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Effects of Fiscal Policy Shocks in the Euro Area (Lessons Learned from Fiscal Consolidation)

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Abstract

European Union member countries are currently exposed to negative implications of the economic and debt crisis. Questions associated with disputable implications of fiscal incentives seem to be contrary to the crucial need of the effective fiscal consolidation that is necessary to reduce excessive fiscal deficits and high sovereign debts. While challenges addressed to the fiscal policy and its anti-cyclical potential rose steadily but not desperately since the beginning of the economic crisis, the call for fiscal consolidation became urgent almost immediately and this need significantly strengthen after the debt crisis contagion flooded Europe.

In the paper we provide an overview of main trends in public budgets and sovereign debts in the Euro Area member countries during last two decades. We identify episodes of successful and unsuccessful (cold showers versus gradual) fiscal (expenditure versus revenue based) consolidations by analyzing effects of improvements in cyclically adjusted primary balance on the sovereign debt ratio reduction. We also estimate VAR model to analyze effects of fiscal shocks (based on one standard deviation in total expenditure, direct and indirect taxes) to real output. It is expected that responses of real output to different types of (consolidating) fiscal shocks may vary and thus provide more precise ideas about a feasibility (i.e. side effects on the macroeconomic performance) of expenditure versus revenue based fiscal consolidation episodes. Economic effects of fiscal consolidating adjustments are evaluated for two periods (pre-crisis and extended) to reveal crisis effects on fiscal consolidation efforts.

Keywords: fiscal adjustments, fiscal consolidation, cyclically adjusted primary balance, government expenditures, tax revenues, unrestricted VAR, Cholesky decomposition, SVAR, structural shocks, impulse-response function

JEL Classification: C32, E62, H20, H50, H60

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1. Introduction

European Union member countries are currently exposed to negative implications of the economic and debt crisis. Questions associated with disputable implications of fiscal incentives seem to be contrary to the crucial need of the effective fiscal consolidation that is necessary to reduce excessive fiscal deficits and high sovereign debts. As a result, governments tend to reduce public expenditures and raise taxes during the periods lagging recession and thus cooling down economies. However, an appropriate composition of fiscal incentives without direct negative effect on the public budget and its revenue and expenditure sides may help to reduce negative budgetary pressures through increased tax capacity of the economy followed by stronger growth of real output.

While challenges addressed to the fiscal policy and its anti-cyclical potential rose steadily but not desperately since the beginning of the economic crisis, the call for fiscal consolidation became urgent almost immediately and this need significantly strengthen after the debt crisis contagion flooded Europe.

The overall success of the fiscal consolidation may seem to differ across countries reflecting the overall burden of sovereign debt and associated costs of debt service. Significant reduction in primary budget deficit (aiming to primary surplus during a reasonable period) is the only way to reduce a negative impact of sovereign debt on economic growth. While the need to reduce a fiscal imbalance is clear, the composition (expenditure versus revenues based consolidation) and nature (gradual or sharp consolidation) of fiscal consolidation, together with the role played by accompanied policies (quantitative monetary easing, exchange rate internal versus external devaluation, reforms of fiscal institutions, etc.), seems to be quite disputable (Barrios, Langedijk and Penc 2010).

In the paper we provide an overview of main trends in public budgets and sovereign debts in the Euro Area member countries during last two decades. We identify episodes of successful and unsuccessful (cold showers versus gradual) fiscal (expenditure versus revenue based) consolidations by analyzing effects of improvements in cyclically adjusted primary balance on the sovereign debt ratio reduction. We also estimate VAR model to analyze effects of fiscal shocks (based on one standard deviation (rise) in total expenditure and (rise) in direct and indirect taxes) to real output. It is expected that responses of real output to the different types of (consolidating) fiscal shocks may vary and thus provide more precise ideas about a feasibility (i.e. side effects on the macroeconomic performance) of expenditure versus revenue based fiscal consolidation episodes. Economic effects of fiscal consolidating adjustments are evaluated for two periods (pre-crisis and extended) to reveal crisis effects on fiscal consolidation efforts.

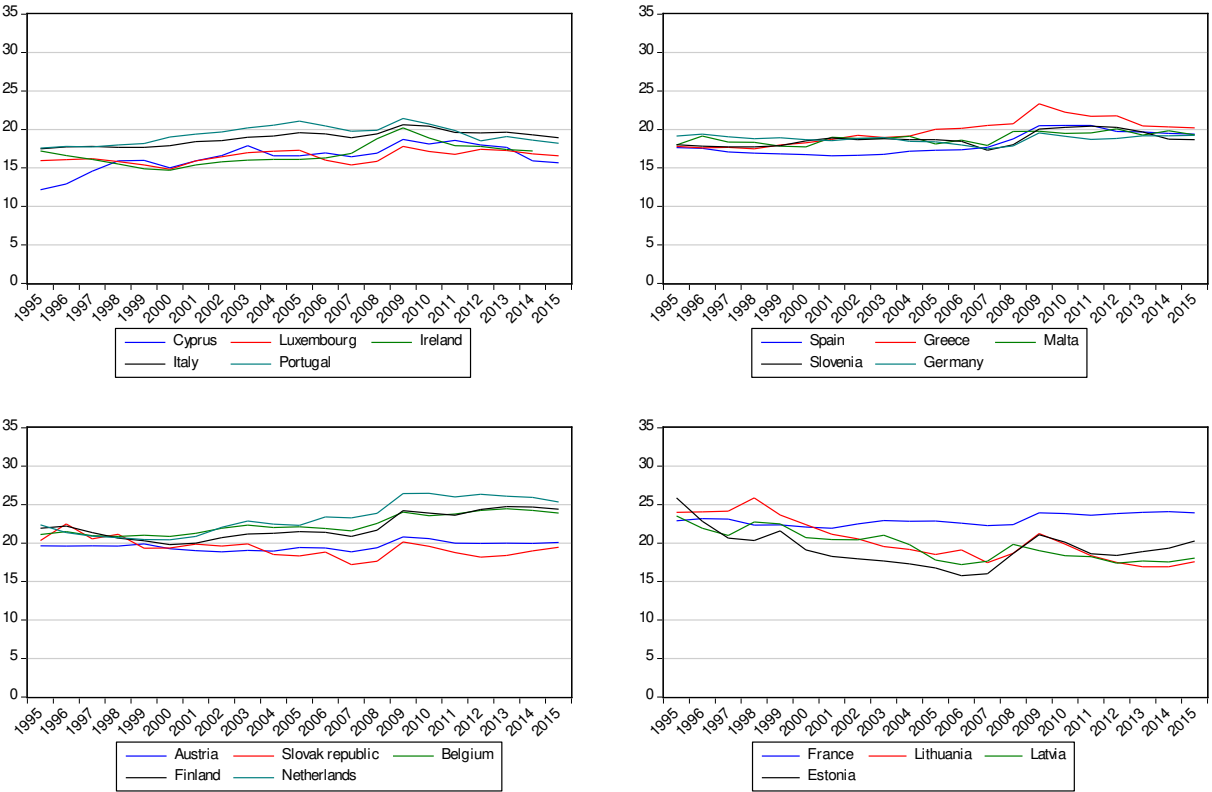
Following the introduction, we provide some stylized facts about fiscal stance in the Euro Area member countries over the period of last two decades. We emphasize main trends in the evolution of government consumption, rate of secondary redistribution, total expenditures and total revenues, fiscal deficit and sovereign debt. In the third section we provide an overview of current empirical evidence about fiscal consolidation and fiscal policy shocks. Wide range of causal effects and implications of expenditure and tax revenue based fiscal adjustments as well as their size and durability seem to be well documented in papers

published in last two decades. Fourth section begins with some methodological remarks to fiscal consolidation and cyclically adjusted primary balance. Subsequent analysis of fiscal consolidation episodes provides an in-depth insight into the degree of success of expenditure and tax revenue based fiscal adjustments in the view of a sustainable sovereign debt reduction in the Euro Area member countries. In section five we deal with fiscal policy shocks trying to provide some alternative guideline for evaluation of side economic effects related to expenditure and tax based fiscal adjustments on the real output performance.

2. Overview of Fiscal Stance

Budgetary development in the Euro Area member countries did not follow the same trend, though some common patterns seem to be present. In general, relative share of total government consumption on overall aggregate expenditures seems to be quite low during last two decades (Figure 1).

Figure 1 General Government Consumption (1995-2015)



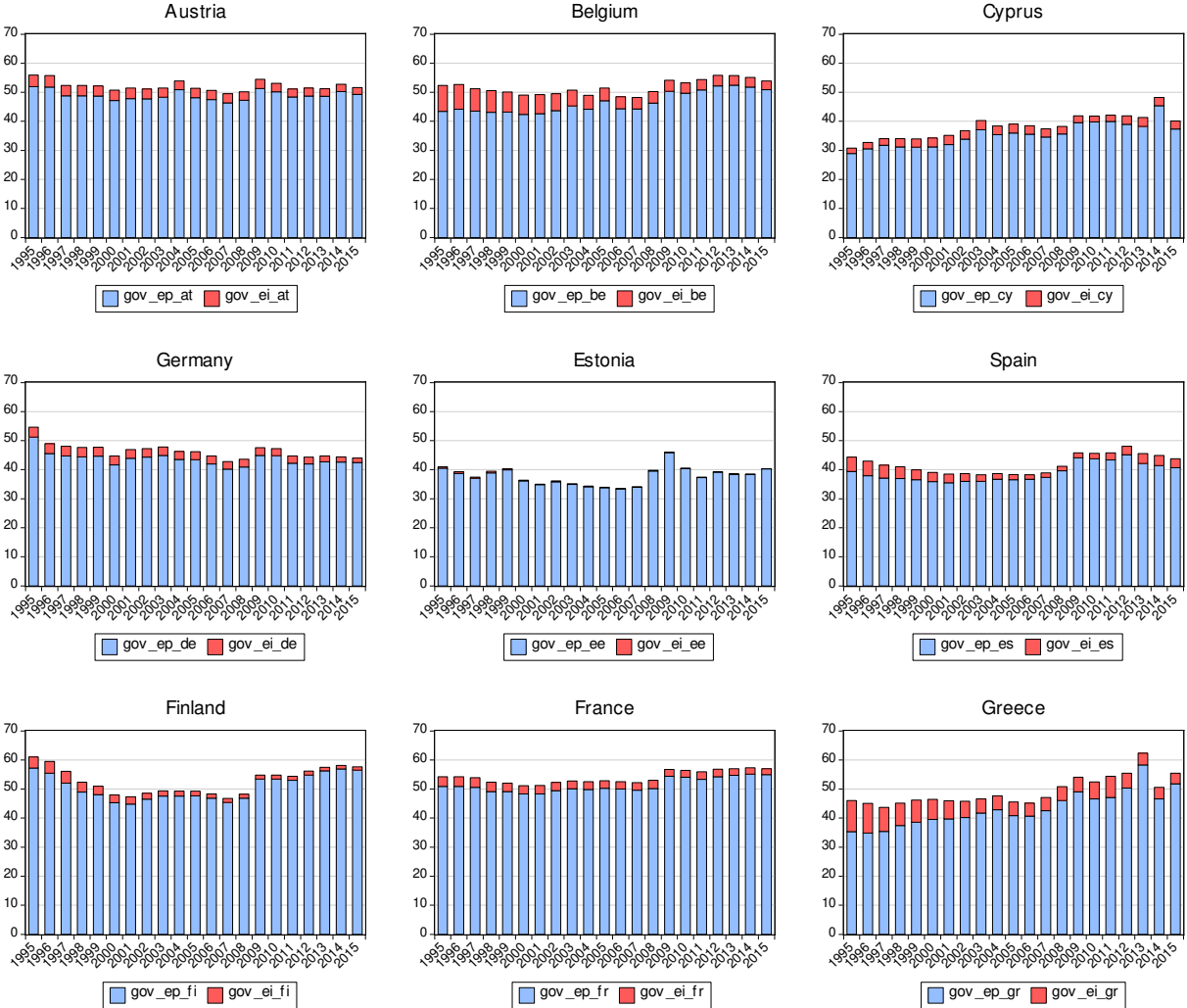
Note: General government consumption is expressed as a percentage shares on GDP.
Source: Compiled by author based on data taken from Eurostat - Government Finance Statistics (October 2016) and IMF - International Financial Statistics (October 2016).

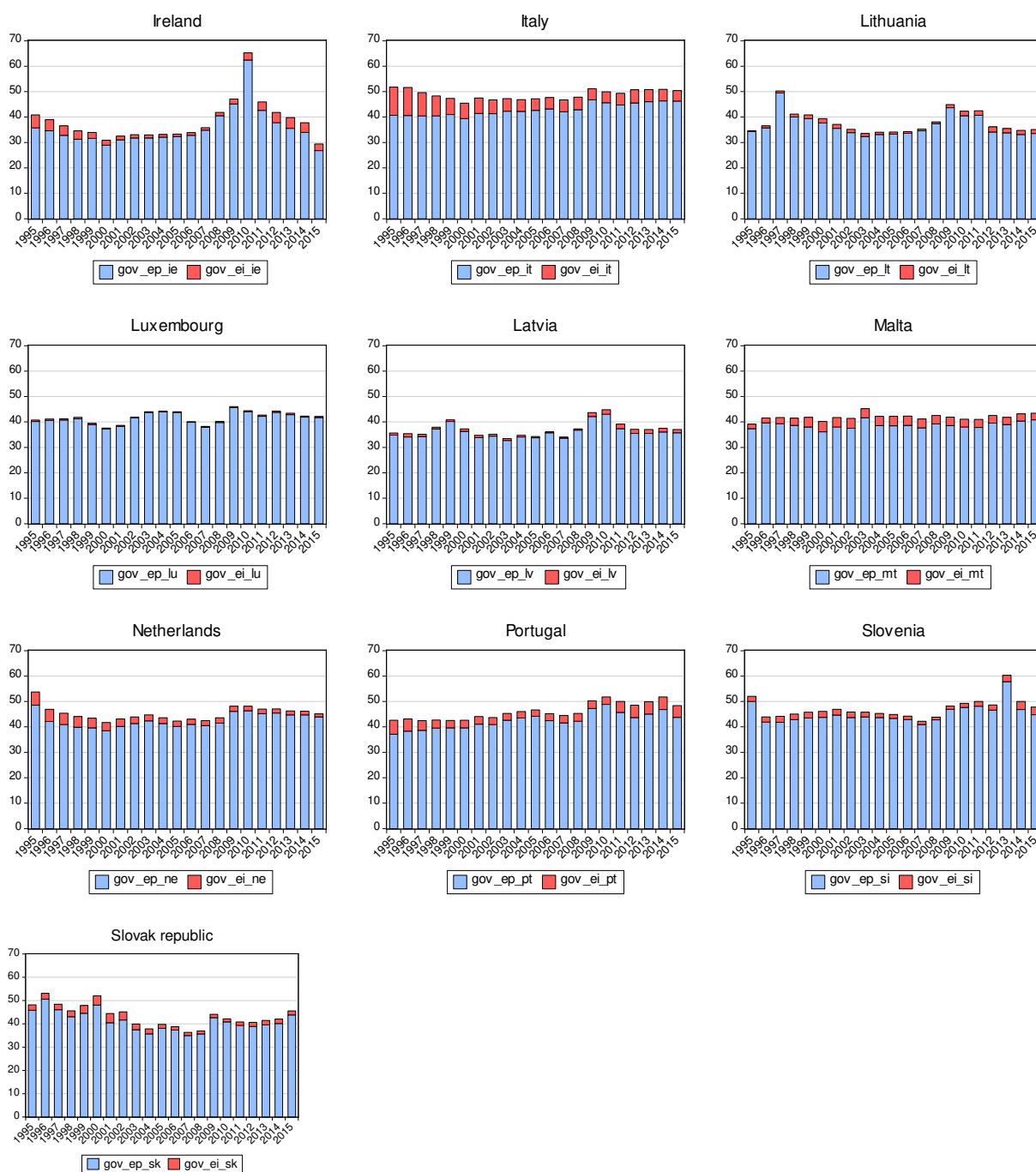
However, there seem to be notable differences among countries especially if we emphasize a relative importance as well as the overall trend in the development of the general government consumption. Despite generally low differences in the relative share of government consumption on total output among the countries at the beginning of the period we have observed increased diverging trend since the establishment of the Euro Area.

Dynamic increase in the government consumption is present especially in the periphery countries like Cyprus, Greece, Italy, Portugal though this trend is also obvious in Belgium, Finland and Netherlands. The overall share the general government consumption on the total output remained quite different even at the end of the observed period though it seems that effects of economic crisis contributed to slight reduction in this gap in the whole group of countries. At the same time we emphasize a relatively persistent decreasing trend in the Baltic countries and the Slovak republic.

Rate of the secondary income redistribution represents one of the most crucial indicators of the government size (Figure 2). It is also convenient to emphasize the size of payable interests to calculate primary government expenditures to express a structural fiscal stance of the government.

Figure 2 Size of Government - Rate of Secondary Income Redistribution (1995-2015)





Note: Variables - primary government expenditures (GOV_EP) and payable interests (GOV_EI) are expressed as percentage shares on GDP.

Source: Compiled by author based on data taken from Eurostat - Government Finance Statistics (October 2016) and IMF - International Financial Statistics (October 2016).

The size of the government in the Euro Area member countries seems to be quite stable in the core countries of the Euro Area, however, countries like Cyprus, Greece and Portugal experienced opposite trend (pre-crisis period). Moreover, increasing indebtedness of periphery countries affected the relative share of associated interest costs that was clearly higher than in the rest of the Euro area in general, though it generally followed decreasing

trend due to reduced interest rates on government bonds due to undesirable convergence in the long-term interest rates in the whole Euro Area.

Table 1 provides more detailed information on the relative shares of government expenditures and government revenues in the Euro Area member countries during the years 1995-2015 divided into short-term sub-periods.

Table 1 Total Government Expenditures and Revenues (1995-2015)

	Total expenditures					Total Revenues				
	1995-1998	1999-2002	2003-2006	2007-2010	2011-2015	1995-1998	1999-2002	2003-2006	2007-2010	2011-2015
Austria	53.650	50.925	51.400	51.425	51.375	49.700	49.275	48.525	48.300	49.200
Belgium	51.725	49.475	49.850	51.475	55.225	48.825	49.375	48.850	48.900	51.650
Cyprus	32.975	35.200	39.325	40.200	43.775	29.900	32.125	36.100	38.675	37.450
Germany	49.850	46.650	46.250	45.325	44.475	45.225	44.675	43.000	43.425	44.300
Estonia	39.300	36.950	34.275	40.100	38.200	39.850	36.250	36.325	39.625	38.550
Spain	42.475	39.025	38.400	42.850	45.800	37.675	38.200	39.125	37.150	37.625
Finland	57.275	48.700	49.075	51.175	56.600	55.075	53.100	51.875	52.150	54.300
France	53.675	51.675	52.675	54.600	56.800	49.925	49.875	49.450	49.675	52.325
Greece	44.975	46.075	46.225	51.125	55.025	37.425	40.725	39.050	40.300	46.250
Ireland	37.725	32.600	33.325	47.675	41.300	37.975	34.600	34.900	34.450	33.800
Italy	50.325	46.775	47.175	48.900	59.525	45.350	44.375	43.525	45.450	47.425
Lithuania	40.675	38.100	34.000	40.150	37.250	35.725	35.275	33.150	35.150	33.375
Luxembourg	41.275	38.450	41.775	41.650	43.400	44.050	42.850	42.075	43.250	44.075
Latvia	36.025	37.025	34.600	39.850	37.450	35.950	34.325	33.725	34.275	35.800
Malta	40.975	41.275	43.025	41.700	42.500	34.125	35.350	38.325	38.450	39.775
Netherland	47.500	43.075	43.400	45.625	46.675	44.400	43.000	42.225	43.100	43.450
Portugal	42.700	43.250	45.825	47.950	50.025	38.200	39.650	40.550	41.025	43.775
Slovenia	46.325	46.175	45.050	45.900	52.175	42.850	42.950	43.300	42.625	44.475
Slovakia	48.825	47.350	38.975	39.675	40.800	42.725	38.925	36.100	34.775	37.425
average	45.171	43.092	42.875	45.650	47.283	41.839	41.311	41.062	41.618	42.896

Note: Fiscal indicators are expressed as percentage shares on GDP.

