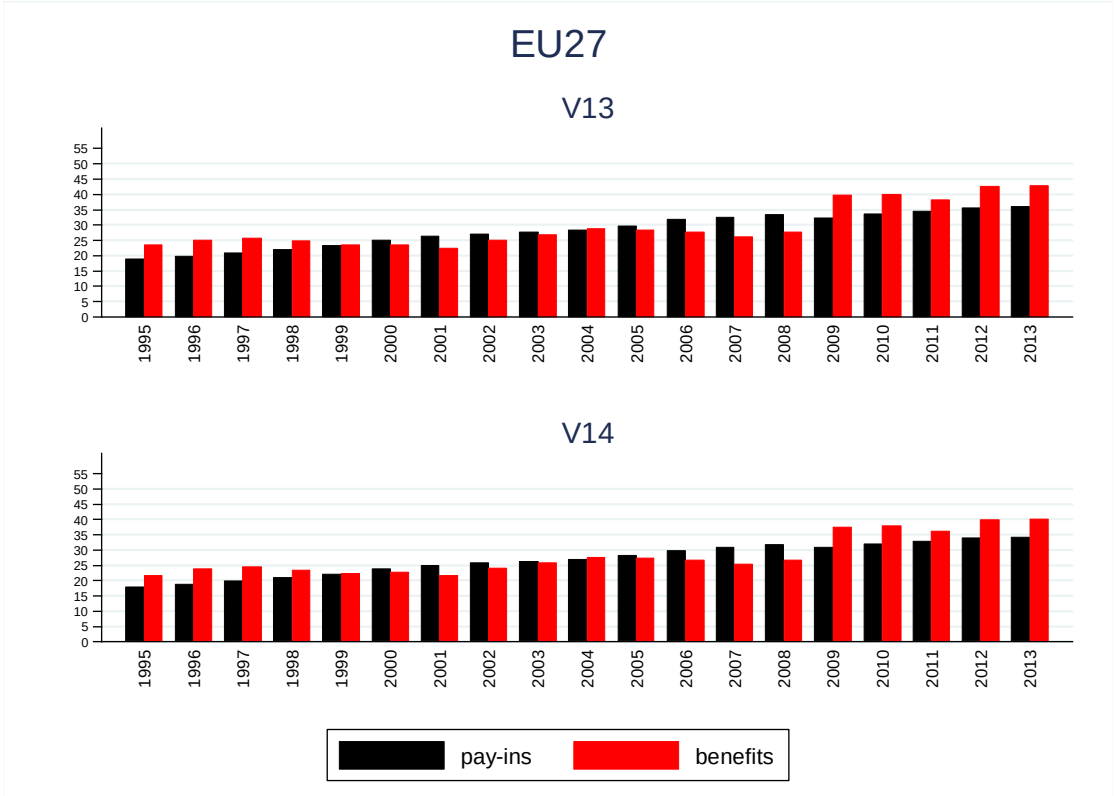

EU27
V3
30
25
20
15
10
5
0
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
V4
30
25
20
15
10
5
0
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
pay-ins
benefits

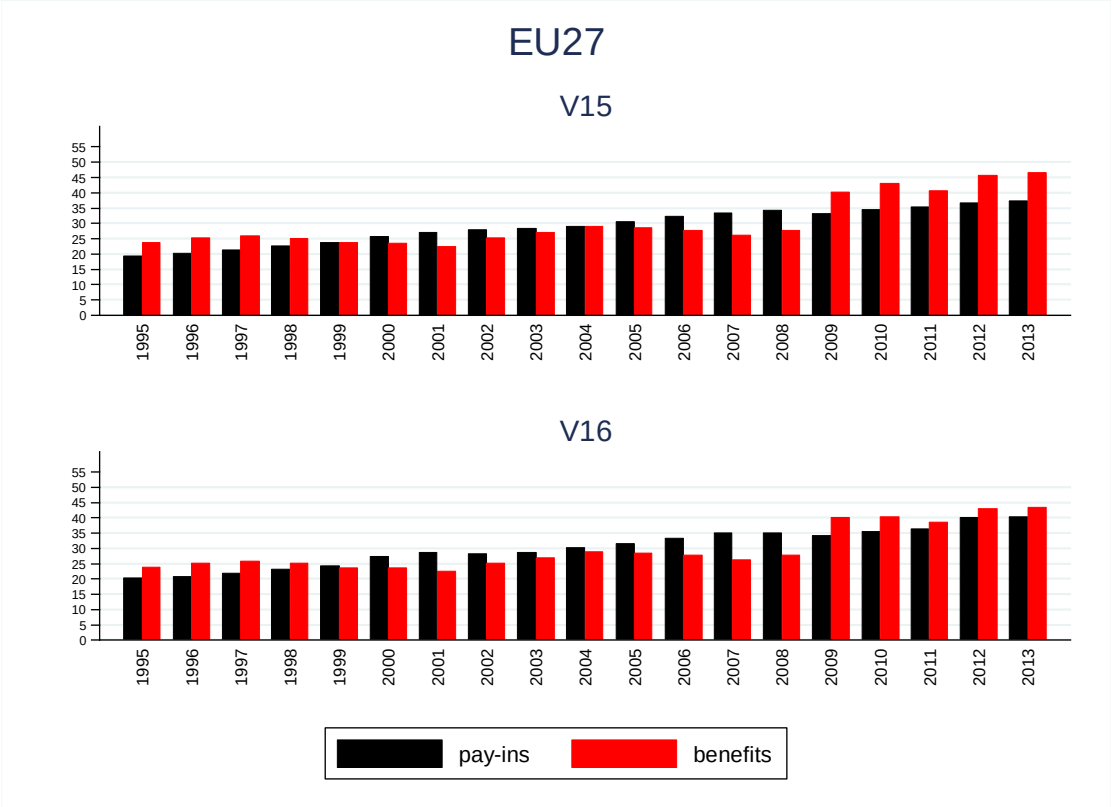

EU27
V5
55
50
45
40
35
30
25
20
15
10
5
0
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
V6
55
50
45
40
35
30
25
20
15
10
5
0
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
pay-ins
benefits


EU27
V7
V8
0
5
10
15
20
25
30
35
40
45
50
55
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
pay-ins
benefits


EU27
V9
V10
0
5
10
15
20
25
30
35
40
45
50
55
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
pay-ins
benefits


EU27
V11
V12
pay-ins
benefits


EU27
V13
V14
pay-ins
benefits


EU27
V15
V16
pay-ins
benefits

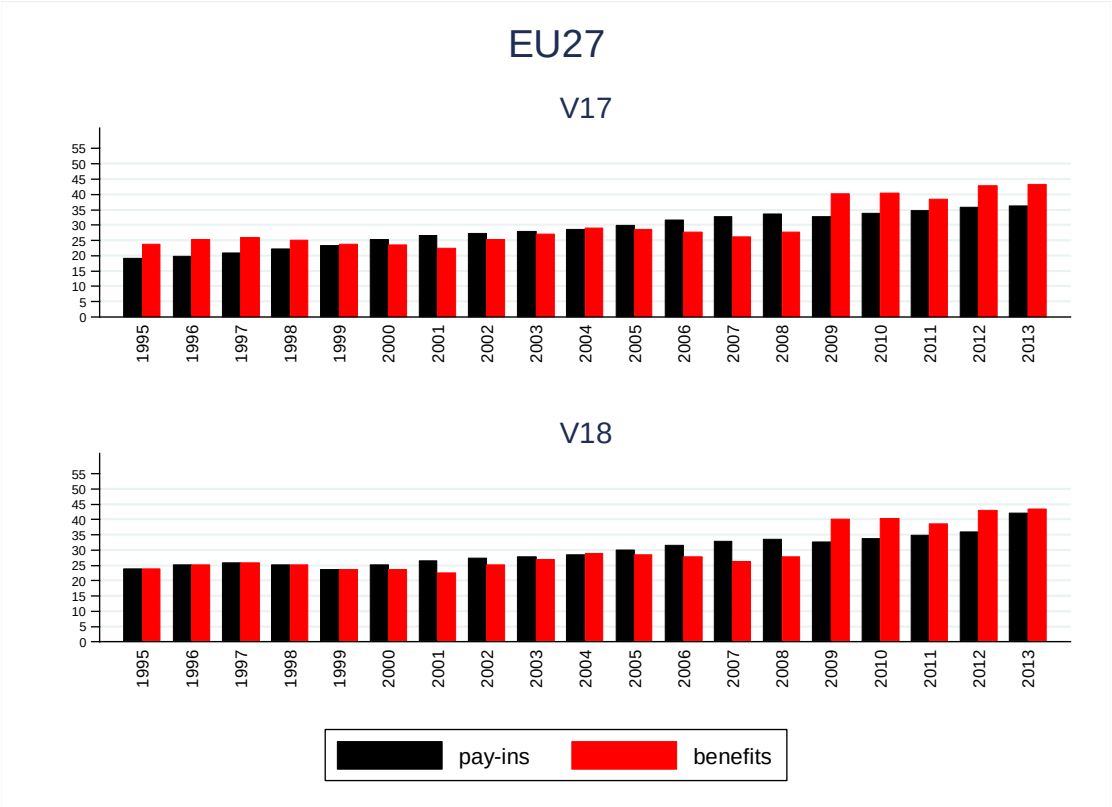
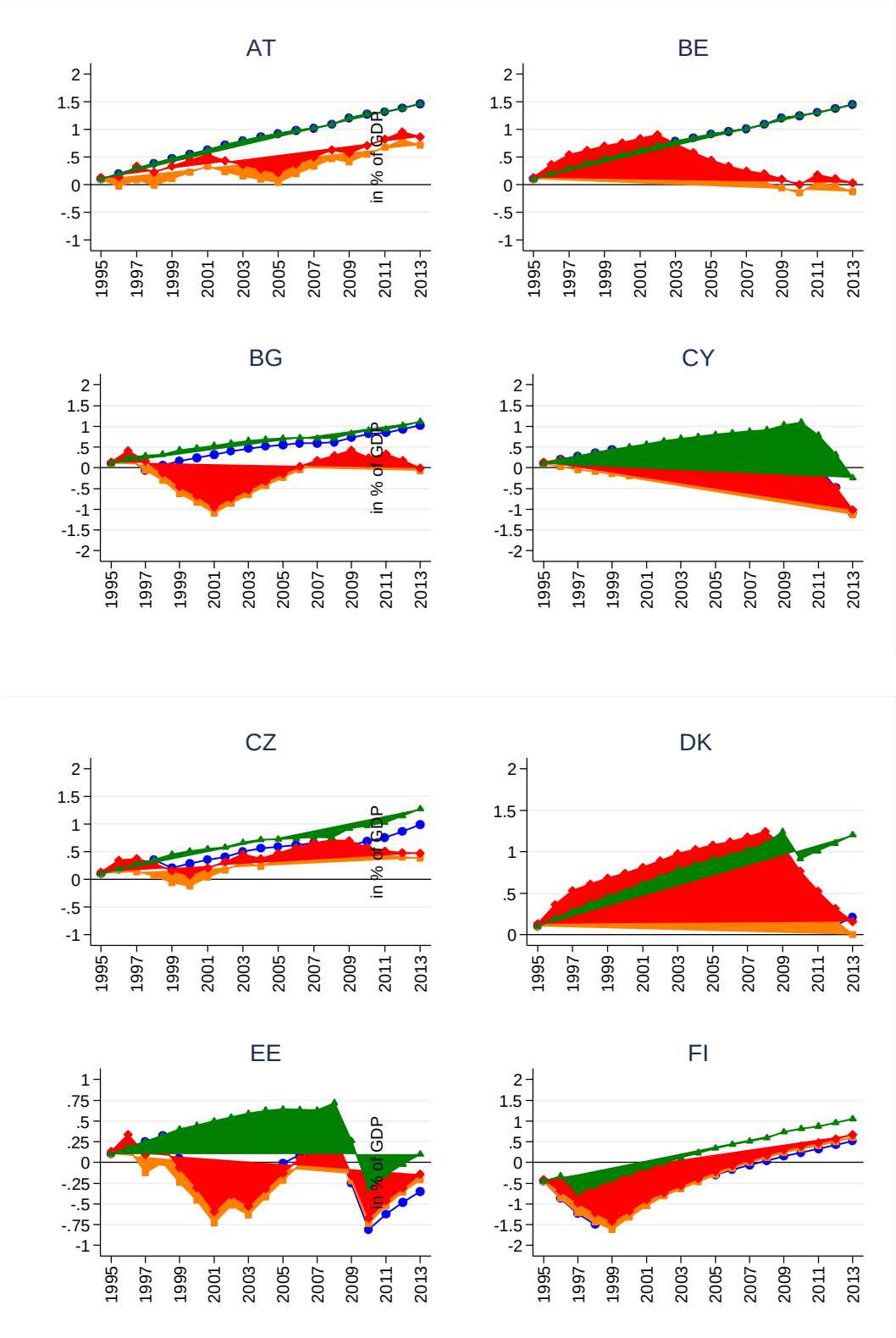
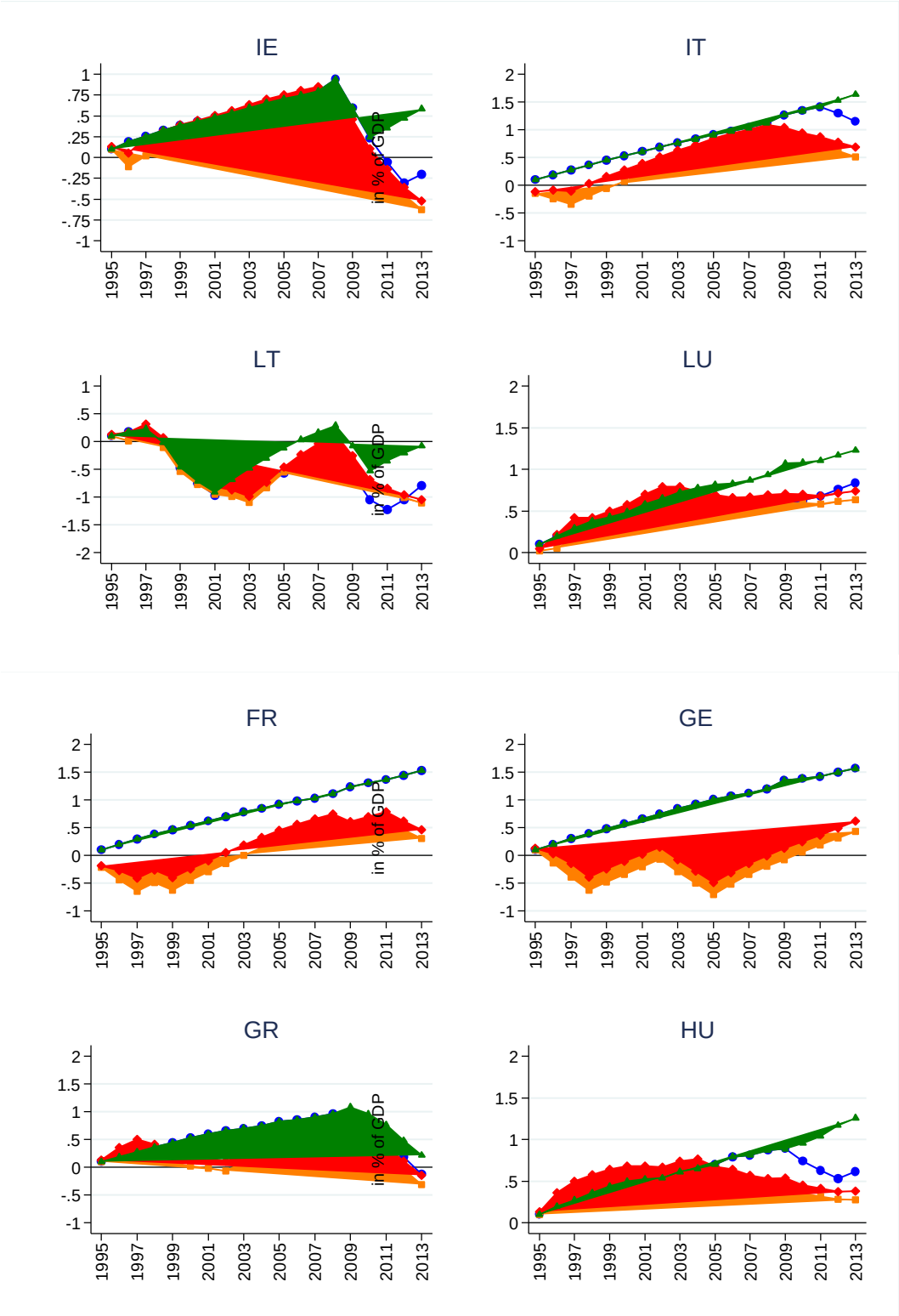
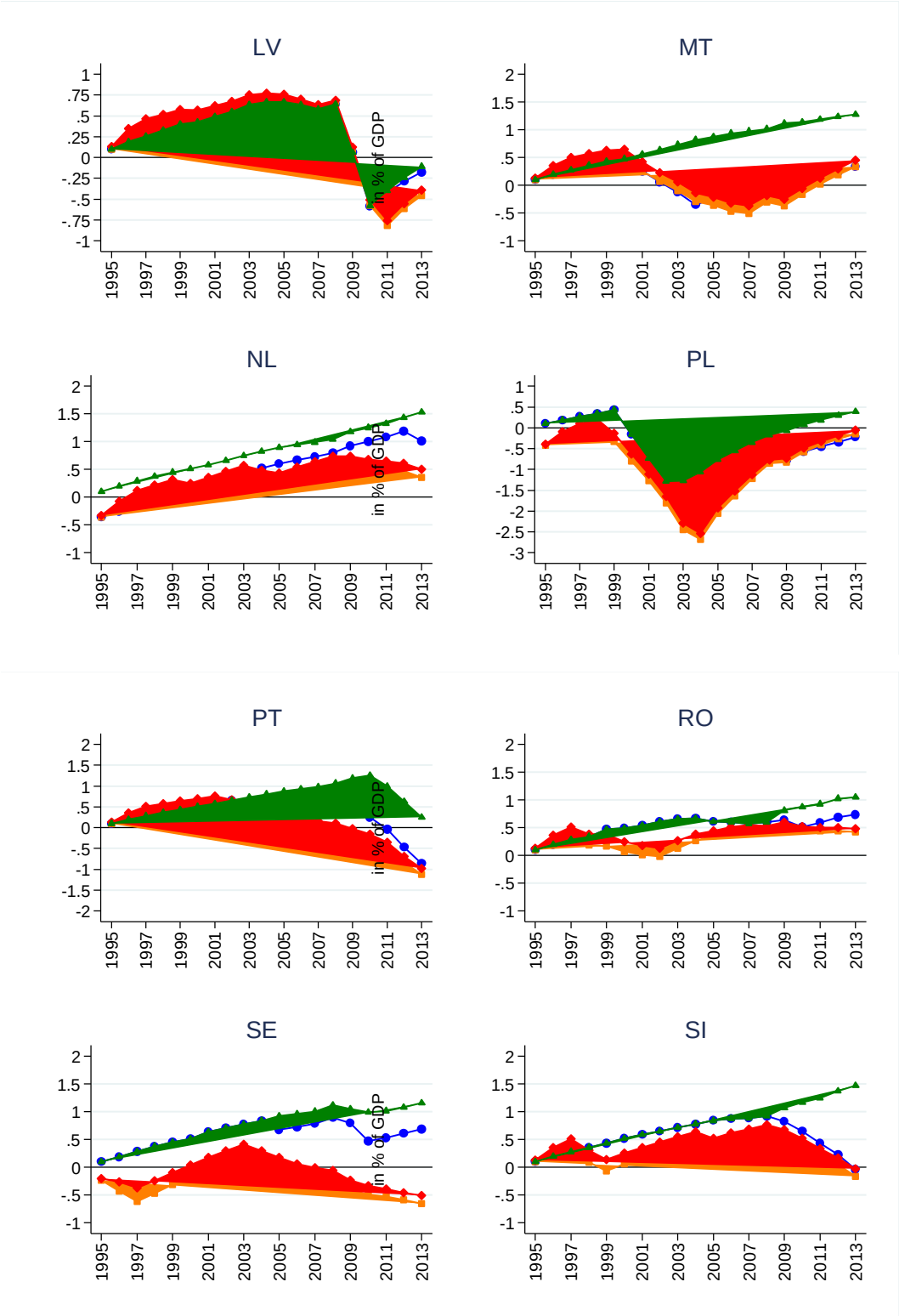

