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Thoughts on a fiscal union in EMU

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Non-technical summary

Research Question

Recently, calls for a deeper fiscal integration in the Euro Area have been voiced. We examine short- and long run effects of precisely three different forms of a fiscal union, ascending in the degree of fiscal integration: i) a per-capita public revenue equalisation scheme, similar to the German *Länderfinanzausgleich*, ii) tax harmonisation, where labour income tax and social security contribution rates are harmonised and iii) a supranational/centralised fiscal authority at the European level, where both revenue and expenditure-side fiscal instruments and public debt are centralised.

Contribution

We analyse and compare the different fiscal union scenarios with the New Keynesian DSGE model GEAR. The model incorporates a detailed fiscal sector and is estimated with a rich set of data for Germany and rest of the Euro Area. It enables us to draw some quantitative conclusions for these (groups of) countries. Furthermore, by means of a welfare analysis, we are able to draw some normative conclusions and provide a ranking of the three fiscal union scenarios, which may be region-specific.

Results

Our analysis shows that all three fiscal union scenarios considered in this paper do not improve international risk sharing significantly. Hence, neither Germany nor the rest of the Euro Area would benefit on a considerable basis from introducing any of these integration steps. Even when introducing risk premia on government bonds, this general finding is not changed – although risk premia per se decrease welfare notably. In the long run, redistribution generates winners and losers depending on the degree of integration and how key macroeconomic variables adjust.

Nichttechnische Zusammenfassung

Fragestellung

In der politischen Diskussion wird zunehmend eine stärkere fiskalische Integration für den Euroraum gefordert. Wir untersuchen in diesem Papier die kurz- und langfristigen Auswirkungen von drei konkreten Formen einer Fiskalunion, ansteigend im Grad der fiskalischen Integration: i) eine Nivellierung öffentlicher Einnahmen pro Kopf, ähnlich dem deutschen *Länderfinanzausgleich*, ii) eine partielle Steuervergemeinschaftung, bei der Lohnsteuer und Sozialversicherungsabgaben vergemeinschaftet werden, und iii) die Zusammenfassung der nationalen Staatshaushalte in einer zentralen europäischen Fiskalbehörde, in der sowohl die einnahmen- als auch die ausgabenseitigen Fiskalinstrumente sowie die Staatsverschuldung zentralisiert sind.

Beitrag

Wir analysieren und vergleichen die verschiedenen fiskalischen Szenarien mit Hilfe des in der Bundesbank entwickelten neukeynesianischen DSGE-Modells GEAR. Das Grundmodell beinhaltet einen detaillierten Fiskalsektor und wurde mit einem umfangreichen Datensatz für Deutschland und den Rest der Eurozone geschätzt. Es erlaubt uns, quantitative Rückschlüsse für diese Länder (-gruppen) zu ziehen. Darüber hinaus können wir durch Wohlfahrtsberechnungen auch normative Aussagen treffen und für jede Integrationsstufe der Fiskalpolitik eine Rangfolge für die beiden Länder (-gruppen) ableiten.

Ergebnisse

Unsere Analyse zeigt, dass die Risikoteilung unabhängig von der fiskalischen Integrationsstufe sehr gering ist. Weder Deutschland noch der Rest der Eurozone würden stark von einer Erhöhung der fiskalischen Integration profitieren. Selbst die Integration von Risikoprämien auf Staatsverschuldung ändert an dieser generellen Erkenntnis nichts, auch wenn die Einführung von Risikoprämien per se die Wohlfahrt merklich reduziert. Langfristig führt die Umverteilung zu Gewinnern und Verlierern je nach Integrationsgrad und welche makroökonomischen Variablen sich anpassen.

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Abstract

Using an estimated large-scale New-Keynesian model, we assess welfare and business cycle consequences of a fiscal union within EMU. We differentiate between three different scenarios: public revenue equalisation, tax harmonisation and a centralised fiscal authority. Relative to the status quo, long term consequences generate winners and losers depending on the degree of integration and on how key macroeconomic variables adjust. Short term differences between the regimes are minor, both in terms of business cycle statistics as well as in terms of risk sharing of asymmetric shocks. This also explains why welfare differences are negligibly small across the fiscal union scenarios. Even when introducing risk premia on government bonds, this general finding is not changed – although risk premia per se decrease welfare notably. We further perform a counterfactual exercise analysing the effects of what would have happened had a fiscal union regime been installed at the start of EMU already. While key macroeconomic variables would have reacted very similarly, debt dynamics could have changed notably over the estimation period.

Keywords: Fiscal Policy, Fiscal Union, DSGE-Modelling, Macroeconomics

JEL-Classification: H2, J6, E32, E62

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1. Introduction

The debt crisis in the EMU has provoked a debate about ways to advance the development of the euro area. There are various positions on this subject. On the one hand, there have been calls for the individual states to strengthen compliance and reinforce individual responsibility within a decentralised framework. Politically, this orientation has in recent years led to various resolutions, such as the fiscal compact. An agenda outlining potential ways to strengthen individual responsibility and how the euro area should deal with future fiscal problems can be found in the March 2015 issue of the Bundesbank's Monthly Report, for example. According to the publication, each country should itself be responsible for cushioning asymmetric shocks. In this case, low debt levels would be necessary to enable member states to absorb shocks, especially as a result of allowing automatic stabilisers to operate. Low debt levels in the public sector and credible compliance are highly crucial for the decentralised framework.

On the other hand, many are also calling for deeper fiscal integration given that this has already taken place for monetary policy following the introduction of the monetary union. The economic argument behind this demand is that a fiscal interconnection has the potential to overcompensate for the costs resulting from the abandonment of individual states' "own" monetary policy in a monetary union. These costs may be triggered by nominal rigidities, for example (a more detailed discussion of the arguments can be found below). In this paper, we will examine the impact that *three* different forms of a fiscal union could have both on Germany and on the euro area within the framework of a state-of-the-art macroeconomic simulation model (New Keynesian DSGE model) that has been estimated for Germany and the rest of the euro area. Specifically, we will analyse the impact of labour tax harmonisation, the per-capita equalisation of public revenues and the creation of a centralised supranational fiscal union. These will be compared respectively with the status quo of country-specific fiscal policy design.

The status quo is based on an estimate of the model incorporating German data as well as an average from the remaining euro-area countries (see Gadatsch et al., 2016). The analysis accordingly allows us to draw quantitative conclusions. Specifically, this

means that, in addition to the literature, the current paper not only answers questions addressed abstractly on a theoretical level based on models involving two *identical countries* (see Evers, 2015, for example), but rather investigates the issue explicitly for two specific countries or country groups. The findings add significant insights to the literature. For example, in two completely alike countries, the transmission of asymmetric shocks is alike in the respective economies. This no longer applies if important features such as price and wage rigidities or openness, to name a few, are different. Consequently, the exact modelling and heterogeneity of the countries is one crucial factor in the quantitative results and the final evaluation.

Our findings show that differences in international risk sharing between the various forms of a fiscal union are principally very low. The degree of fiscal integration has a negligible effect on economic performance or the macroeconomic reaction to shocks. However, differences may emerge in the long term, because more fiscal integration leads to a new long-term equilibrium – and consequently to structural changes in output, employment and other factors. Winners and losers change with the regime considered.

When it comes to the per-capita equalisation of public revenues, Germany would primarily experience a negative impact on the fiscal deficit, whereas all variables in Germany would be negatively affected by tax harmonisation. In this latter case, the new long-term equilibrium would be characterised by higher unemployment, lower gross domestic product (GDP) and lower private consumption in Germany, for example. Conversely, this could apply even more so in the case of a central fiscal authority where Germany could gain while the rest of the euro area could lose. Our simulations show that a transition from one regime to another could take place relatively quickly at least for some macroeconomic variables.

With regard to welfare, it is possible to establish according to our simulations that the welfare gains that would materialise in a fiscal union are likely to be small both for Germany and the euro area. Short-term aspects (with the potential to stabilise the economy) and the fact that business cycles do not change much depending on the fiscal regime are the prime dominating factor here, too, rather than a higher or lower long-term equilibrium level.

In the closing counterfactual analysis, we will examine how GDP, private consumption and the debt ratio would have developed in the past decade had a fiscal union (in

accordance with the three aforementioned forms) been created at the same time as the monetary union. Again, the differences with regard to the development of macroeconomic variables are principally minor, as these developments are not primarily driven by fiscal policy. However, we observe some alignments in the evolution of the debt-to-GDP ratios.