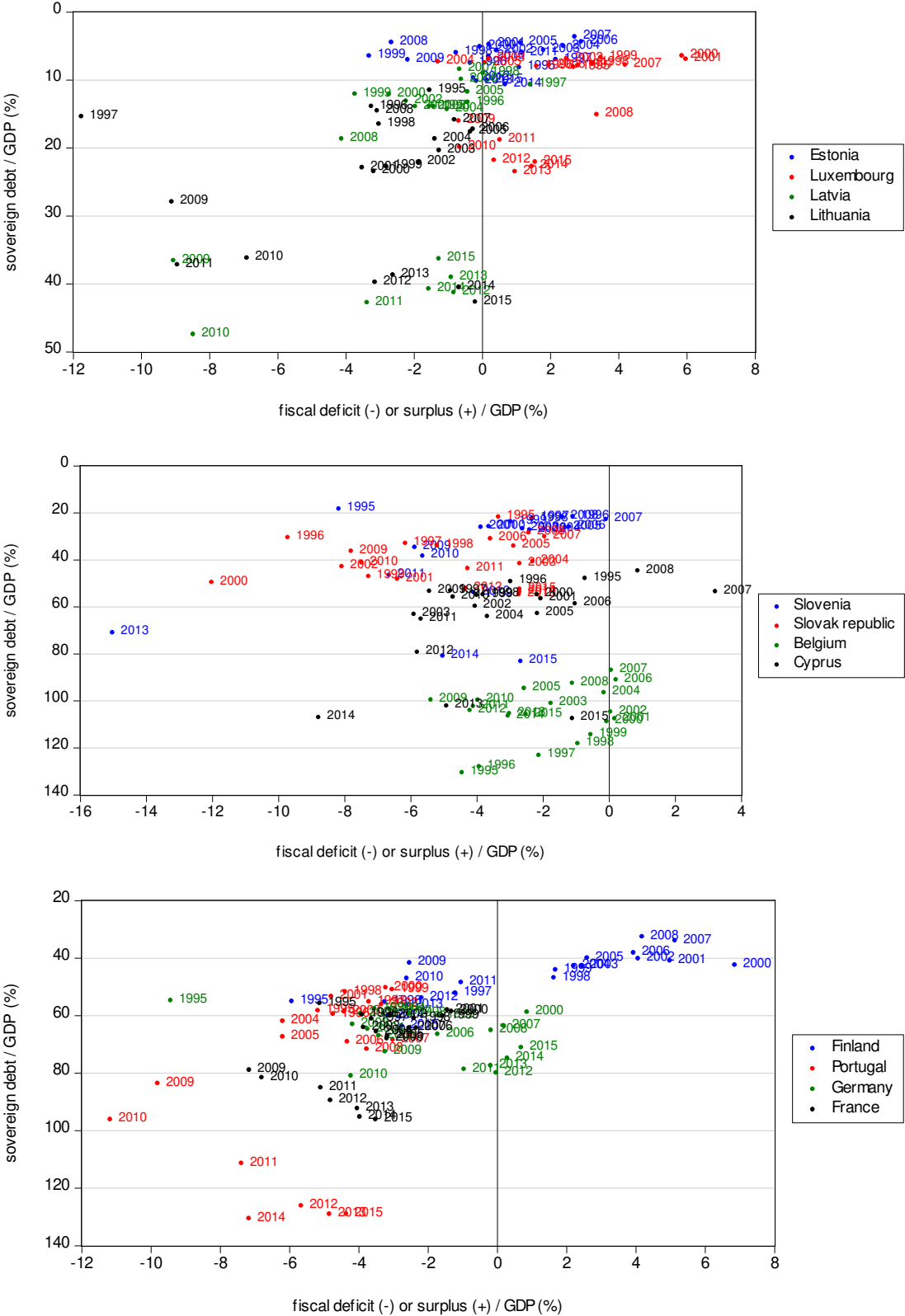
Source: Compiled by author based on data taken from Eurostat - Government Finance Statistics (October 2016) and IMF - International Financial Statistics (October 2016).

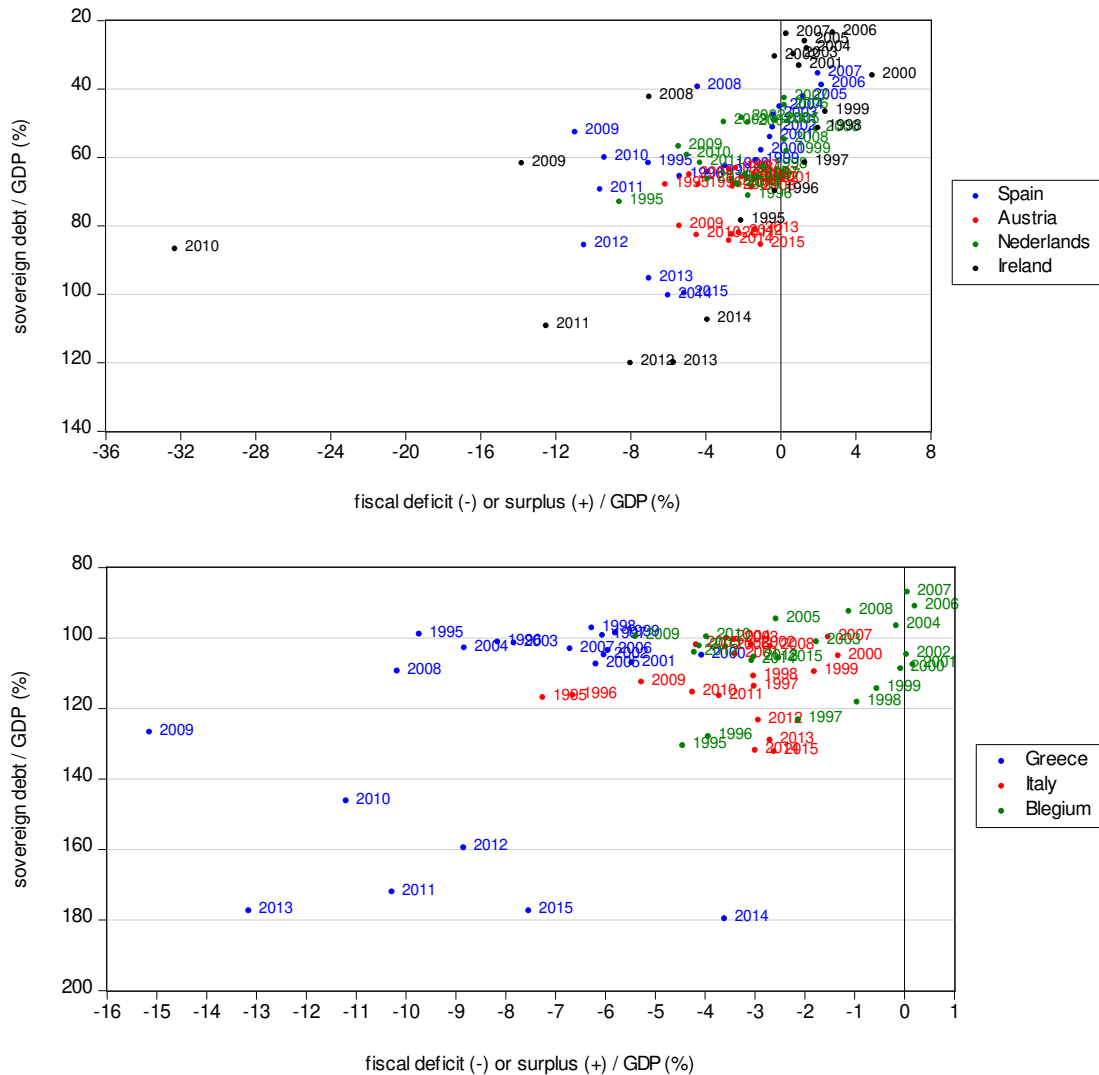
Overview of the relative shares of government expenditures and revenues even emphasized the differences in the size of the government in individual Euro Area member countries. Generally lower shares of government expenditures on the total output in the periphery countries at the beginning of the period and improved conditions on the financial markets since the establishment of the Euro Area were followed by more dynamic increase in the government expenditures in these countries in comparison with the rest of the Euro Area. Moreover, increasing share in government expenditures together with less dynamic increase in government expenditures clearly indicates deterioration in fiscal discipline especially in the south of the Euro Area.

As a one the most crucial aspects representing key features of the overview in the general government financial stance we emphasize risks of increasing sovereign debt burden associate with persistent fiscal deficits that periphery countries of the Euro Area experienced during the most of the period of last two decades (Figure 3). Moreover, crisis period significantly reduced fiscal sustainability in the periphery countries of the Euro Area (similar trend was observed in Baltic countries) that made calls for fiscal consolidation urgent.

However, more comprehensive analysis of the budgetary stance is needed to identify the overall potential as well as effectiveness of a fiscal consolidation to successfully reduce a sovereign debt burden provided that debt constraints strengthened during the crisis period.

Figure 3 Fiscal Deficit and Sovereign Debt (1995-2015)





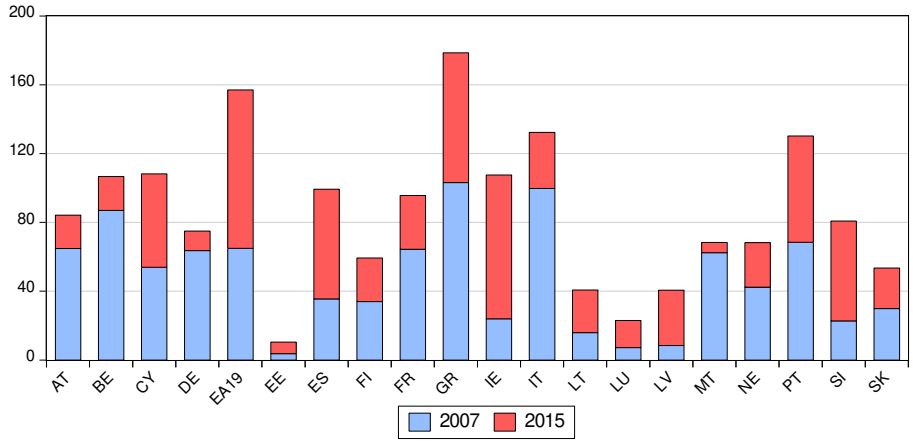
Note: All fiscal indicators are expressed as percentage shares on GDP.

Source: Compiled by author based on data taken from Eurostat - Government Finance Statistics (October 2016) and IMF - International Financial Statistics (October 2016).

Fiscal implications of the economic crisis vary across Euro Area member countries considering existing differences in the financial discipline of fiscal authorities (levels of fiscal budget balance and sovereign debt), overall macroeconomic performance and high level of heterogeneity of individual markets that in altogether affects the overall costs of fiscal consolidation (European Commission, 2012).

The phenomenon of a permanent deficiency of general government budgets stresses many “old” (Austria, France, Greece, Germany, Great Britain, Italy, Portugal) as well as “new” (Croatia, Cyprus, Czech republic, Hungary, Latvia, Lithuania, Malta, Poland, Romania, Slovak republic, Slovenia) European Union member countries (of course we consider the period before the economic crisis put a stress on revenue and expenditures sides of national fiscal budgets). Lack of fiscal discipline in many European Union member countries revealed a crucial need of a fiscal consolidation during the crisis period due to a sharp acceleration in sovereign debt burden.

**Figure 4 Changes in Sovereign Debt Ratio (as a percentage to GDP)
(changes between 2007 and 2015)**

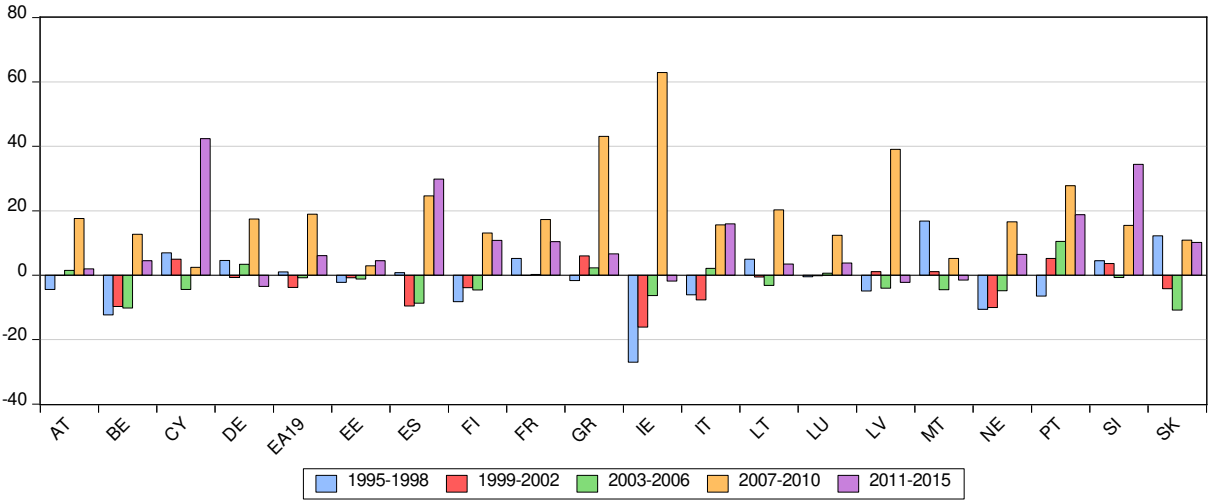


Note: Changes in sovereign debt ratio between 2007 and 2015 (as a percentage to GDP).

Source: Compiled by author based on data taken from Eurostat - Government Finance Statistics (October 2016) and IMF - International Financial Statistics (October 2016).

Figure 4 provides brief overview of the dynamic in the sovereign debt accumulation in individual Euro Area member countries comparing debt burden in 2000 and 2015. Results clearly demonstrate significant accumulation of sovereign debts in the periphery countries of the Euro Area and even stressed the risks of fiscal unsustainability especially in GIIPS countries.

Figure 5 Changes in Sovereign Debt Ratio (as a percentage to GDP) (1995-2015)



Note: Changes in sovereign debt ratio (as a percentage to GDP) during a particular sub-period. Positive change represents an increase and negative change a decrease in sovereign debt burden.

Source: Compiled by author based on data taken from Eurostat - Government Finance Statistics (October 2016) and IMF - International Financial Statistics (October 2016).

Figure 5 provides overview of changes in the accumulation of sovereign debts in the Euro Area member countries during the years 1995-2015 divided into short-term sub-periods.

While the negative trend of the significant increase in the sovereign debt experienced mostly countries from the periphery of the Euro Area during the crisis period, significant debt accumulation was also examined during the initial stage after the establishment of the Euro Area. However, our results indicate that all Euro Area member countries experienced a considerable increase in public debt burden during the crisis period. As a result, improvements in the fiscal stance, fiscal sustainability and reduction the risk of default required flexible responses of governments to the negative pressures on the both expenditure and revenue sides of their budgets.

While sudden changes in the fiscal policy framework accompanied by large adjustments in the budgetary components generally help to improve fiscal discipline and reduces occurrence of excessive fiscal deficits, both theoretical and empirical literature provide lot of evidence about negative (contractionary) effects of fiscal consolidation or in fact, fiscal restriction. As a result, effects of fiscal policy shocks and proper composition of fiscal consolidation are still subject of rigorous academic and political discussions.

3. Overview of the Literature

Fiscal consolidation based on tax increases and expenditures cuts is well documented in empirical literature. Tsibouris, Horton, Flanagan and Maliszewski (2006) provided an overview of the experience of countries that have challenged large fiscal adjustments in the last three decades. By identifying periods of successful and unsuccessful fiscal consolidations authors provide operational guidance to policymakers related to various aspects of fiscal adjustments, including common policy approaches, institutional arrangements and causal implications of various fiscal decisions. Barrios, Langedijk and Pench (2010) from estimated econometric models revealed determinants of successful fiscal consolidation while considering large scale of preconditions, including impacts of financial crisis, debt and deficit levels, real exchange rate adjustments, effects on economic growth as well as types of fiscal consolidation. Alesina and Perotti (1997) analyzed how the composition of fiscal adjustments (gradual versus sharp consolidation, expenditures versus tax revenues based consolidation) influences their likelihood of success in the view of long lasting deficit reduction, and their macroeconomic consequences. Overall success of fiscal consolidation is also evaluated concerning initial fiscal stance. Briotti (2002) analyzed the fiscal consolidation process in EU countries over the 1990s. From observed periods of fiscal adjustments authors highlight that revenue based adjustments have generally preceded expenditure based adjustments. Alesina and Ardagna (2009) examined the evidence of fiscal stimuli and fiscal adjustments episodes in OECD countries from 1970 to 2007. Authors discuss effects of adjustments on the spending and revenues sides concluding that tax cuts seem to have higher expansionary potential that spending increases while spending cuts associated with fiscal adjustments are more appropriate for stabilizing the sovereign debt than tax increases while having less deteriorating effect of the real output performance.

Implications and expected success of fiscal consolidation is largely dependent on effects of tax (revenue) and expenditure based adjustments in the government budget on the overall macroeconomic performance. Contribution of fiscal policy shocks to i.e. slowdown in real output growth rates may provide useful information about contrary effects of fiscal

consolidation and thus a convenient prospect about more feasible composition of fiscal policy arrangements.

Effects of fiscal policy shocks are also well documented especially on a sample of developed countries. Blanchard and Perotti (Blanchard and Perotti, 1999) used mixed structural VAR/event study approach to identify the automatic responses of taxes and government spending to economic activity. They also argued that positive government spending shocks have a positive effect on output, and positive tax shocks have a negative effect, while the multipliers for both spending and tax shocks are typically small.

Perotti (Perotti, 2002) implemented SVAR approach in order to analyze the effect of fiscal policy on GDP, prices and interest rates in five OECD countries. The results we may conclude as follows: 1) The effects of fiscal policy on GDP and its components have become substantially weaker in the last 20 years; 2) The tax multipliers tend to be negative but small; 3) Once plausible values of the price elasticity of governments spending are imposed, the negative effects of government spending on prices that have been frequently estimated become positive, although usually small and not always significant; 4) Government spending shocks have significant effects on the real short-term interest rate, but uncertain signs; 5) Net tax shocks have very small effects on prices; 6) The U.S. is an outlier in many dimensions; U.S. responses to fiscal shocks are often not representative of the average OECD country included in this sample.

Giuliodori and Beetsma (Giuliodori and Beetsma, 2004) also implemented few identifications schemes using VAR methodology to analyze the (spill-over) effects of fiscal policy shocks in European economies. Their analysis is focused on the indirect channel of transmitting the fiscal policy shocks that affect an import of the country. They also emphasized a necessity of enhanced fiscal coordination at the macroeconomic level.

Romer and Romer (Romer and Romer, 2007) analyze the causes and consequences in the level of taxation in the postwar U.S. Their results indicate that tax changes have very large effects on output. At the same time output effects are very persistent. Authors argue it is due to the strong response of investments to the tax burden decrease.

Caldara and Camps (Caldara and Camps, 2008) provide an empirical evidence on the response of key macroeconomic variables to government spending and tax revenue shocks for the U.S. over the period 1955-2006. Authors implemented four approaches (the recursive approach, the Blanchard-Perotti approach, the sign-restrictions approach and the event-study approach) to identify their system based on the VAR methodology. While there is the empirical evidence that the positive responses of private consumption and the real wage are very persistent, authors argued that the most current-generation DSGE models consistent with an increase in these variables predict that the responses turn negative already about one year after the government spending shock occurs. They also find strongly diverging results as regards the effects of tax shocks depending on the identification approach used, with the estimated effects of unanticipated tax increases ranging from non-distortionary to strongly distortionary.