EU27
V17
V18
pay-ins
benefits

**Figure A.4-7. Cumulative net contributions: Equivalent systems**




IE
IT
LT
LU
FR
GE
GR
HU
in % of GDP
1995
1997
1999
2001
2003
2005
2007
2009
2011
2013


LV
MT
NL
PL
PT
RO
SE
SI
in % of GDP

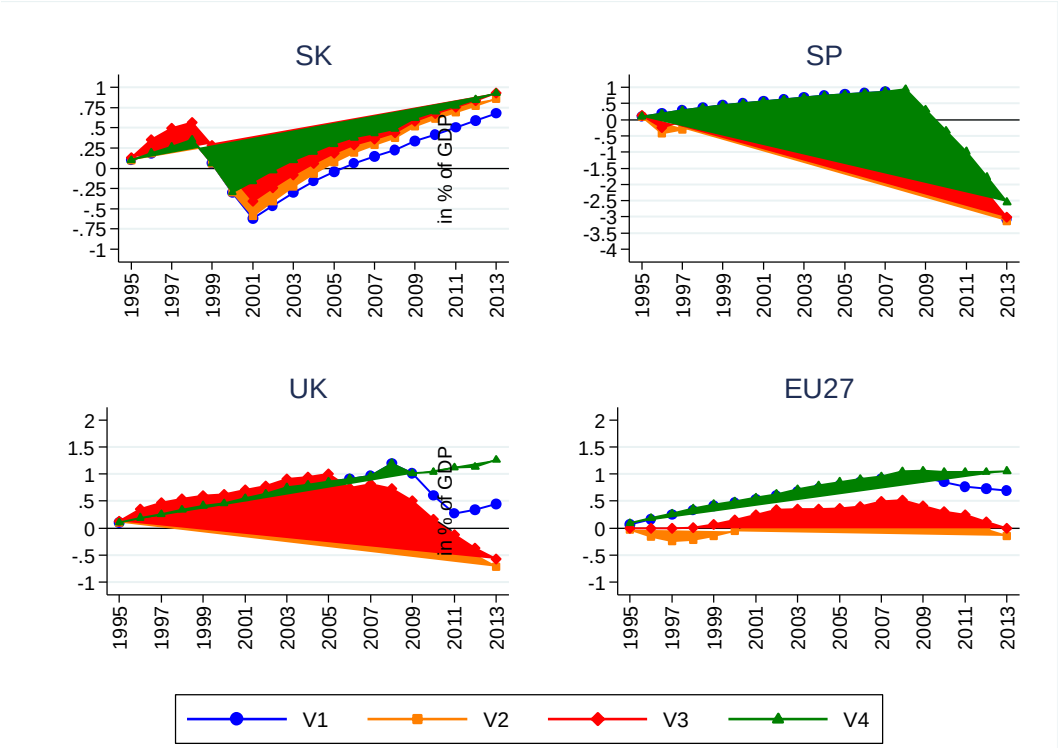
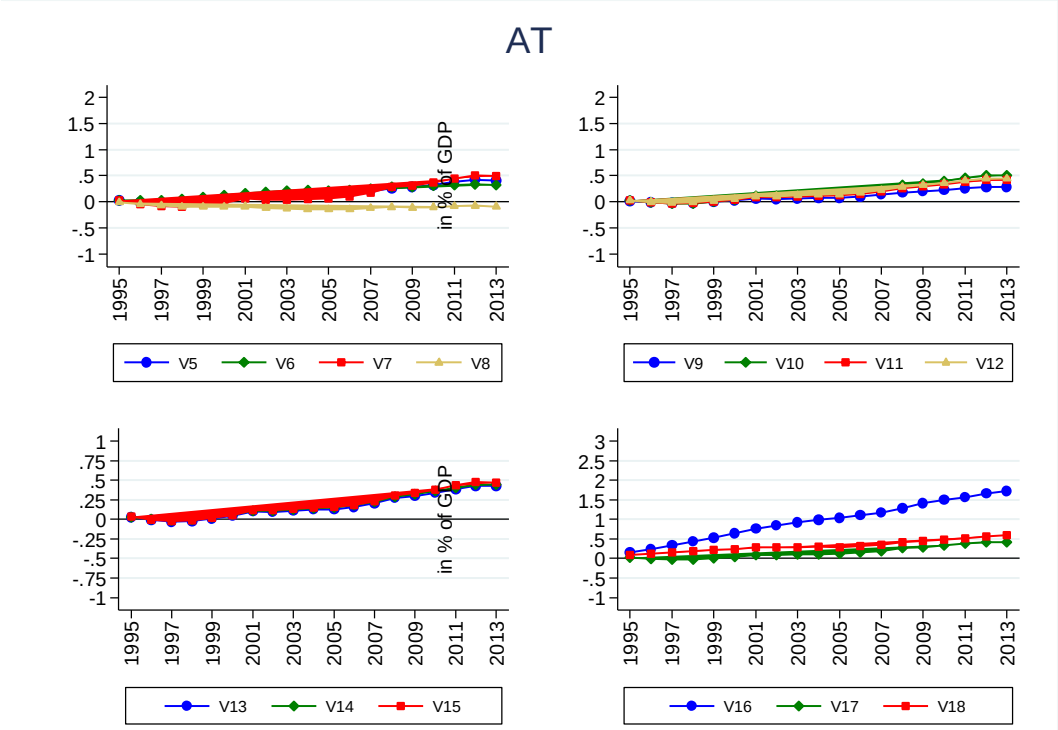
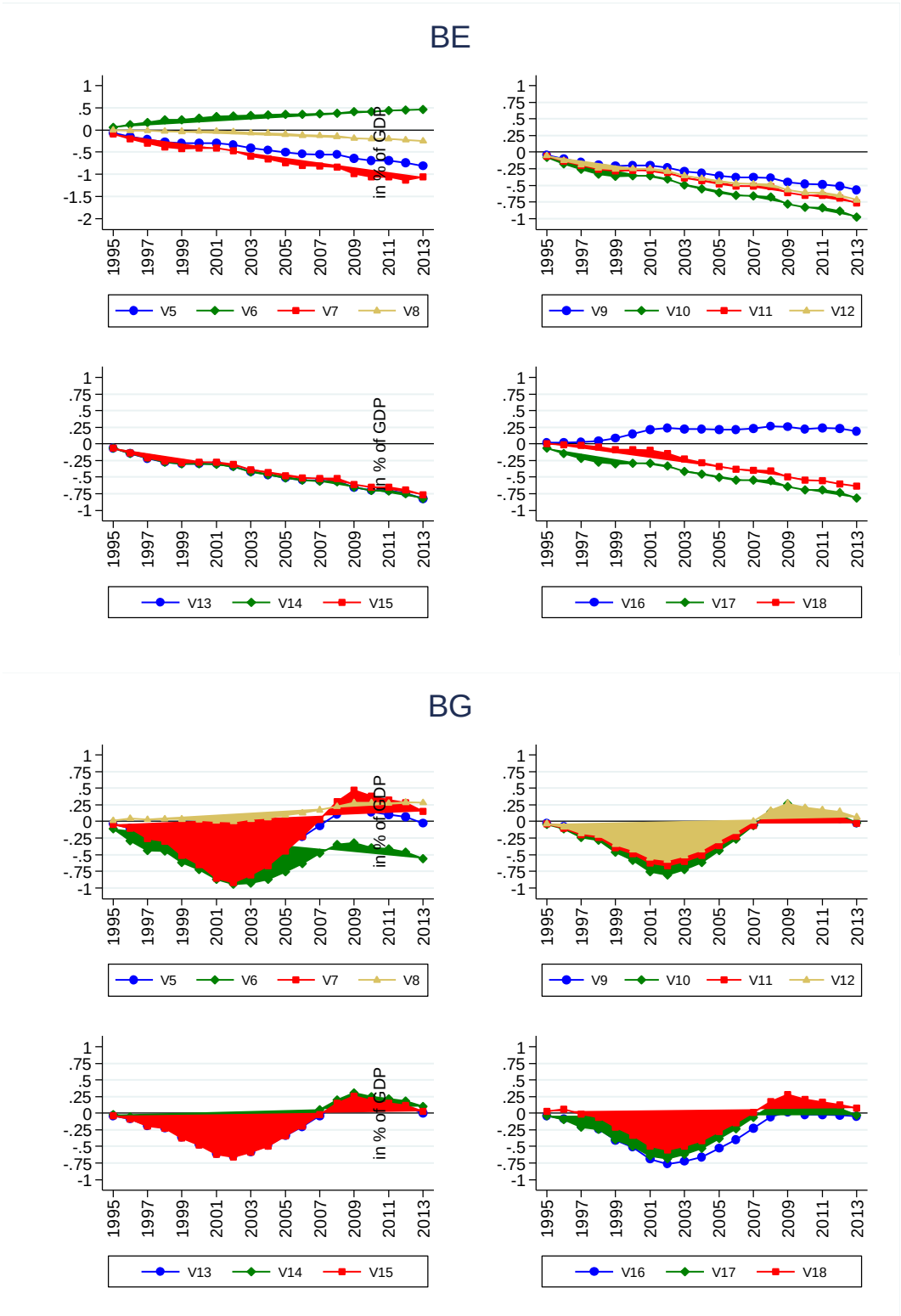
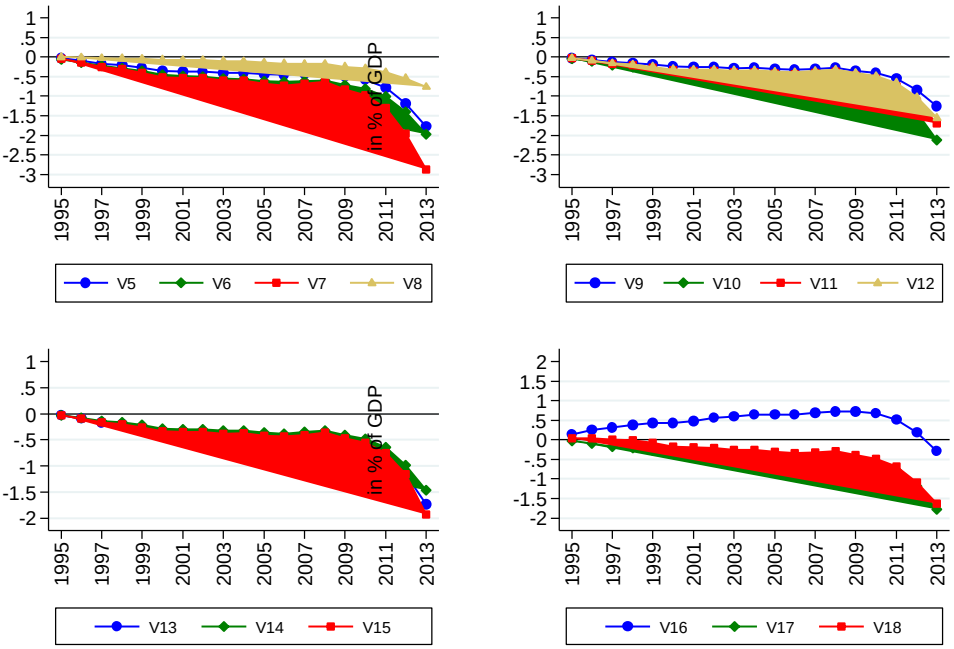



**Figure A.4-8. Cumulative net contributions: Genuine systems**

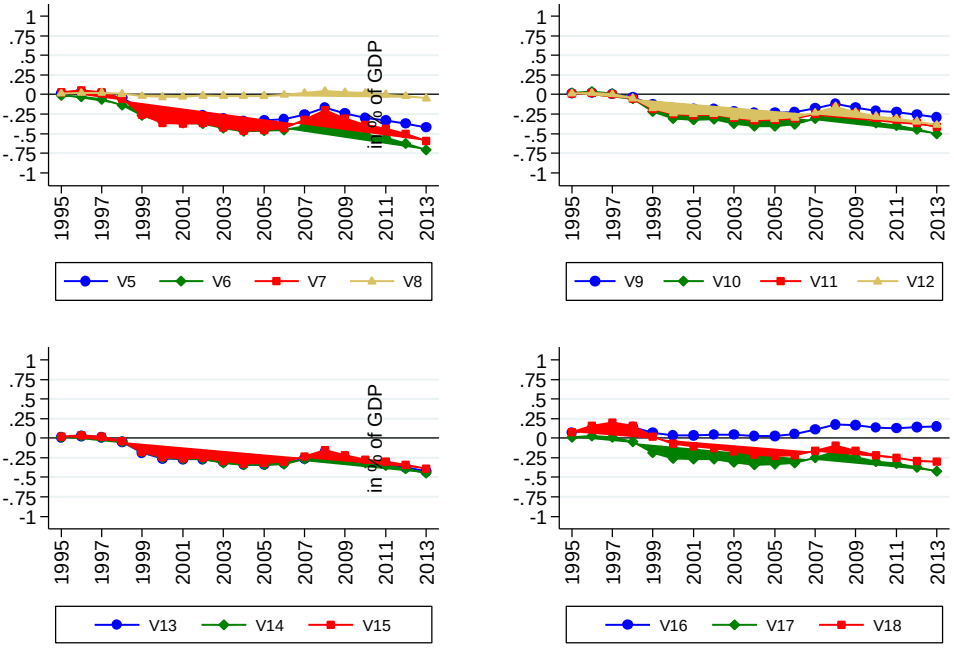



BE
in % of GDP
V5 V6 V7 V8
V9 V10 V11 V12
V13 V14 V15
V16 V17 V18
BG
in % of GDP
V5 V6 V7 V8
V9 V10 V11 V12
V13 V14 V15
V16 V17 V18