The model we use is quite elaborate and makes it possible to perform in-depth analyses. Yet, it still has a potentially important drawback that should be mentioned here: politico-economic aspects such as moral hazard are generally not illustrated in larger New Keynesian DSGE models. But every form of fiscal union can potentially generate incentives for free-riding, for example. With this in mind, the findings presented here should be interpreted as an analysis of the "mechanical" effects, without regard to the incentives to make policy changes. Still, compared to other studies in the literature that have attempted to answer similar questions (see Evers, 2006, 2012, 2015; or Farhi, Werning, 2013), the model used here is more capable of drawing conclusions regarding the quantitative impact of various forms of fiscal union. On account of these weak points, however, the inclusion of politico-economic incentives in larger general equilibrium models should remain on the research agenda in addressing this issue.[2]

The paper is structured as follows: The second part features a brief and intuitive model description as well as a list of the three fiscal union scenarios and a short explanation thereof. The third part examines the findings of the study. Great stress is laid on the distinction between short- and long-term effects. A welfare analysis is used to determine which form of fiscal policy could be advantageous, and a counterfactual analysis illustrates how the economies would have evolved in the past under the different forms of a fiscal union relative to the status quo.

[2] Furthermore, analysing alternative fiscal union scenarios such as, among others, a common unemployment insurance system or other politically viable transfer schemes should also remain on the research agenda (see Moyen et al., 2016, going in that direction).

2. Model description and fiscal union scenarios

The current status quo in the euro area is illustrated by an estimated New Keynesian DSGE model – specifically, the Bundesbank model GEAR:[3] a three-country model, of which two countries (Germany and the rest of the euro area) form a monetary union and together represent an open economy. The developments in the third country (the rest of the world) are assumed to be *exogenous* in nature. However, they influence development, especially demand, in the euro area. Both countries have the same economic structure, but are parameterised differntly: both countries are inhabited by households that make optimal consumption, savings and labour supply decisions. Some households are liquidity-constrained and therefore forced to consume their entire income in each period. As a result, these households do not make any savings decisions. The remaining households can save and borrow. Involuntary unemployment arises if the aggregate labour supply exceeds the demand for labour in the economy, but we assume no labour mobility between regions. Labour and capital are used as production factors for the production of goods and services. Taxes and levies comprise consumption, wage and capital taxes as well as social security levies. They distort supply and demand decisions or savings decisions because they ultimately reduce net earnings or net interest income/profits, thereby potentially increasing financing costs. The components of fiscal expenditures comprise transfers (including unemployment benefits), public consumption, public-sector wages and public investment. Public employment and public capital have a positive effect on private-sector productivity. Public authorities can also borrow to balance the budget in each period, if necessary. In doing so, they have to pay interest that is guided by the nominal interest rate for the euro area. The latter is determined by the monetary policy institution in accordance with a Taylor rule for the entire monetary union (i.e. it sets it in accordance with the aggregate variables inflation and output). In the baseline model, risk premia on government bonds are absent. However, we will show simulation results of an extension that includes risk premia on government bonds if the debt-to-GDP ratio deviates from target.

According to the literature on optimum currency areas (see Mundell, 1961; Kenen, 1961; and McKinnon, 1965), a currency area is essentially optimum if the input factors,

[3] GEAR means Germany in the Euro Area and the Rest of the World. See Gadatsch et al. (2016) for an exact description of the model including all model equations.

such as capital and labour, are sufficiently mobile. Should this not be ensured, asymmetric shocks could have very persistent and negative effects on the country in which the shock occurs, and therefore on the entire currency area. These costs could generally be further exacerbated by high price and wage rigidities or frictions; both in nominal and real terms (see Farhi and Werning, 2013). These frictions and rigidities are taken into account in the GEAR model. Also capital is included as a key input factor. Internationally, both production factors are not mobile. However, especially compared to the United States, this is certainly the case in the euro area. Therefore, a key aspect of the literature on optimum currency areas is not met. The degree of (nominal and real) frictions and rigidities is estimated and is accordingly different within the euro area. Compared to other model-based studies, this is a decisive advantage which brings our model closer to what we observe in practice.

Fiscal union scenarios:

The issue of the pros and cons of a fiscal union is challenging for various reasons. The first obstacle lies in the question of what the term "fiscal union" denotes exactly. For this analysis, we have decided on three different potential scenarios in agreement with Bargain et al. (2013), who also provide some more reasoning for assuming exactly these scenarios. The first scenario includes a per-capita equalisation of public revenues similar to the fiscal equalisation system in Germany or Switzerland. The second consists in tax harmonisation in which labour taxation is harmonised for both Germany and the rest of the euro area. The farthest-reaching form of fiscal integration, our third alternative, illustrates a centralised supranational fiscal authority at European level.

The basis scenario against which we will compare all the fiscal union scenarios is the estimated status quo. Fiscal policy is described here using estimated fiscal reaction functions/rules, which is a standard approach in the literature. More precisely, every fiscal instrument on the revenue side and on the expenditure side reacts to the deviation of the debt level from the long-term target and to the output gap. The latter can be interpreted as a sort of automatic stabiliser. These reaction coefficients have been estimated in the standard model (see Gadatsch et al., 2016). Rules are also required within the centralised framework. We address this necessity in the modelling of scenarios. The three fiscal union scenarios are described briefly in the following section.

An analytical illustration with the most important equations that describe the respective regime can be found in the appendix.

Public revenue equalisation (RE) implies that a European fiscal authority generates revenues through taxes and levies and redistributes them in such a manner that the countries have the same per capita revenue as a result of these "European" tax and levy rates. European tax and levy rates generating the revenue that is redistributed between the member states are assumed to be a weighted average derived from the country-specific tax and levy rates (generating the same union-wide revenue ex ante) that are then applied to the country-specific tax and levy base.[4] Every country is however able to set its own tax and levy rates that may deviate from the European average and/or allow them to react to debt and economic activity, thereby deviating from the European average. Accordingly, these resulting "additional revenues" are either below or above the average that is apportioned to each country. In the original long-term equilibrium (known as the steady state), this is the case on account of the calibrated tax and social security rates. However, the redistribution results in a transfer union.[5] The spending side of the public sector is left untouched. The deficit is still given as the difference of each country's spending decision and the revenues that this country generates including its decision to deviate from the "European" tax.

The second form of fiscal union that we describe is **tax harmonisation (TH)**. In this form, the labour income tax and social security levy rates are standardised. All other fiscal instruments therefore remain in the control of the individual countries. We assume that labour income tax and social security levy rates are set in such a manner that the average union-wide revenues generated by both countries do not differ from those that result from the individual setting of rates. This results in an "European" revenue that is then redistributed among both countries and their fiscal sectors in a population-weighted manner. Although a change in revenues may not materialise within the euro aggregate ex ante, this may very well occur at country level, thereby changing the levy rates in the

[4] Note that, in the end, the supranational fiscal budget only serves as a balance sheet for redistributing tax revenues. Assuming supranational tax and levy rates only brings the system closer to existing federal fiscal unions. While deviations from these rates are not allowed in Germany, they are in Switzerland, for example.

[5] In the steady state, this would mean higher levels of debt in one country than in another. However, in this analysis we assume that they are 60% of GDP. Another fiscal instrument must be adjusted to achieve this. We assume that the adjustment instrument is a per capita tax so as to avoid distortions.

respective countries. We assume that, after harmonisation, these European tax and levy rates no longer react to the national debt level and country-specific economic activity given that they are outside the national control. However, it still contains the two shock terms that were previously estimated for the individual countries in the status quo to account for potential discretionary policy at the European level.

The **centralised supranational fiscal authority (CA)** is the strongest form of fiscal union that we examine in this study. Under this regime, both the revenue-side and expenditure-side fiscal instruments are centralised, as is public debt. The European taxes, levies and expenditure components then react to pan-European public debt and the weighted business cycles. The result is therefore also a single budget equation for the state, which is supranational in this case. Both monetary and fiscal policy would in this case be completely determined at the supranational level, where both countries can be considered regions in the newly formed state.

3. Findings

The paramount interest lies in the issue of how (the introduction of) a fiscal union influences international risk sharing and hence impacts welfare. In doing so, it is essential to differentiate between long-term effects, transitional effects (i.e. short-term effects) and the impact on the business cycle. Finally, we will also look at the hypothetical question of how the debt ratio, GDP and other variables would have developed if a fiscal union had been introduced at the same time as the monetary union (known as a counterfactual analysis).

3.1. Long-term effects

The long-term effects of the respective fiscal union are illustrated in Table 1. The findings are given as percentage (point) deviations relative to the status quo.