4. Fiscal Consolidation

4.1 Methodological Notes to Fiscal Consolidation

Fiscal consolidation is usually addressed to the set of fiscal arrangements on the side of revenues and/or expenditures of the government budget in order to reduce a burden of sovereign debt via improved fiscal stance. As a result, crucial fiscal adjustments are employed relying primarily on expenditures cuts (especially in the area of government consumption and social security transfers) and much lower portion is based on tax increases (Alesina and Perotti, 1997). Another type of fiscal adjustments rely especially on the tax and social contributions increases. While the first type of fiscal adjustments is expansionary and usually has longer durability, second type of fiscal adjustments is restrictive, having contractionary effects on the economy and thus representing risks associated with future reductions in the tax capacity of the country.

There seems to be several approaches to measure fiscal consolidation and to evaluate a success of fiscal consolidation episode. For example, Alesina and Ardagna (2009) identify three types of fiscal adjustment episodes. For the purpose of our study we employ two of these measures slightly revised by Barrios, Langedijk and Pench (2010): (1) Fiscal consolidation is the year at which CAPB improves by at least 1.5 percent of GDP (so called *cold shower*) or (2) takes the place over three years provided CAPB will not deteriorate by more than 0.5 percent of GDP (so called *gradual consolidation*). Considering both definitions, cold showers (consolidations during one year) are recognized as full episodes of fiscal consolidation and each year of gradual consolidation are considered as episodes on their own. The last measure reflects the overall success of fiscal consolidation. Fiscal adjustments are evaluated according to their effects on sovereign debt and fiscal CAPB ratios to GDP and real output performance. (3) Fiscal consolidation is revealed as successful provided it helps to reduce sovereign debt to GDP ratio by 5 percent during three subsequent years after we have recognized an initiation of the fiscal episode. At the same time, successful fiscal consolidation is considered to be an effective only if it is able to bring down a debt ratio while not having deteriorating effect on real output.

4.2 Cyclically Adjusted Primary Balance

To assess detailed overview of fiscal consolidation effects it is necessary to estimate an influence of fiscal adjustments based on tax and/or expenditures changes on fiscal balance. However, it seems to be necessary to reveal changes on revenues and expenditures sides of government balance associated with automatic effects induced by changes in macroeconomic environment and effects of discretionary fiscal policy actions. In first case, i.e. a cool-down of real output growth may be followed by a cut in government revenues (due to reduced tax capacity of an economy in the time of crisis) and an increase in government expenditures (i.e. due higher unemployment benefits). As a result, deterioration of a fiscal balance will occur. At the same time, similar effects on the fiscal balance will be followed by discretionary taxes cuts or expenditures increases. A fiscal stance of a government budget may thus reflect mixed effects of automatic changes in budgetary revenues and expenditures associated with business cycle fluctuations as well as discrete changes on both sides of government budgets associated with discrete fiscal policy actions.

To eliminate effects of a business cycle to the fiscal stance of a government budget it is necessary to eliminate influence of cyclical movements of fiscal variables. As a result of filtered business cycle impacts, together with some other adjustments (i.e. exclusion of interest payable on the side of government expenditures), cyclically adjusted primary balance (CAPB) will be calculated. Empirical literature provides many approaches to calculate CAPB. In general, main algorithm follows the same procedure: (1) estimation of the potential GDP, (2) determination and calculation of key revenues and expenditures categories responses to the fluctuations in cyclical GDP, (3) adjustments in budgetary revenues and expenditures according to the cyclical effects in both sides of government budget. As a result we obtain cyclically adjusted structural or primary balance. On the other hand we have found some differences in step (2) in current empirical literature reflecting relative diversity in approaches employed to estimate income elasticities of main budgetary variables (on both revenue and expenditure sides). At the same time, most studies calculated cyclical component in real output by estimating potential output (and output gap) using simple HP filter² or potential employment based on detrending NAIRU calculations.

Bouthevillain et al. (2001) calculated fiscal elasticities using econometric regressions or derivation from tax or expenditures laws and from detailed information on the distribution of income and revenue. Altâr, Necula and Bobeica (2010) estimated tax and revenues elasticities by applying methodology similar to that employed by OECD and by the European Commission. Authors decomposed main components of revenue and expenditure budgetary sides using linear system of equations. Girouard and André (2005) calculated income elasticities of four different types of taxes while on the expenditure side there is only single item - unemployment related transfers - that authors treated as cyclically sensitive.

Günaydın and Uğraş Ülkü (2002) employed vector-error correction (VEC) model to estimate income elasticities of budgetary components. Provided there is a long-run equilibrium (cointegration) between GDP and budgetary variables, expected elasticity coefficients are represented by normalized cointegrating coefficient derived from cointegrating equations.

To cyclically adjust a government budget, that is to estimate the underlying fiscal position when cyclical and/or automatic components are removed we follow a VEC methodology implemented by Günaydın and Uğraş Ülkü (2002).

Cyclically Adjusted Primary Balance (CAPB) is calculated by subtracting the cyclical component (B^C) from the primary government balance (PB):

$$CAPB_t = PB_t - B_t^C = PB_t - \sum_{i=1}^n B_{t,i}^C \quad (1)$$

where (PB) represents actual government budget balance (B) less interests payable (E^I):

² Despite a wide criticism of Hodrick-Prescott (HP) filter for inducing a spurious cycle in the time series (i.e. it cannot reflect an impact of structural breaks) as well as for poor approximation near the endpoint (so called endpoint bias), it still represents one of most frequently used filter in the current empirical literature.

$$PB_t = B_t - E^I \quad (2)$$

and $(B_{t,i}^C)$ represents a cyclical component of each of n revenue and expenditure budgetary categories included in the model given by the following equation:

$$B_{t,i}^C = B_{t,i} \cdot e_i \cdot Y_t^{gap} \quad (3)$$

where (e_i) represent individual elasticities of each particular budget category (that responds automatically to real output fluctuations) included in the model and (Y^{gap}) represents output gap expressed as a percentage of GDP.

4.3 Income Elasticities of Budgetary Categories

In our model we include three types of budget revenues (revenues from direct taxes, indirect taxes and social contributions) and one budget expenditure category (unemployment related transfers) that seem to respond to short-run (cyclical) movements in real output. As a result, we expect that selected fiscal variables automatically respond to the cyclical fluctuations in real output.

To estimate income elasticities of budgetary categories we expect that there is a long-run equilibrium relationship (cointegration) between each included fiscal variable and real output. Cointegration methodology introduced by Johansen (1988, 1991) and Johansen and Juselius (1990) will be employed to estimate the long-run equilibrium relationships between different types of budgetary variables and real output in the Euro Area member countries. Johansen method is applied to the unrestricted vector autoregression (VAR) model that can be written by the following moving average representation of n non-stationary variables containing p lagged values:

$$Y_t = \mu + A_1 Y_{t-1} + A_2 Y_{t-2} + \dots + A_p Y_{t-p} + \varepsilon_t \quad (4)$$

where Y_t is a $n \times 1$ vector of the contemporaneous endogenous variables, μ is a $n \times 1$ vector of the constants, A_i are $n \times n$ polynomial variance-covariance matrix, $\varepsilon_t \sim N_n(0, \Sigma_\varepsilon)$ is a $n \times 1$ normalized vector of exogenous shocks (innovations) to the model representing unexplained changes in the variables.

If at least two of the variables are cointegrated of the order one (I(1)) the VAR representation in the equation (4) can be rewritten by subtracting Y_{t-1} to the following vector error correction model (VECM):

$$\Delta Y_t = \mu + \Pi Y_{t-p} + \sum_{i=1}^{p-1} \Gamma_i \Delta Y_{t-i} + \varepsilon_t \quad (5)$$

where ΔY_t is a $n \times 1$ vector of the first differences of stochastic variables Y_t , $\Pi = \sum_{i=1}^p A_i - I$,

$$\Gamma_i = - \sum_{j=i+1}^p A_j, I \text{ is } n \times n \text{ identity matrix.}$$

Presented VECM contains information on both short-term and long-term adjustments to changes in Y_t included in estimated Γ and Π respectively. Γ is a $n \times n$ matrix that represents the short-term dynamic - adjustments to changes in Y_t . Π is a $n \times n$ matrix consisting of the long-run coefficients - the cointegrating relationships (cointegrating vectors) and of the error correction term. Π can be decomposed as follows:

$$\Pi = \alpha\beta' \quad (6)$$

where α represents $n \times r$ a loading matrix containing coefficients that describe the contribution of the r long-term (cointegrating) relationships in the individual equations and denotes the speed of adjustment from disequilibrium, while β is a $n \times r$ matrix of long-run coefficients and represents the r linearly independent cointegrating vectors (each column of β is the cointegrating vector). The number of cointegrating relations among variables of Y_t is the same as the rank (r) for the matrix Π . If it has a full rank, the rank $r = n$ and it means there are n cointegrating relationships and that all variables are $I(0)$. If a vector Y_t is a vector of endogenous variables that are $I(1)$, then all terms in equation (5) are $I(0)$, and ΠY_{t-1} must be also stationary for $\varepsilon_n \sim I(0)$ to be white noise. If the matrix Π has reduced rank, $r < n$, there are $n-1$ cointegrating vectors and even if all endogenous variables in the model are $I(1)$, the level-based long-run component would be stationary. VECM requires that there exists at least one cointegrating relationship.

In order to find a presence of cointegrating (long-run) relationships, we use trace test and maximum eigenvalue test. Determination of rank and estimation of the coefficients are computed as maximum likelihood estimation. The corresponding likelihood-ratio test statistics are:

$$\lambda_{trace}(r) = -T \sum_{i=r+1}^n \ln(1 - \hat{\lambda}_i) \quad \lambda_{max}(r, r+1) = -T \ln(1 - \hat{\lambda}_{r+1}) \quad (7)$$

where r is the number of cointegrating vectors under the null hypothesis and $\hat{\lambda}$ is the estimated value for the i th ordered eigenvalue from the Π matrix. Under the trace statistic, the null hypothesis that the number of cointegrating vectors is less than or equal to r is tested against the alternative that there are more than r vectors. Whereas under the maximum eigenvalue test the null hypothesis that there are r cointegrating vectors is tested against the alternative of $r+1$ cointegrating vectors.

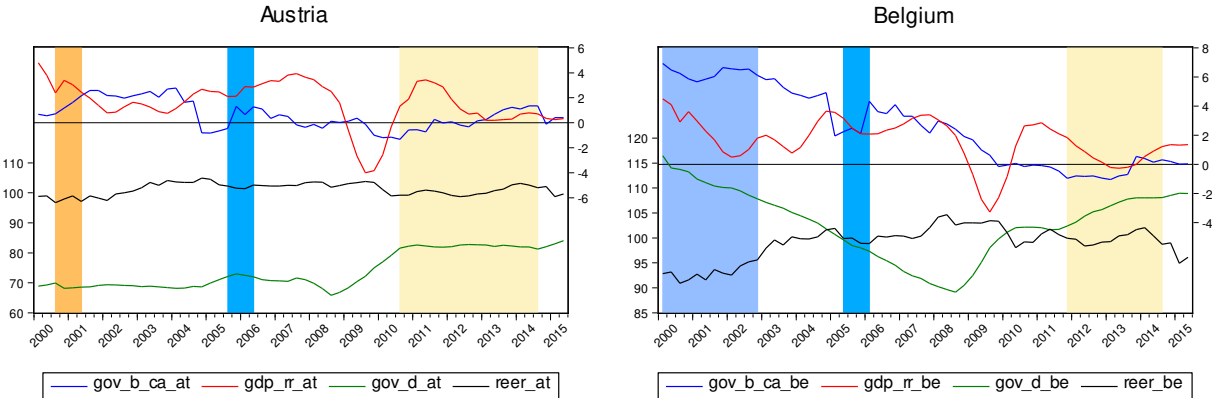
Provided that time series for direct tax revenues, indirect tax revenues, social contributions, unemployment related transfers and real output are $I(1)$ ³ we estimate four different VEC models employing quarterly data for the period 2000Q1-2015Q2 (62 observations) for government expenditures, real output, inflation, tax revenues and long-term interest rates on 10-year government bonds drawn from Eurostat - Government Finance Statistics (October 2016) and IMF database (International Financial Statistics, October 2016). Time series for direct tax revenues, indirect tax revenues, social contributions, unemployment related transfers and real output were seasonally adjusted. Tests for the cointegration were computed using two lags as recommended by the AIC (Akaike Information Criterion).

Results of both Johansen cointegration procedures (trace statistics and maximum eigenvalue statistics) confirmed our hypothesis about existence of one long-run equilibrium (cointegrating) relationship between each fiscal variable and real output. Normalized cointegrating coefficients derived from each cointegrating equation represent elasticity coefficients of each fiscal category with respect to real output.

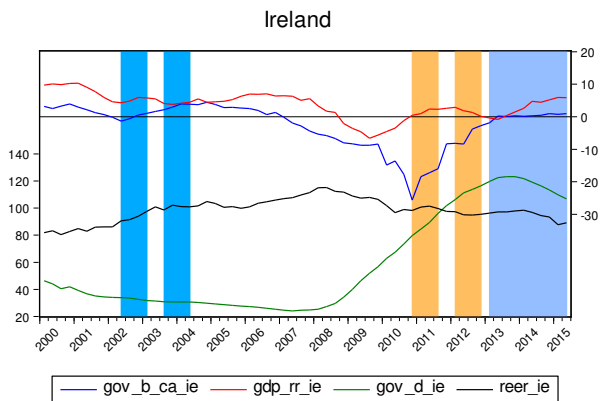
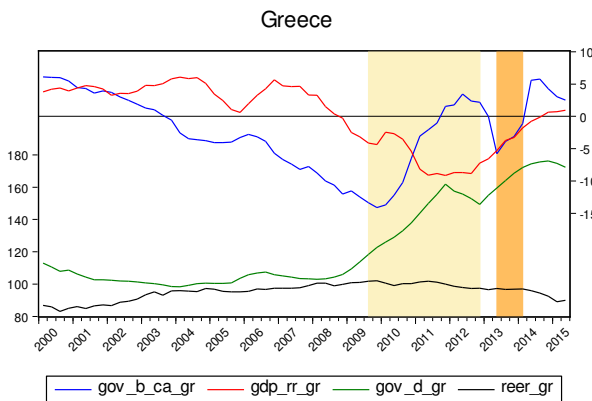
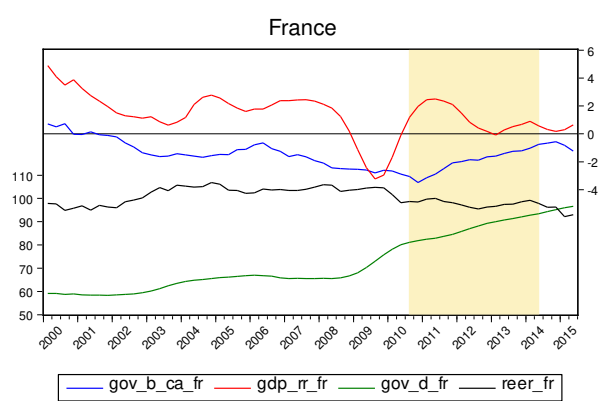
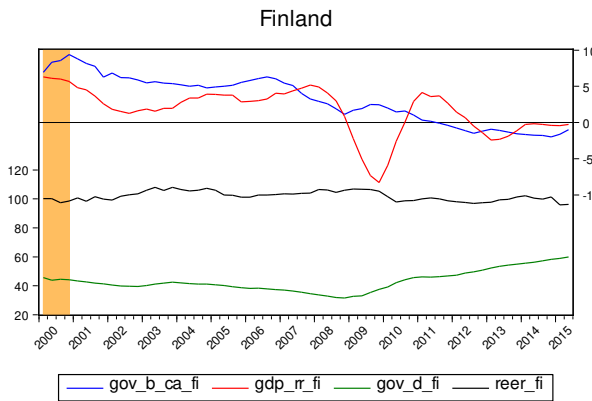
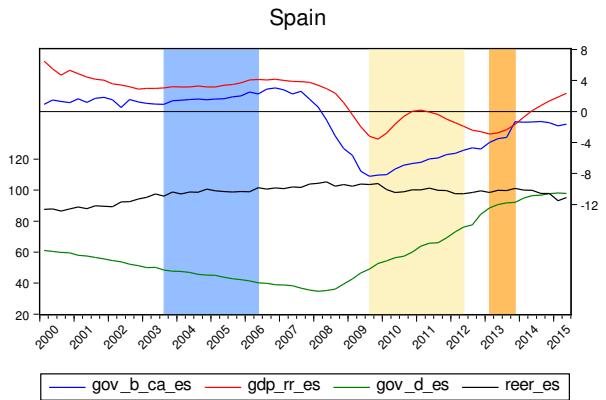
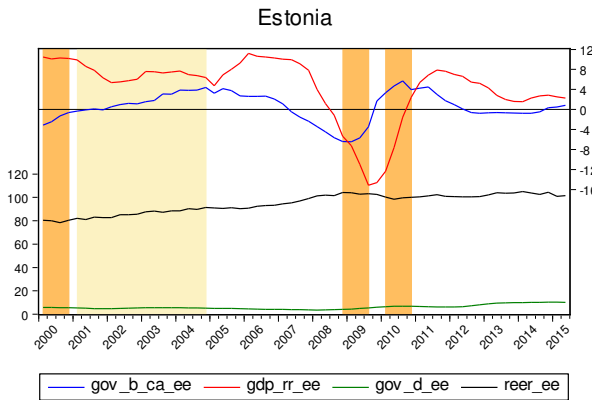
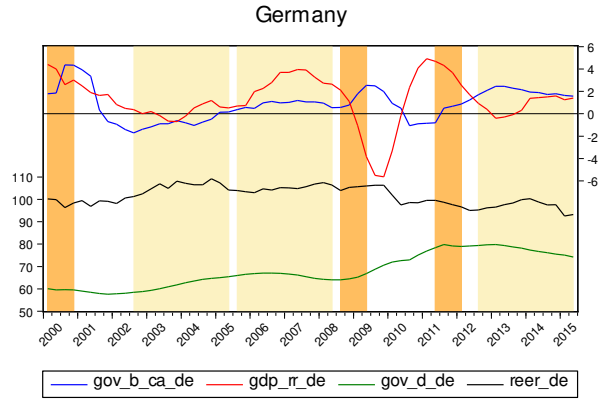
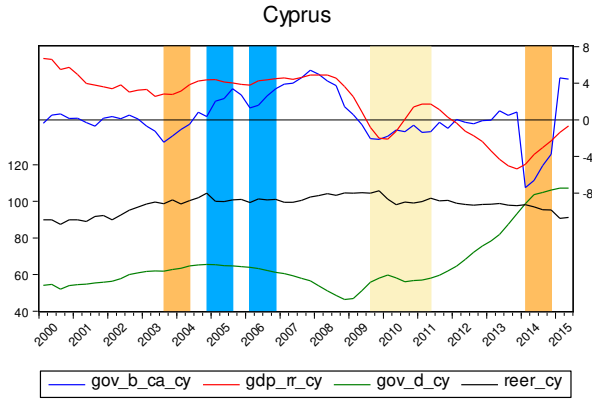
4.4 Episodes of Fiscal Consolidation