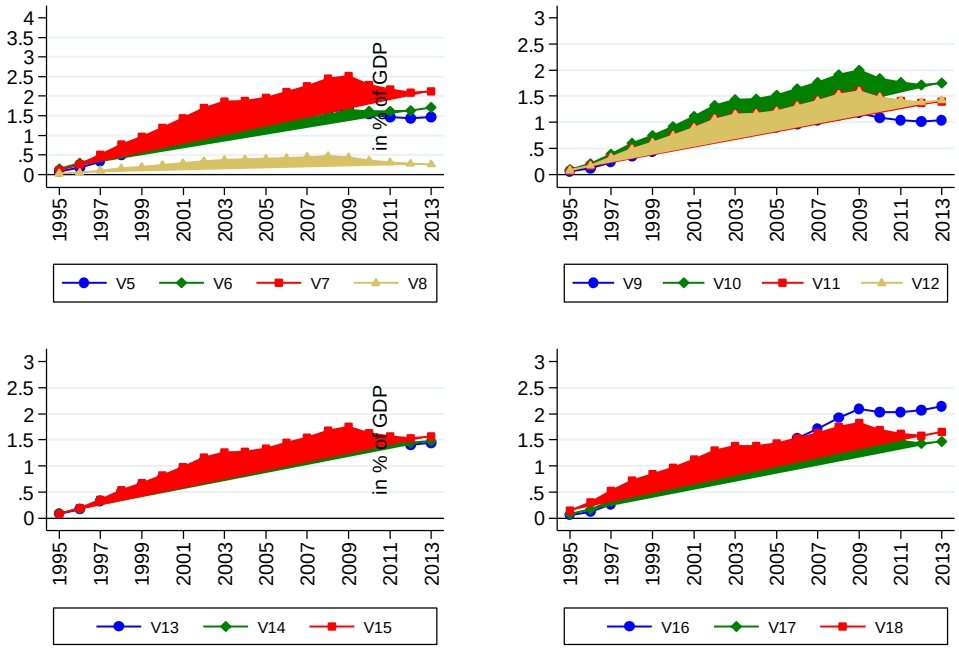
## CY


in % of GDP
V5 V6 V7 V8
V9 V10 V11 V12
V13 V14 V15
V16 V17 V18

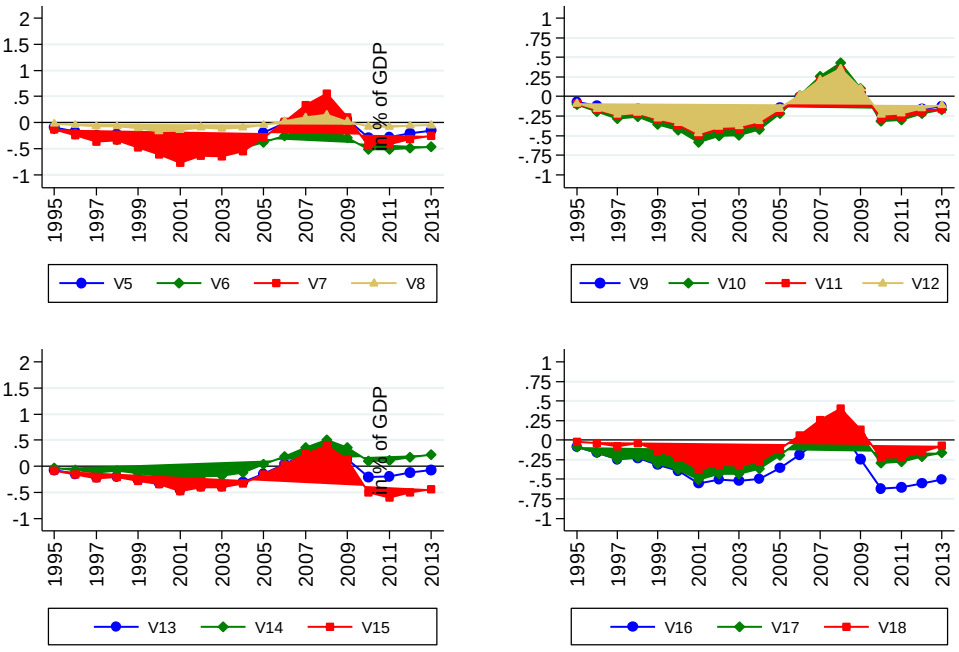
## CZ


in % of GDP
V5 V6 V7 V8
V9 V10 V11 V12
V13 V14 V15
V16 V17 V18

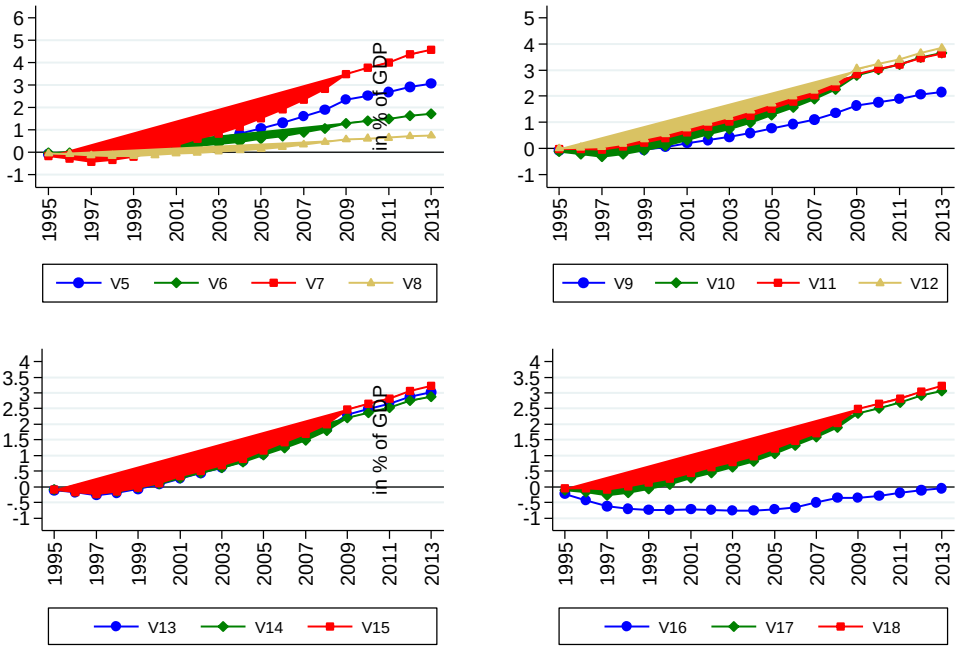
## DK


in % of GDP
V5 V6 V7 V8
V9 V10 V11 V12
V13 V14 V15
V16 V17 V18

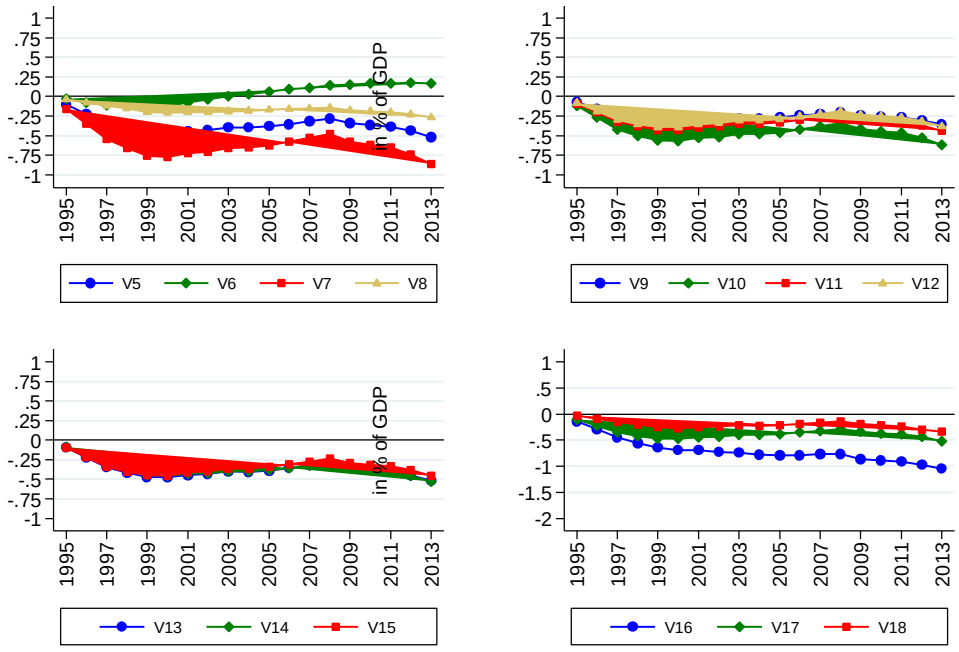
## EE

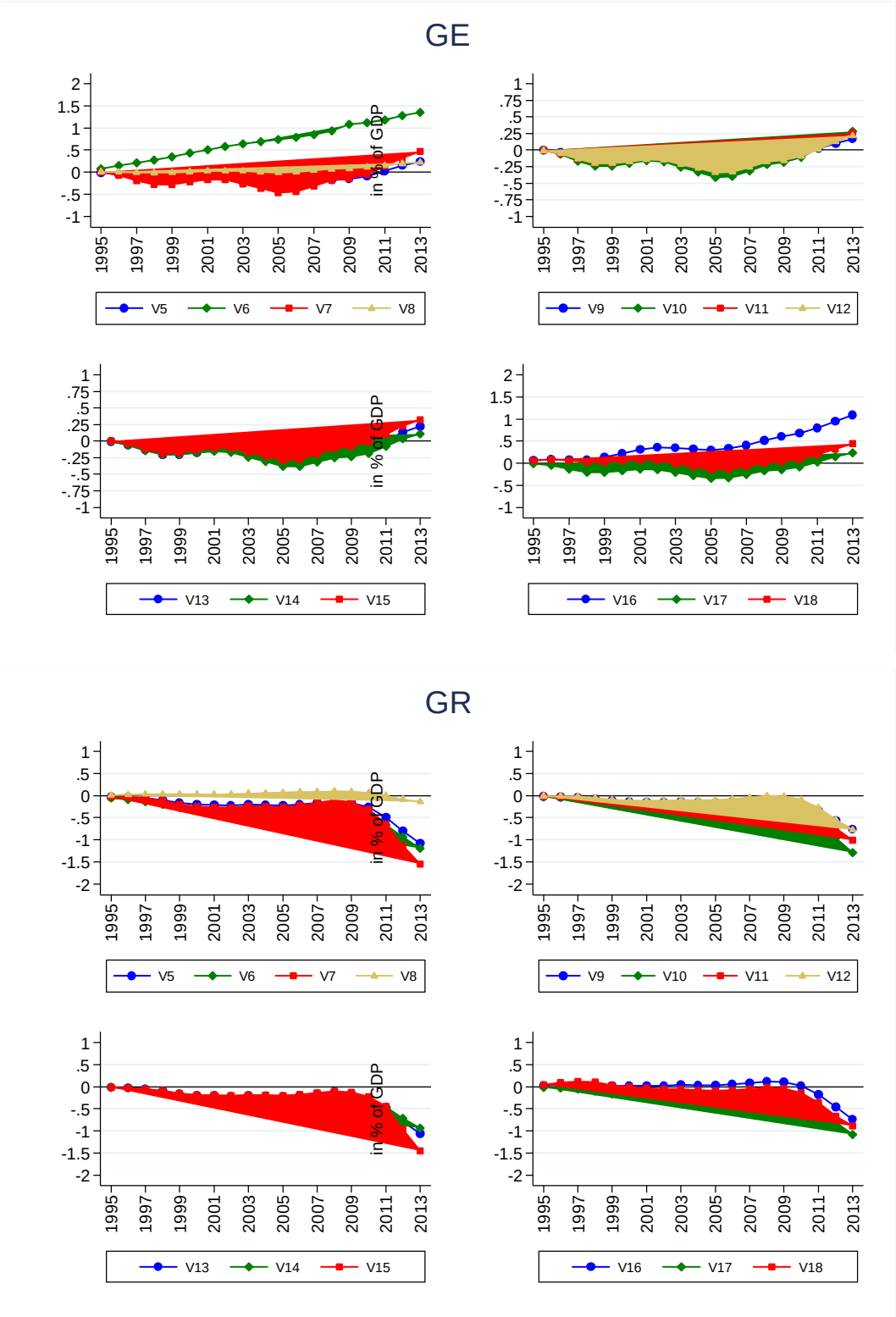

in % of GDP
V5 V6 V7 V8
V9 V10 V11 V12
V13 V14 V15
V16 V17 V18

## FI

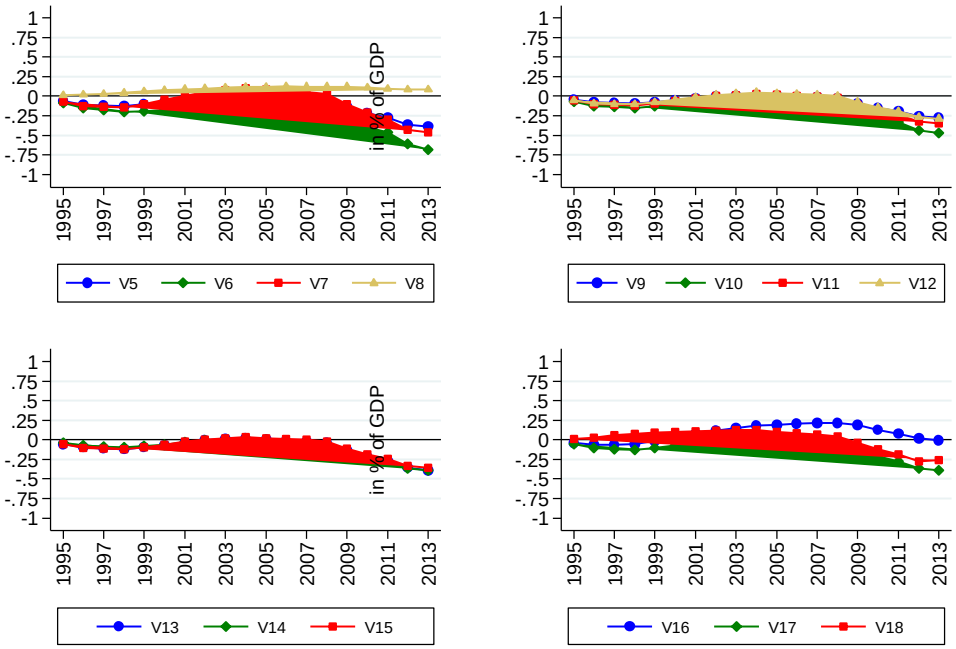

in % of GDP
V5 V6 V7 V8
V9 V10 V11 V12
V13 V14 V15
V16 V17 V18

## FR

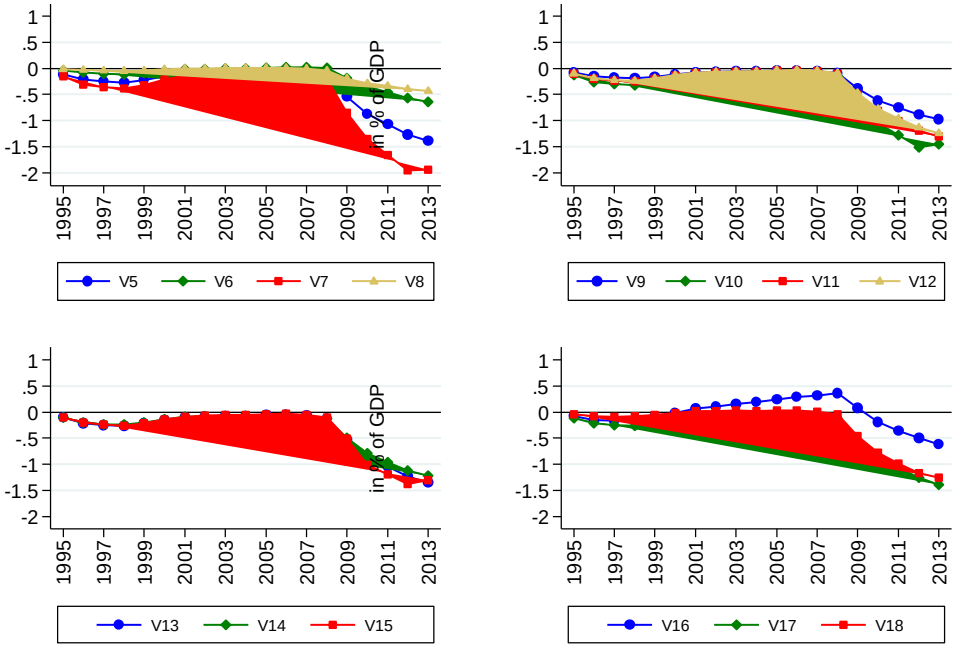

in % of GDP
V5 V6 V7 V8
V9 V10 V11 V12
V13 V14 V15
V16 V17 V18

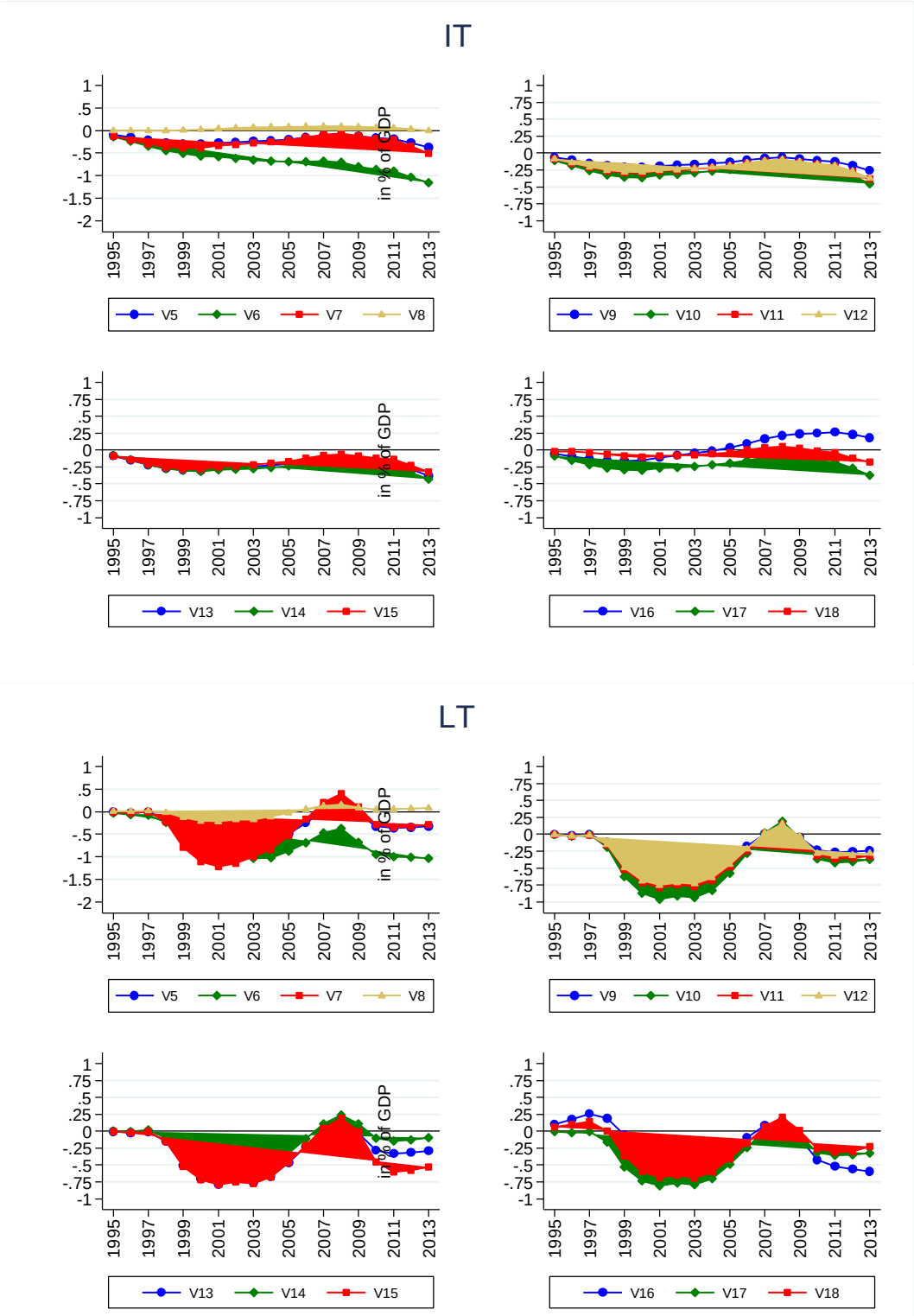

GE
in % of GDP
V5 V6 V7 V8
V9 V10 V11 V12
V13 V14 V15
V16 V17 V18
GR
in % of GDP
V5 V6 V7 V8
V9 V10 V11 V12
V13 V14 V15
V16 V17 V18

## HU

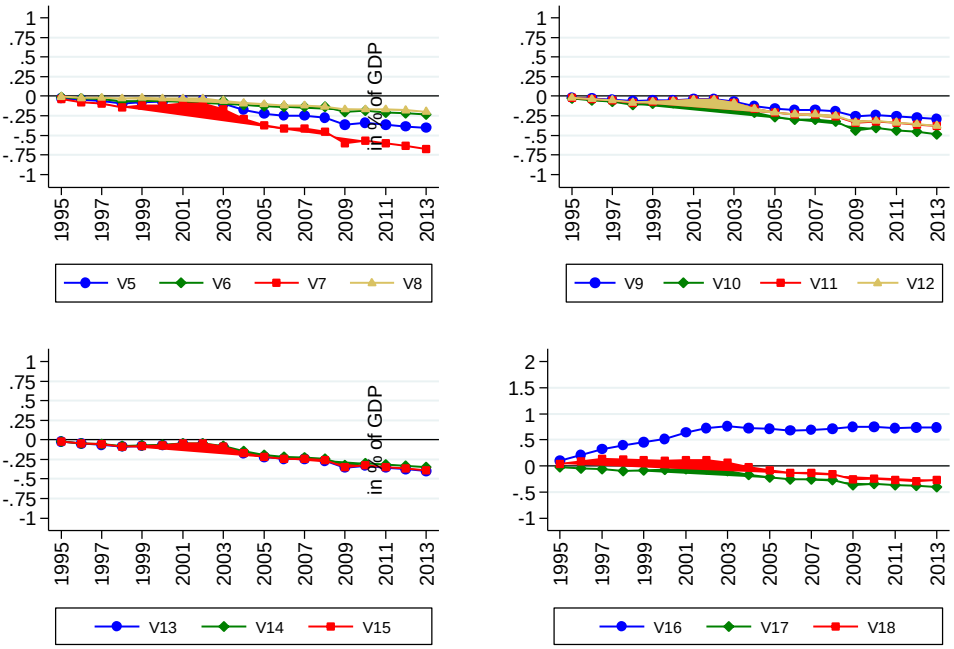

in % of GDP
V5 V6 V7 V8
V9 V10 V11 V12
V13 V14 V15
V16 V17 V18

## IE

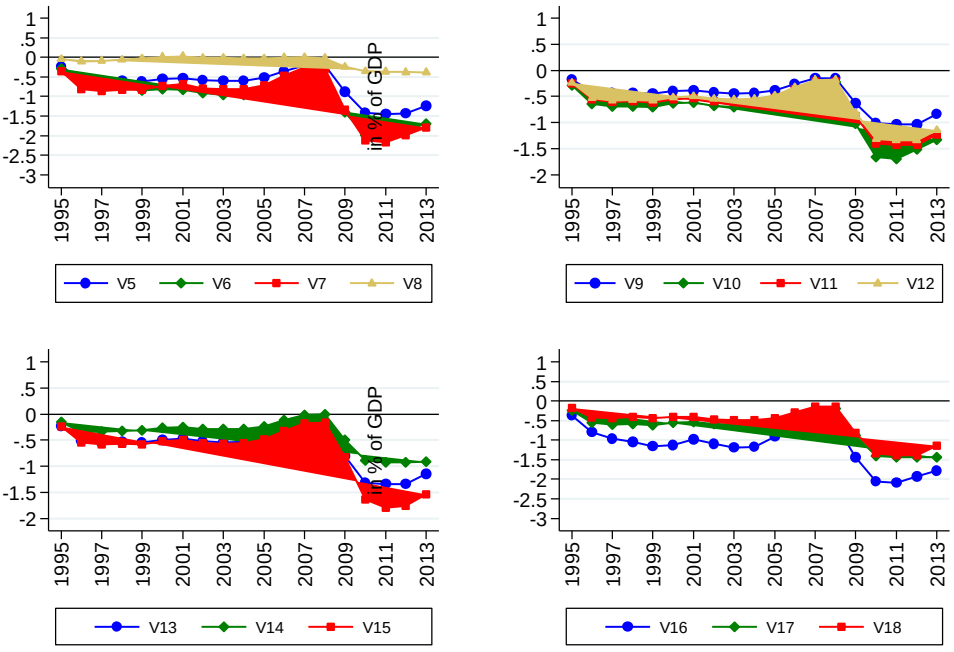

in % of GDP
V5 V6 V7 V8
V9 V10 V11 V12
V13 V14 V15
V16 V17 V18


IT
in % of GDP
V5 V6 V7 V8
V9 V10 V11 V12
V13 V14 V15
V16 V17 V18
LT
in % of GDP
V5 V6 V7 V8
V9 V10 V11 V12
V13 V14 V15
V16 V17 V18

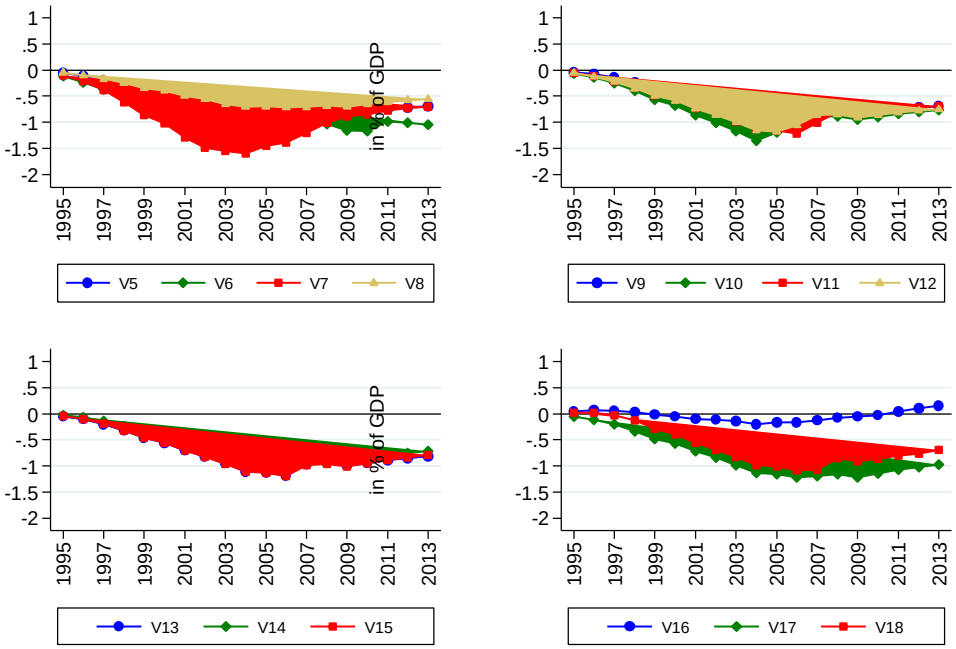
## LU


in % of GDP
V5 V6 V7 V8
V9 V10 V11 V12
V13 V14 V15
V16 V17 V18

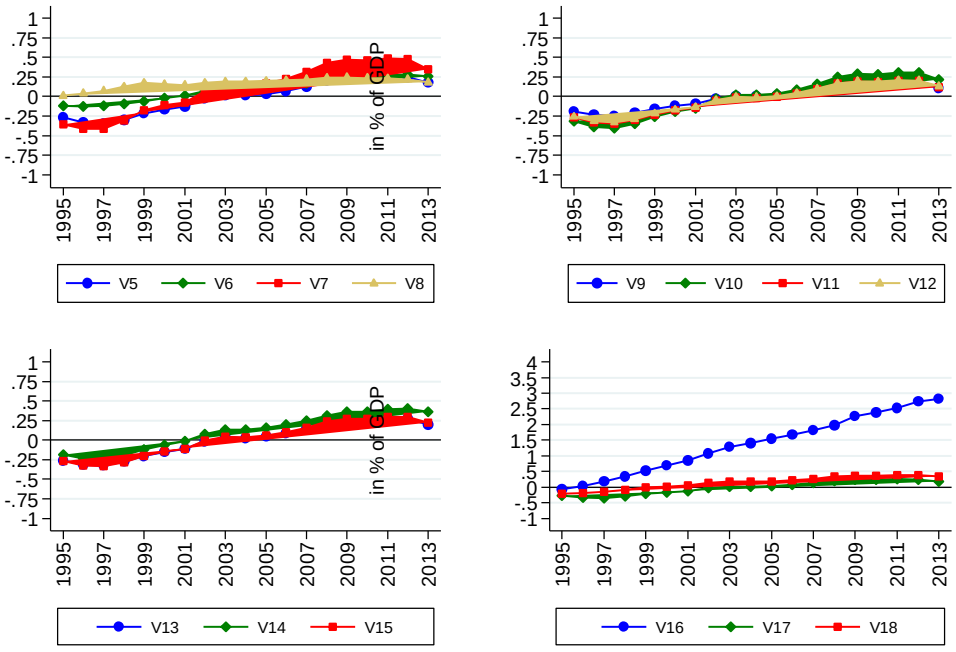
## LV


in % of GDP
V5 V6 V7 V8
V9 V10 V11 V12
V13 V14 V15
V16 V17 V18

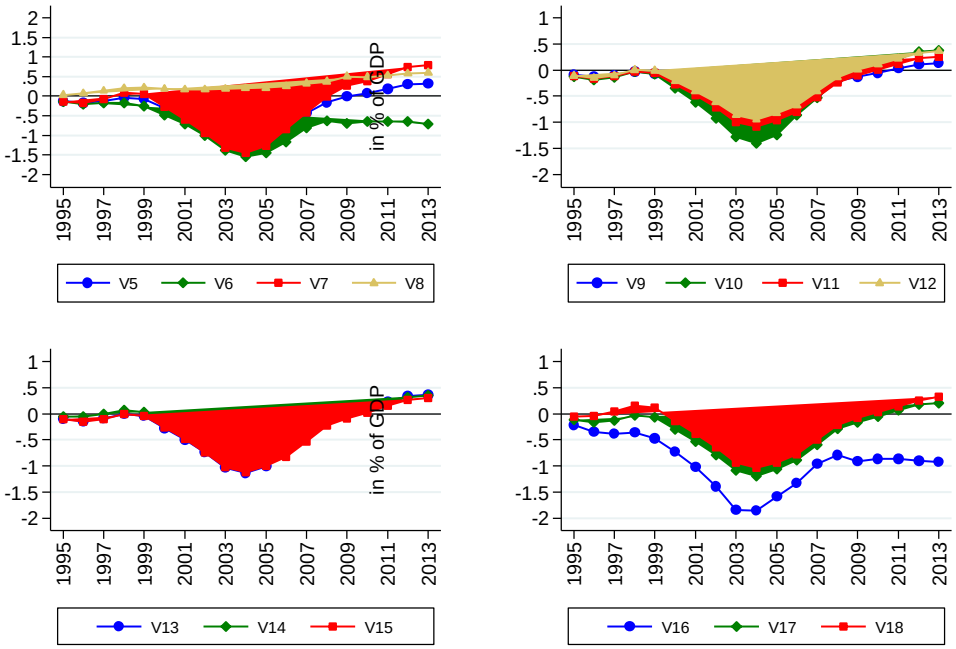
## MT


in % of GDP
1995 1997 1999 2001 2003 2005 2007 2009 2011 2013
V5 V6 V7 V8
V9 V10 V11 V12
V13 V14 V15
V16 V17 V18

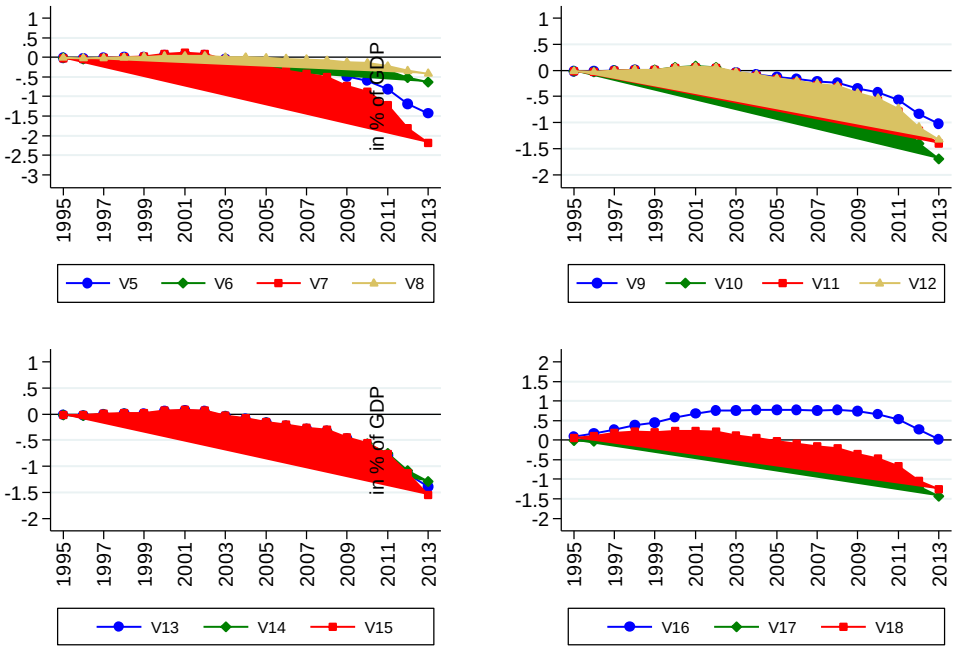
## NL

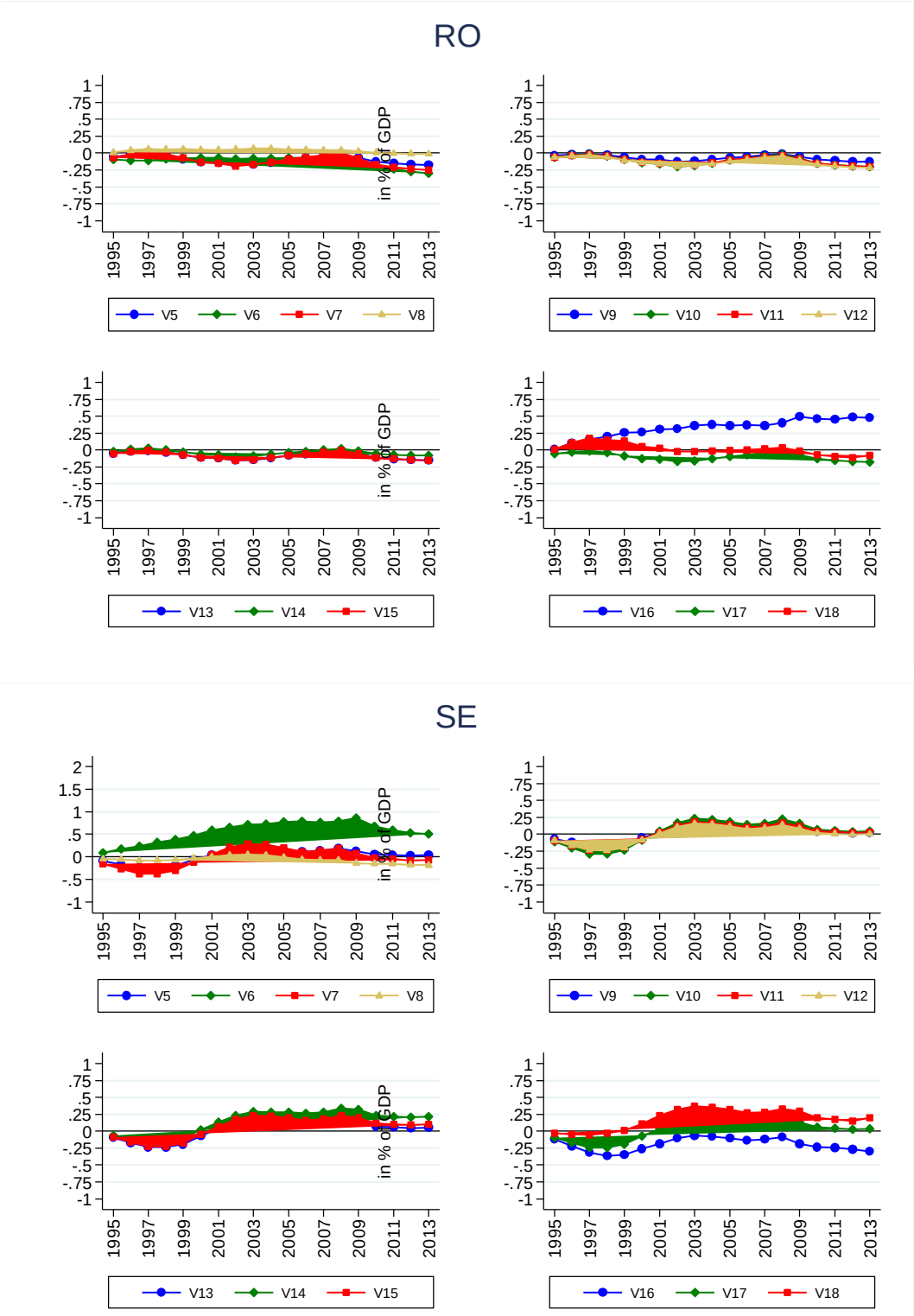

in % of GDP
1995 1997 1999 2001 2003 2005 2007 2009 2011 2013
V5 V6 V7 V8
V9 V10 V11 V12
V13 V14 V15
V16 V17 V18

## PL

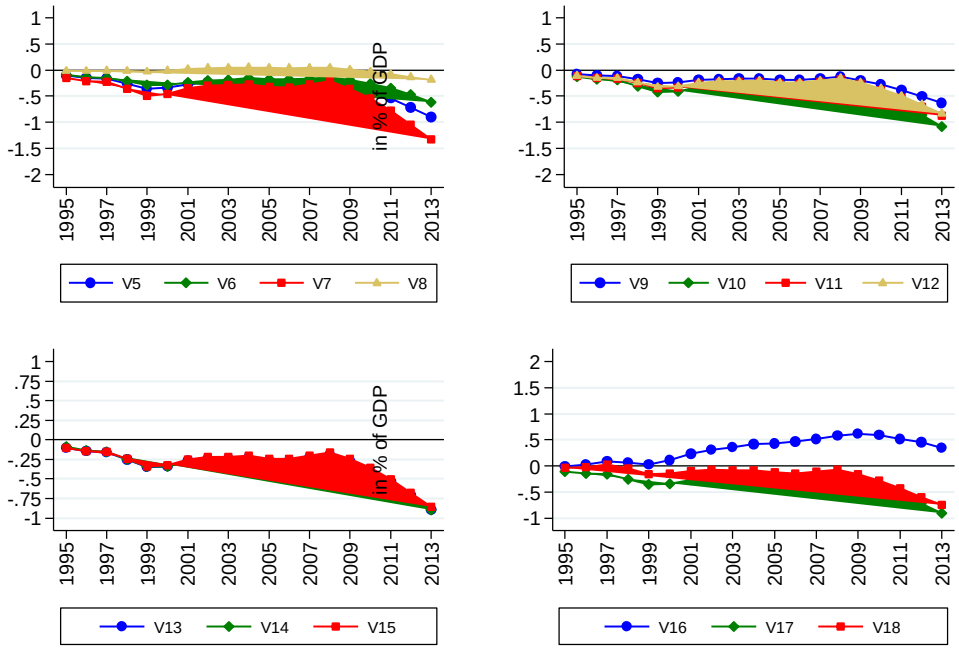

in % of GDP
V5 V6 V7 V8
V9 V10 V11 V12
V13 V14 V15
V16 V17 V18

## PT

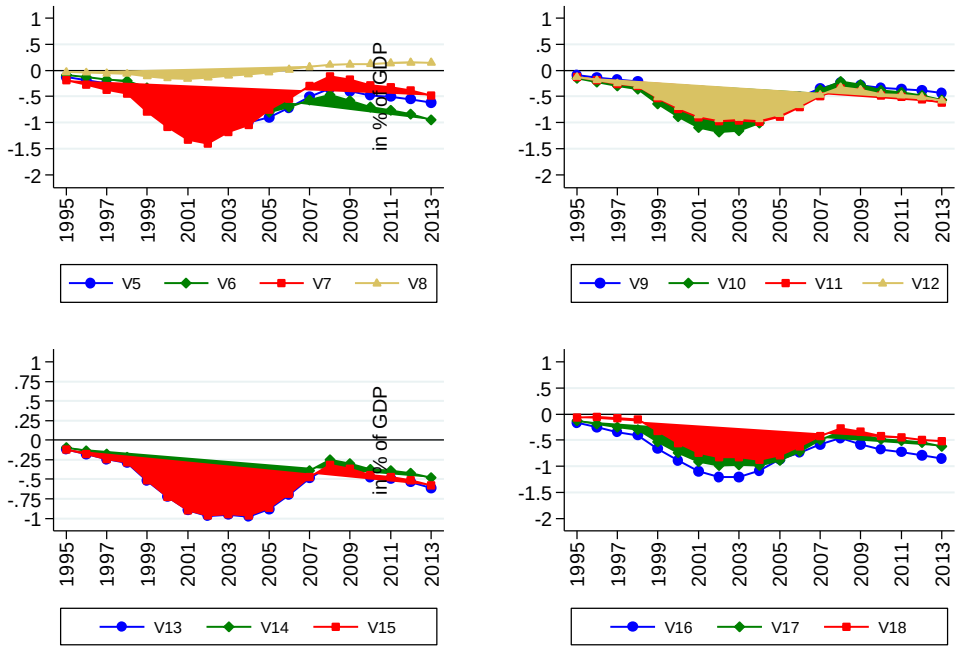

in % of GDP
V5 V6 V7 V8
V9 V10 V11 V12
V13 V14 V15
V16 V17 V18


RO
in % of GDP
V5 V6 V7 V8
V9 V10 V11 V12
V13 V14 V15
V16 V17 V18
SE
in % of GDP
V5 V6 V7 V8
V9 V10 V11 V12
V13 V14 V15
V16 V17 V18