Table 1: Long-term effects of selected macro variables of the respective form of fiscal union compared to the status quo

	Rev. Equalization	Harmonization	Central Authority
…in Germany			
GDP	-0,219	-0,155	0,973
Priv. consumption	-2,123	-0,189	2,164
Priv. investment	-0,280	-0,199	-1,114
Unemployment rate	0,112	0,173	1,462
Real wages	-0,368	-4,712	-0,693
Gov. Purchases to GDP ratio	0,019	-0,014	-1,831
Gov. investment to GDP ratio	0,003	-0,002	0,521
Gov. employment rate	0,000	0,000	0,852
Gov. Real wage rate	0,748	-0,144	1,055
Gov. transfers to GDP ratio	0,158	-2,799	-2,806
Labor tax rate	0,000	-1,977	-1,977
Social security contributions	0,000	5,716	5,716
Consumption tax rate	0,000	0,000	0,864
Capital tax rate	0,000	0,000	7,559
Lump-sum taxes to GDP ratio	2,311	-24,124	-2,231
Primary deficit ratio	1,656	-17,309	-1,564
…in rest of the euro area			
GDP	0,131	0,106	-0,101
Priv. consumption	1,058	0,144	-0,484
Priv. investment	0,146	0,118	0,923
Unemployment rate	-0,070	-0,099	-0,813
Real wages	0,190	1,728	0,467
Gov. Purchases to GDP ratio	-0,009	0,007	0,954
Gov. investment to GDP ratio	-0,002	0,002	-0,196
Gov. employment rate	0,000	0,000	-0,328
Gov. Real wage rate	-0,386	0,116	-17,316
Gov. transfers to GDP ratio	-0,072	1,249	1,492
Labor tax rate	0,000	0,763	0,763
Social security contributions	0,000	-2,204	-2,204
Consumption tax rate	0,000	0,000	-0,426
Capital tax rate	0,000	0,000	-2,591
Lump-sum taxes to GDP ratio	-0,957	-19,066	2,063
Primary deficit ratio	-0,756	-15,089	1,028
…euro area aggregate			
GDP	0,036	0,035	0,189
Priv. consumption	0,198	0,054	0,231
Priv. investment	0,031	0,033	0,372
Unemployment rate	-0,021	-0,025	-0,198
Real wages	0,039	-0,012	0,154
Gov. Purchases to GDP ratio	-0,001	0,001	0,201
Gov. investment to GDP ratio	-0,001	0,001	-0,002
Gov. employment rate	0,000	0,000	-0,009
Gov. Real wage rate	-0,080	0,046	-12,351
Gov. transfers to GDP ratio	-0,010	0,155	0,331
Labor tax rate	0,000	0,022	0,022
Social security contributions	0,000	-0,064	-0,064
Consumption tax rate	0,000	0,000	-0,077
Capital tax rate	0,000	0,000	0,153
Lump-sum taxes to GDP ratio	-0,074	-20,433	0,903
Primary deficit ratio	-0,104	-15,689	0,328

As outlined in the description of the equalisation of public revenues, this regime implies a permanent redistribution of revenues. Germany's "better" fiscal position primarily resulting from higher tax bases implies redistribution of revenues from Germany to the rest of the euro area. This entails a higher primary deficit in Germany and a lower one in the rest of the euro area. Because of this fiscal redistribution, consumption and, thus, GDP are lower in Germany in the new equilibrium while it is higher in the rest of the euro area. The per capita tax is changed in order to keep debt ratios within the new steady state at 60% of the respective GDP pursuant to the Maastricht criteria.[6] If we were to allow the debt ratio to vary, it would rise in Germany, whereas it would fall in the rest of the euro area.

In the case of tax harmonisation, all real variables are impacted because the actual labour income tax and levy rates change. In the original steady state, German personal income tax rates are slightly higher than those in the rest of the euro area, which holds conversely for social security contribution rates. After tax harmonisation, this implies a slight decrease in German personal income tax rates and increases in the social security contribution rates (an opposite for the rest of the euro area). However, the decrease in the labour income tax does not compensate for the significantly higher social security levies in Germany which results in an increase in the overall tax- and levy-induced distortions in the German economy, which negatively impacts employment, output and consumption. The rest of the euro area benefits due to the lower tax burden on the production factor labour. In the long term, Germany loses 0.16% of its GDP, whereas the rest of the euro area gains 0.1%. Similar figures result for private consumption and private investment. Unemployment also rises in Germany, whereas it falls in the other euro-area countries. The steep rise in social security levies in Germany reduces the country's primary deficit. By contrast, it increases in the rest of the euro area.

In the final scenario, the supranational fiscal authority, Germany seems to win while the rest of the euro area loses. This can (mechanically) be explained as follows. Because capital taxes rise in Germany, optimising households invest less, therefore private investment falls. Private consumption rises, also a result of the substitution of lower private investment. The steeply rising social security contributions overcompensate for

[6] The per capita taxes are not assumed to be part of the primary deficit. The changes are identical following correction for the proportion of optimising households (see appendix).

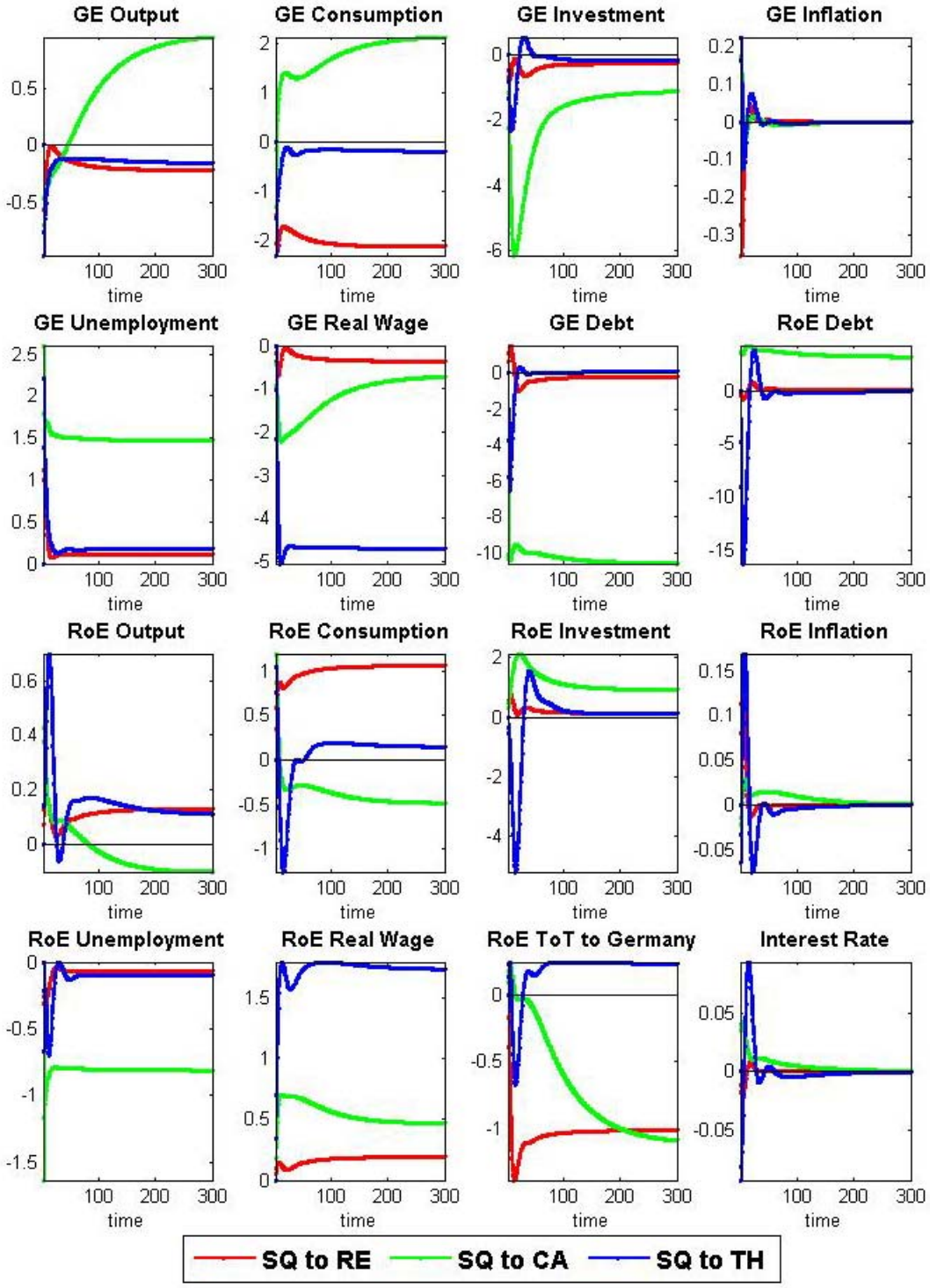
the falling labour tax rate, ultimately resulting in a rise in unemployment (see description above). Overall, public consumption ends up being lower in the long term, which frees up resources for higher public investment. The latter makes its way into the production process in the form of an increase in private-sector productivity, which boosts output. This effect plays a major role in increasing overall economic output in the long term despite a higher unemployment rate. The primary deficit decreases as a result of the mentioned effects. For the rest of the euro area, some of these findings are reversed from a qualitative perspective. As a result, long-term GDP declines, while unemployment falls. Private consumption also falls, whereas private investment increases. This leads to a higher primary deficit in the rest of the euro area in the long term.