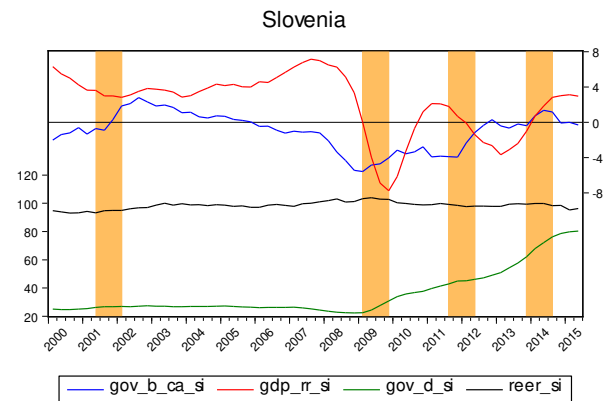
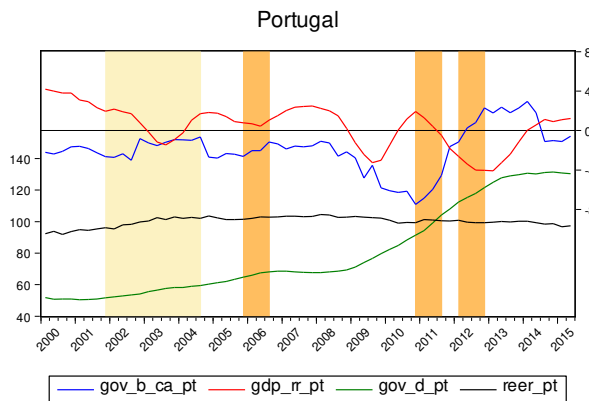
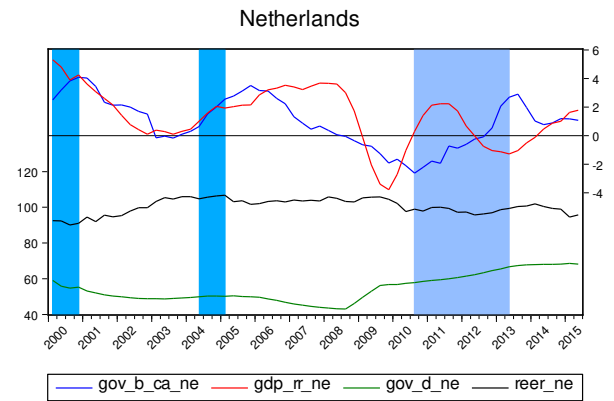
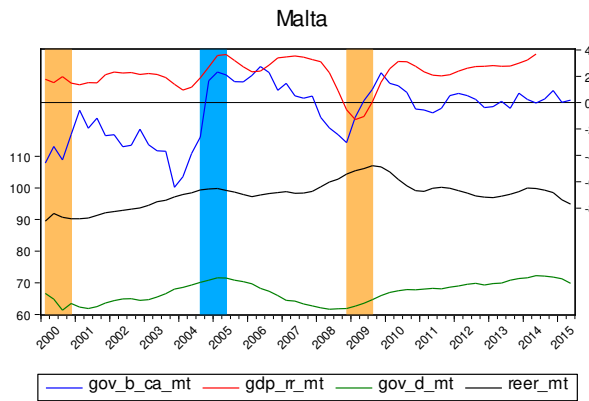
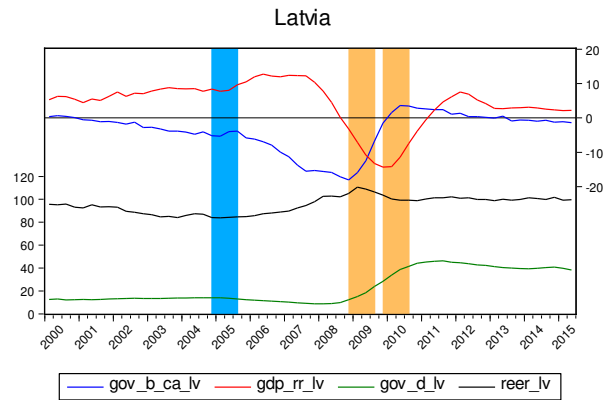
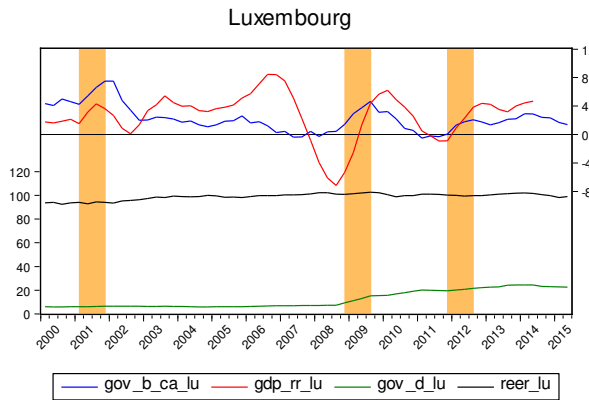
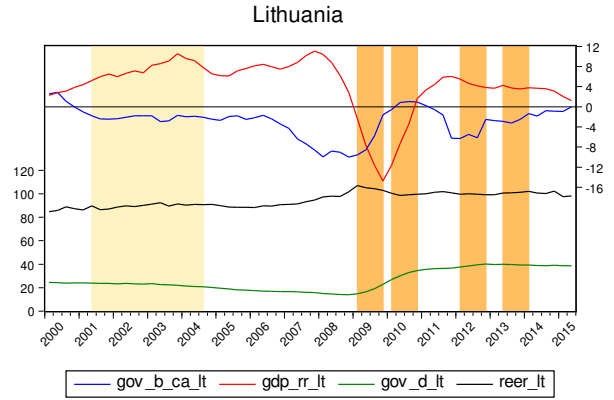
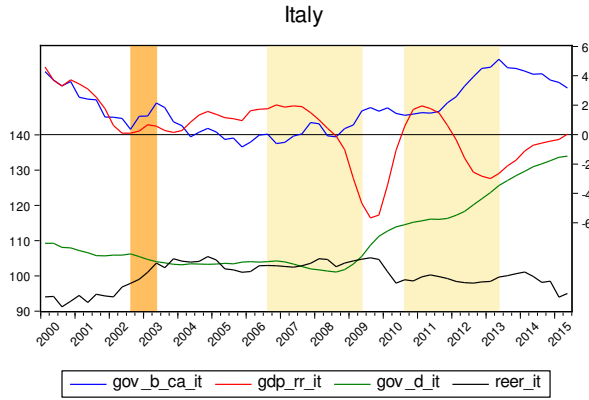
The figure 6 reveals identified episodes of fiscal consolidation in the Euro Area member countries as well as the degree of their success since 2000. Our results are contrary to conclusions assessed by i.e. Barrios, Langedijk and Pench (2010) who performed investigation about a degree of fiscal consolidation success on the sample of EU15 countries since 1970. It seems that governments in our sample of countries significantly seek an effort to undertake gradual multi-year fiscal consolidations and thus strengthen financial discipline during a significant period of their political cycle.

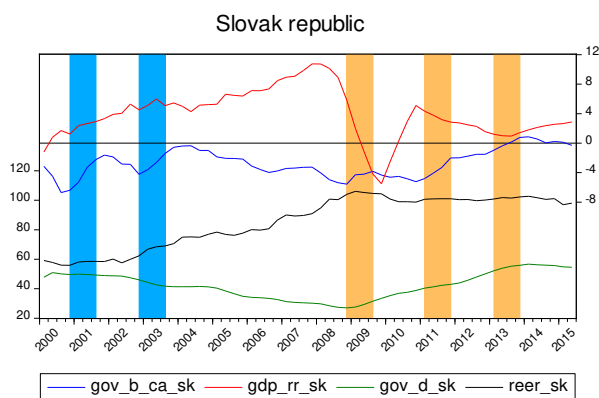
Figure 6 Fiscal Consolidation Episodes (2000Q1-2015Q2)



³ Detail results of unit root test are not reported here to save space. Like any other results, they are available upon request from the author.







Note: Variables - cyclically adjusted primary balance - CAPB (GOV_B_CA) and annual rate (on quarterly basis) of the real GDP growth (GDP_RR) are expressed in percentage (right axis in figures). Sovereign debt (GOV_D) is expressed as percentage share on GDP (left axis in figures). Real effective exchange rate (REER) is expressed as index (left axis in figures) (2010 = 100)

unsuccessful one-year consolidation
 unsuccessful gradual consolidation
 successful one-year consolidation
 successful gradual consolidation

Source: Author's calculation.

Austria experienced three fiscal consolidations. *First*, one-year unsuccessful consolidation (2000Q3-2001Q2) seems to be expenditure based, as it was associated with moderate decrease in budgetary expenditures at faster rates than associated increase in revenues⁴ (especially from direct taxes)). Despite examined positive trend in both budgetary expenditures and revenues, CAPB did not improved strong enough to induce a significant reduction in sovereign debt. At the same time, it doesn't seem to be effective because at the end of the episode it reduced initial increase in the rate of a real GDP growth. During this period REER appreciated and thus reduced consolidation effort. *Second*, one-year successful consolidation (2005Q3-2006Q2) seems to be expenditure based as it was associated with significant reduction in budgetary expenditure (due to decrease in other expenditures). It seems to be effective because the rate of a real GDP growth during this period moderately increased. The rate of REER appreciation was just a negligible that is why it did not reduce consolidation effort. *Third*, gradual unsuccessful consolidation (2010Q3-2014Q3) seems to be both expenditure (compensation of employees) and revenues based (especially due to increase in direct taxes). It seems to be ineffective because the rate of a real GDP growth during this period significantly decreased. Despite initial decrease in REER, since the second half of the period REER started to follow appreciation trend and thus it did not contribute to the consolidation effort.

Belgium experienced three fiscal consolidations. *First*, gradual successful consolidation (2000Q1-2002Q4) seems to be expenditure based, as it was associated with moderate decrease in budgetary expenditures. However, it doesn't seem to be effective because during this period the rate of a real GDP growth decreased. During this period REER appreciated and thus reduced consolidation effort. *Second*, one-year successful consolidation (2005Q2-2006Q1) seems to be expenditure based since we have examined a moderate decrease in other expenditures. However, it seems to be ineffective because the rate of a real

⁴ Development of budgetary components in this section is evaluated according to their share in GDP.

GDP growth during this period slightly decreased. During this period REER moderately depreciated and thus contributed to consolidation effort. *Third*, gradual unsuccessful consolidation (2011Q4-2014Q3) seems to be revenue based as revenues from both direct and indirect taxes increased. It seems to be ineffective because the rate of a real GDP growth during this period slightly increased (despite positive trend in the real output development during the last quarter of the episode). During this period REER followed appreciation trend and thus it did not contribute to the consolidation effort (despite a depreciation trend that was initiated at the end of the episode).

Cyprus experienced five fiscal consolidations. *First*, one-year unsuccessful consolidation (2003Q3-2004Q2) seems to be revenue based, as it was associated with significant increase in budgetary revenues (especially from indirect taxes). Despite examined positive trend in budgetary revenues and moderate improvement in CAPB sovereign debt slightly increased during this episode. However, it seems to be effective because during this episode the rate of a real GDP growth increased. During this period REER appreciated and thus reduced consolidation effort. *Second*, one-year successful consolidation (2004Q4-2005Q3) seems to be both revenue and expenditure based and main contribution refers to an increase in direct taxes (together with negligible increase in indirect taxes) and minor decrease in intermediate consumption. However, it seems to be ineffective because the rate of a real GDP growth during this period slightly decreased. During this episode REER moderately depreciated and thus contributed to consolidation effort. *Third*, one-year successful consolidation (2006Q1-2006Q4) seems to be also revenue based due to reasonable increase in direct taxes and less dynamic increase in indirect taxes together with a minor decrease in government expenditures. It also seems to be effective because the rate of a real GDP growth during this episode slightly increased. However, during this period REER appreciated and thus it did not contribute to the consolidation effort. *Forth*, gradual unsuccessful consolidation (2009Q3-2011Q2) seems to be revenue based though the key component, direct taxes, experienced just a moderate increase. It also seems to be ineffective because the rate of a real GDP growth during this period slightly decreased (despite increased dynamic of real output during few quarters in the middle of the episode). During this period REER moderately depreciated and thus contributed to consolidation effort. *Fifth*, one-year unsuccessful consolidation (2014Q1-2014Q4) seems to be both revenue and expenditure based and main contribution refers to a reduction in government expenditures (capital transfers). However, it seem to be effective because during this period the country experienced a decreasing trend in the real output deterioration. During this period REER moderately depreciated and thus contributed to consolidation effort.

Germany experienced six fiscal consolidations. *First*, one-year unsuccessful consolidation (2000Q1-2000Q4) seems to be expenditure based, as it was associated with sharp decrease in government expenditures (increase in direct taxes was associated with a reduction in indirect taxes that is why revenue side did not contribute to consolidation effort). It seems to be ineffective because during this period the rate of a real GDP growth decreased. During this period REER depreciated and thus contributed to consolidation effort. *Second*, gradual unsuccessful consolidation (2002Q3-2005Q2) seems to be expenditure based due to minor decrease in all key components of government expenditures. It also seems to be

ineffective because the rate of a real GDP growth during this period slightly decreased. During this episode REER appreciated that is why it did not contribute to consolidation effort. *Third*, gradual unsuccessful consolidation (2005Q3-2008Q2) seems to be both expenditure and revenue based due to minor decrease in expenditures and more dynamic increase in revenues. Main contribution refers to an increase in indirect taxes and minor decrease in compensation of employees and social benefits. It also seems to be ineffective because the rate of a real GDP growth during this period decreased. During this period REER followed appreciation trend and thus it did not contribute to the consolidation effort. *Forth*, one-year unsuccessful consolidation (2008Q3-2009Q2) seems to be revenue based due to increase in indirect taxes. It also seems to be ineffective because the rate of a real GDP growth during this period significantly decreased. During this period REER followed appreciation trend and thus it did not contribute to the consolidation effort. *Fifth*, one-year unsuccessful consolidation (2011Q2-2012Q1) seems to be both expenditure and revenue based. Main contribution refers to more dynamic decrease in government expenditures (social benefits and capital transfers). However, it doesn't seem to be effective because during this episode the rate of a real GDP growth decreased. During this period REER depreciated and thus contributed to consolidation effort. *Sixth*, gradual unsuccessful consolidation (2012Q3-2015Q2) seems to be both expenditure and revenue based. Main contribution refers to moderate decrease in capital investments and increase in direct taxes. However, it seems to be effective because the rate of a real GDP growth during this period slightly increased. During this period REER followed depreciation trend that is why it contributed to consolidation effort.

Estonia experienced four fiscal consolidations. *First*, one-year unsuccessful consolidation (2000Q1-2000Q4) seems to be purely revenue based due to significant decrease in government expenditures (during this period CAPB improved despite reduction in government revenues). It seems to be effective because during this period the rate of a real GDP growth did not change at all. During this period REER did not experience any significant shift and thus it was in neutral stance. *Second*, gradual unsuccessful consolidation (2001Q1-2004Q4) seems to be both revenue and expenditure based and main contribution refers to small increase in direct taxes and decrease in intermediate consumption and capital investments. It seems to be ineffective because the rate of a real GDP growth during this period decreased. During this period REER appreciated and thus it did not contribute to consolidation effort. *Third*, one-year unsuccessful consolidation (2008Q4-2009Q3) seems to be purely revenue based (during this period CAPB improved despite significant increase in government expenditures, i.e. social benefits and compensation of employees) and main contribution refers to an increase in indirect taxes and social contributions. It seems to be ineffective because the rate of a real GDP growth during this period significantly dropped. During this episode REER slightly depreciated and thus contributed to consolidation effort. *Forth*, one-year unsuccessful consolidation (2010Q1-2010Q4) seems to be expenditure based (during this period CAPB improved despite significant decrease in revenues, i.e. both direct and indirect taxes). Main contribution refers to a decrease in compensation of employees and social benefits. It seems to be effective because the rate of a real GDP growth during this

period significantly increased. During this period REER did not experience any significant shift and thus it was in neutral stance.

Spain experienced three fiscal consolidations. *First*, gradual **successful** consolidation (2003Q3-2006Q2) seems to be both expenditure and revenue based as it was associated with moderate decrease in budgetary expenditures (compensation of employees) and increase in both direct and indirect taxes. Moreover, it seems to be effective because during this period the rate of a real GDP growth increased. During this episode REER appreciated that is why it reduced consolidation effort. *Second*, gradual **unsuccessful** consolidation (2009Q3-2012Q2) seems to be revenue due to increase mainly in direct taxes. It seems to be effective because the rate of a real GDP deterioration significantly reduced during this episode. During this period REER depreciated and thus contributed to consolidation effort. *Third*, one-year **unsuccessful** consolidation (2013Q1-2013Q4) seems to be both expenditure and revenue based as it was associated with decrease in budgetary expenditures (capital transfers) and moderate increase in indirect taxes. It seems to be effective because the rate of a real GDP deterioration significantly reduced during this episode. During this period REER followed appreciation trend and thus it did not contribute to the consolidation effort.

Finland experienced just one fiscal consolidation. *First*, one-year **unsuccessful** consolidation (2000Q1-2000Q4) seems to be both revenue and revenue based, as it was associated with increase in budgetary revenues (direct taxes) and reduction in government expenditures (compensation of employees and social contributions). However, it doesn't seem to be effective because during this period the rate of a real GDP growth decreased. During this period REER depreciated and thus it contributed to consolidation effort.

France experienced just one fiscal consolidation. *First*, gradual **unsuccessful** consolidation (2010Q3-2014Q2) seems to be revenue based, as it was associated with significant increase in budgetary revenues (both direct and indirect taxes). It seems to be effective because during this period the rate of a real GDP growth increased. During this period REER moderately depreciated and thus contributed to consolidation effort.

Greece experienced two fiscal consolidations. *First*, gradual **unsuccessful** consolidation (2009Q3-2012Q4) seems to be purely revenue based, as it was associated with significant increase in budgetary revenues (both direct and indirect taxes, capital transfers). During this period CAPB improved despite moderate increase in government expenditures. It also seems to be ineffective because during this episode the rate of a real GDP growth decreased. During this period REER depreciated and thus contributed to consolidation effort. *Second*, one-year **unsuccessful** consolidation (2013Q2-2014Q1) seems to be both revenue and expenditure based and main contribution refers to an increase in direct and indirect taxes and minor decrease in compensations of employees, social benefits and capital transfers. It also seems to be effective because the rate of a real GDP growth during this period slightly increased. Rate of REER appreciation nearly stagnated and thus not weakening consolidation effort.

Ireland experienced five fiscal consolidations. *First*, one-year **successful** consolidation (2002Q2-2003Q1) seems to be both expenditure and revenue based. Main contribution refers to more dynamic increase in government revenues (indirect taxes) and

moderate decrease in government expenditures (capital investments). It seems to be effective because during this period the rate of a real GDP growth increased. During this period REER appreciated and thus reduced consolidation effort. *Second*, one-year **successful** consolidation (2003Q3-2004Q2) seems to be both revenue and expenditure based and main contribution refers to an increase in direct and less dynamic increase in indirect taxes and minor decrease in government expenditures (intermediate consumption and capital investments). It also seems to be effective because the rate of a real GDP growth during this period slightly increased. During this episode REER slightly appreciated and thus reduced consolidation effort. *Third*, one-year **unsuccessful** consolidation (2010Q4-2011Q3) seems to be both revenue and expenditure based due to really sharp reduction in government expenditures (capital transfers and capital investments) and moderate increase in government revenues (direct taxes). It also seems to be effective because the rate of a real GDP growth during this episode slightly increased. During this period REER moderately appreciated and thus reduced consolidation effort. *Forth*, one-year **unsuccessful** consolidation (2012Q1-2012Q4) seems to be both expenditure and revenue based and main contribution refers to dynamic reduction in government expenditures (capital transfers, capital investments and intermediate consumption) and moderate increase in government revenues (direct and indirect taxes). It seems to be ineffective because the rate of a real GDP growth during this period decreased. During this episode REER depreciated and thus contributed to consolidation effort. *Fifth*, gradual **successful** consolidation (2013Q1-2015Q2) seems to be purely expenditure based, as it was associated with another wave of considerable decrease in government expenditures (compensation of employees and social benefits). It seems to be effective because during this episode the rate of a real GDP growth increased. During this period REER depreciated and thus contributed to consolidation effort.

Italy experienced three fiscal consolidations. *First*, one-year **unsuccessful** consolidation (2002Q3-2003Q2) seems to be both expenditure and revenue based, as it was associated with moderate decrease in government expenditures (intermediate consumptions and capital investments) and moderate increase in government revenues (capital taxes). It seems to be effective because during this period the rate of a real GDP growth moderately increased. During this period REER appreciated and thus reduced consolidation effort. *Second*, gradual **unsuccessful** consolidation (2006Q3-2009Q2) seems to be purely revenue based (during this period CAPB improved despite increase in government expenditures) and main contribution refers to increase direct taxes and social contributions. It seems to be ineffective because the rate of a real GDP growth during this episode considerably decreased. During this period REER moderately appreciated and thus reduced consolidation effort. *Third*, gradual **unsuccessful** consolidation (2010Q3-2013Q2) seems to be also revenue based (during this period CAPB improved despite increase in government expenditures) and main contribution refers to increase direct and indirect taxes. It seems to be ineffective because the rate of a real GDP growth during this period decreased. During this period REER moderately appreciated and thus reduced consolidation effort.