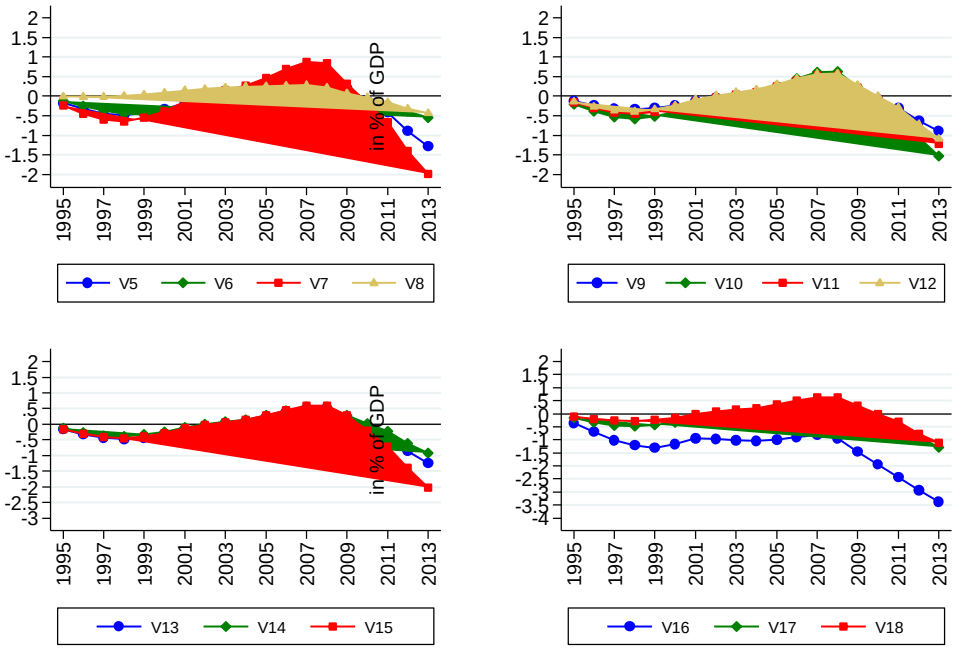
## SI


in % of GDP
V5 V6 V7 V8
V9 V10 V11 V12
V13 V14 V15
V16 V17 V18

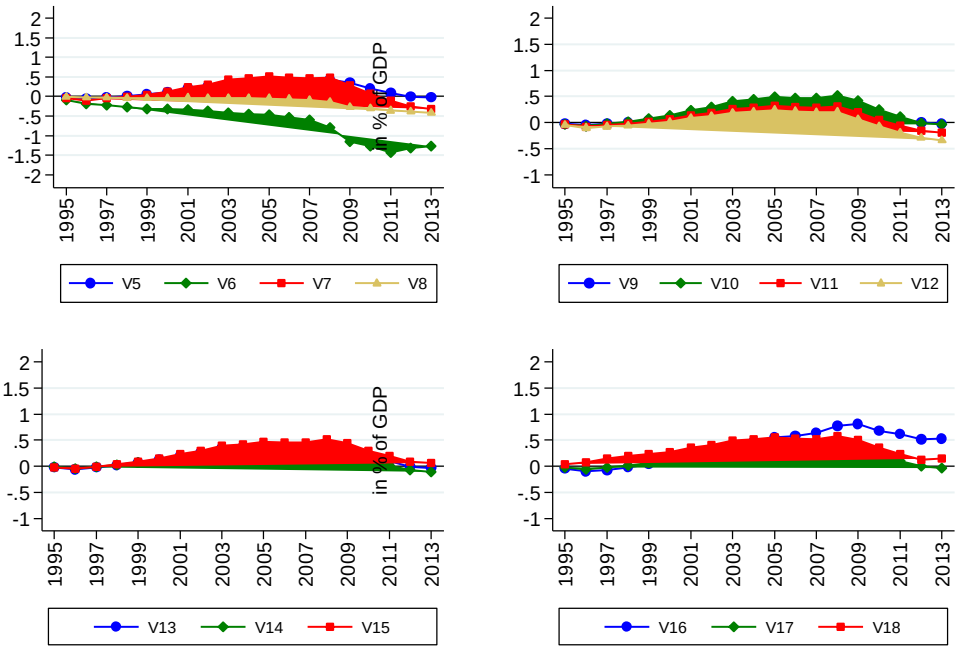
## SK


in % of GDP
V5 V6 V7 V8
V9 V10 V11 V12
V13 V14 V15
V16 V17 V18

## SP


in % of GDP
V5 V6 V7 V8
V9 V10 V11 V12
V13 V14 V15
V16 V17 V18

## UK


in % of GDP
V5 V6 V7 V8
V9 V10 V11 V12
V13 V14 V15
V16 V17 V18

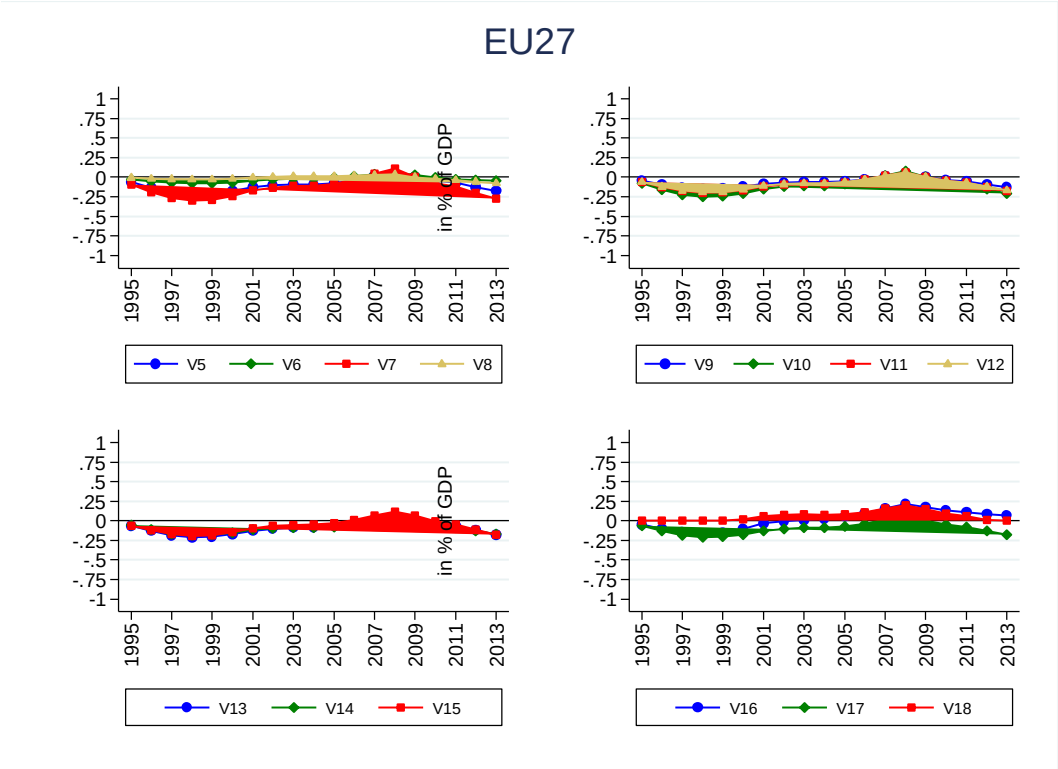
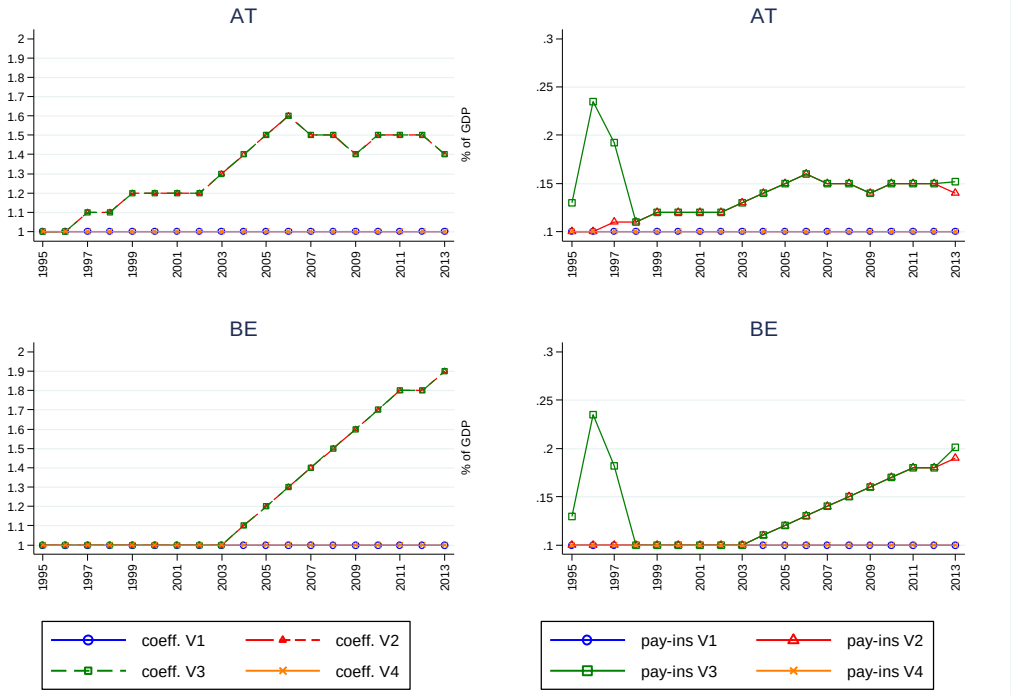
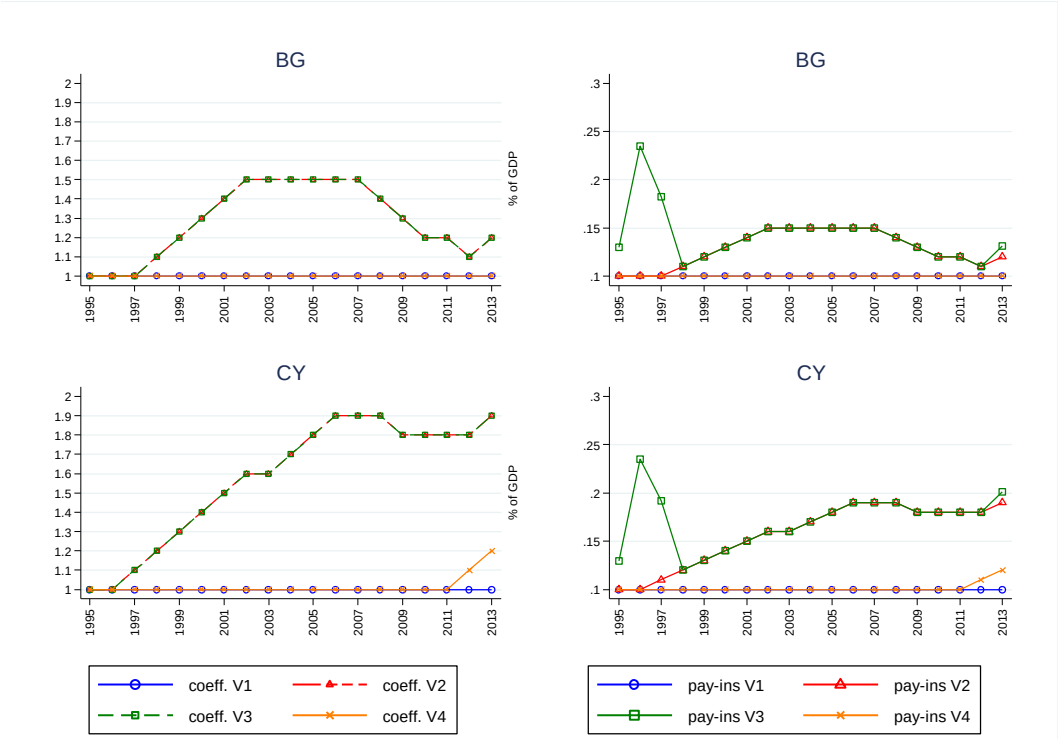
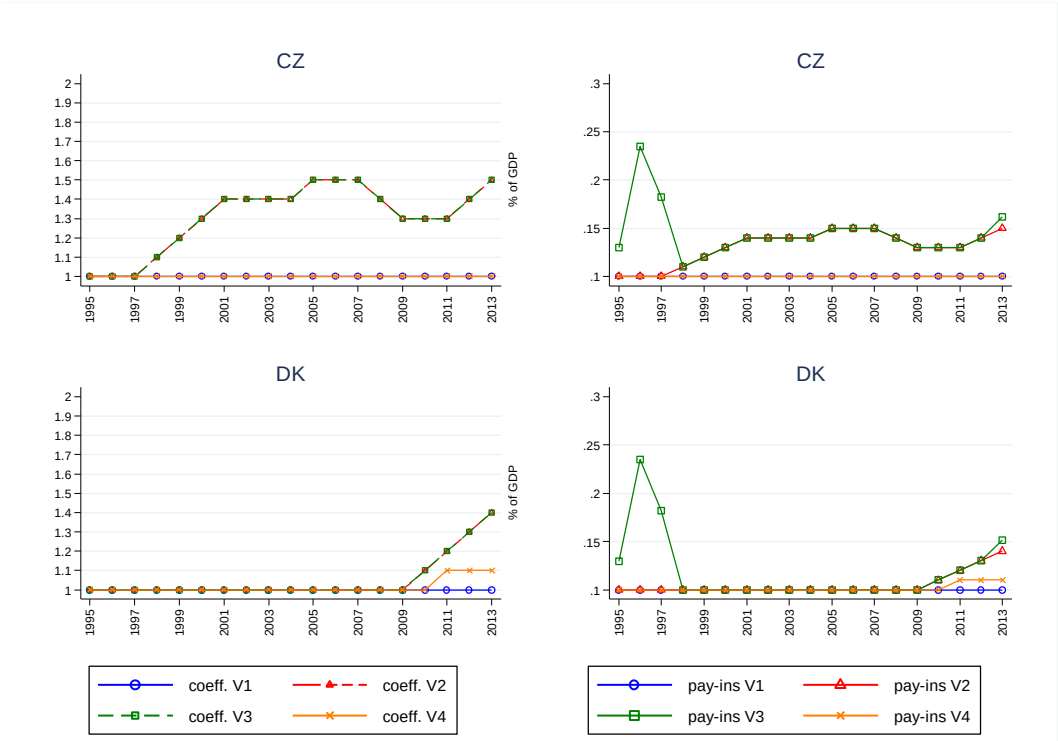


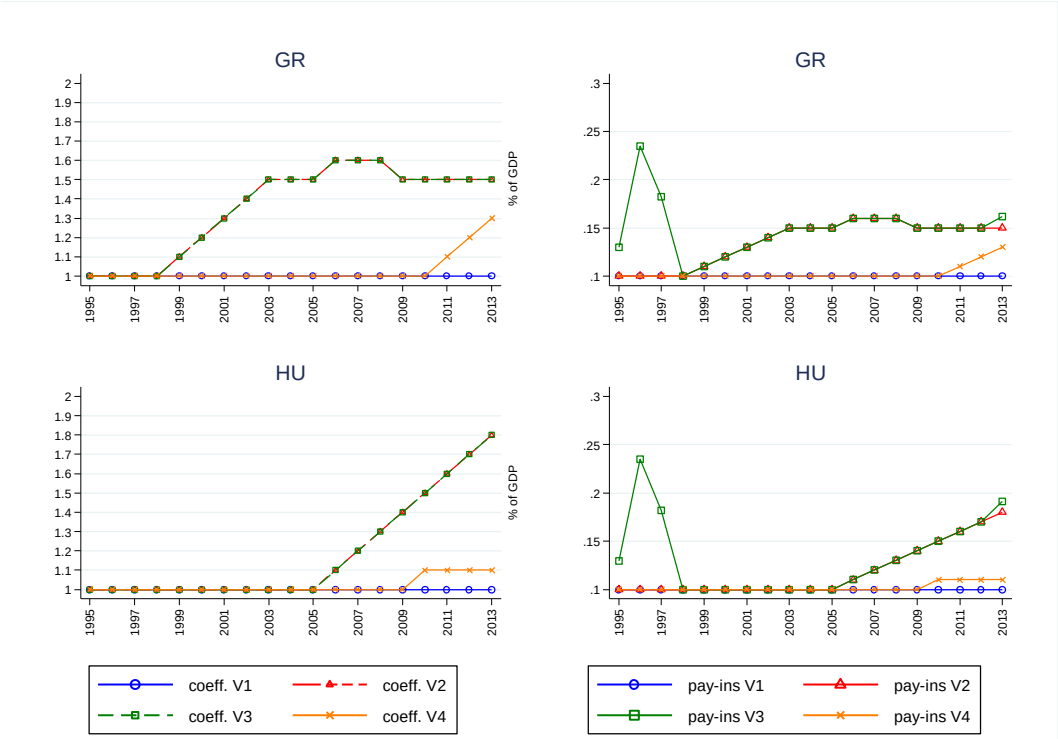

**Figure A.4-9. Experience rating and pay-ins: Equivalent systems**

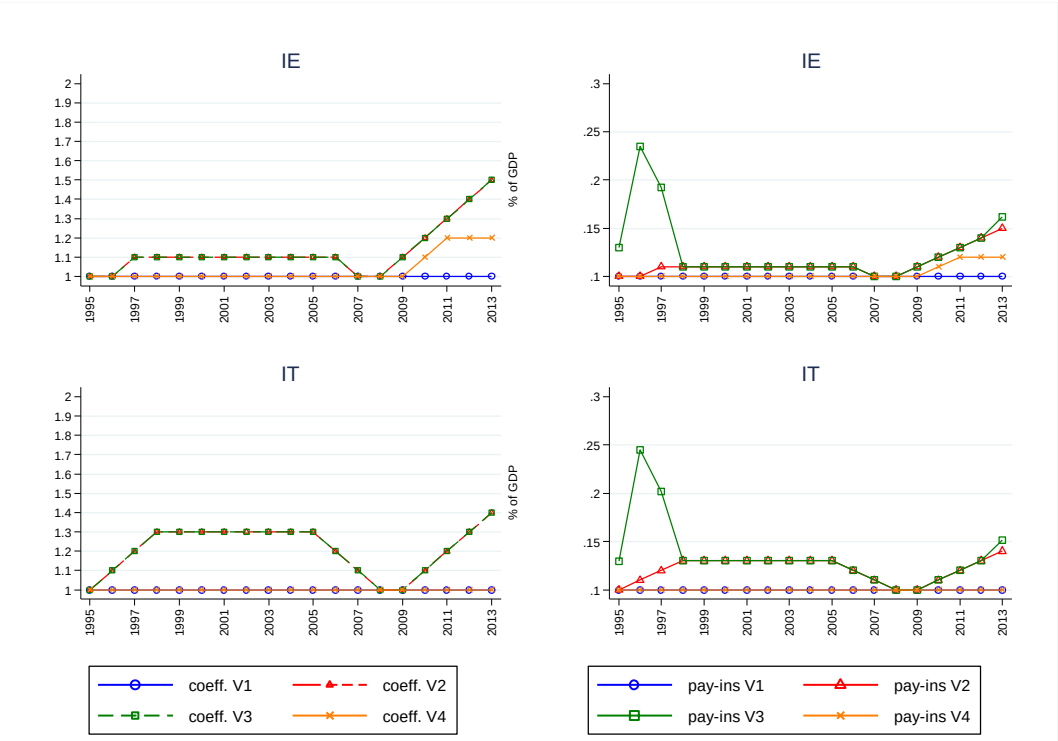


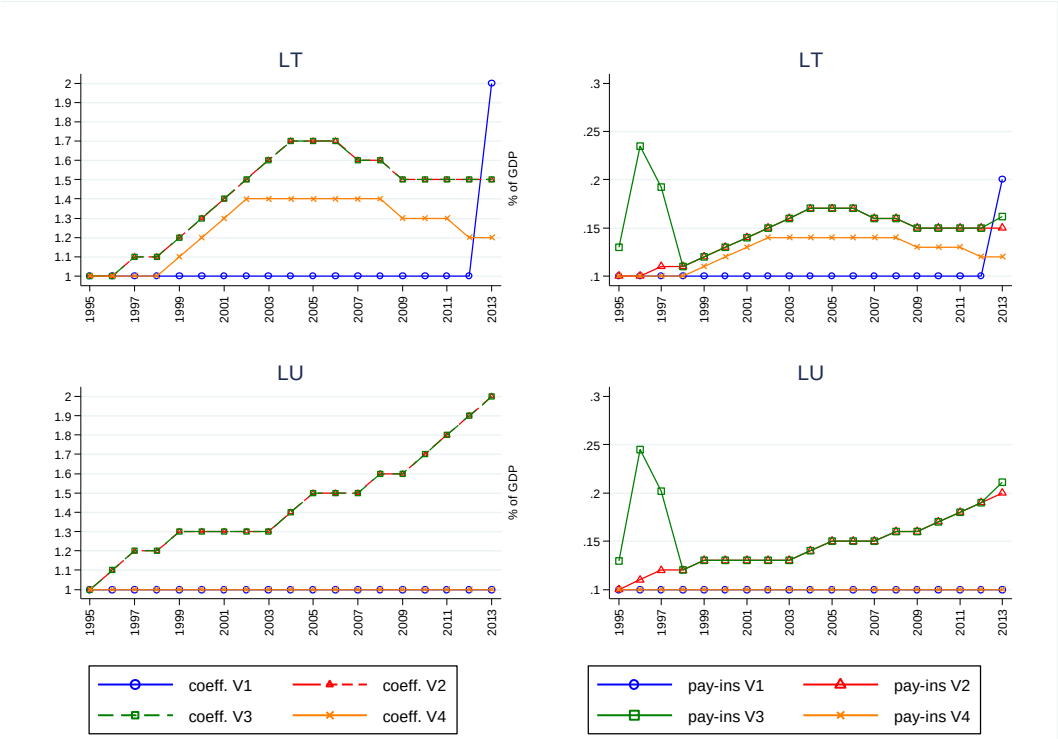

BG
BG
CY
CY
% of GDP
coeff. V1
coeff. V2
coeff. V3
coeff. V4
pay-ins V1
pay-ins V2
pay-ins V3
pay-ins V4