3.2. Transitional phase

As seen in 3.1, the individual regimes lead to different steady states. However, the specifics of the transitional phase from the status quo to a fiscal union and its duration are just as crucial for the policy analysis. Depending on which country is examined, this transfer is associated with costs or is profitable from a macroeconomic perspective. The relevant long-term differences for the macro variables – such as unemployment, GDP and debt ratio – have already been illustrated in Table 1 and described in Section 3.1. Figure 1 illustrates the transition from the status quo to a fiscal union.

As described in Section 3.1, the transition from the status quo to the equalisation of public revenues should not lead to major adjustments for most variables. As described above, however, consumption is now considerable lower in Germany and higher in the rest of the euro area. But the adjustment occurs quickly. As a result, the long-run terms of trade are also affected.

Figure 1: Representation of the transition from the status quo to one of the other regimes



In the other scenarios long-run adjustments may take longer and are more pronounced as can be seen based on the change in long-term output and unemployment in Germany, for example. After undershooting or exceeding the starting value in the first periods, they settle down at a lower or higher level in the long term. This applies in a more moderate form to a transition to a scenario of tax adjustment and in a quantitatively stronger form to a transition to a centralised tax authority. The opposite can be seen for the rest of the euro area in nearly reversed form. Because unemployment rises in Germany in the long term, the real wage falls. This is exacerbated by the 6% decrease in investment, which reduces capital stock on the whole, thereby also reducing marginal factor productivity. With the exception of a few variables, these changes will take place in both Germany and the euro area within a few quarters.

3.3. Economic statistics

Key (business cycle) statistics regarding the economic implications of the various forms of fiscal union are illustrated in Table 2.

Table 2: Effects of the status quo and the respective fiscal union on (cyclical) economic activity

	Status quo	Rev. Equalization	Harmonization	Central Authority
Standard deviations				
German GDP	0.028	0.028	0.029	0.030
German priv. consumption	0.034	0.035	0.037	0.035
German employment	0.014	0.014	0.015	0.015
RoE GDP	0.025	0.025	0.025	0.024
RoE priv. consumption	0.035	0.031	0.035	0.034
RoE employment	0.008	0.008	0.008	0.008
Autocorrelations				
German GDP	0.920	0.921	0.928	0.935
German priv. consumption	0.936	0.942	0.942	0.939
German employment	0.793	0.793	0.805	0.822
RoE GDP	0.952	0.953	0.953	0.950
RoE priv. consumption	0.968	0.961	0.968	0.968
RoE employment	0.845	0.845	0.843	0.840
Cross-correlations				
GDP	0.328	0.306	0.356	0.334
Priv. consumption	0.655	0.704	0.689	0.665
Employment	0.163	0.176	0.186	0.144
GDP-correlation with deficit ratio				
Germany	-0.668	-0.676	-0.557	-0.451
Rest of the Euro Area	-0.189	-0.172	-0.126	-0.222

Generally speaking, the overall economic implications of the various scenarios are very similar. The indicators we examine here are standard deviations as well as autocorrelations and cross-correlations for selected key variables that indicate the moments in the business cycle. The standard deviations – a measure for volatility of macroeconomic variables – for employment are practically the same for Germany as for the rest of the euro area. Slightly higher standard deviations result under tax harmonisation and under a supranational fiscal authority. This is due to the lower number of fiscal instruments contributing to smoothing out the business cycle in these scenarios, which leads to a slightly higher volatility of macro variables. Autocorrelations measure the persistence of shocks. We observe that the various forms of fiscal union and the status quo are very similar with regard to the autocorrelation of the variables. Hence, a fiscal union does not improve too much the shock absorption. While the centralised form of fiscal union results in a slightly higher persistence for German GDP and employment, it does not have any effect in this respect in the rest of the euro area. Similarly, we only see a notable increase in the cross-correlations – a measure for how synchronised business cycles are – of country-specific GDP and employment if we compare the centralised fiscal authority with the status quo. The pattern of consumption, too, changes very little from one scenario to the next. But the following is an important finding, at least for policy analysis: the synchronisation of the two business cycles increases by approximately 2% (cross-correlation of GDP rises from 0.32 to 0.33) under a centralised fiscal authority. This could make a single monetary policy for both countries easier as the impact of a policy change would be more aligned, for example.

The largest differences between the status quo and a fiscal union emerge from the GDP correlation with the deficit ratio. It decreases significantly for Germany, as the domestic economy is then less closely correlated with domestic fiscal policy and because redistribution is then more pronounced over the business cycle. Developments in the rest of the euro area – in which the correlations also grow more negative, resulting in a more pronounced anticyclical relationship between the fiscal sector and the business cycle – stands in contrast to this. The centralisation of fiscal instruments means that they no longer have as much a targeted effect on a country's individual economy. For both countries, this results in a lower correlation between the business cycle and the fiscal

sector. In summary, however, it is possible to conclude that – with a few exceptions – the economic statistics do not demonstrate any major differences between the status quo and the fiscal union scenarios.

Apart from the examination of the statistical properties of the various fiscal policy scenarios, it is interesting to see how certain macro variables react to shocks in the economy. Here, we present the impulse responses of certain selected macro variables to two different shocks. These shocks are asymmetric, meaning they impact only one country directly, whereas the other country is affected only by spillover effects. We employ a supply shock (technology) and a demand shock (consumer preference) in Germany. For each of these shocks, we examine the responses of the macro variables in the four different scenarios. [7]

Conspicuously, there is almost no quantitative difference on key macroeconomic variables across the various scenarios in the event of a technology shock in Germany (see Figure 2), while some differences with regard to public debt are discernible. The adjustment back to the steady state is significantly faster given the existence of a centralised fiscal authority, since the burden is shared by Eurozone member states as a whole, in contrast to a reaction to the shock and its impact by German fiscal policy only. As a result, the debt ratio in the rest of the euro area reacts much more strongly than in the basis scenario. All told, the spillover effects of a shock in Germany, which are principally minor, lead to quantitatively minor changes in the rest of the euro area. These are most severe with a supranational fiscal authority because the deviations from the steady state are the most pronounced. Intuitively, this is due to the fact that European fiscal policy reacts most directly to a shock in Germany in this scenario.

[7] We intentionally forgo the illustration of a fiscal policy shock, as our focus in this study is the reaction of both fiscal policy approaches to a shock that arises on the real side of the economy rather than the fiscal spillover effects that result automatically from fiscal policy.

Figure 2: Reaction of selected macro variables under the four regimes after a technology shock in Germany