Lithuania experienced five fiscal consolidations. *First*, gradual **unsuccessful** consolidation (2001Q2-2004Q3) seems to be expenditure based (during this period CAPB improved despite decrease in government revenues), as it was associated with decrease in

social benefits capital transfers. It seems to be effective because during this period the rate of a real GDP growth increased. During this episode REER moderately appreciated and thus slightly reduced consolidation effort. *Second*, one-year unsuccessful consolidation (2009Q1-2009Q4) seems to be revenue based and main contribution refers to an increase in indirect taxes. It seems to be effective because the rate of a real GDP growth during this period increased. During this period REER depreciated and thus contributed to consolidation effort. *Third*, one-year unsuccessful consolidation (2010Q1-2010Q4) seems to be expenditure based (during this period CAPB improved despite moderate decrease in government revenues) and main contribution refers to an increase in compensation of employees and social benefits. It seems to be ineffective because the rate of a real GDP growth during this period decreased. During this period REER depreciation trend and thus contributed to the consolidation effort. *Forth*, one-year unsuccessful consolidation (2012Q1-2012Q4) seems to be expenditure based (during this period CAPB improved despite moderate decrease in government revenues) and main contribution refers to decrease in compensation of employees, social benefits and capital investments. It seems to be ineffective because the rate of a real GDP growth during this period decreased. During this period REER did not experience any significant shift and thus it was in neutral stance. *Fifth*, one-year unsuccessful consolidation (2013Q2-2014Q1) seems to be both expenditure and revenue based, as it was associated with decrease in budgetary expenditures (compensation of employees and social benefits) and increase in government revenues (indirect taxes and capital transfers). It seems to be ineffective because during this episode the rate of a real GDP growth decreased. During this period REER appreciated and thus reduced consolidation effort.

Luxembourg experienced three fiscal consolidations. *First*, one-year unsuccessful consolidation (2001Q1-2001Q4) seems to be revenue based (during this period CAPB improved despite moderate increase in government expenditures) and main contribution refers to indirect taxes. It seems to be effective because during this period the rate of a real GDP growth decreased. During this period REER did not experience any significant shift and thus it was in neutral stance. *Second*, one-year unsuccessful consolidation (2008Q4-2009Q3) seems to be also revenue based (during this period CAPB improved despite considerable increase in government expenditures) due increase in direct taxes, indirect taxes and social contributions. It seems to be ineffective because the rate of a real GDP growth during this episode slightly decreased. During this period REER appreciated and thus reduced consolidation effort. *Third*, one-year unsuccessful consolidation (2011Q4-2012Q3) seems to be revenue based and main contribution refers to an increase in indirect taxes and social contributions. It also seems to be ineffective because the rate of a real GDP growth during this period considerably decreased. During this period REER slightly depreciated and thus contributed to consolidation effort.

Latvia experienced three fiscal consolidations. *First*, one-year successful consolidation (2004Q4-2005Q3) seems to be both expenditure and revenue based, as it was associated with decrease in government expenditures (intermediate consumption, compensation of employees and capital investments) and increase in government revenues (indirect taxes and capital transfers). It seems to be effective because during this period the rate of a real GDP growth increased. During this period REER did not experience any

significant shift and thus it was in neutral stance. *Second*, one-year unsuccessful consolidation (2008Q4-2009Q3) seems to be revenue based (during this period CAPB improved despite moderate increase in government expenditures) and main contribution refers to an increase in social contributions and sales. It seems to be ineffective because the rate of a real GDP growth during this period considerable decreased. During this period REER appreciated and thus reduced consolidation effort. *Third*, one-year unsuccessful consolidation (2009Q4-2010Q3) seems to be revenue based and main contribution refers to an increase in direct and indirect taxes. It seems to be effective because the rate of a real GDP growth during this period increased. During this period REER depreciated and thus contributed to consolidation effort.

Malta experienced three fiscal consolidations. *First*, one-year unsuccessful consolidation (2000Q1-2000Q4) seems to be expenditure based (during this period CAPB improved despite decrease in government revenues), as it was associated with decompensation of employees and social benefits. It seems to be effective because during this period the rate of a real GDP growth increased. During this period REER moderately appreciated and thus reduced consolidation effort. *Second*, one-year successful consolidation (2004Q3-2005Q2) seems to be both revenue and expenditure based and main contribution refers to an increase in indirect taxes and capital transfers and decrease in compensation of employees and capital transfers. It seems to be ineffective because the rate of a real GDP growth during this episode decreased. During this period REER did not experience any significant shift and thus it was in neutral stance. *Third*, one-year unsuccessful consolidation (2008Q4-2009Q3) seems to be expenditure based and main contribution refers to a decrease in intermediate consumption and capital investments. It seems to be ineffective because the rate of a real GDP growth during this period decreased. During this period REER followed appreciation trend and thus it did not contribute to the consolidation effort.

Netherlands experienced three fiscal consolidations. *First*, one-year successful consolidation (2000Q1-2000Q4) seems to be both expenditure and revenue based, as it was associated with decrease in budgetary expenditures (compensation of employees and social benefits) and just a moderate increase in budgetary revenues (social contributions). It seems to be ineffective because during this period the rate of a real GDP growth decreased. During this period REER depreciated and thus reduced consolidation effort. *Second*, one-year successful consolidation (2004Q2-2005Q1) seems to be both revenue and expenditure based and main contribution refers to an increase in direct taxes and social contributions and decrease in social benefits and capital investments. It also seems to be effective because the rate of a real GDP growth during this period increased. During this period REER appreciated and thus reduced consolidation effort. *Third*, gradual successful consolidation (2010Q3-2013Q2) seems to be both revenue and expenditure based and main contribution refers to increase in social contributions and decrease in intermediate consumption, compensation of employees and capital investments. It seems to be ineffective because the rate of a real GDP growth during this period decreased. During this episode REER did not experience any significant shift and thus it was in neutral stance.

Portugal experienced four fiscal consolidations. *First*, gradual unsuccessful consolidation (2001Q4-2004Q3) seems to be revenue based, as it was associated with

increase in budgetary revenues (during this period CAPB improved despite increase in government expenditures) and the main contribution refers to increase in direct taxes and social contributions. It seems to be ineffective because during this period the rate of a real GDP growth slightly decreased. During this period REER appreciated and thus reduced consolidation effort. *Second*, one-year unsuccessful consolidation (2005Q4-2006Q3) seems to be both revenue and expenditure based and main contribution refers to an increase in indirect taxes and direct taxes and decrease in the intermediate consumption, compensation of employees and capital investments. It seems to be effective because the rate of a real GDP growth during this period slightly increased. During this period REER appreciated and thus reduced consolidation effort. *Third*, one-year unsuccessful consolidation (2010Q4-2011Q3) seems to be both revenue and expenditure based and main contribution refers to an increase in indirect taxes and direct taxes and slight reduction in compensation of employees. It seems to be ineffective because the rate of a real GDP growth during this period decreased. During this period REER followed appreciation trend and thus reduced consolidation effort. *Forth*, one-year unsuccessful consolidation (2012Q1-2012Q4) seems to be expenditure based and main contribution refers to decrease in intermediate consumption, compensation of employees and capital investments. It seems to be ineffective because the rate of a real GDP growth during this period decreased. During this period REER slightly depreciated and thus contributed to consolidation effort.

Slovenia experienced four fiscal consolidations. *First*, one-year unsuccessful consolidation (2001Q2-2002Q1) seems to be both revenue and expenditure based, as it was associated with increase in budgetary revenues (indirect taxes) and decrease in budgetary expenditures (subsidies, other current expenditures and capital transfers). It seems to be ineffective because during this period the rate of a real GDP growth decreased. During this period REER appreciated and thus reduced consolidation effort. *Second*, one-year unsuccessful consolidation (2009Q1-2009Q4) seems to be revenue based and main contribution refers to an increase in social contributions. It seems to be ineffective because the rate of a real GDP growth during this period considerably decreased. During this period REER depreciated and thus contributed to consolidation effort. *Third*, one-year unsuccessful consolidation (2011Q3-2012Q1) seems to be both expenditures and revenue based and main contribution refers to decrease in social benefits and capital transfers and increase in social contributions and sales. It seems to be ineffective because the rate of a real GDP growth during this period decreased. During this period REER depreciated and thus contributed to consolidation effort. *Forth*, one-year unsuccessful consolidation (2013Q4-2014Q3) seems to be expenditure based (during this period CAPB improved despite decrease in government revenues) and main contribution refers to a decrease in intermediate consumption, compensation of employees, social benefits and capital transfers. It seems to be effective because the rate of a real GDP growth during this period increased. During this period REER followed depreciation trend and thus contributed to consolidation effort.

Slovak republic experienced five fiscal consolidations. *First*, one-year successful consolidation (2000Q4-2001Q3) seems to be expenditure based (during this period CAPB improved despite decrease in government revenues) and main contribution refers to decrease in capital transfers and other current expenditures. It seems to be effective because during this

period the rate of a real GDP growth increased. During this period REER appreciated and thus reduced consolidation effort. *Second*, one-year successful consolidation (2002Q4-2003Q3) seems to be expenditure based as it was associated with decrease in intermediate consumption, compensation of employees, social benefits, capital transfers and capital investments. It seems to be effective because the rate of a real GDP growth during this period increased. During this period REER appreciated and thus reduced consolidation effort. *Third*, one-year unsuccessful consolidation (2008Q4-2009Q3) seems to be revenue based (during this period CAPB improved despite increase in government expenditures) and main contribution refers to increase in social contributions, sales and capital transfers. It seems to be ineffective because the rate of a real GDP growth during this period decreased. During this period REER followed appreciation trend and thus reduced consolidation effort. *Forth*, one-year unsuccessful consolidation (2011Q1-2011Q4) seems to be both expenditures and revenue based and main contribution refers to decrease in compensation of employees and social benefits and increase in indirect taxes and direct taxes, sales and other current revenues. It seems to be ineffective because the rate of a real GDP growth during this period decreased. During this episode REER did not experience any significant shift and thus it was in neutral stance. *Fifth*, one-year unsuccessful consolidation (2013Q1-2013Q4) seems to be revenue based (during this period CAPB improved despite increase in government expenditures) and main contribution refers to increase in indirect taxes, direct taxes, social contributions and sales. It seems to be effective because the rate of a real GDP growth during this period increased. During this period REER appreciated and thus reduced consolidation effort.

In general, we have identified 66 episodes of both types – one-year consolidations (49) and gradual consolidations (17). However, only 24 percent of one-year consolidation episodes (12 *cold showers*) and 23 percent of gradual consolidation episodes (4 *multi-year consolidations*) succeeded. It seems that governments in our sample of countries significantly seek an effort to undertake fiscal consolidations and thus strengthen financial discipline during a significant period of their political cycle. Our results indicate that more than half of all consolidation episodes (55 percent of one-year and 53 percent of multi-year consolidations) were conducted during the crisis period) though all successful one-year and half of successful multi-year consolidations occurred during the pre-crisis period. As a result, tightened fiscal conditions and strongly demanded improvements in the fiscal discipline during the crisis period was not followed by generally needed periods (either one-year or multi-year) of successful consolidations that would reduce the burden of increasing sovereign debt. Moreover, it also reveals wasted chance of successful fiscal consolidation that would governments undertake during “good (pre-crisis) times”.

Table 2 summarizes consolidation efforts in the Euro Area member countries during the period 2000-2015.

Table 2 Summary of Fiscal Consolidation Episodes in the Euro Area (2000-2015)

type of consolidation episode		expenditure based								revenue based								expenditure and revenue based							
		successful				unsuccessful				successful				unsuccessful				successful				unsuccessful			
GDP		+		-		+		-		+		-		+		-		+		-		+		-	
NEER		A	D	A	D	A	D	A	D	A	D	A	D	A	D	A	D	A	D	A	D	A	D	A	D
2000-2007	one-year	3			1	1		1	1	1				1	2			3	1		3	2		1	1
	multi-year			1		1		1							2			1					1	1	
2007-2015	one-year						2	1	3					1	2	4	3					3	1	4	3
	multi-year		1											1	2	1	2				1		1		

Note: GDP (+) represents positive effect of the fiscal consolidation episode on the real output, GDP (-) represents negative effect of the fiscal consolidation episode on the real output, NEER (A) - nominal effective exchange rate appreciated during specified fiscal consolidation episode, NEER (D) - nominal effective exchange rate depreciated during specified fiscal consolidation episode.

x successful fiscal consolidation episode, x unsuccessful fiscal consolidation episode
 x - number of consolidation episodes of a specified type; higher is the number, darker is the color

Source: Author's calculation.

Brief overview of fiscal consolidation efforts in the Euro Area countries indicates that most of the successful consolidation episodes are concentrated to the pre-crisis period and are of the one-year pattern. It seems that if governments were willing to improve a fiscal discipline than it was mostly on the one-year basis revealing lack of intention to preserve fiscal sustainability over longer horizon of their political cycle. Most of successful one-year consolidations were conducted solely via cuts in government expenditures or in combination with increases in government revenues (only one third of them had a negative effect on the real output). At the same time, one-year consolidations conducted during the crisis period were clearly unsuccessful while most of them were conducted via increases in government revenues or in combination with cuts in government expenditures (more than two third of them had a negative effect on the real output). Finally, exchange rate shifts and associated improvements and deteriorations in the international price competitiveness did not have a significant influence on the rate of success of the conducted fiscal consolidations during identified episodes.

Overview of fiscal consolidation episodes in the Euro Area:

- 66 consolidation episodes of both types:
 - 49 one-year consolidations (22 during pre-crisis period)
 - 17 multi-year consolidations (8 during pre-crisis period)
- 16 successful episodes (24 percent):
 - 12 one-year consolidations (all during pre-crisis period)
 - 4 multi-year consolidations (2 during pre-crisis period)
- Pre-crisis period:
 - 36 (30) consolidations during the crisis (pre-crisis) period
 - 6 of 8 multi-year consolidations (just 2 successful) had negative effect on the real output
 - 8 of 22 one-year consolidations (12 successful) had negative effect on the real output

- Whole period:
 - From 22 revenue based consolidations we found just 1 successful (in pre-crisis period)! From remaining 21 unsuccessful consolidations just 12 (10 during the crisis period) had negative effect on the real output.
 - From 17 expenditure based consolidations we found 6 successful (just 1 in crisis period). From remaining 11 unsuccessful consolidations just 7 (4 during the crisis period) had negative effect on the real output.
 - From 27 both revenue and expenditure based consolidations we found 9 successful (just 1 during the crisis period). From remaining 18 unsuccessful consolidations just 10 (7 during the crisis period) had negative effect on the real output.
 - Exchange rate adjustment (appreciation or depreciation) did not affect the rate of success of fiscal consolidation efforts though it occurred mostly during unsuccessful consolidation episodes.

5. Fiscal Policy Shocks

5.1 Econometric Model

VAR models represent dynamic systems of equations in which the current level of each variable depends on past movements of that variable and all other variables involved in the system. Residuals of vector ε_t represent unexplained movements in variables (effects of exogenous shocks hitting the model); however as complex functions of structural shocks effects they have no economic interpretation. Structural shocks can be still recovered using transformation of the true form representation into the reduced-form by imposing a number of identifying restrictions. Applied restrictions should reflect some general assumptions about the underlying structure of the economy and they are obviously derived from economic theory. There are two general (most used) approaches to identify VAR models. (I) Cholesky decomposition of innovations implies the contemporaneous interactions between exogenous shocks and the endogenous variables are characterized by a Wald causal chain. Ordering of endogenous variables then reflects expected particular economy structure following general economic theory assumptions. However, the lack of reasonable guidance for appropriate ordering led to the development of more sophisticated and flexible identification methods - (II) structural VAR (SVAR) models. Identifying restrictions implemented in SVAR models reflect theoretical assumptions about the economy structure more precisely. However, restrictions based on the theoretical assumptions employed in both identifying schemes should be empirically tested to avoid shocks identification bias and imprecisions associated with endogenous variables responses to the shocks.

Understanding effects of fiscal policy shocks (positive government expenditure shock, positive direct and indirect tax revenue shock) on real output would help us to examine an impact of an initiation of the fiscal consolidation episodes. As a result, we should be able to reveal an appropriateness of fiscal revenues and expenditures based adjustments in each particular economy. Comparison of results for pre-crisis and extended period seems to be convenient to identify effects of the crisis period on the reasonability of particular fiscal adjustments.

Approach we use in our analysis to estimate effects of the fiscal policy shocks is based on the vector autoregressive (VAR) methodology. In order to recover the structural shocks that affect the endogenous variables of the model we implement two identification approaches. First approach is based on the recursive Cholesky decomposition of the variance-covariance matrix of the model residuals. The recursive identification approach also considers the causal ordering of the variables. Second approach is based on the identification scheme that imposes long-run restrictions on the variance-covariance matrix of the model residuals. Nevertheless both approaches uses different scheme to recover structural shocks we expect they both provide comparable results of the effects of the fiscal policy shocks in the Euro Area member countries.

True model is represented by the following infinite vector moving average representation:

$$A_0 Y_t = A(L)Y_{t-1} + B\varepsilon_t \quad (7)$$

where Y_t is a $n \times 1$ vector of the endogenous macroeconomic variables, $A(L)$ is a polynomial variance-covariance matrix (represents impulse-response functions of the shocks to the elements of Y) of lag-length l , L is lag operator and (ε_t) is a $k \times 1$ vector of identically normally distributed, serially uncorrelated and mutually orthogonal white noise disturbances (vector of true structural shocks in elements of Y):

$$E(\varepsilon_t) = 0, \quad E(\varepsilon_t \varepsilon_t') = \Sigma_\varepsilon = I, \quad E(\varepsilon_t \varepsilon_s') = [0] \quad \forall t \neq s \quad (8)$$

The vector Y_t of the endogenous variables of the model consists of the following five elements: government expenditures (g_t), real output ($y_{r,t}$), tax revenues (t_t), inflation (p_t) and long-term interest rates (i_t). In our five-variate model we assume five exogenous shocks that determine endogenous variables - government expenditures shock ($\varepsilon_{g,t}$), demand shock ($\varepsilon_{y_{r,t}}$), tax revenues shock ($\varepsilon_{t,t}$), inflation shock ($\varepsilon_{p,t}$) and monetary policy shock ($\varepsilon_{i_{r,t}}$).

By multiplying equation (7) by an inverse matrix A_0^{-1} we obtain the reduced-form of the VAR model (this adjustment is necessary because the model represented by the equation (7) is not directly observable and structural shocks cannot be correctly identified):

$$Y_t = A_0^{-1}A(L)Y_{t-1} + A_0^{-1}B\varepsilon_t = C(L)Y_{t-1} + u_t \quad (9)$$

where $C(L)$ is again a matrix representing the relationship among variables on the lagged values and u_t is a $n \times 1$ vector of normally distributed shocks (shocks in reduced form) that are serially uncorrelated but can be contemporaneously correlated with each other:

$$E(u_t) = 0, \quad E(u_t u_t') = \Sigma_u = \begin{pmatrix} \sigma_{11}^2 & \sigma_{12} & \sigma_{13} \\ \sigma_{12} & \sigma_{22}^2 & \sigma_{23} \\ \sigma_{13} & \sigma_{23} & \sigma_{33}^2 \end{pmatrix}, \quad E(u_t u_s') = [0] \quad \forall t \neq s \quad (10)$$

Equation (9) reveals the relationship between reduced-form VAR disturbances u_t and structural disturbances (ε_t), that is given by

$$u_t = A_0^{-1} B \varepsilon_t \text{ or } A_0 u_t = B \varepsilon_t \quad (11)$$

As we have already mentioned we implement an identification scheme based on two approaches. The first, recursive approach, is based on the Cholesky decomposition of innovations that allows us to identify structural shocks hitting the model. Cholesky decomposition of variance-covariance matrix of VAR residuals defines the matrix A_0 as a lower triangular matrix and matrix B as k-dimensional identity matrix.