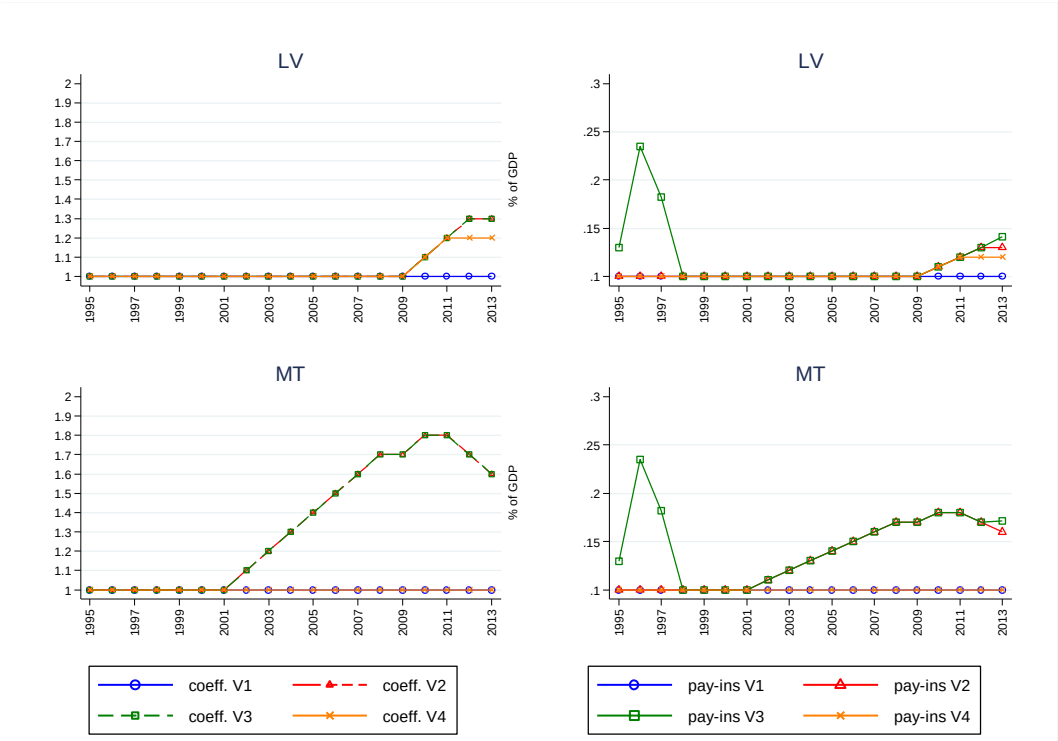

CZ
CZ
DK
DK
% of GDP
coeff. V1
coeff. V2
coeff. V3
coeff. V4
pay-ins V1
pay-ins V2
pay-ins V3
pay-ins V4


EE
FI
FR
GE
% of GDP
coeff. V1
coeff. V2
coeff. V3
coeff. V4
pay-ins V1
pay-ins V2
pay-ins V3
pay-ins V4

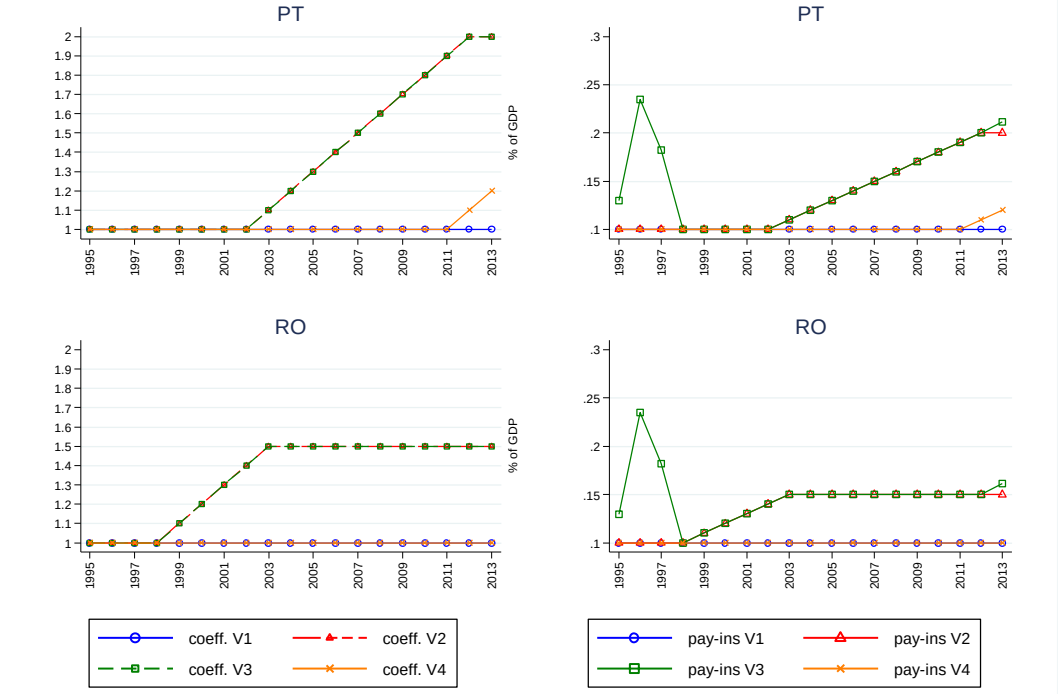

GR
HU
% of GDP
coeff. V1
coeff. V2
coeff. V3
coeff. V4
GR
HU
% of GDP
pay-ins V1
pay-ins V2
pay-ins V3
pay-ins V4

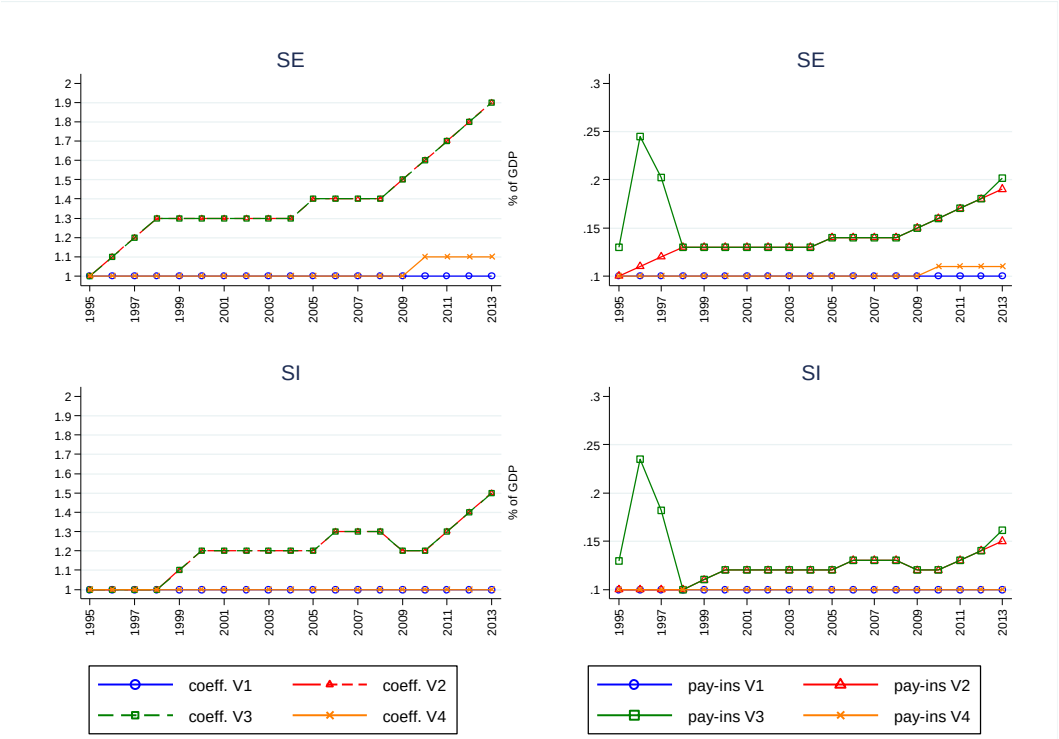

IE
IT
% of GDP
coeff. V1
coeff. V2
coeff. V3
coeff. V4
IE
IT
% of GDP
pay-ins V1
pay-ins V2
pay-ins V3
pay-ins V4

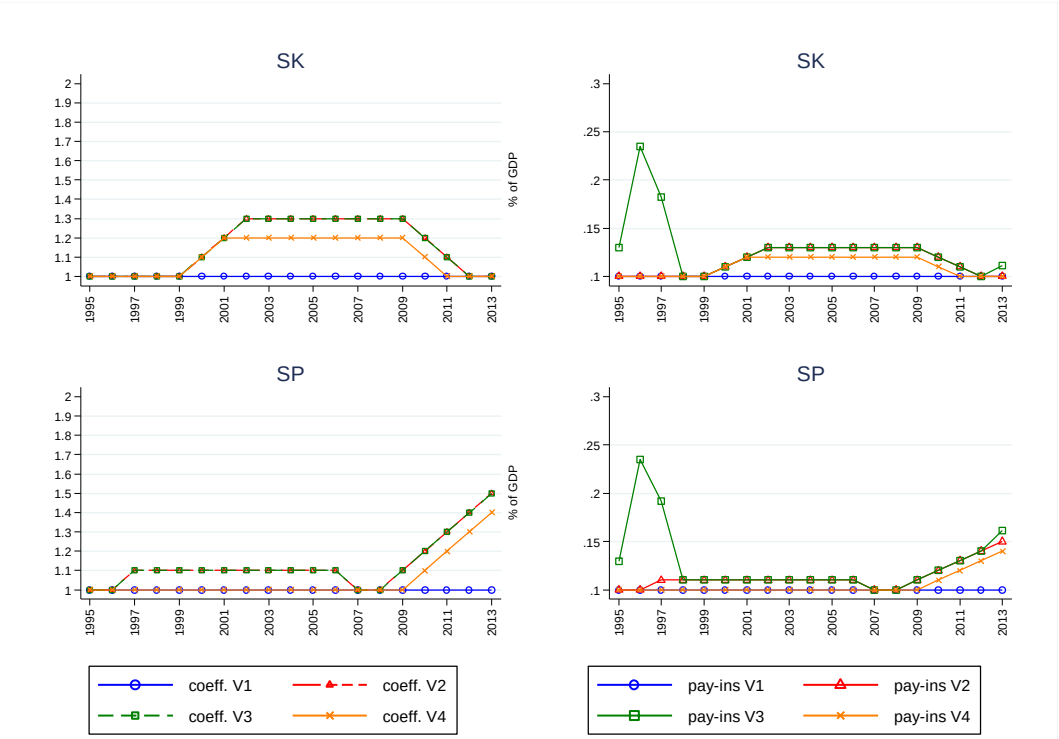

LT
LT
LU
LU
% of GDP
coeff. V1
coeff. V2
coeff. V3
coeff. V4
pay-ins V1
pay-ins V2
pay-ins V3
pay-ins V4


LV
LV
MT
MT
% of GDP
coeff. V1
coeff. V2
coeff. V3
coeff. V4
pay-ins V1
pay-ins V2
pay-ins V3
pay-ins V4


NL
NL
PL
PL
% of GDP
coeff. V1
coeff. V2
coeff. V3
coeff. V4
pay-ins V1
pay-ins V2
pay-ins V3
pay-ins V4


PT
PT
RO
RO
% of GDP
coeff. V1
coeff. V2
coeff. V3
coeff. V4
pay-ins V1
pay-ins V2
pay-ins V3
pay-ins V4


SE
SE
SI
SI
% of GDP
coeff. V1
coeff. V2
coeff. V3
coeff. V4
pay-ins V1
pay-ins V2
pay-ins V3
pay-ins V4


SK
SK
SP
SP
% of GDP
coeff. V1
coeff. V2
coeff. V3
coeff. V4
pay-ins V1
pay-ins V2
pay-ins V3
pay-ins V4

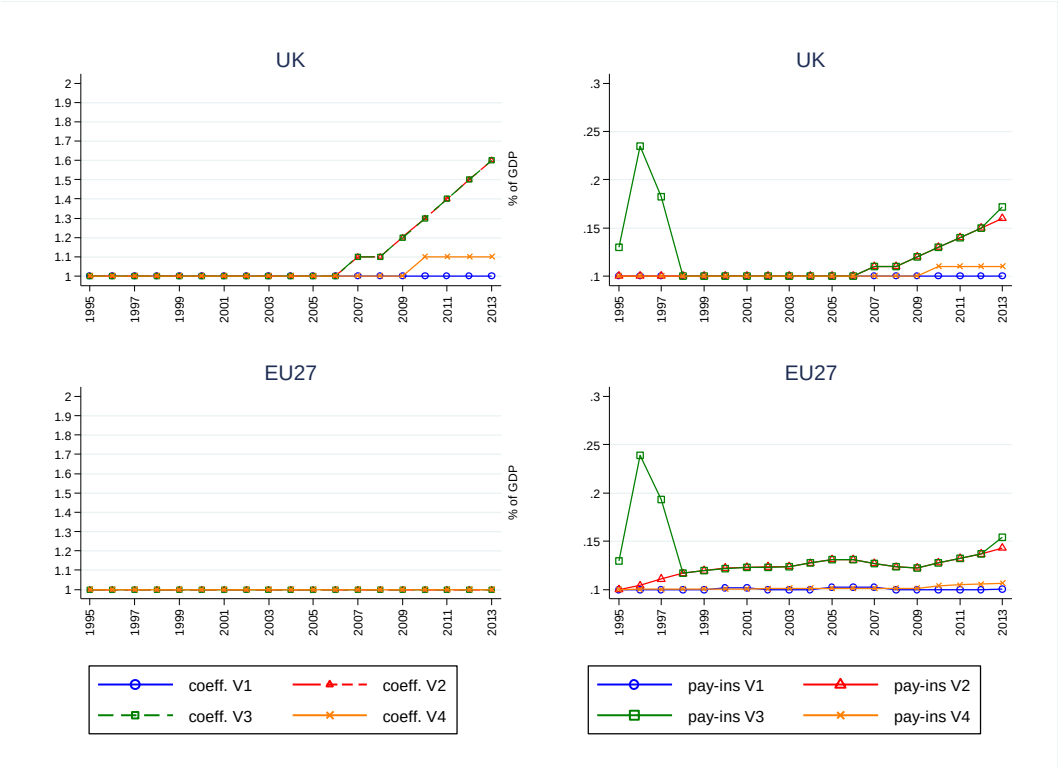
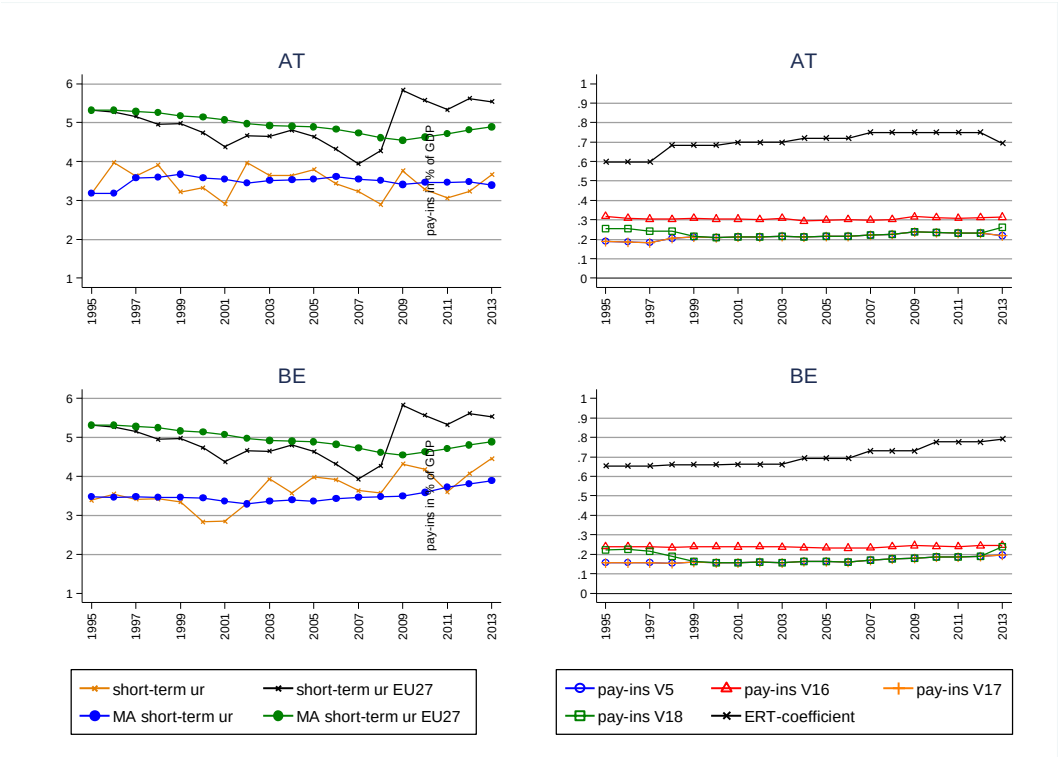
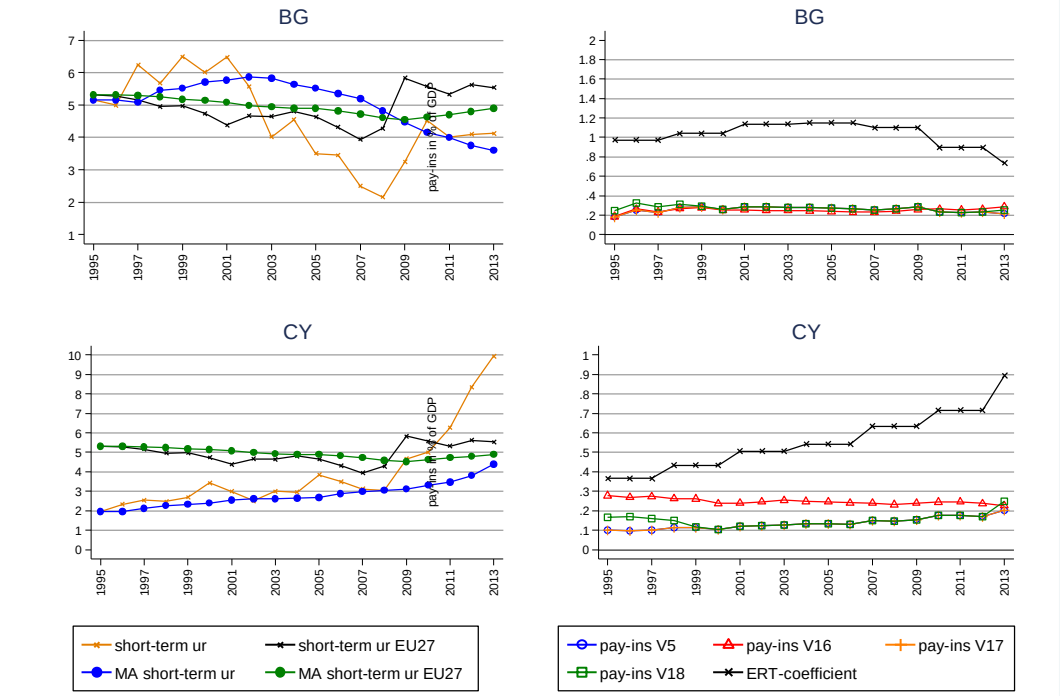



**Figure A.4-10. Experience rating and pay-ins: Genuine systems**

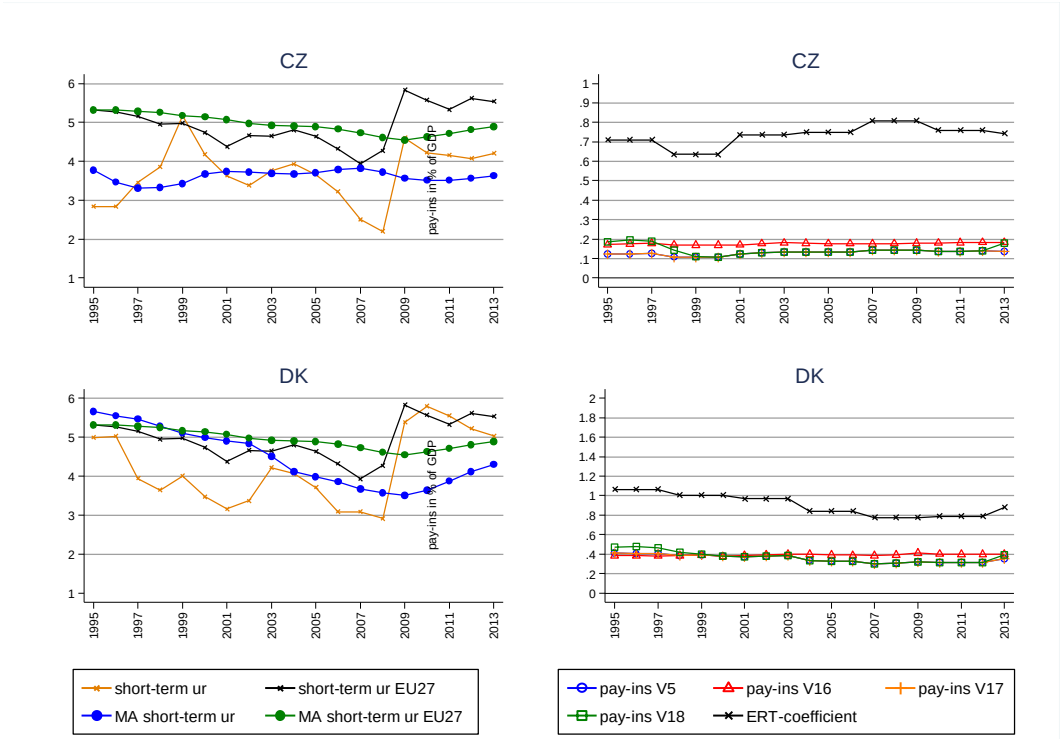



BG
pay-ins in % of GDP
short-term ur
short-term ur EU27
MA short-term ur
MA short-term ur EU27