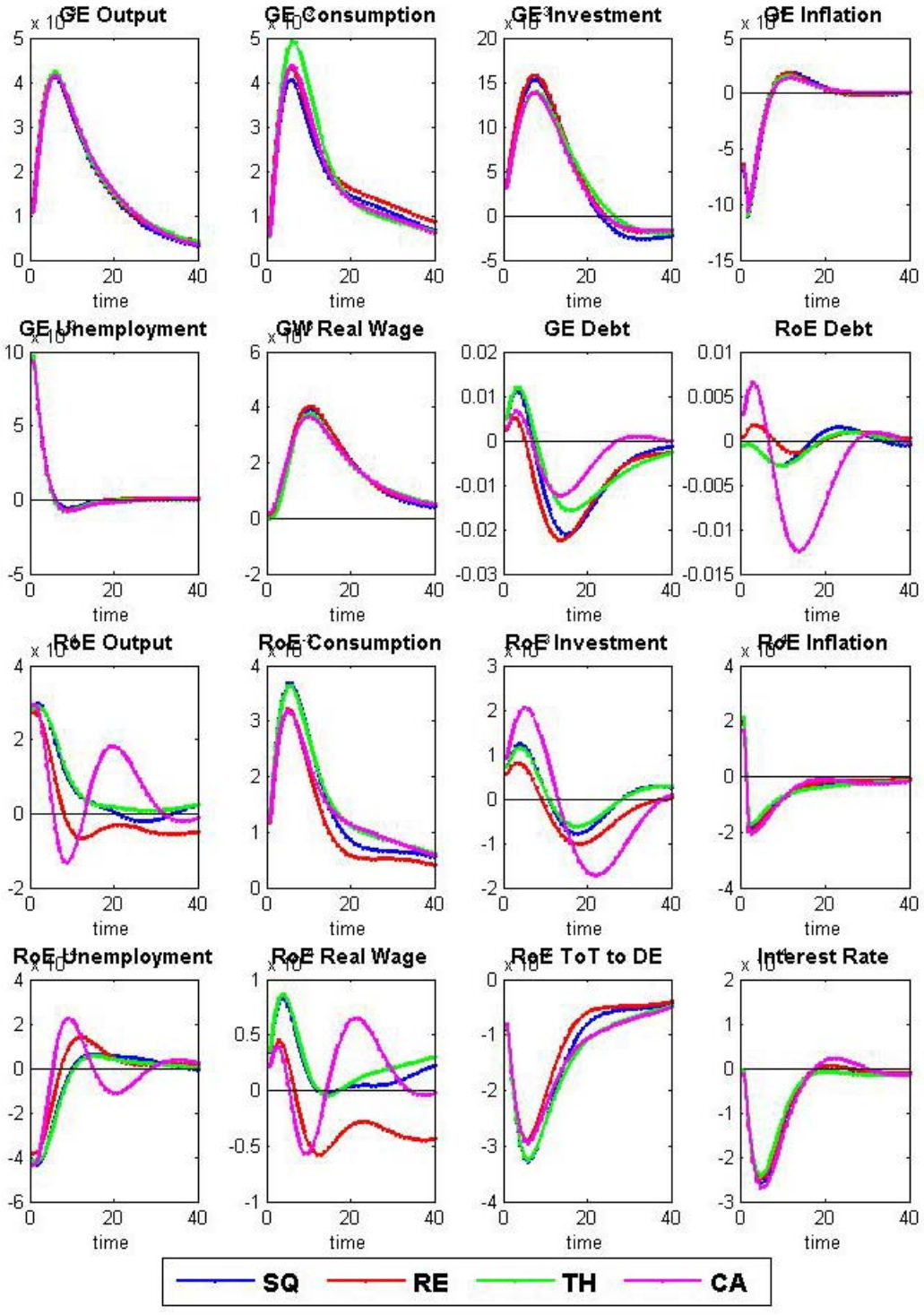
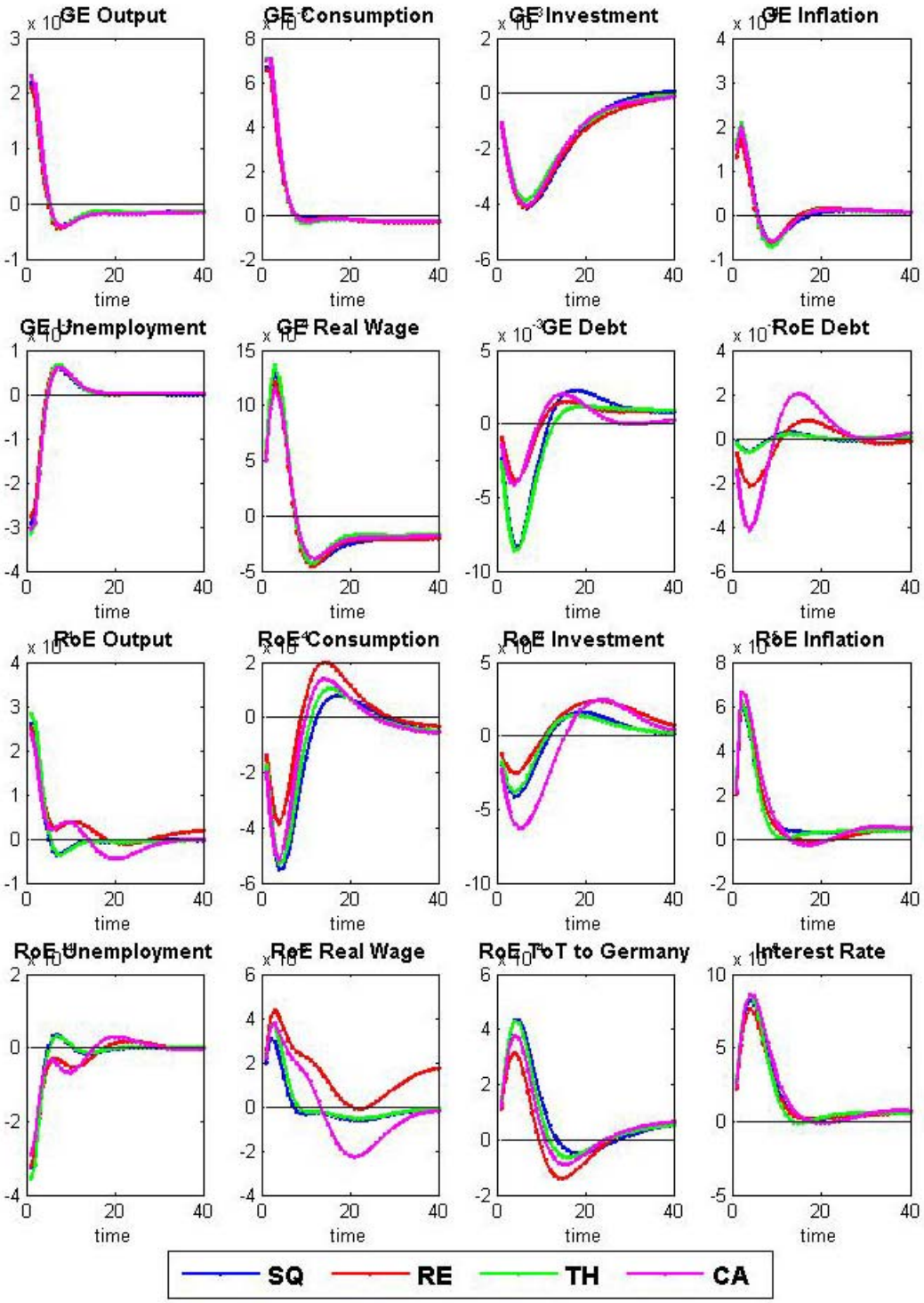


Figure 3: Reaction of selected macro variables under the four regimes after a consumer preference shock in the rest of the euro area



The same picture with regard to the deviations between the fiscal union regimes results in the wake of a consumer preference shock (see Figure 3). In this case, consumption rises, leading to an increase in prices due to the impact on demand. Production increases, which initially causes unemployment to fall. These two aspects lead to higher government revenues, thereby lowering debt. On the other hand, the macro variables in Germany are not different, whereas investment and consumption deviate slightly in the rest of the euro area due to the presence of small spillover effects. In the rest of the euro area, the initial dip in investments is significantly larger under a supranational fiscal authority relative to under the status quo. The largest changes are again apparent in the fiscal variables, both in Germany and in the rest of the euro area. Debt therefore varies more or less depending on the regime. The stronger fiscal integration is, the weaker the debt reduction. The reaction of the fiscal variables aims increasingly towards the European aggregate. Accordingly, less is cushioned through domestic activity than through foreign activity. As a result, the contradictory reaction of debt in the rest of the euro area is stronger the deeper fiscal integration is. Here, too, fiscal policy is the channel for the transmission of the differences into the real economic variables in the rest of the euro area. However, these also remain sufficiently quantitatively similar from one scenario to the next.

3.4. Welfare analysis

In New Keynesian models, welfare analysis is the decisive criteria for the evaluation of different policies. As a result, this also applies to the evaluation of the introduction of a fiscal union. It is necessary to differentiate between welfare gains and losses due to business cycle fluctuations and those triggered by a change in the steady state. The welfare gains and losses that arise on account of business cycle fluctuations are determined in the following by maximising the utility level of households. This is done by investigating how many units of steady-state consumption households would be willing to give up per period in order to live in a deterministic world, i.e. in a world without stochastic shocks and therefore in absence of business cycles in line with expectations. The units of consumption are measured as a percentage of the long-term level of consumption. We initially perform this analysis for each scenario, including the

status quo. After that, we compare the fiscal union scenarios with the basis scenario to determine the relative welfare gains and losses from one scenario to the next. The respective findings for both Germany and the rest of the euro area can be seen in Table 3. The findings are listed in per cent.[8]

Table 3: Welfare analysis for Germany, the rest of the euro area and the euro area as a whole; welfare has been calculated as the consumption equivalent

	Overall		
	Germany	Rest of the Euro Area	Whole Union
Costs of Business Cycle (in %)			
SQ	0.000	0.060	0.043
RE	0.009	0.055	0.042
TH	0.000	0.064	0.046
CA	0.000	0.052	0.038
Relative total welfare gains/losses (including long-run adjustment)			
RE	-3.82	2.01	0.39
TH	-0.04	-0.41	-0.31
CA	1.46	0.07	0.46

In terms of business cycle costs, a representative German household would neither gain nor lose significantly in any form of a fiscal union compared to the status quo. In the scenario of revenue equalisation German households would be willing to give up close to 1% of their consumption to live in a deterministic world without business cycles. In all other cases this value is zero. Accordingly, the inclination in Germany towards hedging against business cycle fluctuations through any form of fiscal union or demanding something in return for it is low, as the welfare gains and/or losses resulting from business cycle fluctuations would be very minor. In the rest of the euro area, households would have to spend a higher percentage to live in a world without shocks; this affects both the status quo as well as revenue and tax harmonisation with a nearly identical quantity of around 6%. In the case of a centralised union, they would have to