The lower triangularity of A_0 implies a recursive scheme among variables that has clear economic implications and has to be empirically tested as any other relationship. Identification scheme of the matrix A_0 implies that some structural shocks have no contemporaneous effects on some endogenous variables given the ordering of the endogenous variables.

At the same time the off-diagonal elements of B are all zero, implying that we do not allow for the structural shocks to be mutually correlated. This assumption is consistent with empirical results - the correlation between government spending and tax revenue shocks is not statistically different from zero.

The equation (11) we can now rewrite to the following form:

$$\begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ a_{21} & 1 & 0 & 0 & 0 \\ a_{31} & a_{32} & 1 & 0 & 0 \\ a_{41} & a_{42} & a_{43} & 1 & 0 \\ a_{51} & a_{52} & a_{53} & a_{54} & 1 \end{bmatrix} \begin{bmatrix} u_{g,t} \\ u_{y,t} \\ u_{p,t} \\ u_{i,t} \\ u_{i_n,t} \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} \varepsilon_{g,t} \\ \varepsilon_{y,t} \\ \varepsilon_{p,t} \\ \varepsilon_{i,t} \\ \varepsilon_{i_n,t} \end{bmatrix} \quad (12)$$

The ordering of variables reveals following relations among them:

- Government expenditures don't respond contemporaneously to the shock from any other endogenous variable of the model.
- Real output doesn't respond contemporaneously to inflation, tax revenue and interest rate shocks, while it is contemporaneously affected only by the government expenditure shock.

- Inflation doesn't respond contemporaneously to the tax revenue and interest rate shocks, while it is contemporaneously affected by the government expenditure and the real output shocks.
- Tax revenues don't respond contemporaneously to the interest rates shock, while it is contemporaneously affected by the government expenditure, the real output and tax revenue shocks.
- Interest rates are contemporaneously affected by the shocks from all of the endogenous variables of the model.

It is also necessary to emphasize that after the initial period the endogenous variables of the model can interact freely without any restrictions.

The second approach, structural VAR (SVAR) approach, is based on decomposing a series into its permanent and temporary components. It imposes long-run restrictions to the reduced-form VAR model. Identification scheme in the SVAR models reflects a long-run neutrality assumption so that we expect the cumulative effect of a certain shock on the certain endogenous variable development is zero. The equation (11) we can now rewrite to the following form:

$$\begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ a_{21} & 1 & 0 & a_{24} & 0 \\ a_{31} & 0 & 1 & a_{34} & 0 \\ 0 & a_{42} & a_{43} & 1 & 0 \\ a_{51} & a_{52} & a_{53} & a_{54} & 1 \end{bmatrix} \begin{bmatrix} u_{g,t} \\ u_{y,t} \\ u_{p,t} \\ u_{i,t} \\ u_{i_n,t} \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} \varepsilon_{g,t} \\ \varepsilon_{y,t} \\ \varepsilon_{p,t} \\ \varepsilon_{i,t} \\ \varepsilon_{i_n,t} \end{bmatrix} \quad (13)$$

In order to correctly identify the model we impose following long-run restrictions:

- Government expenditures do not have a permanent effect on tax revenues.
- Real output does not have a permanent effect on government expenditures and inflation.
- Inflation does not have a permanent effect on government expenditures and real output.
- Tax revenues do not have a permanent effect on government expenditures.
- Interest rates do not have a permanent effect on any other endogenous variable of the model.

Both systems are now just-identified and can be estimated using vector autoregression. From both identified true models we compute impulse-response functions to estimate the responses of the real output to the one standard deviation fiscal shocks. Effects of fiscal consolidating adjustments on the real output are calculated for two periods (pre-crisis with data 2000Q1-2007Q4 (model A) and extended with data 2000Q1-2015Q2 (model B)) to reveal crisis effects on fiscal consolidation efforts. Effects of shocks in each particular fiscal

variable (positive (increase in) one standard deviation government expenditure shock ($\varepsilon_{g,t}$), direct tax revenues shock ($\varepsilon_{dt,t}$) and indirect tax revenues shock ($\varepsilon_{it,t}$)) on the macroeconomic performance were computed from separately estimated VAR models. As a result, three models were estimated with following endogenous variables:

- model A1, B1 ($Y_t = [g_t, y_{r,t}, p_t, t_t, i_{n,t}]$)
- model A2, B2 ($Y_t = [g_t, y_{r,t}, p_t, dt_t, i_{n,t}]$)
- model A3, B3 ($Y_t = [g_t, y_{r,t}, p_t, it_t, i_{n,t}]$)

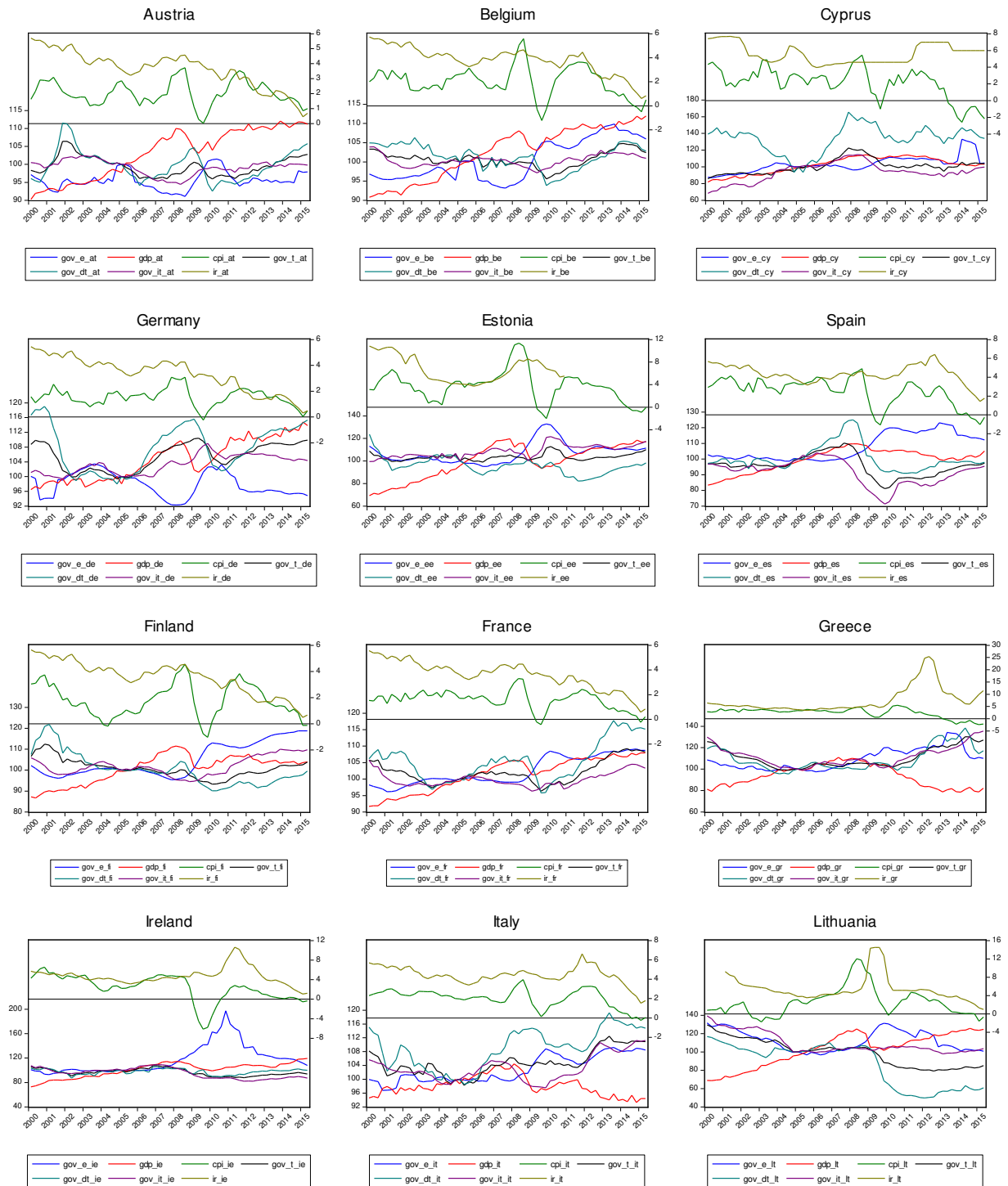
Impulse-response functions calculated from estimated VAR models with true shocks identified employing both identification schemes (based on Cholesky factorization and structural factorization) provided very similar results that is why we present results from structural VAR models (estimated results from models identified by recursive identification scheme are available upon request from the author). However, under Cholesky identification structure, the real government spending is not contemporaneously (within the same quarter) affected by changes in the real economic activity. That is the reason why government expenditure shock is considered as a discretionary fiscal adjustment. On the other hand, tax revenues are contemporaneously affected by the changes in the real economic activity and thus respond automatically to the real output adjustments.

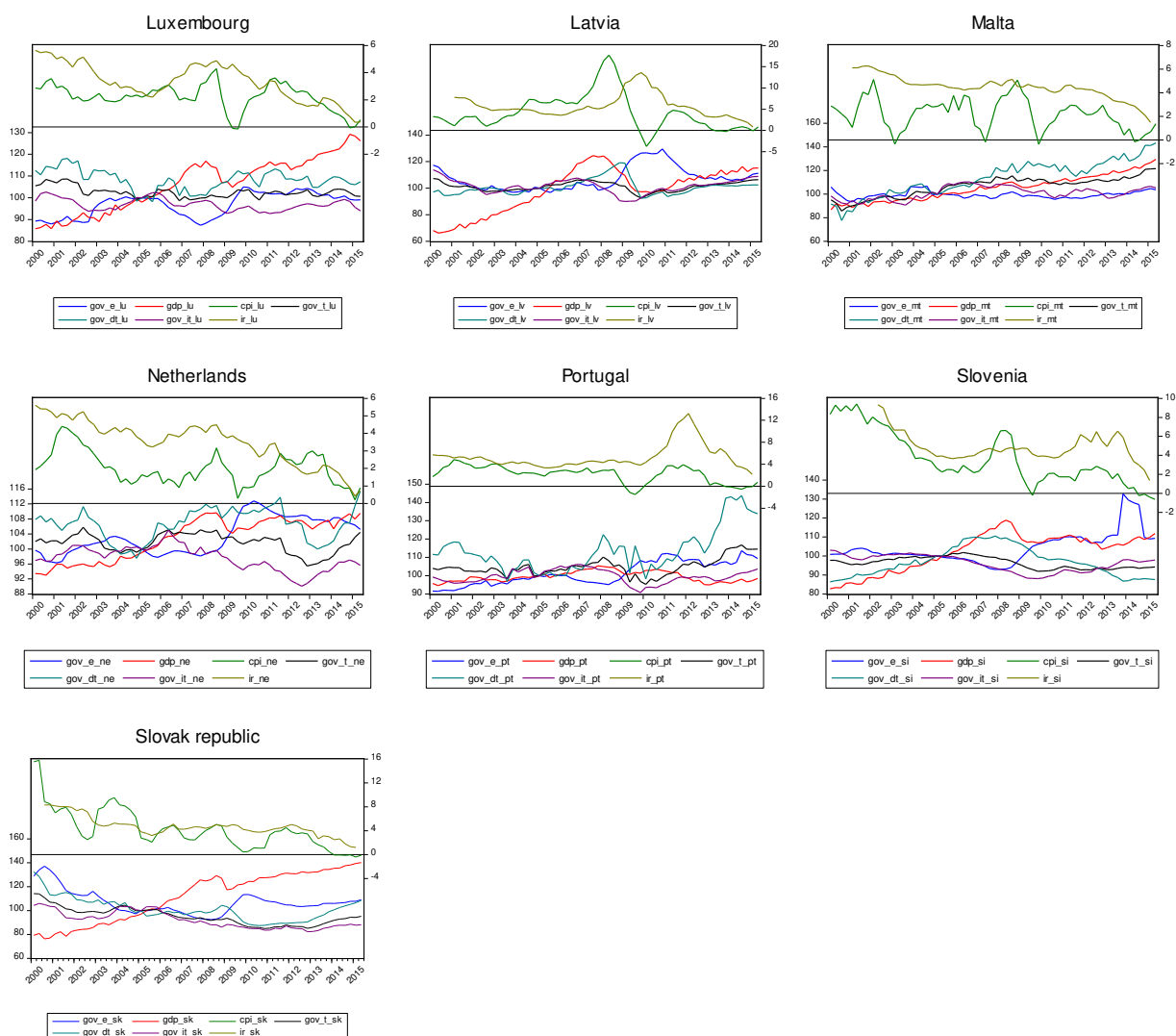
As a result, structural VAR models seem to be more convenient for estimation of discrete fiscal shocks (both expenditure and revenue based) because recursive approach is sensitive to variables ordering and thus it has impact on shocks interpretation. However, Cholesky decomposition of innovations is more convenient to trace the distribution of the shock inside the country as it considers the underlying structure of the economy. In our model, tax revenues are positioned behind real output. As a result, associated changes in tax revenues could be interpreted as automatic response to changes in real output (due to cyclical adjustment) and operating more as automatic stabilizers while it rules out any impact response out real output to a revenue shock (Blanchard and Perotti, 2002).

5.2 Data and Results

In order to estimate our model represented by five endogenous variables for each Euro Area member country we employ quarterly data ranging from 2000Q1 to 2007Q4 (32 observations) for model A and quarterly data from 2000Q1 to 2015Q2 (62 observations) for model B for the government expenditures, real gross domestic product, inflation, tax revenues and long-term interest rates (figure 7). Time series for endogenous variables were drawn from Eurostat - Government Finance Statistics (November 2015) and IMF database - International Financial Statistics (November 2015).

Figure 7 Government Expenditures, Real output, Inflation, Tax Revenues and Interest Rates in the Euro Area member countries (2000Q1-2015Q2)





Note: Endogenous variables - government expenditures (GOV_E), real output (GDP), tax revenues (GOV_T), direct tax revenues (GOV_DT) and indirect tax revenues (GOV_IT) are expressed as indexes (left axis in figures) (2005 = 100). Inflation (CPI) and interest rates (IR) are expressed in percentage (right axis in figures).

Source: Compiled by author based on data taken from Eurostat - Government Finance Statistics (October 2016) and IMF - International Financial Statistics (October 2016).

Time series for the quarterly government expenditures, real output and tax revenues were seasonally adjusted. Time series for the nominal government expenditures and tax revenues were deflated using gross domestic product deflator. As an inflation indicator we used core inflation without food and energy. As a long-term interest rates indicator we used nominal interest rates on 10-year government bonds.

Before we estimate the model it is necessary to test the time series for stationarity and cointegration. The augmented Dickey-Fuller (ADF) and the Phillips-Perron (PP) tests were computed to test the endogenous variables for the existence of unit roots. Both ADF and PP tests indicate that most variables are non-stationary on the values so that the null hypothesis of a unit root cannot be rejected for any of the series. Testing variables on the first differences indicates the time series are stationary so that we conclude that variables are I(1).

Because most of endogenous variables had a unit root on values it is necessary to test time series for cointegration using the Johansen and Juselius cointegration test (we found it reasonable to include variables $I(0)$ for testing purposes following economic logic of expected results). The test for the cointegration was computed using two lags as recommended by the AIC (Akaike Information Criterion) and SIC (Schwarz Information Criterion). The results of the Johansen cointegration tests confirmed the results of the unit root tests. Both trace statistics and maximum eigenvalue statistics (both at 0.05 level) indicate that there is no cointegration among endogenous variables in most of estimated models (trace statistics reported a presence of single cointegrating equation in some models). However, increasing the lag length to three quarters resulted in the loss of long-run equilibrium among variables. The results of unit root and cointegration tests are not reported here to save space. Like any other results, they are available upon request from the author.

To test the stability of the VAR model we also applied a number of diagnostic tests. We found no evidence of serial correlation, heteroskedasticity and autoregressive conditional heteroskedasticity effect in the disturbances. The model also passes the Jarque-Bera normality test, so that errors seem to be normally distributed. The VAR models seem to be stable also because the inverted roots of the model for each country lie inside the unit.

Before we estimate VAR model we have to solve some model specification issues. In section 4.3 we have estimated four bivariate models consisting of one particular fiscal variable and real output considering that there exist long-run equilibrium relationships in each model. Existence of cointegrating relationship (assumption widely confirmed by many empirical studies) was required to calculate income elasticities of budgetary categories. Presence on one cointegrating equation in each model was confirmed by Johansen cointegrating test statistics. Thus, we have estimated VEC models.

However, testing five-variate models in section 5.2 for cointegration revealed ambiguous results. While trace statistics mostly confirmed the presence of single cointegrating equation, maximum eigenvalue statistics reported no cointegration in majority of countries (both at 0.05 level). Despite possible candidates for cointegration (fiscal variables and real output) we may find another potential couple of variables for cointegration - tax revenues and government expenditures, though according to Blanchard and Perotti (2002) the imposition of a cointegration between government expenditures and tax revenues leads to very similar results in estimated effects of fiscal shocks (as a result such an expected cointegration may be confusing in estimating the cointegration rank). At the same time, Caldara and Camps (2008) suggest that in order to avoid imposing a wrong cointegration rank (in systems with just one ambiguous cointegration it seems to be quite disputable) it may be convenient to estimate unrestricted VAR models instead of VEC models.