BG
pay-ins V5
pay-ins V16
pay-ins V17
pay-ins V18
ERT-coefficient


CY
pay-ins in % of GDP

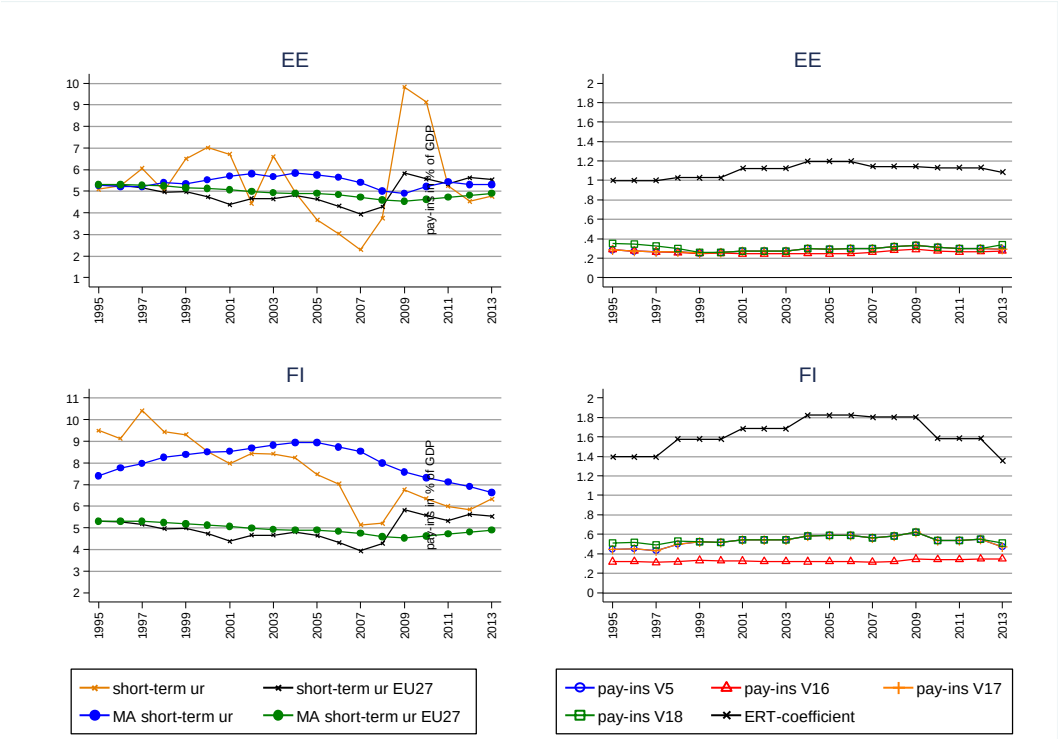

CY

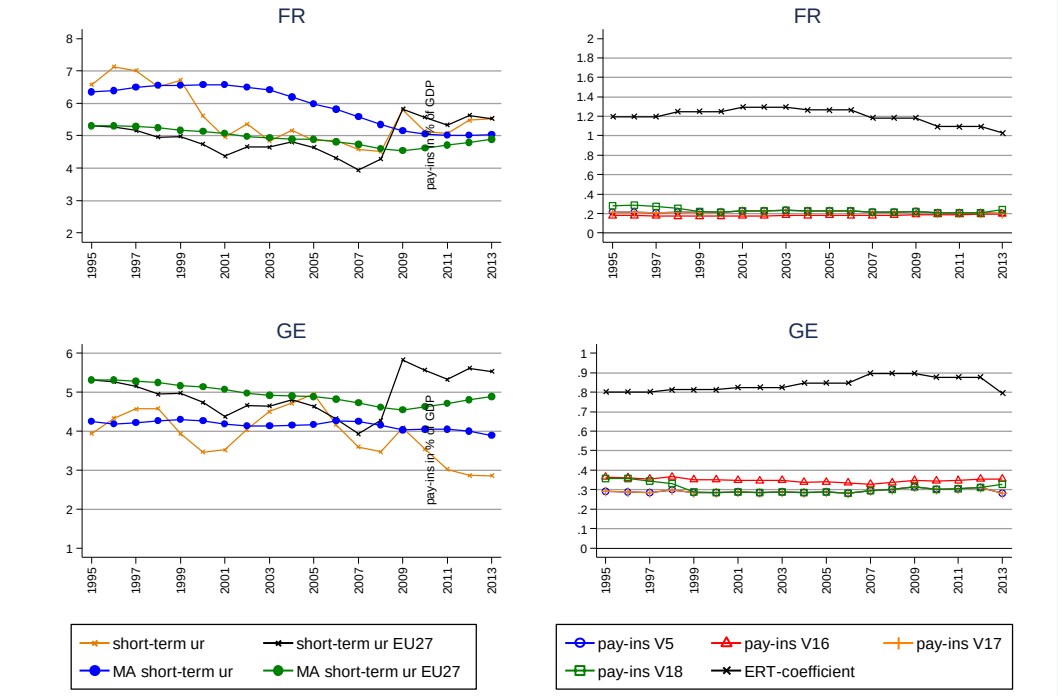

CZ
pay-ins in % of GDP
short-term ur
short-term ur EU27
MA short-term ur
MA short-term ur EU27

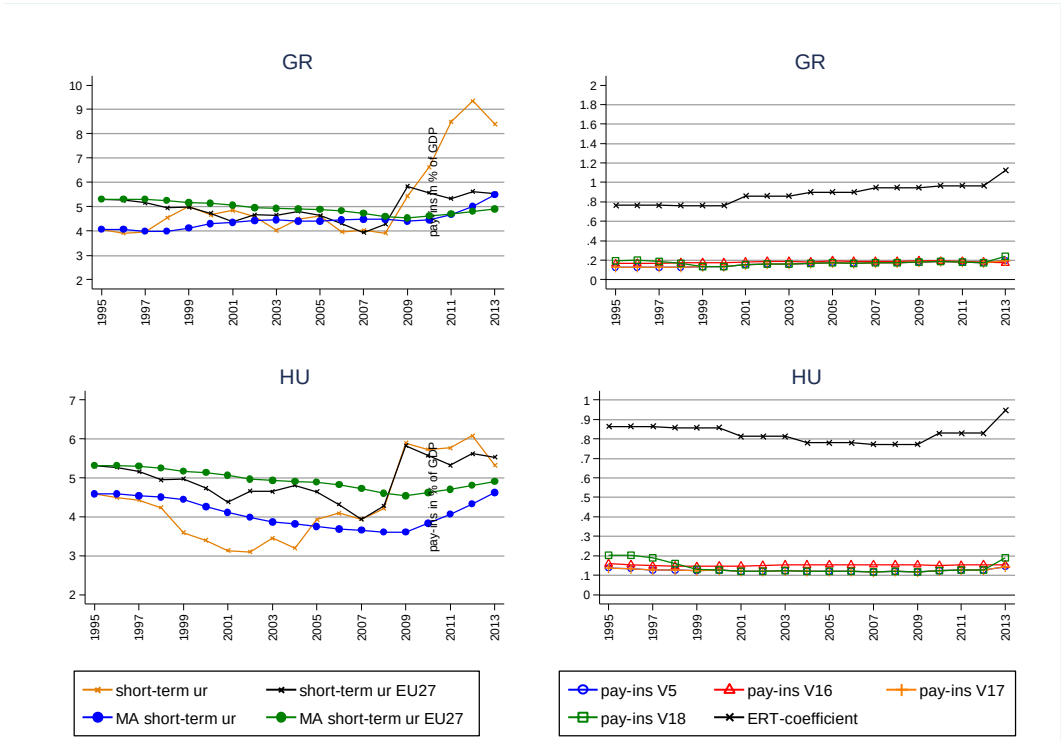

CZ
pay-ins V5
pay-ins V16
pay-ins V17
pay-ins V18
ERT-coefficient

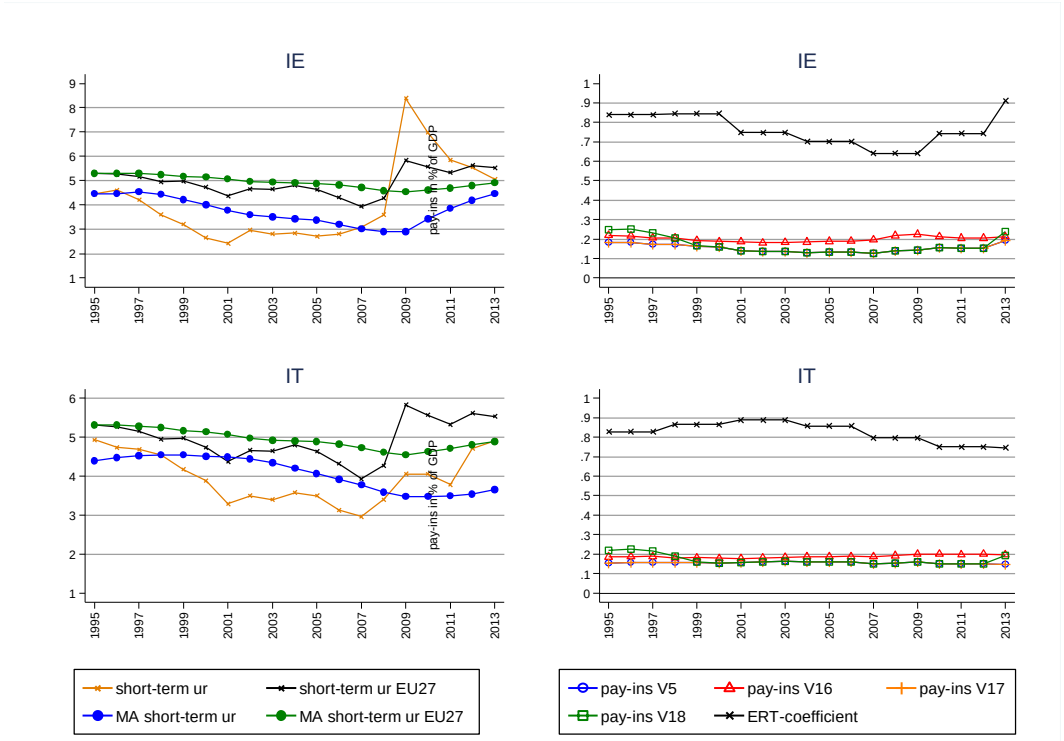

DK
pay-ins in % of GDP

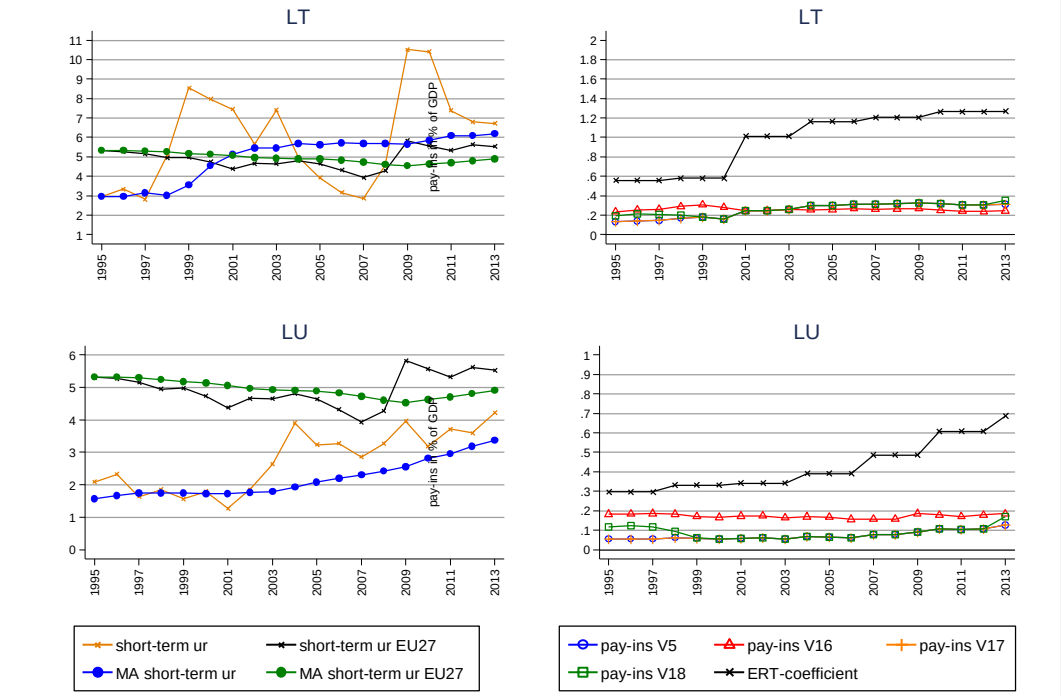

DK

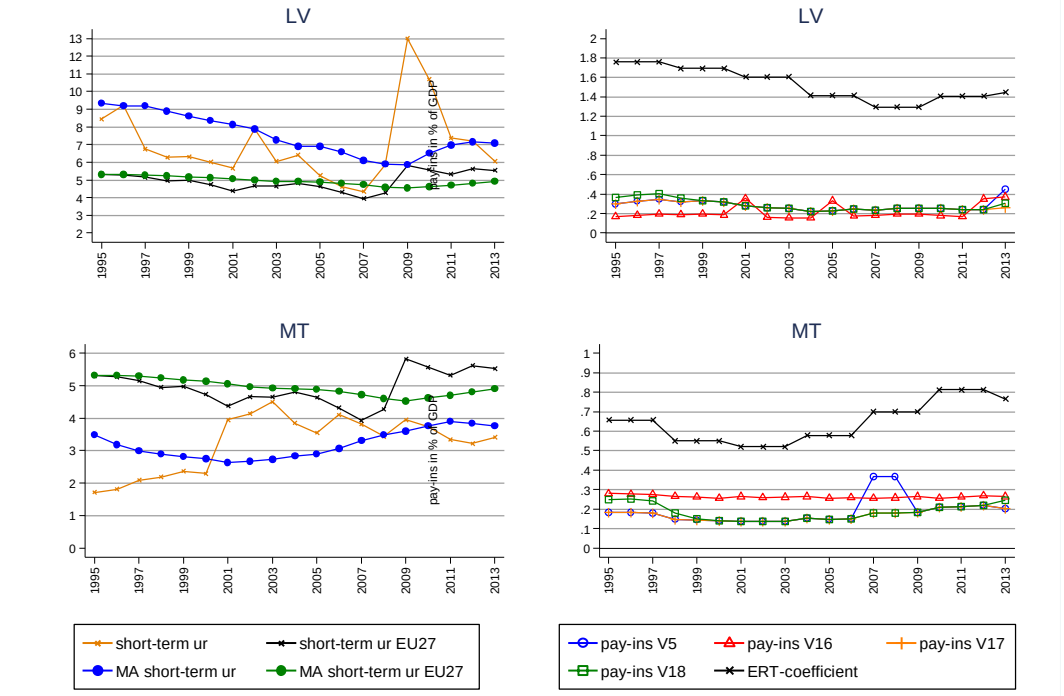

EE
pay-ins in % of GDP
EE
FI
pay-ins in % of GDP
FI
short-term ur
short-term ur EU27
MA short-term ur
MA short-term ur EU27
pay-ins V5
pay-ins V16
pay-ins V17
pay-ins V18
ERT-coefficient

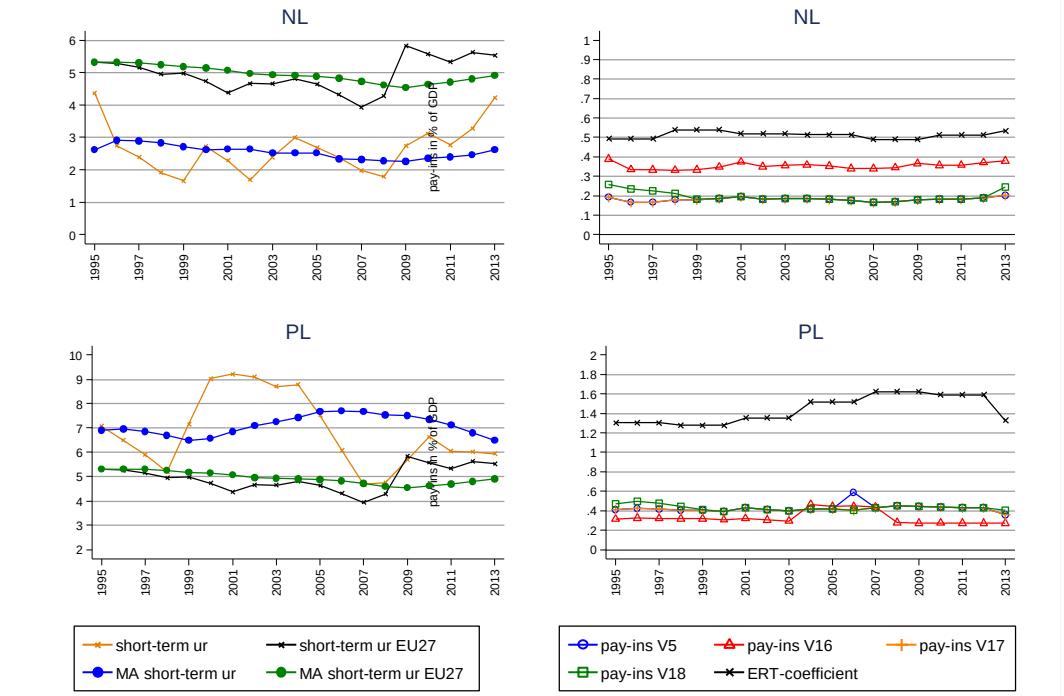

FR
pay-ins in % of GDP
FR
GE
pay-ins in % of GDP
GE
short-term ur
short-term ur EU27
MA short-term ur
MA short-term ur EU27
pay-ins V5
pay-ins V16
pay-ins V17
pay-ins V18
ERT-coefficient

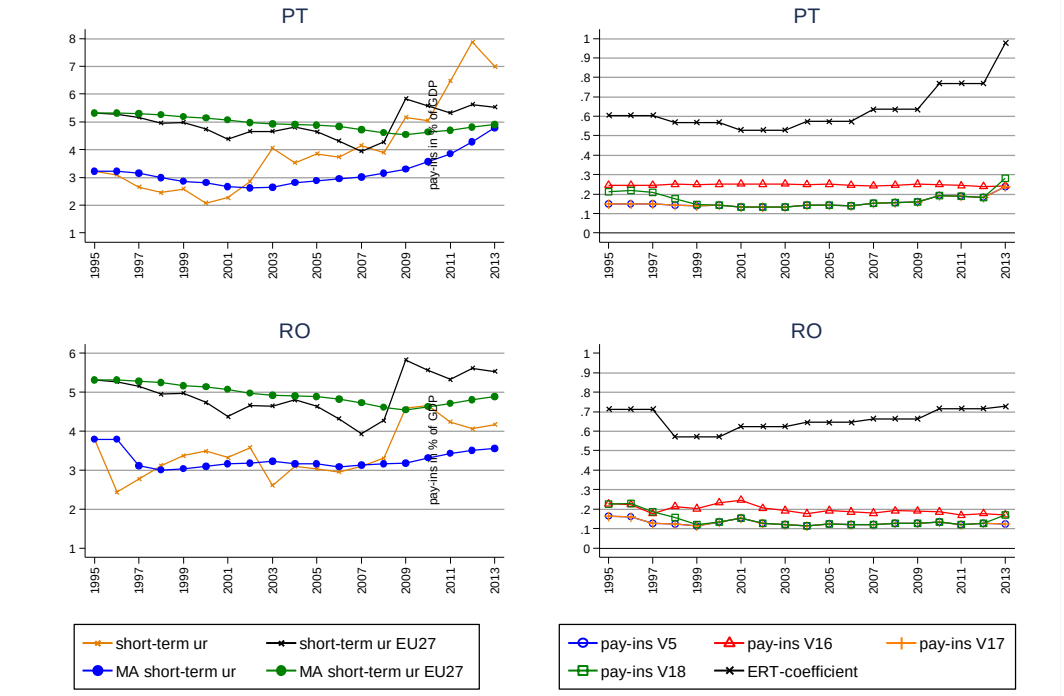

GR
HU
pay-ins in % of GDP
short-term ur
short-term ur EU27
MA short-term ur
MA short-term ur EU27
pay-ins V5
pay-ins V16
pay-ins V17
pay-ins V18
ERT-coefficient

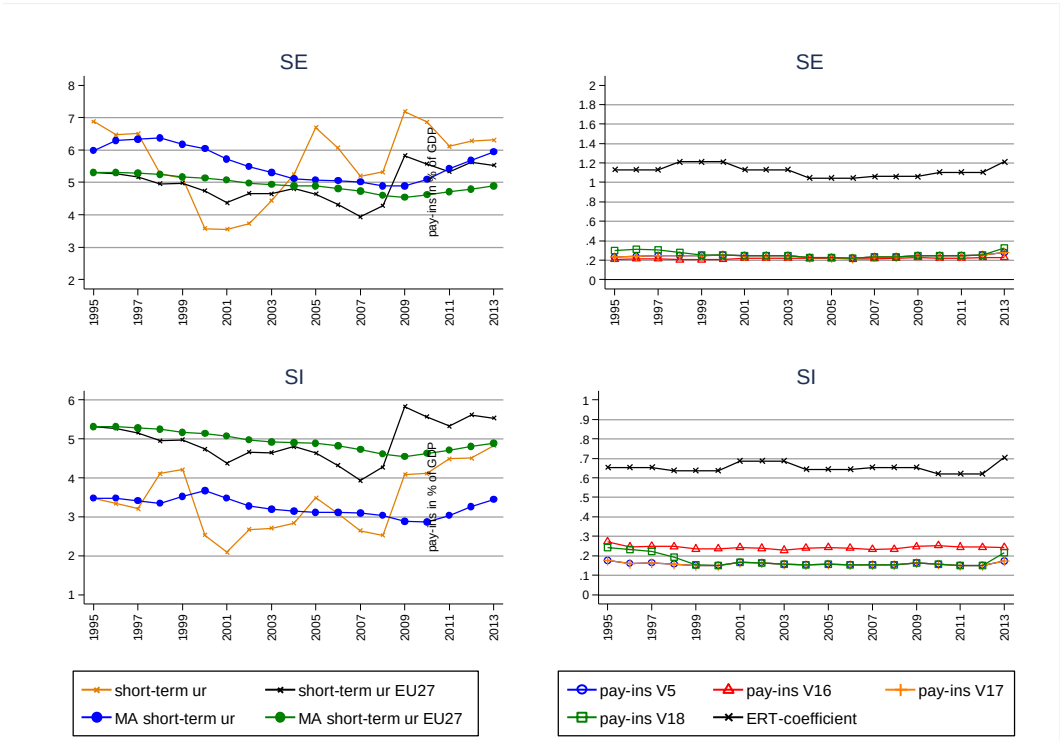

IE
IT
pay-ins in % of GDP
short-term ur
short-term ur EU27
MA short-term ur
MA short-term ur EU27
pay-ins V5
pay-ins V16
pay-ins V17
pay-ins V18
ERT-coefficient


LT
LT
LU
LU
pay-ins in % of GDP
short-term ur
short-term ur EU27
MA short-term ur
MA short-term ur EU27
pay-ins V5
pay-ins V16
pay-ins V17
pay-ins V18
ERT-coefficient

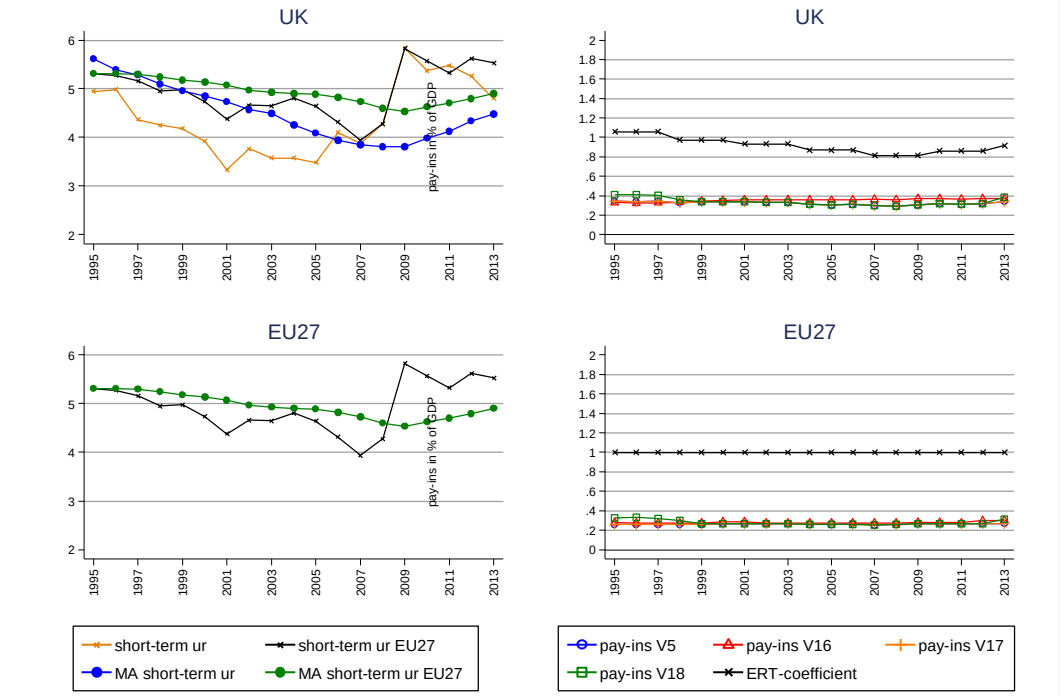

LV
LV
MT
MT
pay-ins in % of GDP
short-term ur
short-term ur EU27
MA short-term ur
MA short-term ur EU27
pay-ins V5
pay-ins V16
pay-ins V17
pay-ins V18
ERT-coefficient


NL
PL
pay-ins in % of GDP
short-term ur
short-term ur EU27
MA short-term ur
MA short-term ur EU27
pay-ins V5
pay-ins V16
pay-ins V17
pay-ins V18
ERT-coefficient


PT
RO
pay-ins in % of GDP
short-term ur
short-term ur EU27
MA short-term ur
MA short-term ur EU27
pay-ins V5
pay-ins V16
pay-ins V17
pay-ins V18
ERT-coefficient


SE
pay-ins in % of GDP
SE
SI
pay-ins in % of GDP
SI
short-term ur
short-term ur EU27
MA short-term ur
MA short-term ur EU27
pay-ins V5
pay-ins V16
pay-ins V17
pay-ins V18
ERT-coefficient


SK
pay-ins in % of GDP
SK
SP
pay-ins in % of GDP
SP
short-term ur
short-term ur EU27
MA short-term ur
MA short-term ur EU27
pay-ins V5
pay-ins V16
pay-ins V17
pay-ins V18
ERT-coefficient


UK
pay-ins in % of GDP
EU27
short-term ur
short-term ur EU27
MA short-term ur
MA short-term ur EU27
pay-ins V5
pay-ins V16
pay-ins V17
pay-ins V18
ERT-coefficient

## A.5 Brief description of E3ME

### 5.1.1 The theoretical background

Economic activity undertaken by persons, households, firms and other groups in society has effects on other groups after a time lag, and the effects persist into future generations, although many of the effects soon become so small as to be negligible. But there are many actors, and the effects, both beneficial and damaging, accumulate in economic and physical stocks. The effects are transmitted through the environment (with externalities such as greenhouse gas emissions contributing to global warming), through the economy and the price and money system (via the markets for labour and commodities), and through the global transport and information networks. The markets transmit effects in three main ways: through the level of activity creating demand for inputs of materials, fuels and labour; through wages and prices affecting incomes; and through incomes leading in turn to further demands for goods and services. These interdependencies suggest that an E3 model should be comprehensive, and include many linkages between different parts of the economic and energy systems.