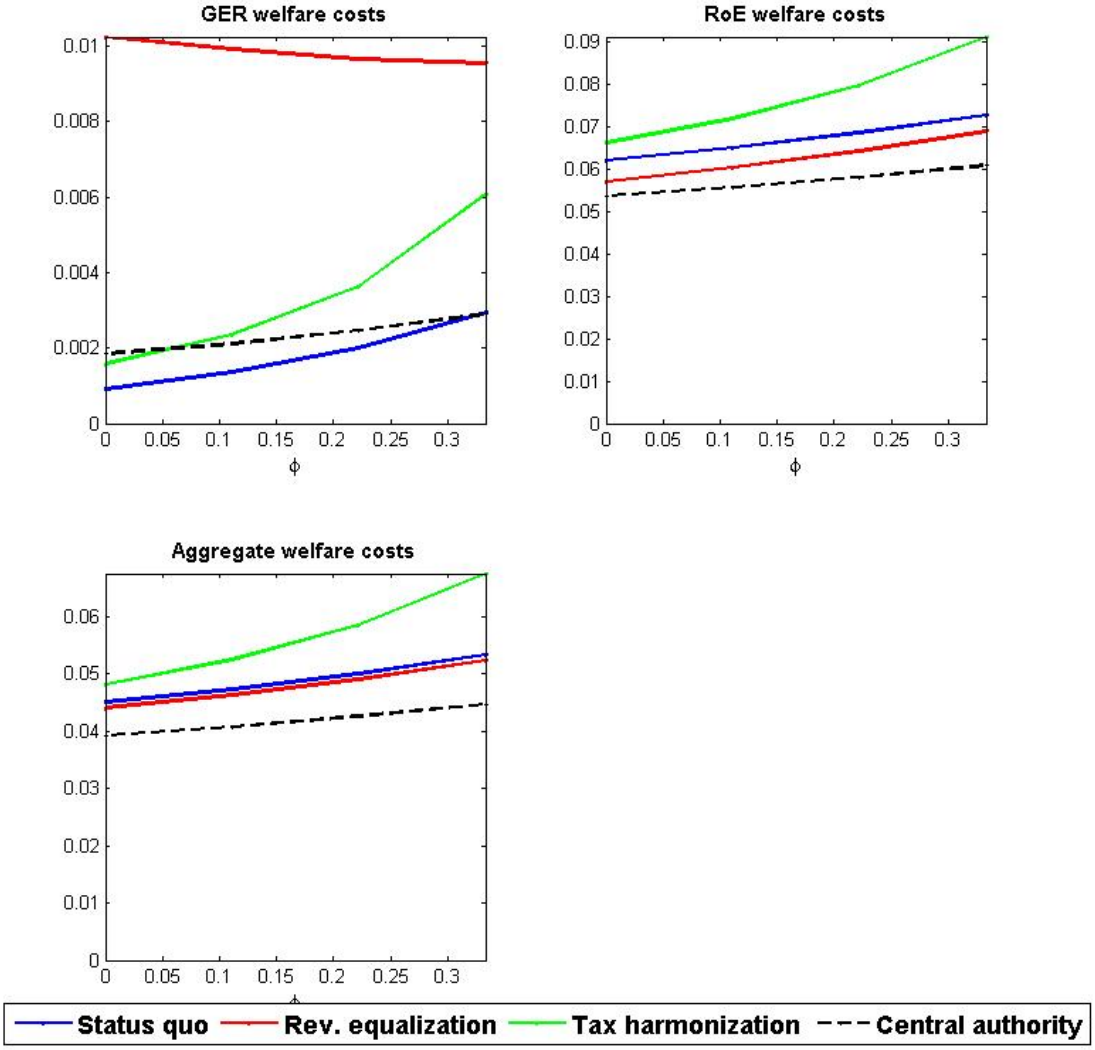
[8] Technically, we compute a second-order Taylor approximation of the full non-linear model around a deterministic steady state as in Lucas (2003). While a second-order Taylor expansion is a sufficiently good approximation to account for the non-linearities of the model, it may still not account for changes in risk that can emerge when considering the stochastic steady state. However, academia has not yet offered a commonly accepted way to circumvent this issue in large-scale models and we, therefore, present the results emerging from a state-of-the-art analysis.

spend 5.2%. As a result, this regime would be advantageous from their perspective, as would be the revenue equalisation with an amount of 5.5%. Qualitatively, this is also the case for the entire euro area, which would improve from roughly 4.3% to 3.8%. In the lower half of Table 3, we also take into account changes in the long-run equilibrium. Compared to the status quo, Germany (and, to a lesser extent, the rest of the euro area) would benefit from a centralised fiscal authority, while all other fiscal union scenarios yield a welfare loss from an entire union perspective.

This model analysis accordingly does not allow us to conclude that fiscal integration (of the form discussed in this paper) will benefit the union as a whole, and it will not result in greater risk sharing. Risk sharing is not significantly more pronounced than in the baseline scenario.

A common argument for introducing a fiscal union often made in practice is that it alleviates the burden of (unjustifiably high) movements in risk premia. As our baseline simulations so far do not include risk premia, we perform an analysis of the same model that incorporates a premium on government interest if debt deviates from target.

Figure 4: Welfare comparisons for different fiscal union scenarios depending on the reagibility of the risk premium



In Figure 4 we show the development of welfare depending on how strongly risk premia react to such debt-deviations from target. In doing so, we assume a quarterly steady-state default probability of 4% (which is a common assumption in the literature, see Corsetti et al. 2013) and vary the degree how strongly the deviation of the debt ratio from its target (60%) affects this probability. The more sensitive it is, the more the default probability increases if the deviation of the debt ratio from its steady state is positive. It can be seen that the higher the risk premium sensitivity to debt deviations is the lower is welfare in all scenarios and countries. The reason for this is that the more the debt ratio affects the default probability the more volatile the interest rate becomes.

This worsens consumption smoothing for households. The consumption equivalent that households are willing to pay in order to live in a risk-free world is therefore rising along with the reaction of the debt ratio on interest rates in each scenario. However, it is more interesting to see whether there are relative differences between the scenarios or, put differently, if the above findings regarding the ranking of the fiscal union regimes changes due to the risk premium. As we see, this is not the case neither for the rest of the euro area nor for the euro area aggregate altogether. In Germany, however, we initially start with the ordering that we discussed above. For any risk premium the scenario of revenue equalisation remains the worst alternative. If the deviation of the debt-ratio contributes sufficiently to an interest rate reaction, the ordering may be inversed for the other degrees of integration, however. The centralised fiscal authority becomes ultimately better than the status quo at high risk premia and tax harmonization becomes inferior to the full integration scenario at relatively low levels of interest rate sensitivity to debt deviations. In aggregate terms for the entire union, these changes are however not strong enough to reverse the ordering here.

While the above results indicate that our results regarding the costs and benefits of a fiscal union are quite robust to even alternative specifications of how government risk transmits through the economy, a word of caution may still be in order. First, the model simulations we conducted primarily contain standard shock processes, even though the estimation period includes the recent crisis. Hence, should one region be hit by a very large shock, while the other is not, benefits of sharing the fiscal burden of such a shock may turn out to be larger. This holds even more should one region systematically be hit by larger (negative) shocks. Second, the rest of the euro area is assumed to be one large block within the economy. In the estimation process, shocks hitting single countries of this block may average out, thus, underestimating the volatility of the rest of the euro area. So for single – especially small and volatile – member countries of this block, it could be the case that a fiscal union regime is much more beneficial than what we report here, especially if these small countries indeed face the risk of losing capital market access. Whether or not those potential benefits are sufficient to turn welfare implications around should be addressed in further research.

3.5. Counterfactual analysis

The counterfactual analysis asks the question which course both economies would have taken if they had also entered into a fiscal union at the time at which the euro was introduced. More specifically, we examine the years 1999 to 2012 and simulate the model economy for the respective fiscal union scenarios.

The estimation of the model in the status quo results in a series of quarterly shocks (for technology, demand, government expenditure, taxes, etc.) for the entire estimation period. We assume that these shock processes remain as estimated and feed them into the model variants for the various fiscal union scenarios to allow us to compare the fiscal union scenarios and the status quo by means of a counterfactual analysis.[9] The findings of the analysis are shown in Figure 5.[10]

Generally speaking, it is possible to identify few differences between the individual forms of fiscal union and the status quo. In this respect, the key macro aggregates would probably have seen similar development under a fiscal union, provided there was no change to the shock processes. More apparent differences emerge in the case of a centralised fiscal authority, which is mainly due to the initial (i.e. steady state) effects, however. The same holds true for the evolution of consumption in both regions which also does not seem to be driven by cyclical factors but by the long run shift that is incorporated ex ante.