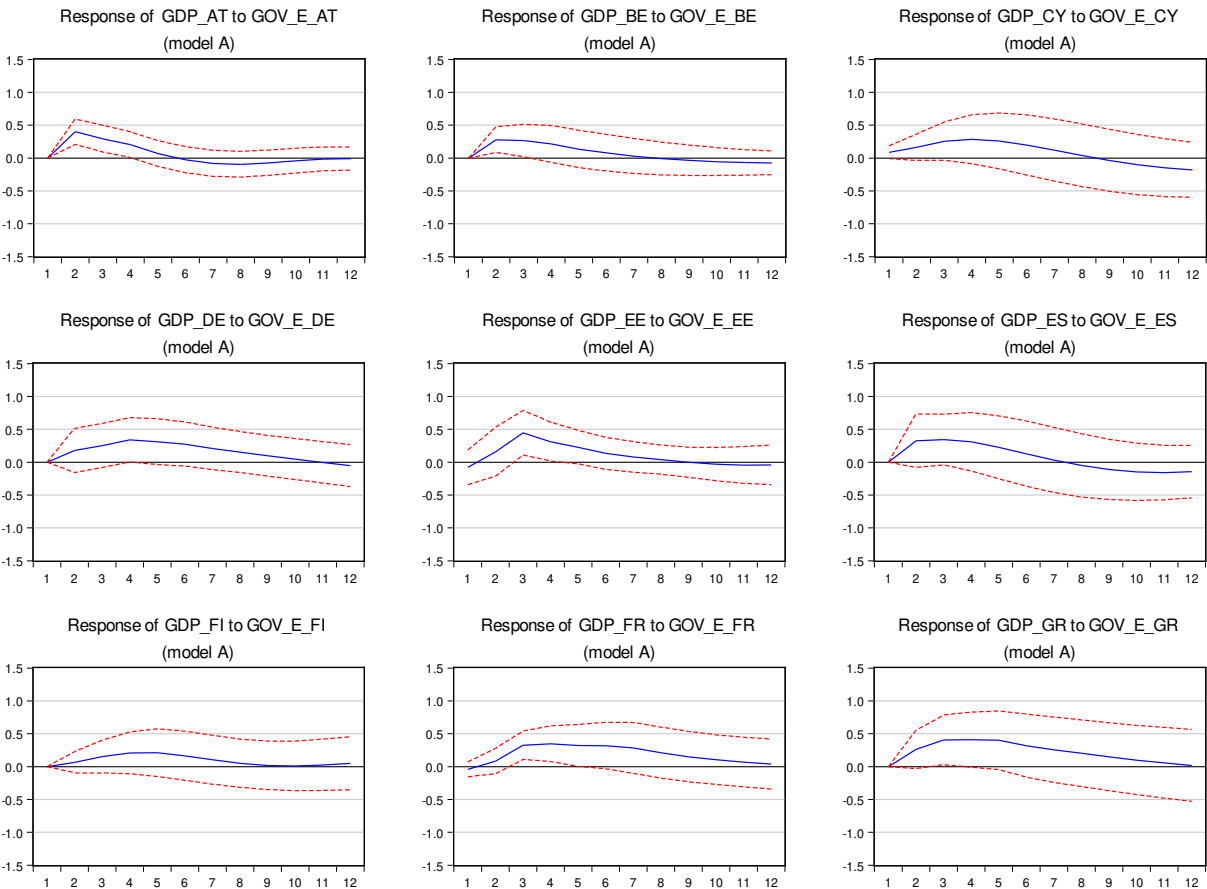
Following the results of the stationarity and cointegration tests we estimate three SVAR models for pre-crisis (2000Q1-2007Q4) and extended period (2000Q1-2015Q2) for each country from the Euro Area using the variables in the first differences to calculate impulse-response functions of government expenditures, direct taxes and indirect taxes (responses of the real output to a positive one standard deviation government expenditures

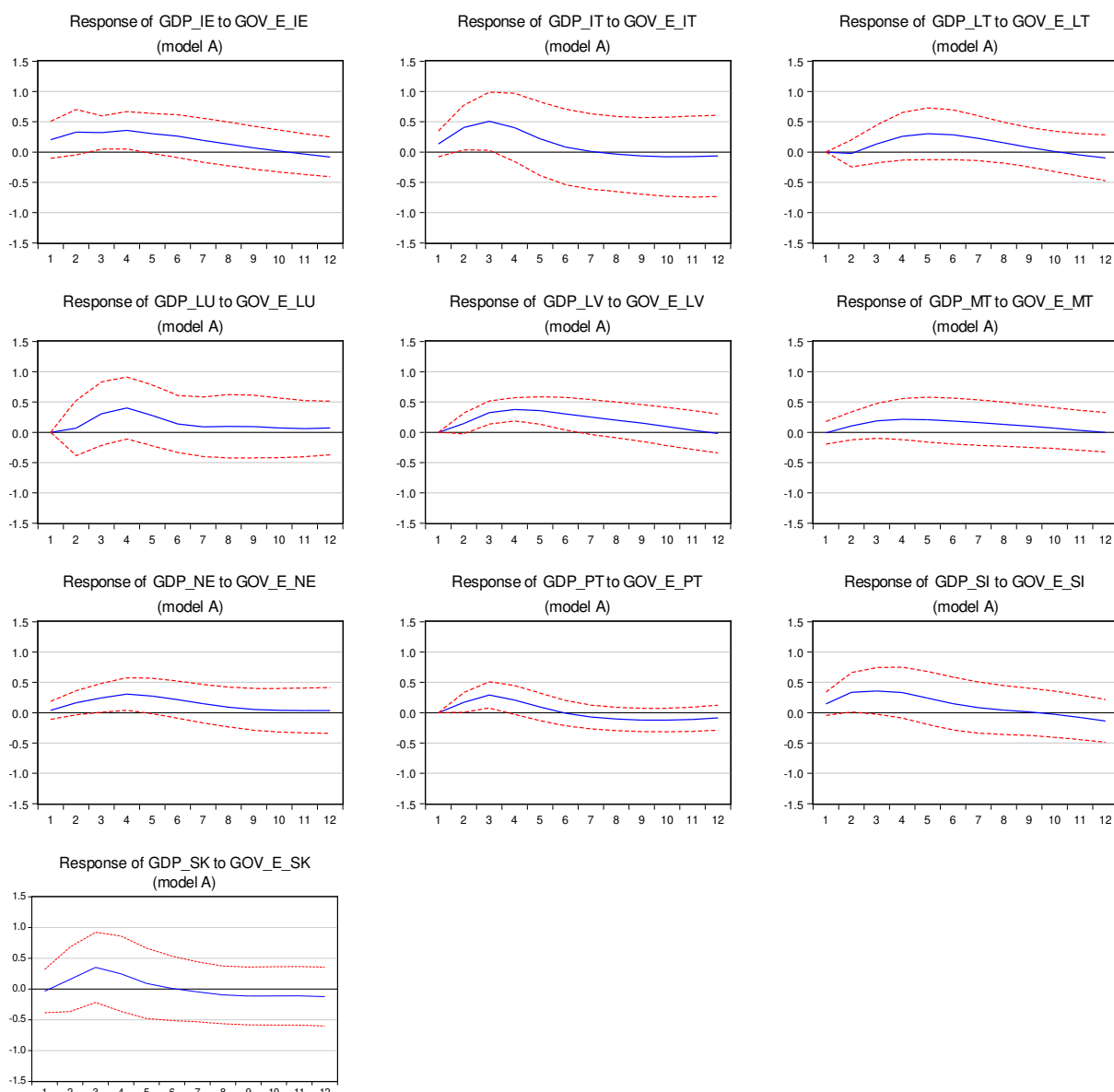
shock and positive one standard deviation tax revenues shocks). Estimated responses of the real output fiscal shocks help us to evaluate macroeconomic effects of revenue and expenditure based fiscal adjustments and thus assess indirect costs of fiscal consolidation. At the same time, by estimating models for pre-crisis and extended period we evaluate crisis related costs of fiscal adjustments.

In figures 8-10 we summarize the responses of the real output to the positive (increase in) government expenditure shock and positive (increase) direct and indirect tax revenues during the pre-crisis period (model A1 with data 2000Q1-2007Q4) in the Euro Area member countries. In figures 11-13 we summarize the responses of the real output to the positive (increase in) government expenditure shock and positive (increase) direct and indirect tax revenues during the extended period (model B1 with data 2000Q1-2015Q2) in the Euro Area member countries.

In the figure 8 we summarize responses of the real output to the one standard deviation government expenditures for the model with time series for the pre-crisis period (model A1) in the Euro Area member countries.

Figure 8 Responses of Real Output to the Positive Government Expenditures Shock (2000Q1-2007Q4) (Model A)





Source: Author's calculations.

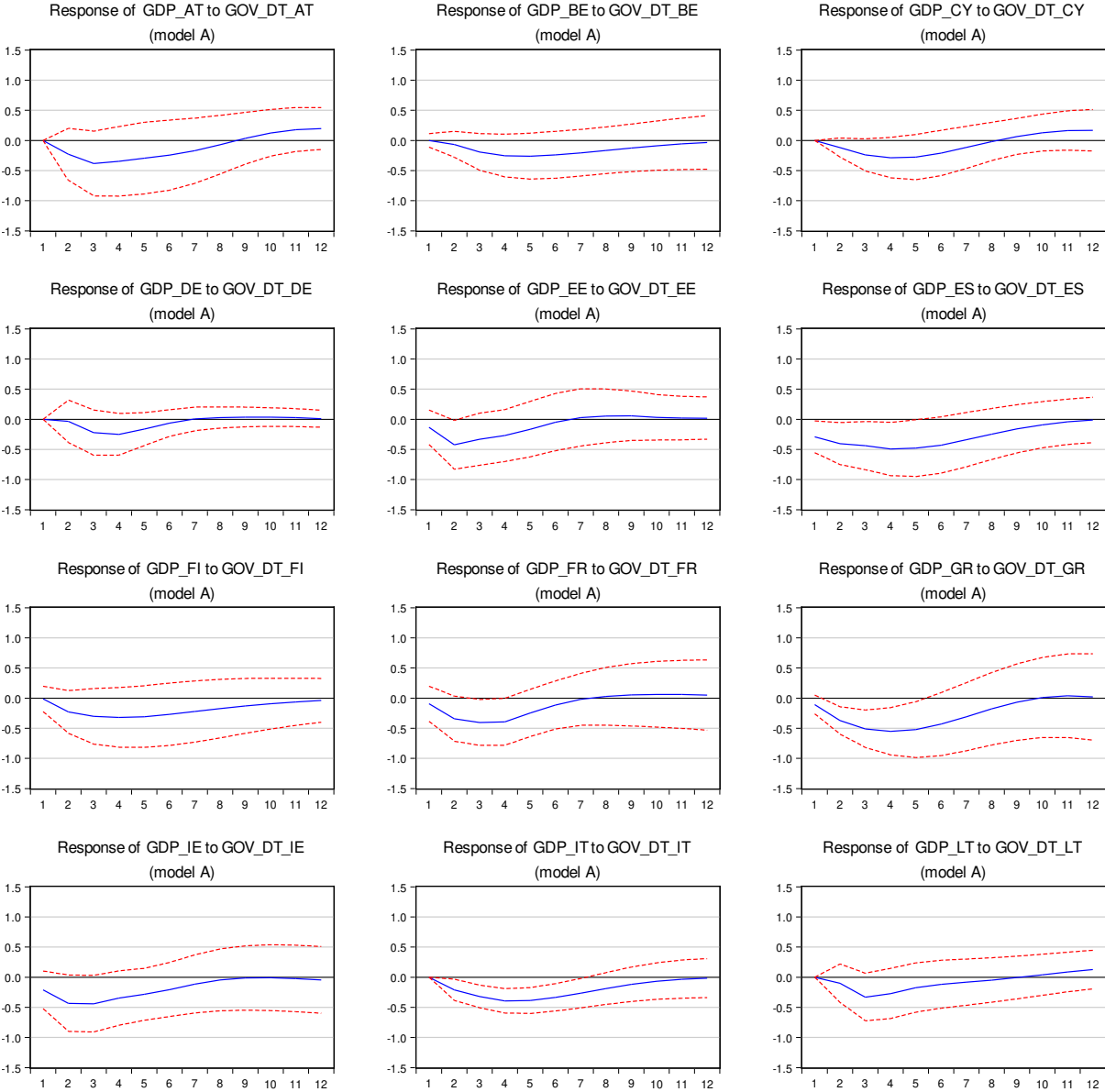
Positive shock (increase in) government expenditures shock was followed by the real output increase in Euro Area member countries. We have examined some differences in the initial as well as short-term responsiveness of the real output followed by the positive shock in government expenditures. However, the positive effect of the shock culminated within first two years and steadily died out during the third year since the shock. Government expenditures shock had just a temporary effect on the real output that is why it seems to be neutral in the long run.

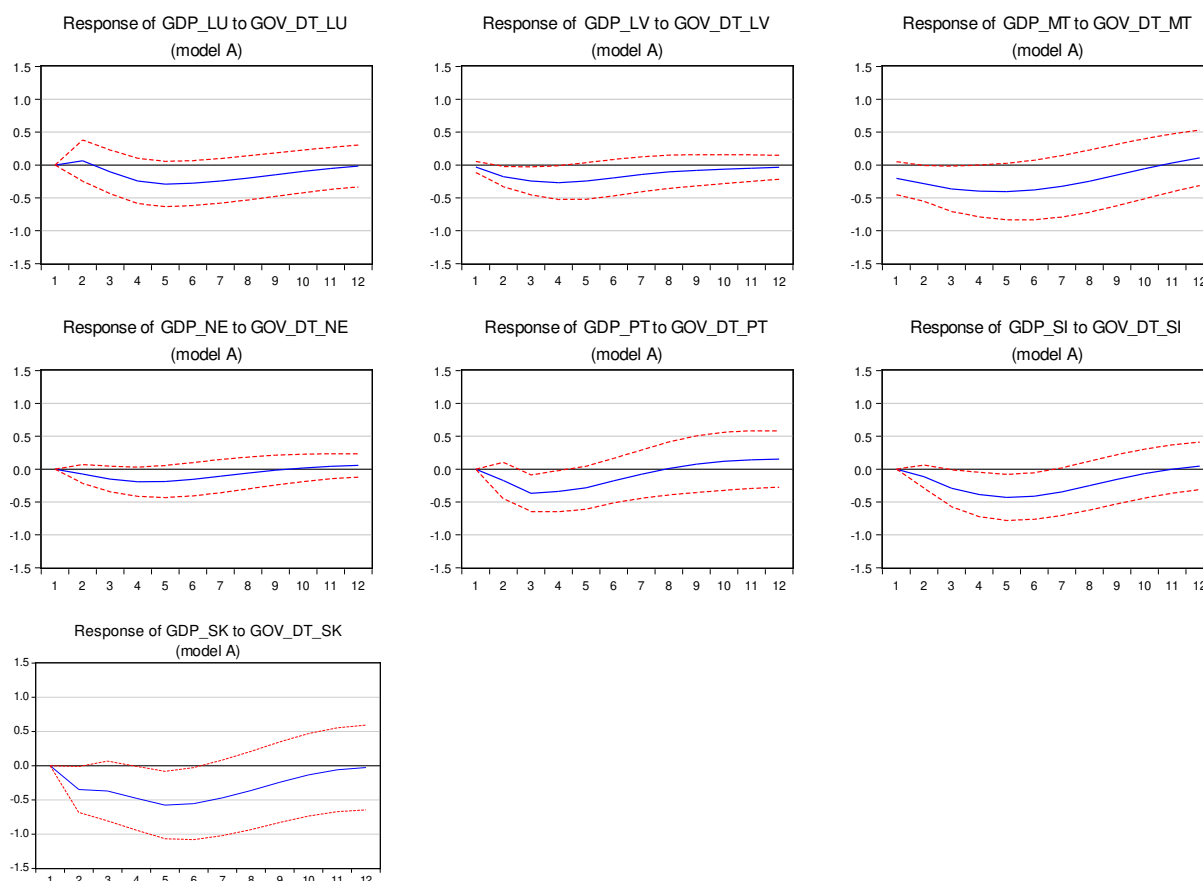
Identified differences in the short-term response patterns of the real output reveals opened questions associated with distortionary effects of expenditure oriented changes in the fiscal stance across the Euro Area member countries (Kickert, Randma-Liiv and Savi, 2013). As a result, the relative contribution of government spending to reduced synchronization of business cycles among the Euro Area members during the pre-crisis period or more generally

in good times represents an important lesson learned for a future coordination in the national fiscal policy frameworks.

In the figure 9 we summarize responses of the real output to the positive one standard deviation shock of direct tax revenues for the model with time series for the pre-crisis period (model A1) in the Euro Area member countries.

Figure 9 Responses of Real Output to the Positive Direct Tax Revenues Shock (2000Q1-2007Q4) (Model A)





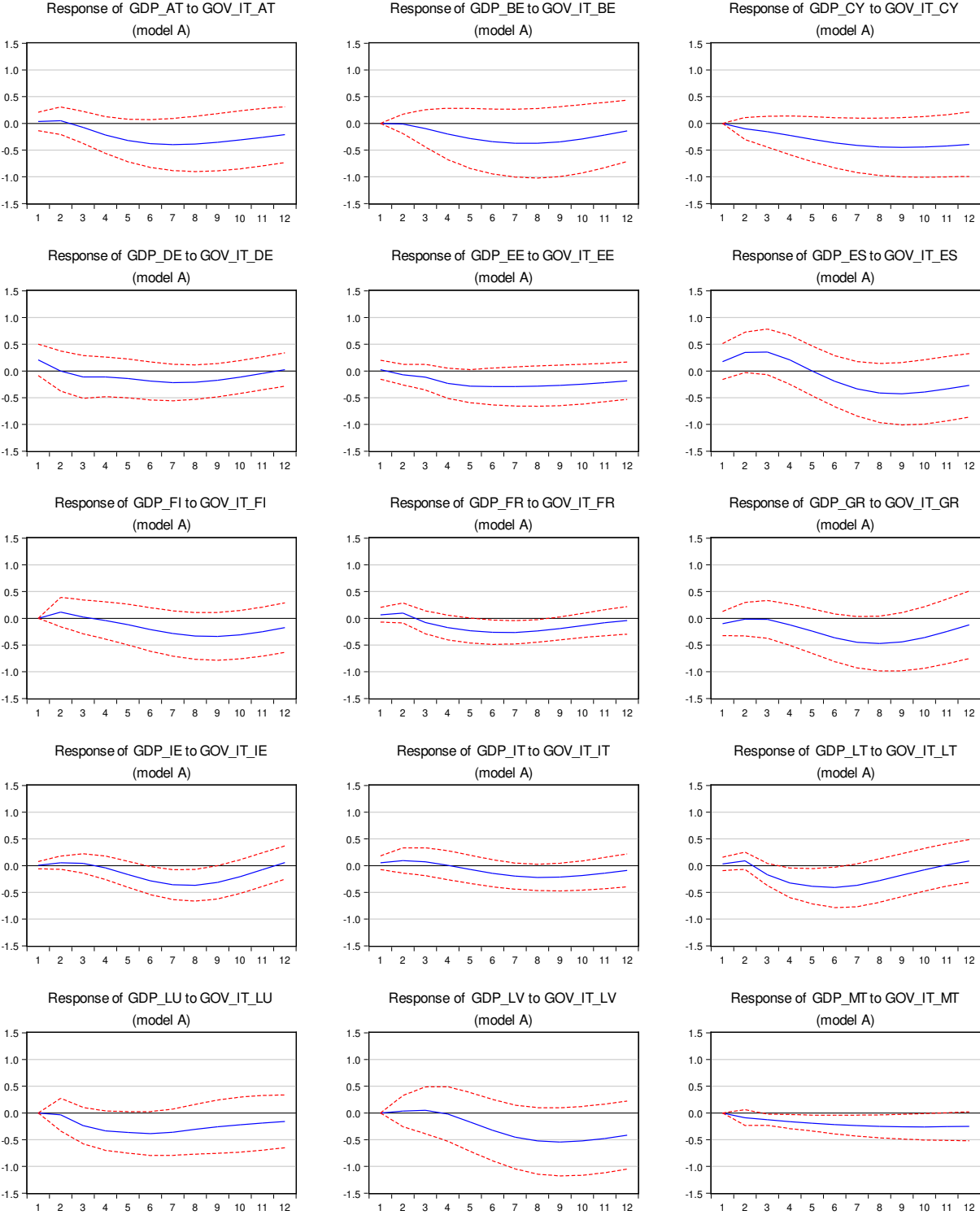
Source: Author's calculations.

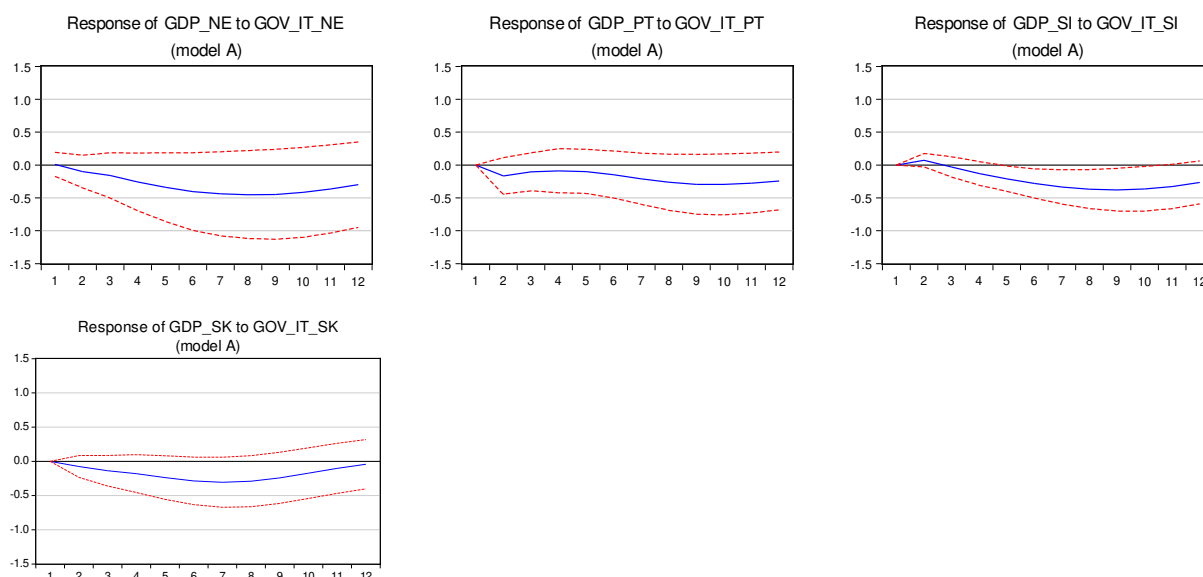
Positive (increase in) direct tax revenues shock was associated with a decline in the real output in all Euro Area member countries. Short-term responsiveness of the real output to the direct tax revenue shock was generally more dynamic in comparison with the government expenditure shock. Changes in direct taxes caused the real output decline during 2-3 years following initial impulse till the negative effect completely died out.