These economic and energy systems have the following characteristics: economies and diseconomies of scale in both production and consumption; markets with different degrees of competition; the prevalence of institutional behaviour whose aim may be maximisation, but may also be the satisfaction of more restricted objectives; and rapid and uneven changes in technology and consumer preferences, certainly within the time scale of greenhouse gas mitigation policy. Labour markets in particular may be characterised by long-term unemployment.

### 5.1.2 Basic model structure

Figure A5.1 shows the logic of the determination of demand and output for each region. Most of the economic variables shown in the figure are defined at the sectoral level. The whole system is solved simultaneously for all industries and all countries.

#### 5.1.2.1 Intermediate demand

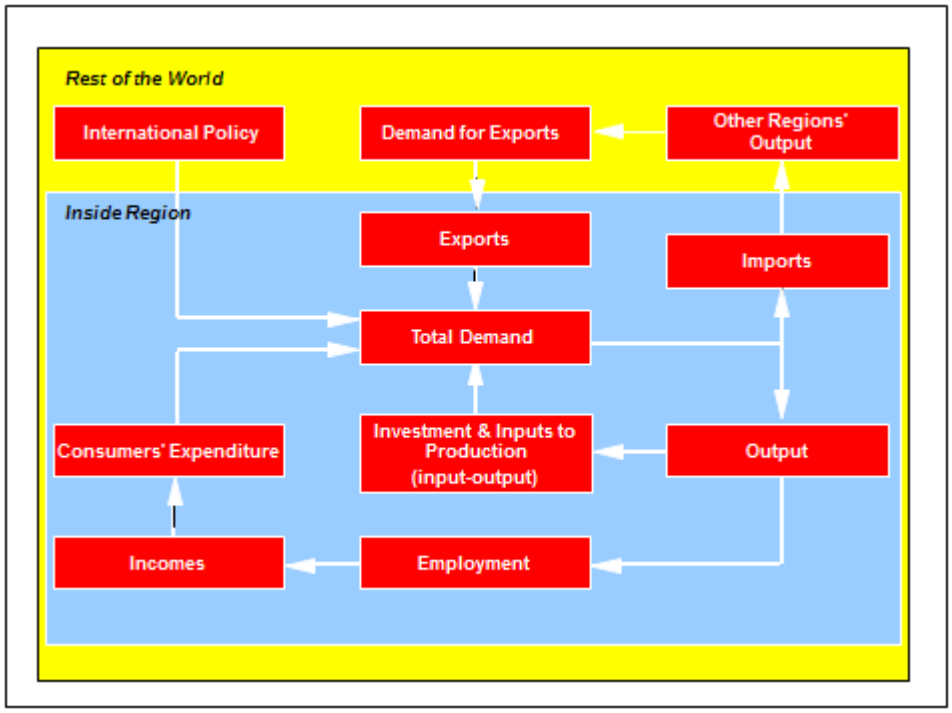
Intermediate demand (the sum of demand from other production sectors) is determined by the input-output relationships in the model. When one sector increases its production, it requires more inputs to do so. The sectors in its supply chain thus see an increase in intermediate demand.

#### 5.1.2.2 Household consumption

Estimating household consumption is a two-stage process. Total consumer spending by region is derived from functions estimated from time-series data. These equations relate consumption to regional personal disposable income, a measure of wealth for the personal sector, inflation and interest rates. Share equations for each of the 43 consumption categories reported by Eurostat[21] are then estimated. In the model solution, disaggregate consumption is always scaled to be consistent with the total.

[21] 28 categories for regions outside Europe.

**Figure A5.1: E3ME's Basic Economic Structure**




### 5.1.2.3 Government consumption

Government consumption is usually given by assumption, split into the main different components of spending, but rules are sometimes introduced to make government consumption (or investment) respond to macroeconomic circumstances.

### 5.1.2.4 Investment

Gross fixed capital formation is determined through econometric equations estimated on time-series data. Expectations of future output, formed on the basis of recent trends, are a key determinant of investment, but investment is also affected by relative prices and interest rates.

### 5.1.2.5 International trade

The treatment of international trade has four stages:

- For each country, total imports are estimated using equations based on time-series national accounts data. Import volumes are determined primarily by domestic activity rates and relative prices.
- Separate bilateral equations for import shares are then estimated for each region, sector and origin region. These equations have the same structure as the aggregated ones.
- Bilateral imports are then scaled so that they sum to the total estimated at the first stage.
- Finally, export volumes are determined by inverting the flows of imports.

### 5.1.2.6 Output and determination of supply

Total product output, in gross terms, is determined by summing intermediate demand and the components of final demand described above. This gives a measure of total demand for domestic production.

It is assumed that, subject to certain constraints, domestic supply increases to match demand. The most obvious constraint is the labour market (see below); if there is not enough available labour then production levels cannot increase. However, the model's 'normal output' equations also provide an implicit measure of capacity, for example leading to higher prices and rates of import substitution when production levels exceed available capacity.

#### 5.1.2.7 The labour market and incomes

E3ME includes econometric equation sets for employment (as a headcount), average working hours, wage rates and participation rates. The first three of these are disaggregated by industry sector while participation rates are disaggregated by gender and five-year age band (only gender for non-EU countries).

The labour force is determined by multiplying labour market participation rates by population. Unemployment (including both voluntary and involuntary unemployment) is determined by taking the difference between the labour force and employment.

There are important interactions between the labour market equations. They are summarised below:

**Employment = F (Economic output, Wage rates, Working hours, …)**

**Wage rages = F (Labour productivity, Unemployment, …)**

**Working hours = F (Economic output in relation to capacity, …)**

**Participation rates = F (Economic output, Wage rates, Working hours, …)**

**Labour supply = Participation rate * Population**

**Unemployment = Labour supply – Employment**

**Household income is determined as:**

**Income = Wages – Taxes + Benefits + Other income**

The taxes currently distinguished are standard income taxes and employees' social security payments (employers' social security payments are not included in wages). A single benefit rate is used for each region.

'Other income' includes factors such as dividend payments, property rent and remittances. At present it is not possible to derive data for these financial flows and so they are either estimated, fixed, or held constant in relation to wages.

Household income, once converted to real terms, is an important component in the model's consumption equations, with a one-to-one relationship assumed in the long run.

#### 5.1.2.8 Price formation

Aside from wages, there are three econometric price equations in the model:

- domestic production prices
- import prices

- export prices

These are influenced by unit costs (derived by summing wage costs, material costs and taxes), competing prices and technology. Each one is estimated at the sectoral level.

One of the key price variables in the model is the price of domestic consumption. It is also determined by sector, by taking a weighted average of domestic and import prices, subtracting off the export component. This price is then used to determine the prices for final consumption goods; for example if the car industry increases prices, this will be reflected in the price consumers pay for cars.

Aggregate deflators, including the Consumer Price Index, are derived by taking the average of prices across products and sectors.

#### 5.1.2.9 Endogenous technological progress.

The approach to constructing the measure of technological progress in E3ME is adapted from that of Lee et al (1990). It adopts a direct measure of technological progress by using cumulative gross investment, but this is altered by using data on R&D expenditure, thus forming a quality adjusted measure of investment.

#### 5.1.2.10 Monetary policy, the exchange rate and finance

In the version of E3ME used for this study, a Taylor-type rule has been applied for monetary authorities and an uncovered interest parity rule for the exchange rate of their currency.

E3ME assumes that agents form expectations on the basis of observed indicators, rather than by looking forward. The expectation of inflation that is used to determine the spot exchange rate is based on an extrapolation of the current inflation rate.

E3ME assumes that money is created endogenously by banks in response to profitable lending opportunities, but the spread between banks' lending rates and the short-term rate set by the central bank is not modelled. There are no financial frictions.

### 5.1.3 Functions in E3ME

In common with other economic models, E3ME consists of a combination of accounting balances and behavioural relationships. The accounting structure is described in Chapter 0; in this chapter we describe the behavioural relationships within the model.

The modelling approach is econometric, meaning that the basis for determining the equation parameters is the historical time-series data.

There are 29 model variables which are estimated through econometric relationships. However, these variables are in most cases disaggregated in two dimensions (e.g. by country/region and industry). A selection of these, most relevant to the present study, is presented below.

Nearly all the variables and parameters are defined over the regional dimension. In order to reduce the complexity of the notation this regional dimension is omitted in the tables below: therefore all variables and parameters should be assumed to vary over the regions of E3ME unless otherwise stated.

Individual elements of vectors, rows, columns or elements of matrices are denoted by replacing the dot by the appropriate number in the classification, e.g. YR(5,.) is gross

output of the oil and gas industry (in each region) which is the fifth industry in the European sectoral classification[22].

The full syntax is given below.

| | |
|---|---|
| + - * and / | denote addition, subtraction, multiplication and division of scalars and of individual elements of vectors and matrices. |
| ( ) | are grouping brackets. |
| [ ] | enclose comments. |
| (.) | as a postscript on a name indicates that it is a vector with the dot denoting all the elements. |
| (.,.) | as a postscript on a name indicates that it is a matrix. |
| (^) | denotes that the vector is converted to a diagonal matrix. |
| (.,.)' | denotes that the matrix is transposed. |
| (-1), (-2) etc. | as applied to a variable or a group of variables as a postscript denote a one, two etc. period lag. |
| LN(V) | is the natural logarithm of variable V. |
| DLN(V) | is the change in LN(V). |
| MATP(M1(.,.),M2(.,.)) | denotes matrix multiplication of variable matrices M1 and M2. |

[22] The appropriate sector is used for each region, so in this case it would be sector 3 for non-European regions.

**The Aggregate Consumption Equations**

| | | | |
|---|---|---|---|
| *Co-integrating long-term equation:* | | | |
| LN(RSC) | | | [real consumers' expenditure] |
| | = | BRSC(11) | |
| | + | BRSC(12) * LN(RRPD) | [real gross disposable income] |
| | + | BRSC(13) * LN(RRLR) | [real rate of interest] |
| | + | BRSC(14) * LN(CDEP) | [child dependency ratio] |
| | + | BRSC(15) * LN(ODEP) | [OAP dependency ratio] |
| | + | BRSC(16) * LN(RVD) | [household wealth] |
| | + | ECM | [error] |
| | | | |
| *Dynamic equation:* | | | |
| DLN(RSC) | | | [real consumers' expenditure] |
| | = | BRSC(1) | |
| | + | BRSC(2) * DLN(RRPD) | [real gross disposable income] |
| | + | BRSC(3) * DLN(RRLR) | [real rate of interest] |
| | + | BRSC(4) * DLN(CDEP) | [child dependency ratio] |
| | + | BRSC(5) * DLN(ODEP) | [OAP dependency ratio] |
| | + | BRSC(6) * DLN(RVD) | [household wealth] |
| | + | BRSC(7) * LN(RUNR) | [unemployment rate] |
| | + | BRSC(8) * DLN(RPSC) | [consumer price inflation] |
| | + | BRSC(9) * DLN(RSC(-1)) | [lagged change in consumers' expenditure] |
| | + | BRSC(10) * ECM(-1) | [lagged error correction] |
| | | | |
| *Identities:* | | | |
| RRLR | = | 1 + (RLR– DLN(PRSC))/100 | [real rate of interest] |
| RRPD | = | (RGDI*EX/PRSC) | [real gross disposable income] |
| CDEP, ODEP | = | CPOP/RPOP, OPOP/RPOP | [dependency ratios] |
| | | | |
| *Restrictions:* | | | |
| BRSC(12) = 1 | | | ['life cycle hypothesis'] |
| BRSC(2, 6, 16) >= 0 | | | ['right sign'] |
| BRSC(3, 7, 8, 13) <= 0 | | | ['right sign'] |
| 0 > BRSC(10) > -1 | | | ['right sign'] |
| | | | |

| | |
|---|---|
| *Definitions* | |
| BRSC | is a matrix of parameters |
| RSC | is a vector of total consumers' expenditure for 53 regions, m euro at 2005 prices |
| RGDI | is a matrix of gross disposable income for 53 regions, in m euro at current prices |
| RLR | is a matrix of long-run nominal interest rates for 53 regions |
| EX | is a vector of exchange rates, local currency per euro, 2005=1.0 |
| RPOP | is a vector of regional population for 53 regions, in thousands of persons |

| | |
|---|---|
| CPOP | is a vector of child population for 53 regions, in thousands of persons |
| OPOP | is a vector of old-age population for 53 regions, in thousands of persons |
| RUNR | is a vector of unemployment rates for 53 regions, measured as a percentage of the labour force |
| PRSC | is a vector of consumer price deflator for 53 regions, 2005=1.0 |
| RPSC | is a vector of consumer price inflation for 53 regions, in percentage terms |
| RVD | is the cumulative sum of investment in dwellings for 53 regions, m euro at 2005 prices |

**The Industrial Investment Equations**

| | | | |
|---|---|---|---|
| *Co-integrating long-term equation:* | | | |
| LN(KR(.)) | | | [investment] |
| | = | BKR(.,11) | |
| | + | BKR(.,12) * LN(YR(.)) | [real output] |
| | + | BKR(.,13) * LN(PKR/PYR(.)) | [relative price of investment] |
| | + | BKR(.,14) * LN(YRWC(.)) | [real average labour cost] |
| | + | BKR(.,15) * LN(PQRM(.,5)(.)) | [real oil price effect] |
| | + | BKR(.,16) * RDEU | [German unification] |
| | + | ECM | [error] |
| | | | |
| *Dynamic equation:* | | | |
| DLN(KR(.)) | | | [change in investment] |
| | = | BKR(.,1) | |
| | + | BKR(.,2) * DLN(YR(.)) | [real output] |
| | + | BKR(.,3) * DLN(PKR/PYR(.)) | [relative price of investment] |
| | + | BKR(.,4) * DLN(YRWC(.)) | [real average labour costs] |
| | + | BKR(.,5) * DLN(PQRM(.,5)(.)) | [real oil price effect] |
| | + | BKR(.,6) * DRDEU | [German unification] |
| | + | BKR(.,7) * LN(RRLR) | [real rate of interest] |
| | + | BKR(.,8) * LN(YYN(.)) | [actual/normal output] |
| | + | BKR(.,9) * DLN(KR)(-1) | [lagged change in investment] |
| | + | BKR(.,10) * ECM(-1) | [lagged error correction] |
| | | | |
| *Identities:* | | | |
| YRWC | = | (YRLC(.)/PYR(.))/YREE(.) | [real labour costs] |
| RRLR | = | 1+(RLR – DLN(PRSC))/100 | [real rate of interest] |
| | | | |
| *Restrictions:* | | | |
| BKR(.,2 .,4 .,8 .,12 .,14) >= 0 | | | ['right sign'] |

| | |
|---|---|
| BKR(.,3 .,7 .,13) <= 0 | [‘right sign’] |
| 0 > BKR(.,10) > -1 | [‘right sign’] |
| | |

| *Definitions:* | |
|---|---|
| BKR | is a matrix of parameters |
| KR | is a matrix of investment expenditure for 42 industries and 29 regions, m$ at 2000 prices |
| YR | is a matrix of gross industry output for 42 industries and 29 regions, m euro at 2000 prices |
| PYR | is a matrix of industry output price for 42 industries and 29 regions, 2000=1.0, local currency |
| PKR | is a matrix of industry investment price for 42 industries and 29 regions, 2000=1.0, local currency |
| PQRM | is a matrix of import prices for 42 industries and 29 regions, 2000=1.0, local currency |
| PRSC | is a vector of consumer price deflator for 29 regions, 2000=1.0 |
| YRLC | is a matrix of wage costs (including social security contributions) for 42 industries and 29 regions, local currency at current prices |
| YREE | is a matrix of employees for 42 industries and 29 regions, in thousands of persons |
| RLR | is a vector of long-run nominal interest rates for 29 regions |
| YYN | is a matrix of the ratio of gross output to normal output, for 42 industries and 29 regions |
| RDEU | is a dummy matrix for German unification (=0 for other countries) |
| | |

**The Intra-EU Export Volume Equations**

| *Co-integrating long-term equation:* | | | |
|---|---|---|---|
| LN(QIX(.)) | | | [intra-EU exports] |
| | = | BQIX(.,11) | |
| | + | BQIX(.,12) * LN(QZXI(.)) | [other-EU domestic demand] |
| | + | BQIX(.,13) * LN(PQRX(.)/EX) | [export price effect] |
| | + | BQIX(.,14) * LN(PQRZ(.)/EX) | [other-EU export price] |
| | + | BQIX(.,15) * LN(YRKC(.)*YRKS(.)) | [ICT technological progress] |
| | + | BQIX(.,16) * LN(YRKN(.)) | [non-ICT technological progress] |
| | + | BQIX(.,17) * SVIM | [proxy for internal market programme] |
| | + | BQIX(.,18) * RDEU | [German unification] |
| | + | ECM | [error] |
| | | | |
| *Dynamic equation:* | | | |
| DLN(QIX(.)) | | | [change in intra-EU exports] |
| | = | BQIX(.,1) | |

| | | | |
|---|---|---|---|
| | + | BQIX(.,2) * DLN(QZXI(.)) | [other-EU domestic demand] |
| | + | BQIX(.,3) * DLN(PQRX(.)/EX) | [export price effect] |
| | + | BQIX(.,4) * DLN(PQRZ(.)/EX) | [other-EU export price] |
| | + | BQIX(.,5) * DLN(YRKC(.)*YRKS(.)) | [ICT technological progress] |
| | + | BQIX(.,6) * DLN(YRKN(.)) | [non-ICT technological progress] |
| | + | BQIX(.,7) * DSVIM | [proxy for internal market programme] |
| | + | BQIX(.,8) * DRDEU | [German unification] |
| | + | BQIX(.,9) * DLN(QIX)(-1) | [lagged change in exports] |
| | + | BQIX(.,10) * ECM(-1) | [lagged error correction] |
| | | | |
| *Identities:* | | | |
| QZXI | = | SUM(((QZXC(.)*VQR(.)+VQRM(.)-VQR(.))/(QR(.)+QRM(.)-QRX(.))) | [other-EU domestic demand] |
| PQRZ | = | SUM(QZXC(.)*PQRX(.)) | [other-EU export price] |
| | | | |
| *Restrictions:* | | | |
| BQIX(.,12) + BQIX(.,14) = 0 | | | [price homogeneity] |
| BQIX(.,2 .,4 .,6 .,12 .,14), .,15 ,16) >= 0 | | | [‘right sign’] |
| BQIX(.,3 .,12) <= 0 | | | [‘right sign’] |
| 0 > BQIX(.,10) > -1 | | | [‘right sign’] |
| | | | |
| *Definitions:* | | | |
| BQIX | is a matrix of parameters | | |
| QZXI | is a matrix of weighted EU industry exports for 42 industries and 29 regions, excluding the region being estimated, m euro at 2000 prices | | |
| PQRX | is a matrix of price of export prices for 42 industries and 29 regions, 2000=1.0, local currency | | |
| EX | is a vector of exchange rates, local currency per euro, 2000=1.0 | | |
| PQRZ | is a matrix of weighted EU competing export prices for 42 industries and 29 regions | | |
| YRKC | is a matrix of ICT technological progress for 42 industries and 29 regions | | |
| YRKN | is a matrix of non-ICT technological progress for 42 industries and 29 regions | | |
| YRKS | is a matrix of skills for 42 industries and 29 regions | | |
| QZXC | is a matrix of shares of EU industry exports by destination for 42 industries and 29 regions, excluding the region being estimated | | |
| VQR(QR) | is a matrix of EU industry gross outputs for 42 industries and 29 regions, m euro at current (constant) prices | | |
| VQRM(QRM) | is a matrix of EU industry imports for 42 industries and 29 regions, m euro at current (constant) prices | | |

| | |
|---|---|
| SVIM | is an indicator of progress in the EU internal market |
| RDEU | is a dummy matrix for German unification (=0 for other countries) |
| | |