The largest differences emerge in the development of the debt ratio, which is, in some cases, highly divergent over time. In Germany, the debt ratio prior to the debt crisis would have been substantially lower in the scenario featuring a centralised fiscal authority, yet significantly higher after the crisis than under the status quo. In the basis scenario with the status quo, the debt ratio is lowest at the present time compared to the fiscal union scenarios. The opposite effect becomes apparent when looking at the debt ratio in the rest of the euro area.

[9] This assumption is – as in all counterfactual analyses – relatively strong, because we assume that the shock sequence would not have changed in the case of having revenue harmonisation, tax harmonisation or a centralised fiscal authority. It may, however, be likely that the shock sequences would have changed after such a policy change. Still, this exercise gives some insight into how a certain sequence of shocks (namely those of the last ten years) would have affected the key variables.

[10] In this counterfactual analysis, we face the challenge of a mix of long- and short-term effects. We therefore need to make an assumption regarding the structure. Here, we have decided to illustrate the different structure as a long-term equilibrium effect. Accordingly, we start out by deviating from the status quo for certain variables.

As demonstrated in the previous sections, the findings vary the greatest if the focus is placed on structure and long-term effects. This can also be seen in the counterfactual analysis. Over time, the development of the macro variables – such as consumption, investment and GDP – is practically identical. Changes only emerge if the starting value (i.e. the long-term equilibrium effect) is also taken into account. Short-term changes only become apparent in the fiscal variables, as seen with the impulse responses. This is not particularly surprising, as the macro variables are, for the most part, not driven by fiscal policy shocks. Instead, they are driven by monetary policy shocks and other shocks occurring in the real economy.

A shock decomposition – describing in detail which shock contributed how much to the development of the selected variable –illustrates this (see Table 4). The fiscal shocks (in Germany and the rest of the euro area) have an impact of just below 2% on GDP in Germany, whereas 98% of the business cycle fluctuations can be explained by other shocks. Similar values result for private investment and private consumption. However, fiscal shocks account for 15% of the fluctuation of the debt ratio in Germany. With somewhat higher values, this is qualitatively identical for the rest of the euro area. Fiscal shocks are responsible for around 3% of the fluctuation in the macro variables and for 25% of the fluctuation in the debt ratio. The impact of foreign fiscal shocks on the respective domestic macro variables is negligible.

Figure 5: Counterfactual analysis of the four scenarios over the last decade

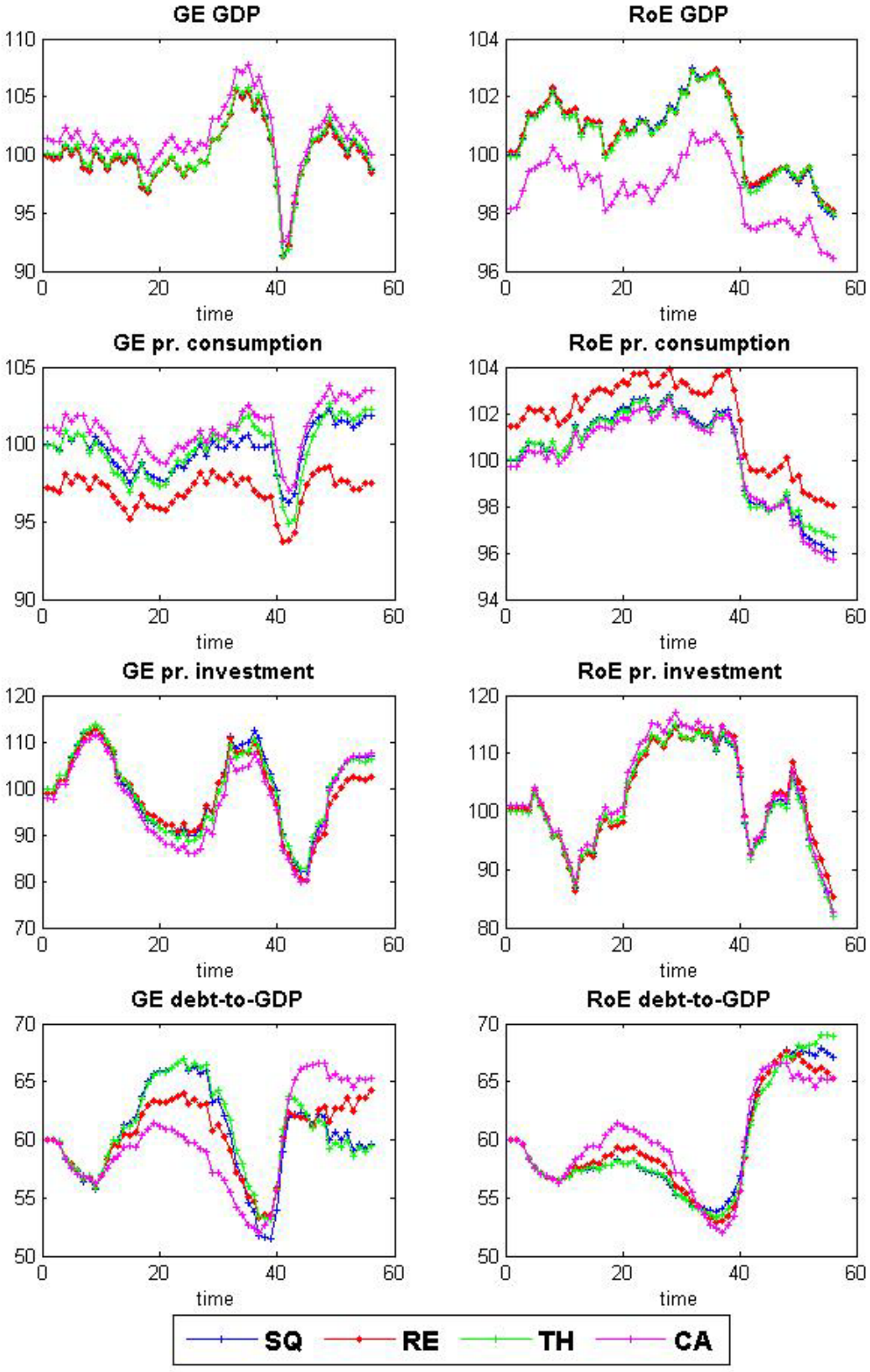


Table 4: Variance decomposition by fiscal and other shocks for selected macro variables

	Fiscal shocks (GER)	Fiscal shocks (Rest)	Other shocks
GDP (GER)	1.9	0.08	98.02
CONS (GER)	2.4	0.07	97.53
INV (GER)	0.87	0.08	99.05
Deficit ratio (GER)	15.62	0.15	84.23
GDP (Rest)	0	3.35	96.65
CONS (Rest)	0	3.12	96.88
INV (Rest)	0.01	2.66	97.33
Deficit ratio (Rest)	0.01	25.42	74.57

3.6. Robustness analysis

In order to better understand the findings and identify the significant driving forces, we examine the welfare analysis under different conditions. To do so, we ask the question of how welfare in Germany and the rest of the euro area would change if the countries were made "more equal", i.e. if the structural parameters among the countries were gradually standardised. Another way to ask this question would be: "Which parameters in the countries primarily drive the differences in welfare?" This can, for example, affect the standard deviation of the shocks, i.e. the difference in the volatility of the reactions of the two countries to the same shock. Equalising the variance of the shocks for both countries therefore standardises the transmission of the shocks to the respective economies. In addition to the standard deviations, individual parameters are initially adjusted. Then all parameters are adjusted until both countries are identical in all respects except for size. The adjustment of the parameters also levels out the differences in the long-term equilibrium values (steady states).

Table 5 shows the welfare calculation for Germany and the rest of the euro area as well as for the entire monetary union for the various scenarios. To begin, the version of the basis scenario is replicated in the upper section for comparison. In the second section, the variances of the shocks are identical (at the estimated level of Germany), resulting in a projection qualitatively similar to the one seen before. In the rest of the euro area, the costs of the business cycle are halved compared to the completely different parameters.

The costs therefore only amount to 3% in the status quo, in the revenue equalisation and tax harmonisation scenarios slightly lower and higher respectively, whereas they would have fallen to 2.7% in the centralised authority scenario. For the union as a whole, this would result in an approximate halving of the costs from slightly over 4% to around 2%. Adjusting both the standard deviations as well as all parameters (to the level of Germany) to make them equal results in a projection where the costs for Germany and the rest of the euro area would be around zero and are no longer different in the various fiscal union scenarios. This result highlights the fact that looking at non-symmetric countries to examine the effect of a fiscal union is essential and disregarding differences in parameters could lead to welfare reversals. This begs the question of which individual parameters are specifically responsible for the differences that we observe. We can see in Table 5 that different consumption behaviour across countries plays a crucial role. Technically, the differences created by the "habit" parameter, which influences the extent to which households evaluate (especially negative) deviations from previous consumption from a benefit perspective, makes a substantial difference and clearly influences welfare in the four scenarios. On the one hand, this is due to the significant deviation of the estimated value from one country to another. While this value is 0.49 in Germany, it is markedly higher in the rest of the currency area at 0.75 (see Gadatsch et al., 2016, for details). On the other hand, this parameter is a component of the stochastic discount factor, which households use to evaluate their marginal consumption and therefore plays an important role in the economy. Finally, differences are not due to different speed of adjustment costs, as the last row shows.