**The Intra-EU Import Volume Equations**

| | | | |
|---|---|---|---|
| *Co-integrating long-term equation:* | | | |
| LN(QIM(.)) | | | [intra-EU import volumes] |
| | = | BQIM(.,13) | |
| | + | BQIM(.,14) * LN(QRDI(.)) | [home sales] |
| | + | BQIM(.,15) * LN(PQRM(.)) | [import price effect] |
| | + | BQIM(.,16) * LN(PYH(.)) | [price of home sales by home producers] |
| | + | BQIM(.,17) * LN(EX) | [exchange rate] |
| | + | BQIM(.,18) * LN(YRKC(.)*YRKS(.)) | [ICT technological progress] |
| | + | BQIM(.,19) * LN(YRKN(.)) | [non-ICT technological progress] |
| | + | BQIM(.,20) * SVIM | [proxy for internal market programme] |
| | + | BQIM(.,21) * RDEU | [German unification] |
| | + | ECM | [error] |
| | | | |
| *Dynamic equation:* | | | |
| DLN(QIM(.)) | | | [change in intra-EU import volumes] |
| | = | BQIM(.,1) | |
| | + | BQIM(.,2) * DLN(QRDI(.)) | [home sale] |
| | + | BQIM(.,3) * DLN(PQRM(.)) | [import price effect] |
| | + | BQIM(.,4) * DLN(PYH(.)) | [price of home sales by home producers] |
| | + | BQIM(.,5) * DLN(EX) | [exchange rate] |
| | + | BQIM(.,6) * DLN(YRKC(.))*(YRKS(.)) | [ICT technological progress] |
| | + | BQIM(.,7) * DLN(YRKN(.)) | [non-ICT technological progress] |
| | + | BQIM(.,8) * DSVIM | [proxy for internal market programme] |
| | + | BQIM(.,9) * DRDEU | [German unification] |
| | + | BQIM(.,10) * LN(YYN(.)) | [actual/normal output] |
| | + | BQIM(.,11) * DLN(QIM)(-1) | [lagged change in import volumes] |
| | + | BQIM(.,12) * ECM(-1) | [lagged error correction] |
| | | | |
| *Identity:* | | | |
| QRDI | = | QR(.) + QRM(.) | [home sale] |
| PYH | = | (VQR(.) - VQR(.))/(QR(.) - QRX(.)) | [price of home sales by home producer] |
| | | | |
| *Restrictions:* | | | |

| | |
|---|---|
| BQIM(.,15) + BQIM(.,16) = 0 | [price homogeneity] |
| BQIM(.,17) = BQIM(.,15) + BQIM(.,16) | [price and exchange rate symmetry] |
| BQIM(.,2), BQIM(.,4), BQIM(.,13) >= 0 | [‘right sign’] |
| BQIM(.,3), BQIM(.,5), BQIM(.,6), BQIM(.,7) <=0 | [‘right sign’] |
| 0>BQIM(.,12)>-1 | [‘right sign’] |
| | |

| *Definitions:* | |
|---|---|
| BQIM | [is a matrix of parameters] |
| QRDI | [is a matrix of sales to the domestic market for 42 industries and 29 regions, m euro at 2000 prices] |
| PQRM | is a matrix of import prices for 42 industries and 29 regions, 2000=1.0, local currency |
| PYH | is a matrix of price of sales to the domestic market for 42 industries and 29 regions, 2000=1.0, local currency |
| EX | is a vector of exchange rates, local currency per euro, 2000=1.0 |
| VQR (QR) | is a matrix of EU industry gross output for 42 industries and 29 regions, m euro at current (constant) prices |
| VQRM (QRM) | is a matrix of EU industry imports for 42 industries and 29 regions, m euro at current (constant) prices |
| VQRX (QRX) | is a matrix of EU industry exports for 42 industries and 29 regions, m euro at current (constant) prices |
| YRKC | is a matrix of ICT technological progress for 42 industries and 29 regions |
| YRKN | is a matrix of non-ICT technological progress for 42 industries and 29 regions |
| YRKS | is a matrix of skills for 42 industries and 29 regions |
| SVIM | is an indicator of progress in the EU internal market |
| RDEU | is a dummy variable for German unification (=0 for other countries) |
| YYN | is a matrix of the ratio of gross output to normal output, for 42 industries and 29 regions |
| (.) | indicates that a matrix is defined across sectors |
| LN | indicates natural logarithm |
| DLN | indicates change in natural logarithm |
| ECM | [error] |
| | |

**The Industrial Hours-Worked Equations**

| | | | |
|---|---|---|---|
| *Co-integrating long-term equation:* | | | |
| LN(YRH(.)) | | | [average hours worked] |
| | = | BYRH(.,9) | |
| | + | BYRH(.,10) * LN(YRNH(.)) | [normal hours worked] |
| | + | BYRH(.,11) * LN(YRKC(.)*(YRKS(.)) | [ICT technological progress] |
| | + | BYRH(.,12) * LN(YRKN(.)) | [non-ICT technological progress] |
| | + | BYRH(.,13) * RDEU | [German unification] |
| | + | ECM | [error] |
| | | | |
| *Dynamic equation:* | | | |
| DLN(YRH(.)) | | | [change in average hours worked] |
| | = | BYRH(.,1) | |
| | + | BYRH(.,2) * DLN(YRNH(.)) | [normal hours worked] |
| | + | BYRH(.,3) * DLN(YRKC(.)*YRKS(.)) | [ICT technological progress] |
| | + | BYRH(.,4) * DLN(YRKN(.)) | [non-ICT technological progress] |
| | + | BYRH(.,5) * LN(YYN(.)) | [actual/normal output] |
| | + | BYRH(.,6) * DRDEU | [German unification] |
| | + | BYRH(.,7) * DLN(YRH)(-1) | [lagged change in average hours worked] |
| | + | BYRH(.,8) * ECM(-1) | [lagged error correction] |
| | | | |

| | |
|---|---|
| *Restrictions:* | |
| BYRH(.,3), BYRH(.,4), BYRH(.,11), BYRH(.,12) <= 0 | [‘right sign’] |
| BYRH(.,2), BYRH(.,10) = 1 | [normal hours homogeneity] |
| 0 > BYRH(.,8) > -1 | [‘right sign’] |
| | |

| | |
|---|---|
| *Definitions:* | |
| BYRH | is a matrix of parameters |
| YRH | is a matrix of average hours worked per week for 42 industries and 29 regions |
| YRKC | is a matrix of ICT technological progress for 42 industries and 29 regions |
| YRKN | is a matrix of non-ICT technological progress for 42 industries and 29 regions |
| YRKS | is a matrix of skills for 42 industries and 29 regions |
| YRNH | is a matrix of normal hours worked for 42 industries and 29 regions |
| YYN | is a matrix of the ratio of gross output to normal output, for 42 industries and 29 regions |
| RDEU | is a dummy matrix for German unification (=0 for other countries) |

| | |
|---|---|

**The Industrial Employment Equations**

| *Co-integrating long-term equation:* | | | |
|---|---|---|---|
| LN(YRE(.)) | | | [total employment] |
| | = | BYRE(.,11) | |
| | + | BYRE(.,12) * LN(YR(.)) | [real output] |
| | + | BYRE(.,13) * LN(YRWC(.)) | [real wage costs] |
| | + | BYRE(.,14) * LN(YRH(.)) | [hours worked effect] |
| | + | BYRE(.,15) * LN(PQRM(.,5)) | [real oil price effect] |
| | + | BYRE(.,16) * LN(YRKC(.)*YRKS(.)) | [ICT technological progress] |
| | + | BYRE(.,17) * LN(YRKN(.)) | [non-ICT technological progress] |
| | + | BYRE(.,18) * RDEU | [German unification] |
| | + | ECM | [error] |
| | | | |
| *Dynamic equation:* | | | |
| DLN(YRE(.)) | | | [change in total employment] |
| | = | BYRE(,.1) | |
| | + | BYRE(,.2) * DLN(YR(.)) | [real output] |
| | + | BYRE(,.3) * DLN(LYLC(.)) | [real wage costs] |
| | + | BYRE(,.4) * DLN(YRH(.)) | [hours worked effect] |
| | + | BYRE(,.5) * DLN(PQRM(.,5)) | [real oil price effect] |
| | + | BYRE(,.6) * DLN(YRKC(.)YRKS(.)) | [ICT technological progress] |
| | + | BYRE(,.7) * DLN(YRKN(.)) | [non-ICT technological progress] |
| | + | BYRE(,.8) * DRDEU | [German unification] |
| | + | BYRE(,.9) * DLN(YRE)(-1) | [lagged change in employment] |
| | + | BYRE(,.10) * ECM(-1) | [lagged error correction] |
| | | | |
| *Identity:* | | | |
| LYLC | = | (YRLC(.)/PYR(.)) / YREE(.) | [real labour costs] |
| | | | |
| *Restrictions:* | | | |
| BYRE(.,2), BYRE(.,12) >= 0 | | | ['right sign'] |
| BYRE(.,3), BYRE(.,4), BYRE(.,14) <= 0 | | | ['right sign'] |
| 0 > BYRE(.,10) > -1 | | | ['right sign'] |
| | | | |
| *Definitions:* | | | |
| BYRE | is a matrix of parameters | | |
| YRE | is a matrix of total employment for 42 industries and 29 regions, in thousands of persons | | |
| YR | is a matrix of gross industry output for 42 industries and 29 regions, m euro at 2000 prices | | |
| YRH | is a matrix of average hours worked per week for 42 industries | | |

| | |
|---|---|
| | and 29 regions |
| YRLC | is a matrix of employer labour costs (wages plus imputed social security contributions) for 42 industries and 29 regions, local currency at current prices |
| YRKC | is a matrix of ICT technological progress for 42 industries and 29 regions |
| YRKN | is a matrix of non-ICT technological progress for 42 industries and 29 regions |
| YRKS | is a matrix of skills for 42 industries and 29 regions |
| PYR | is a matrix of industry output prices for 42 industries and 29 regions, 2000=1.0, local currency |
| YREE | is a matrix of wage and salary earners for 29 regions, in thousands of persons |
| PQRM | is a matrix of import prices for 42 industries and 29 regions, 2000=1.0, local currency |
| RDEU | is a dummy matrix for German unification (=0 for other countries) |

**The Industrial Price Equations**

| | | | |
|---|---|---|---|
| *Co-integrating long-term equation:* | | | |
| LN(PYH(.)) | | | [price of home sales by home producers] |
| | = | BPYH(.,11) | |
| | + | BPYH(.,12) * LN(YRUC(.)) | [unit costs] |
| | + | BPYH(.,13) * LN(PQRM(.)) | [import price] |
| | + | BPYH(.,14) * LN(YRKC(.)*YRKS(.)) | [ICT technology index] |
| | + | BPYH(.,15) * LN(YRKN(.)) | [non-ICT technology index] |
| | + | BPYH(.,16) * LN(PQRM(.,5)) | [oil and gas import price] |
| | + | BPYH(.,17) * RDEU | [German unification] |
| | + | ECM | [error] |
| | | | |
| *Dynamic equation:* | | | |
| DLN(PYH(.)) | | | [change in price of home sales by home prods.] |
| | = | BPYH(.,1) | |
| | + | BPYH(.,2) * DLN(YRUC(.)) | [unit costs] |
| | + | BPYH(.,3) * DLN(PQRM(.)) | [import price] |
| | + | BPYH(.,4) * DLN(YRKC(.)*YRKS(.)) | [ICT technology index] |
| | + | BPYH(.,5) * DLN(YRKN(.)) | [non-ICT technology index] |
| | + | BPYH(.,6) * DLN(PQRM(.,5)) | [oil and gas import price] |
| | + | BPYH(.,7) * DRDEU | [German unification] |
| | + | BPYH(.,8) * LN(YYN(.)) | [normal/actual output] |
| | + | BPYH(.,9) * DLN(PYH)(-1) | [lagged change in prices] |
| | + | BPYH(.,10) * ECM(-1) | [lagged error correction] |
| | | | |
| *Identities:* | | | |
| PYH | = | (VQR(.) - VQRX(.))/(QR(.) - | [price of home sales by home |

| | | | |
|---|---|---|---|
| | | QRX(.)) | producers] |
| YRUC | = | YRUM(.) + YRUL(.) + YRUT(.) | [unit costs] |
| YRUM | = | SUM(QYC(.)*PQRD(.))/YR(.) | [material input unit costs] |
| YRUL | = | YRLC(.)/YR(.) | [unit labour costs] |
| YRUT | = | YRT(.)/YR(.) | [unit tax costs] |
| PQRD | = | (VQR(.) + VQRM(.) – VQRX(.))/(QR(.) + QRM(.) – QRX(.)) | [price of sales to the domestic market] |
| | | | |
| *Restrictions:* | | | |
| BPYH(.,11) + BPYH(.,12) + BPYH(.,14) = 1 | | | [price homogeneity] |
| BPYH(.,2 .,3 .,4 .,5 .,11 .,12 .,13 .,14.,15 .,16) >= 0 | | | [‘right sign’] |
| 0 > BPYH(.,10) > -1 | | | [‘right sign’] |
| | | | |
| *Definitions:* | | | |
| BPYH | is a matrix of parameters | | |
| PQRM | is a matrix of import prices for 42 industries and 29 regions, m euro at 2000 prices | | |
| YR | is a matrix of gross industry output for 42 industries and 29 regions, m euro at 2000 prices | | |
| YRKC | is a matrix of technological progress for 42 industries and 29 regions | | |
| YRKN | is a matrix of non-ICT technological progress for 42 industries and 29 regions | | |
| YRKS | is a matrix of skills for 42 industries and 29 regions | | |
| YYN | is a matrix of the ratio of gross output to normal output, for 42 industries and 29 regions | | |
| QYC | is an input-output coefficient matrix | | |
| YRLC | is a matrix of labour costs for 42 industries and 29 regions, local currency at current prices | | |
| YRT | is a matrix of net taxes for 42 industries and 29 regions, local currency at current prices | | |
| RDEU | is a dummy matrix for German unification (=0 for other countries) | | |
| | | | |

**The Industrial Average Earnings Equations**

| | | | |
|---|---|---|---|
| *Co-integrating long-term equation:* | | | |
| LN(YRW(.)) | | | [gross nominal average earnings] |
| | = | BYRW(.,14) | |
| | + | BYRW(.,15) * LN(YRWE(.)) | [external industry wage rates] |
| | + | BYRW(.,16) * LN(YRXE(.)) | [external regional wage rates] |
| | + | BYRW(.,17) * (LYR(.)-LYRE(.)+LPYR(.)-LAPSC) | [productivity effect] |
| | + | BYRW(.,18) * LN(RUNR) | [unemployment rate effect] |
| | + | BYRW(.,19) * LN(RBNR) | [benefit rate effect] |
| | + | BYRW(.,20) * LAPSC | [adjusted consumer prices] |
| | + | BYRW(.,21) * ARET | [adjusted wage retention rate] |
| | + | BYRW(.,22) * RDEU | [German unification] |
| | + | ECM | [error] |
| | | | |
| *Dynamic equation:* | | | |
| DLN(YRW(.)) | | | [change in gross earnings] |
| | = | BYRW(.,1) | |
| | + | BYRW(.,2) * DLN(LYRWE(.)) | [external industry wage rates] |
| | + | BYRW(.,3) * DLN(LYRXE(.)) | [external regional wage rates] |
| | + | BYRW(.,4) * D(LYR(.)-LYRE(.)+LPYR(.)-LAPSC) | [productivity effect] |
| | + | BYRW(.,5) * DLN(RUNR(.)) | [unemployment rate effect] |
| | + | BYRW(.,6) * DLN(RBNR(.)) | [benefit rate effect] |
| | + | BYRW(.,7) * D(LAPSC) | [adjusted consumer prices] |
| | + | BYRW(.,8) * DLN(ARET) | [adjusted wage retention rate] |
| | + | BYRW(.,9) * DRDEU | [German unification] |
| | + | BYRW(.,10) * D(DLAPSC) | [change in adjusted consumer prices] |
| | + | BYRW(.,11) * LN(YYN(.)) | [normal/actual output] |
| | + | BYRW(.,12) * DLN(YRW)(-1) | [lagged change in wage rates] |
| | + | BYRW(.,13) * ECM(-1) | [lagged error correction] |
| | | | |
| *Identities:* | | | |
| LAPSC | = | LN(PRSC) + LYEC + RRET | [log adjusted consumer price deflator] |
| LYEC | = | LN(1+(YEC/RWS)) | [log employers' social security rate] |
| ARET | = | RRET*RETR*RITR | [adjusted wage retention rate] |
| YRWE(.) | = | SUM OVER I (I NE J) (LN(YRW(1)*YRLC(I)/SUM(YRLC | [external industry wage rates] |

| | | | |
|---|---|---|---|
| | | (I))-LAPSC) | |
| YRXE(.) | = | LN(YRW(.))*RRDD+LN(EX)-LAPSC | [external regional wage rates] |
| RBNR | = | RBEN/RWS | [the benefit rate] |
| | | | |
| *Restrictions:* | | | |
| BYRW(.,15) + BYRW(.,16) + BYRW(.,17) = 1 | | | [price homogeneity] |
| BYRW(.,2 .,3.,4 .,6 .,15 .,16 .,17 .,19) > 0 | | | [‘right sign’] |
| BYRW(.,5 .,18) < 0 | | | [‘right sign’] |
| 0 > BYRW(.,13) > -1 | | | [‘right sign’] |
| | | | |
| *Definitions:* | | | |
| YRW | is a matrix of nominal average earnings (contractual wage) for 42 industries and 29 regions, national currency per person-year | | |
| BYRW | is a matrix of parameters | | |
| YRLC | is a matrix of nominal employer costs (wages and salaries plus employers’ and imputed social security contributions) for 42 industries and 29 regions, local currency at current price | | |
| RWS | is a vector of the YRW for 29 regions | | |
| RLC | is a vector of the YRLC for 29 regions | | |
| LYRE | is a matrix of the log of total employment for 42 industries and 29 regions, in thousands of persons | | |
| LYR | is a matrix of the log of gross industry output for 42 industries and 29 regions, m$ 2005 prices | | |
| LPYR | is a matrix of the log of prices of gross output for 42 industries and 29 regions, 2000=1.0, local currency | | |
| YYN | is a matrix of the ration of gross output to normal output, for 42 industries and 29 regions | | |
| PRSC | is the price deflator for total consumers’ expenditure, 2000=1.0, local currency | | |
| RRET | is a vector of wage retention rate for 29 regions | | |
| RETR | is a vector of 1 + employers social security rate for 29 regions | | |
| RITR | is a vector of 1 + indirect tax rate for 29 regions | | |
| RUNR | is the standardized unemployment rate | | |
| RBEN | is the social benefit paid to households, m euro at current prices for 29 regions | | |
| RDTX | is the total direct tax payments made by households, m euro at current prices | | |
| YEC | is a matrix of employers’ contributions to NIC, m euro at current prices | | |
| REES | is the total of employees’ contributions to NIC, m euro at current prices | | |
| RRDD | is a normalized distance indicator matrix for 29 regions with zeros down the leading diagonal and rows summing to one | | |
| EX | is a vector of exchange rates, local currency per euro, 2000=1.0 | | |
| RDEU | is a dummy matrix for German unification (=0 in other countries) | | |

| | |
|---|---|

**The Normal Output Equation**

| *Co-integrating long-term equation:* | | | |
|---|---|---|---|
| LN(YRN) | | | [normal industrial output] |
| | = | BYRN(7) | |
| | + | BYRN(8) * LN(YRY) | [external industrial output-same region other industries] |
| | + | BYRN(9) * LN(YRX) | [external regional output-same industry other regions] |
| | + | BYRN(10) * RDEU | [German unification] |
| | + | ECM | [error] |
| | | | |
| *Dynamic equation:* | | | |
| DLN(YRN) | | | [normal industrial output] |
| | = | BYRN(1) | |
| | + | BYRN(2) * DLN(YRY) | [external industrial output-same region other industries] |
| | + | BYRN(3) * DLN(YRX) | [external regional output-same industry other regions] |
| | + | BYRN(4) * DRDEU | [German unification] |
| | + | BYRN(5) * DLN(YR)(-1) | [lagged change in industrial output] |
| | + | BYRN(6) * ECM(-1) | [lagged error correction] |
| | | | |
| *Restrictions:* | | | |
| BYRN(.,8) = 0 | | | [no long-run effect from YRY] |
| BYRN(.,9) = 1 | | | [long-run homogeneity with respect to YRX] |
| -1<BYRN(.,6)<0 | | | [‘right sign’] |
| | | | |

| *Definitions:* | |
|---|---|
| YRN | is a matrix of normal industrial output for 42 sectors and 29 regions, m euro at constant 2000 prices, calculated as the fitted values of the dependent variable |
| BYRN | is a matrix of parameters |
| YR | is a matrix of gross industry output for 42 industries and 29 regions, m euro at 2000 prices |
| YRY | is a matrix of average industrial output (excluding own sector) for 42 sectors and 29 regions, m euro at constant 2000 prices |
| YRX | is a matrix of average industrial output (excluding own region) for 42 sectors and 29 regions, m euro at constant 2000 prices |
| RDEU | is a dummy matrix for German unification (=0 for other countries) |
| LN | indicates natural logarithm |
| DLN | indicates change in natural logarithm |
| ECM | [error] |

## A.6 Interregional and intertemporal smoothing results reported in Dolls et al. (2016)

Dolls et al. (2016) provide a formal decomposition framework in order to disentangle stabilisation effects of a) harmonising national UI systems, b) centralising the harmonised national UI systems, i.e. introducing a EUBS system (interregional smoothing) and c) allowing the EUBS system to issue debt (intertemporal smoothing). Running counterfactual simulations for the period 2000-13, they isolate and quantify harmonisation effects as well as interregional and intertemporal smoothing effects for euro area member states (EA18). In the baseline, they simulate a basic EUBS that is similar to the genuine EUBS systems considered in this paper. It has a replacement rate of 50 per cent, a maximum duration of benefit receipt of 12 months and a broad coverage of all new unemployed with previous employment income.

Interregional smoothing effects are derived by comparing the stabilisation effects of harmonised national unemployment insurance systems – which correspond to the EUBS in terms of benefit generosity and coverage - with those of the centralised EUBS, while intertemporal smoothing effects arise when the EUBS is allowed to run deficits and surpluses in single years. Smoothing effects are calculated as the fraction of unemployment shocks, measured as income fluctuations that arise due to transitions into and out of unemployment, that is absorbed through interregional and intertemporal smoothing.[23] The EUBS has a counter-cyclical (and hence stabilising) effect through interregional smoothing if – in the presence of rising unemployment – the increase in contribution payments to the centralised EUBS is smaller than to the harmonised NUBS, and vice versa. In that case, interregional smoothing coefficients are positive. Intertemporal smoothing gains materialise if in the presence of a negative shock the increase in contribution payments to the EUBS that is allowed to issue debt is smaller than the change in contribution payments to the EUBS that cannot run deficits, and vice versa in case of a positive shock. In that case, intertemporal smoothing coefficients are positive indicating counter-cyclical effects.

Table A.6-1 is taken from Dolls et al. (2016) and reports interregional and intertemporal smoothing effects of their baseline EUBS (see section 4.1 in Dolls et al. (2016) for the formal decomposition framework and further results). Interregional smoothing effects are in a range between -5 per cent (Malta) and 22 per cent (Latvia). Their results suggest that the extent of synchronisation of changes in short-term unemployment has been sufficiently low over the period 2000--13 to allow for interregional smoothing gains, but that these gains are unevenly distributed across countries. Overall, all member states except Malta would have been stabilised through the geographical widening of the budget, even though the authors find pro-cyclical effects for most countries in some years.[24] Ceteris paribus a move from harmonised NUBS to a centralised EUBS would have made fiscal policy in the euro area as a whole more counter-cyclical. The average interregional smoothing effect at EA-level amounts to 10 per cent. Letting the EUBS scheme issue debt would have made contributions less volatile and thus would have contributed to improved counter-cyclicality. The average cushioning effect through intertemporal smoothing ranges between 1 per cent (Estonia) to 25 per cent (Malta). At EA-level, it amounts to 9 per cent being of similar magnitude as the interregional smoothing effect.

[23] Note that overall stabilsation effects over the period 2000-13 are weighted with the relative size of the shocks in single years.

[24] Pro-cyclical interregional effects arise, for example, in the presence of a union-wide shock for those member state that are hit by a comparatively small shock. For member states whose shock is smaller than the average shock in the EA, contribution payments to the EUBS rise more than those to the (harmonized) NUBS. Dolls et al. (2016) find pro-cyclical interregional smoothing effects for Malta in 7 out of the 14 years which explains why the overall interregional smoothing effect is slightly pro-cyclical in Malta.

**Table A.6-1. Inter-regional and inter-temporal smoothing effects of income fluctuations due to transitions into and out of unemployment of baseline EUBS scheme reported in Dolls et al. (2016)**

| | Interregional | Intertemporal (debt-issuing) | Overall |
|---|---|---|---|
| AT | 5.8 | 18.2 | 24.0 |
| BE | 3.0 | 14.5 | 17.5 |
| CY | 17.7 | 7.3 | 25.0 |
| DE | 11.0 | 5.8 | 16.8 |
| EE | 19.4 | 0.8 | 20.2 |
| ES | 17.8 | 5.3 | 23.0 |
| FI | 2.4 | 22.5 | 25.0 |
| FR | 7.7 | 12.8 | 20.5 |
| GR | 12.0 | 4.8 | 16.9 |
| IE | 15.7 | 5.9 | 21.6 |
| IT | 5.5 | 11.4 | 16.9 |
| LU | 7.1 | 18.0 | 25.1 |
| LV | 21.6 | 1.2 | 22.8 |
| MT | -4.6 | 24.9 | 20.3 |
| NL | 8.3 | 13.9 | 22.2 |
| PT | 13.4 | 5.8 | 19.2 |
| SI | 5.6 | 13.5 | 19.1 |
| SK | 9.6 | 5.6 | 15.2 |
| EA18 | 9.9 | 9.3 | 19.2 |

Note: Table is taken from Dolls et al. (2016). It reports stabilisation coefficients for interregional and intertemporal smoothing weighted by shock size over period 2000-13. Stabilisation coefficients at EA18 level calculated as population-weighted average of member state's smoothing coefficients. The un-weighted smoothing coefficients at EA18 level are 10.0 for interregional smoothing and 10.7 for intertemporal smoothing. Source: Dolls et al. (2016).

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