Table 5: Robustness analysis

	Germany	Rest of Eurozone	Currency Union
Costs of Business Cycle	Baseline		
SQ	0.000	0.060	0.043
RE	0.009	0.055	0.042
TH	0.000	0.064	0.046
CA	0.000	0.052	0.038
Costs of Business Cycle	Same standard deviations in both countries		
SQ	0.002	0.030	0.022
RE	0.003	0.029	0.022
TH	0.003	0.032	0.024
CA	0.002	0.027	0.020
Costs of Business Cycle	Same standard deviations and paramters in both countries		
SQ	-0.001	-0.001	-0.001
RE	0.004	-0.003	-0.001
TH	-0.001	-0.001	-0.001
CA	-0.004	0.000	-0.001
Costs of Business Cycle	Same consumption habits in both countries		
SQ	0.000	0.019	0.014
RE	-0.001	0.020	0.014
TH	0.000	0.021	0.015
CA	0.000	0.013	0.009
Costs of Business Cycle	Same nominal adjustment costs in both countries		
SQ	0.061	0.053	0.060
RE	0.056	0.049	0.055
TH	0.059	0.079	0.063
CA	0.050	0.059	0.052

Overall, it should be noted that welfare, in all scenarios, is always equally reduced (or not reduced), and that the relative welfare analysis between the status quo and the fiscal union regimes is never affected.

4. Conclusion and policy implications

In this paper, we investigate quantitatively the effects that we can expect from a fiscal union for Germany and the rest of the euro area. To do so, we define three possible fiscal union scenarios that are discussed in the literature: fiscal revenue equalisation, tax harmonisation and a centralised fiscal authority. We find that the desired or expected international risk sharing through fiscal integration is rather limited and, from a welfare perspective, neither Germany nor the rest of the euro area would benefit significantly. The differences are primarily explained by the divergent structure of fiscal policy over the long term, whereby the short term aspects in the various scenarios are not depicted particularly differently.

Although the model we use and the quantitative analysis are state of the art, some of assumptions have to be made that, in turn, may influence the conclusions. For example, the three fiscal union scenarios we analyse are exogenously integrated, meaning that we do not focus on "the optimal form" of a fiscal union or transfer mechanisms. Even though these forms of fiscal integration are debated in the literature, there may be welfare-improving schemes of deeper fiscal integration. In addition, our model – as the entire model class – is not capable of factoring in politico-economic aspects such as moral hazard. The simulations are therefore rather mechanical and can produce explanations and policy recommendations in some respects, but these must be viewed with the above-mentioned limitations in mind. Furthermore, we model the euro area and Germany as two large blocks. Were we able to disaggregate the rest of the euro area (excluding Germany) even more, improvements in risk sharing could be larger because considering the rest of the euro area as one block may underestimate its volatility. This especially holds for small and potentially very volatile member countries, which play, by construction, not a large role when embedded into a large block. Further research

should focus on improving the understanding of the importance of these drawbacks to draw more reliable results.

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Appendix:

Analytical representation of the different forms of a fiscal union:

The status quo of our model economy is characterised by individual policy-making of the member countries. This implies that each economy faces its own budget constraint in which revenues must equal expenditure including interest payment on outstanding debt. Hence, it sets its own tax and expenditure policies and has to deal with stabilising its own debt level. As is common in the DSGE literature, fiscal policy is characterised by estimated fiscal reaction functions. For income taxes τ^w, the reaction function looks as follows (and is analogous for other fiscal instruments):

$$\tau_t^{w,a} - \bar{\tau}^{w,a} = \rho^{\tau,a}(\tau_{t-1}^{w,a} - \bar{\tau}^{w,a}) + \xi_a^{b,\tau w}\left(\frac{B_{t-1a}}{2.4 * \bar{Y}^a}\right) + \xi_a^{y,\tau w}\left(\frac{Y_t^a}{\bar{Y}_a}\right).$$

These fiscal rules and the parameter estimation are described in more detail in Gadatsch et al. (2016) who describe the underlying model we use for the present analysis. However, note that the rule has an autoregressive reaction to itself (hence, it can deviate from its long-term target) and to deviations in the debt ratio (B/Y with 60% annualised) and the business cycle (Y).

Equalisation of public revenues:

As in the basis scenario, the country-specific tax rates are set according to the equation shown above. However, we assume that all taxes collected in the entire monetary union are now redistributed to equalise per-capita tax revenues in the two regions. Given that tax bases and tax rates differ across regions, we can calculate a hypothetical European tax rate that generates the same revenues as the country-specific tax rates do. European revenues, Rev^{EU}_t, are now made up of the individual revenue components, with the respective tax rate serving as an average from the corresponding country.

Then, country-specific per-capita revenue is given by the revenue from the average of the EMU-wide revenue Rev^{EU}_t and a country-specific surcharge or discount (here exemplarily shown for labour tax and social security levies in region *a*):

$$\mathrm{Rev}^a_t = \mathrm{Rev}^{EU}_t + (\tau^{w,a}_t - \tau^{w,EU} + \tau^{sc,a}_t - \tau^{sc,EU})(w^a_t * N^{p,a}_t + w^{g,a}_t * N^{g,a}_t) + \ldots$$

Tax harmonisation:

In the tax harmonisation regime, we assume that personal income taxation and social security contribution rates are harmonised. The formula for a "European labour tax" (the formula for social security τ_t^{sc} is analogue) is as follows:

$$\tau_t^{w,EU} - \bar{\tau}^{w,EU} = \rho^{\tau,EU}(\tau_{t-1}^{w,EU} - \bar{\tau}^{w,EU}) + (\frac{P^a}{P^a + P^b} v_t^{\tau^w,a} + \frac{P^b}{P^a + P^b} v_t^{\tau^w,b})$$

This tax rate is persistent (deviating from its long-term equilibrium), because it exhibits an autoregressive component and also reacts to the respective country-specific shock, which is also weighted. According to this formula, the two instruments together result in the revenues on a European level:

$$Rev_t^{EU} = (\tau_t^{w,Eu} + \tau_t^{sc,Eu}) \frac{P^a(w_t^a N_t^{P,a} + w_t^{G,a} N_t^{G,a}) + P^b \frac{w_t^b N_t^{P,b} + w_t^{G,b} N_t^{G,b}}{R_t^{b,a}}}{P^a + P^b}$$

The respective revenues are weighted using the size of the country, and the labour and social security levies or taxes are levied on wages. This applies to both the private sector (*P*) and the public sector (*G*). Wages are made up of real wages (*w*) and the number of hours worked (*N*). As usual, the rest of the budget is made up of the consumption and capital tax revenues.

Centralised fiscal union:

In the centralised fiscal union scenario, the central equation for each fiscal instrument (seen here with labour tax as an example) is as follows:

$$\tau_t^{w,EU} - \bar{\tau}^{w,EU} = \rho^{\tau,EU}(\tau_{t-1}^{w,EU} - \bar{\tau}^{w,EU}) + \xi_b^{\tau w}(\frac{B_{t-1}^{EU}}{2.4 * \frac{P^a \bar{Y}^a + P^b \bar{Y}^b}{P^a + P^b}}) + \xi_y^{\tau w}(\frac{P^a}{P^a + P^b} \frac{Y_t^a}{\bar{Y}_a} + \frac{P^b}{P^a + P^b} \frac{Y_t^b}{\bar{Y}^b}$$

The labour tax rate is once again autoregressive and reacts to the deviations from the European debt ratio (*B*) of 60% (240% annually) and to the weighted deviations of the output (*Y*) from the corresponding long-term equilibrium. The two ξ symbols indicate the strength with which the labour tax reacts to the respective deviation.

The European debt level is calculated using the revenues, which are applied to the weighted consumption, capital and payroll of both countries, and the expenditures measured at a European level. The budget equation for the "Fiscal State of Europe" is now as follows:

$$G_t^{EU} + (1 + i_t^a) \frac{B_t^{EU}}{\pi_t^a} = B_t^{EU} + Rev_t^{EU} + (1 - \mu^a) T_t^{EU}$$

G represents total European expenditures, and *T* stands for the per capita tax payable by all households without limited liquidity. Its proportion is expressed with μ. Interest payments are represented by *i* and are divided by the rate of inflation (π) when calculating real values.