Fiscal consolidations based on direct tax changes are generally less popular and mostly employed on a selective basis (i.e. progressive taxing or increased tax burdens on the higher incomes classes). We suggest that governments should avoid employing consolidation based on the changes in direct taxes due to revealed sizeable negative effects on the real output (Wöhlbier, Astarita and Mourre, 2014). Moreover, tax increases seem to be much more costly way of achieving fiscal sustainability GDP compared with spending restraint (Cournède and Gonand, 2006). On the other hand, when revenue based fiscal consolidations (increase in direct taxes) are later accompanied by broader consolidation strategy involving a reduction in current spending (so called switching strategies), consolidation effort is obviously more effective though politically sensitive (von Hagen, 2002).

In the figure 10 we summarize responses of the real output to the positive one standard deviation shock of indirect tax revenues for the model with time series for the pre-crisis period (model A1) in the Euro Area member countries.

Figure 10 Responses of Real Output to the Positive Indirect Tax Revenues Shock (2000Q1-2007Q4) (Model A)





Source: Author's calculations.

Deterioration, though delayed in comparison with direct taxes, in the real output also occurred after the unexpected positive (increase in) indirect tax revenues shock. Despite some differences identified across individual countries it seems that the negative effect of the shock culminated during the third year after the shock. Moreover, initial response of the real output is mostly weak, even slightly positive in some countries and moderately increases over the time after the first year since the shock. Negative effect of the shock seems to be neutral in the long run as its impact of the real output died out during the third year after the shock (in almost all countries).

Revenue based fiscal adjustments associated with indirect tax changes deteriorate real output with increased lag in comparison with effects of direct tax increase though the overall dynamics of the real output decrease is clearly comparable. As a result, adjustments in indirect taxes seem to be more convenient for short-term consolidations as their side effect on the real output are distributed across several years.

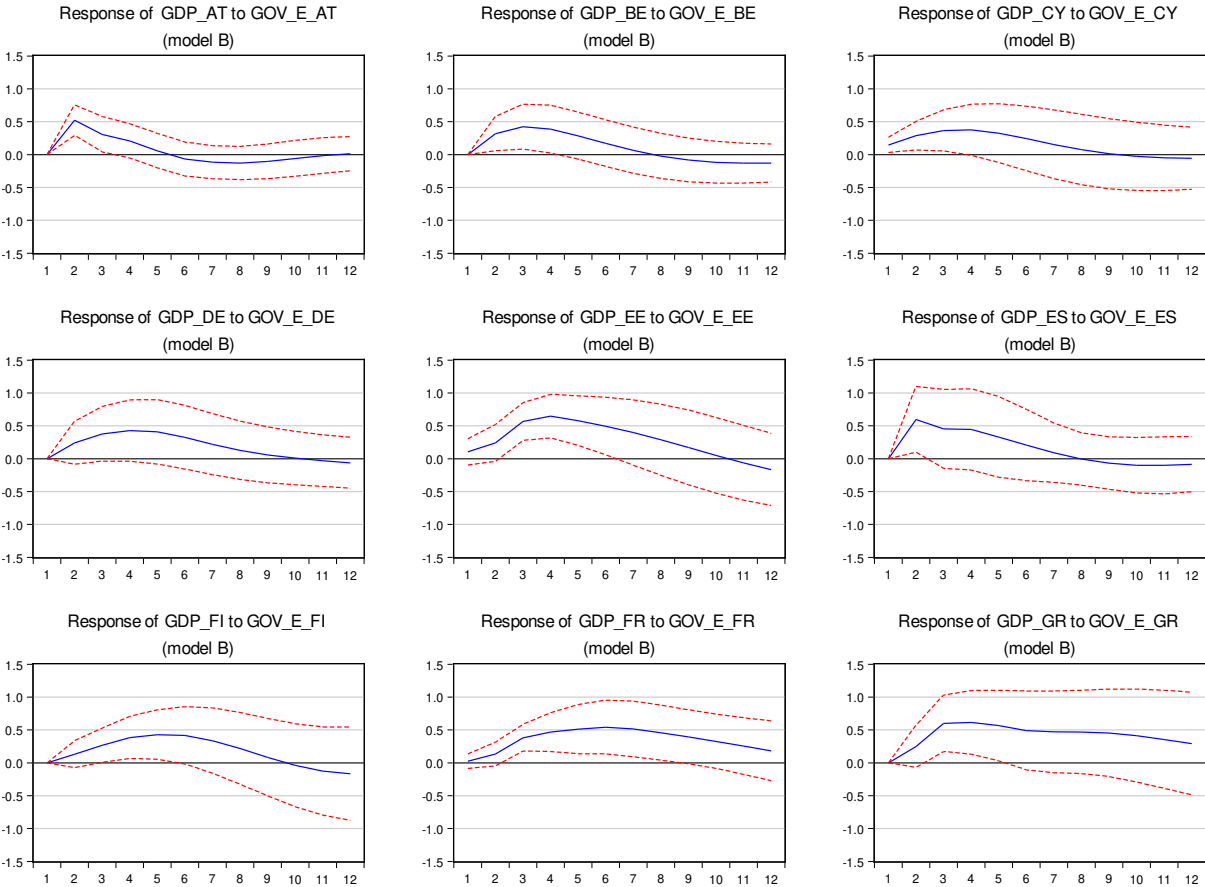
However, effects of revenue based adjustments relying on indirect tax increases are usually accompanied by higher spending that partially offset consolidation efforts. In such a case, fiscal consolidation achieves smaller improvements in the fiscal stance, has shorter duration and is more backtracking (Larch and Turrini, 2008).

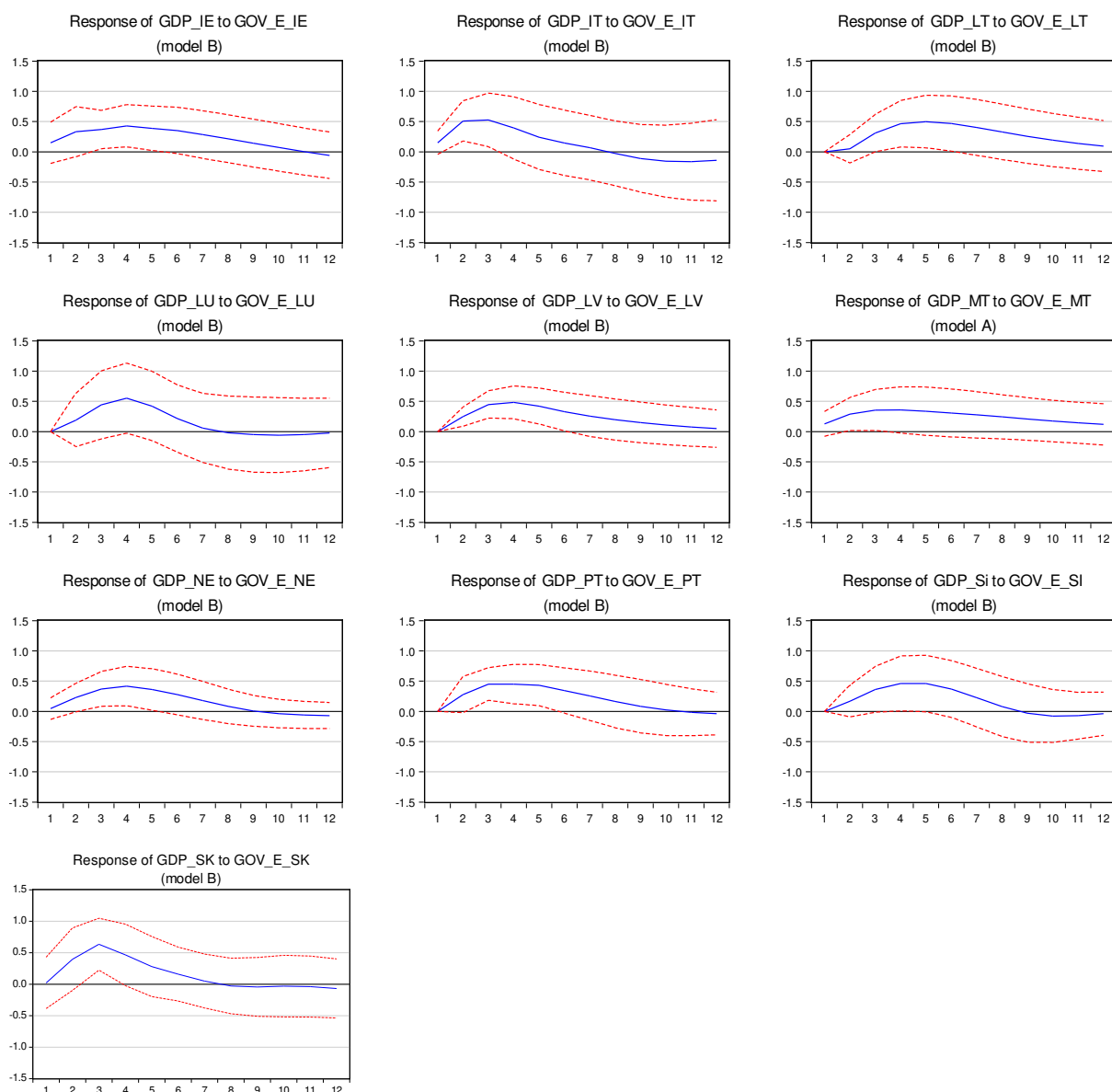
Analysis of the real output responsiveness to the positive fiscal policy shocks revealed interesting side (macroeconomic) implications of the fiscal adjustments associated with tax (revenue) and expenditure based fiscal consolidation in the Euro Area member countries. Unexpected increase in both government expenditures and tax (both direct and indirect) revenues induced deterioration in the real output. While effects of the expenditure based adjustments were more significant within the first year since the shock, effects of both direct and indirect tax based adjustments generally dominated during the second and third year since the shock. Moreover, effects of unexpected changes in taxes are generally followed by more responsive adjustments in real output. We suggest that expenditure based fiscal adjustments

are more appropriate for episodes based on the gradual fiscal consolidations provided that (negative) distortionary effects on the real output is reduced during the years following the one-year large consolidating fiscal adjustment. Moreover, shocks in government expenditures have less distortionary effect on the real output. On the other hand, effects of adjustments in direct but mainly in indirect tax revenues were largely distributed across several years (with slightly reduced deteriorating effect during the second year since the direct tax shock and third year since indirect tax shock in most countries) and thus we suggest that revenue based fiscal adjustments are more appropriate for episodes of one-year fiscal consolidations. However, delayed deterioration in the real output together with expected benefits of reduced public debt burden (in case of successful one-year consolidation) favors consolidation efforts based on indirect tax changes.

In the figure 11 we summarize responses of the real output to the positive one standard deviation government expenditures for the model with time series for the extended period (model B1) in the Euro Area member countries.

Figure 11 Responses of Real Output to the Positive Government Expenditures Shock (2000Q1-2015Q2) (Model B)





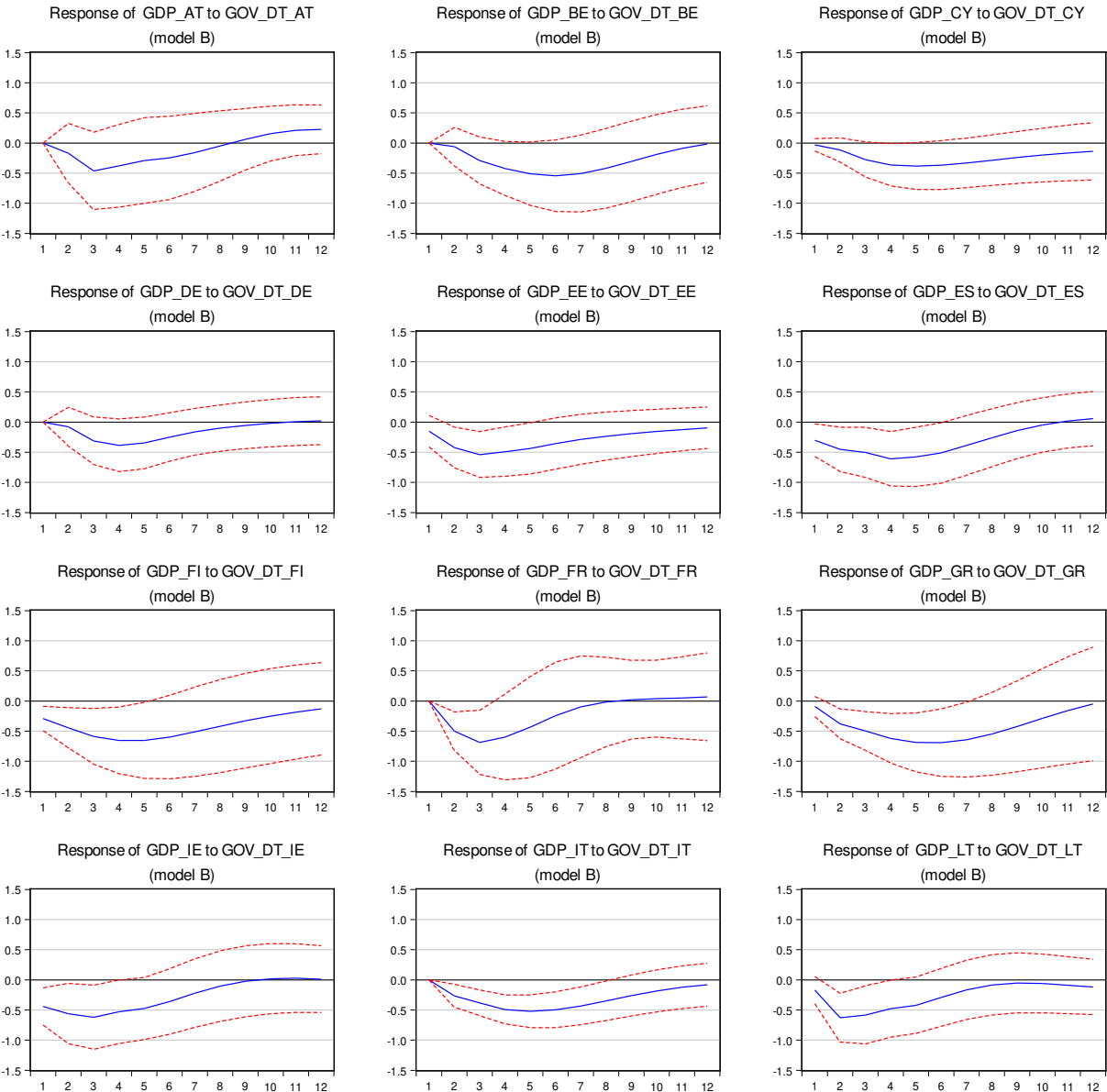
Source: Author's calculations.

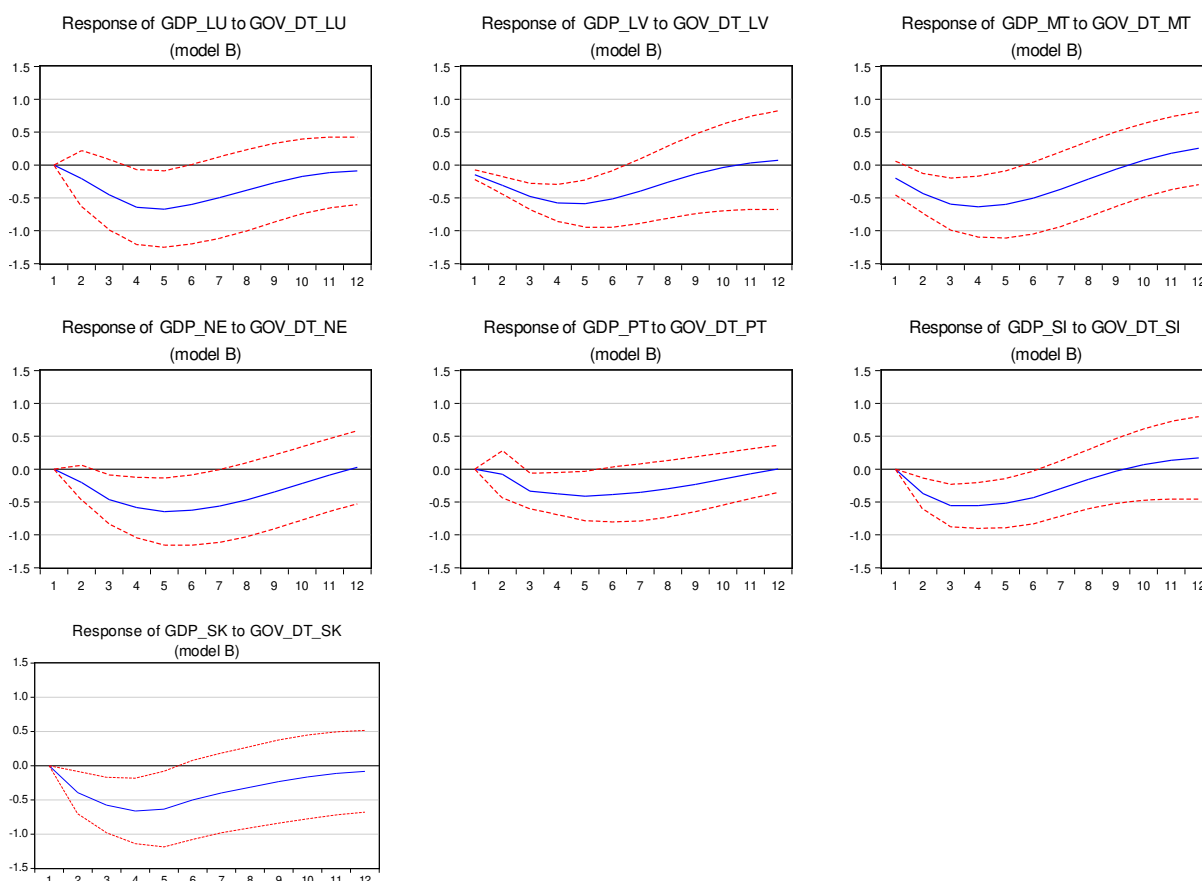
Crisis period affected responsiveness of real output to the positive (increase in) government expenditures shock in individual countries with a changing pattern. Both intensity and durability of the positive real output response considerably increased though overall effect in the long-run remained neutral (and effect of the shock mostly died out during the third year since the shock). It seems that the crisis period intensified positive effects associated with government expenditure based adjustments. We suggest that the time vulnerability of real output to the expenditure based fiscal adjustments during the crisis period generally increased. However, considering increased positive responsiveness of the real output to the government spending shocks some authors suggest that increase in public investments during bad times is associated with disputable effects on private consumption as well as private investments that are either positive (i.e. Afonso, Grüner and Kolerus, 2010; Auerbach and Gorodnichenko, Y. (2011) or negative (Bruckner and Tuladhar, 2011; Corsetti, Meier and Müller, 2012). Provided that the size of fiscal expenditure multiplier generally

decreased during the crisis period (Warmedinger, Checherita-Westphal and Hernández De Cos, 2015) reducing negative effects of expenditure based fiscal consolidation of the real output we find cuts in public spending more appropriate way of improving fiscal discipline and maintaining fiscal sustainability.

In the figure 12 we summarize responses of the real output to the positive one standard deviation shock of direct tax revenues for the model with time series for the extended period (model B1) in the Euro Area member countries.

Figure 12 Responses of Real Output to the Positive Direct Tax Revenues Shock (2000Q1-2015Q2) (Model B)



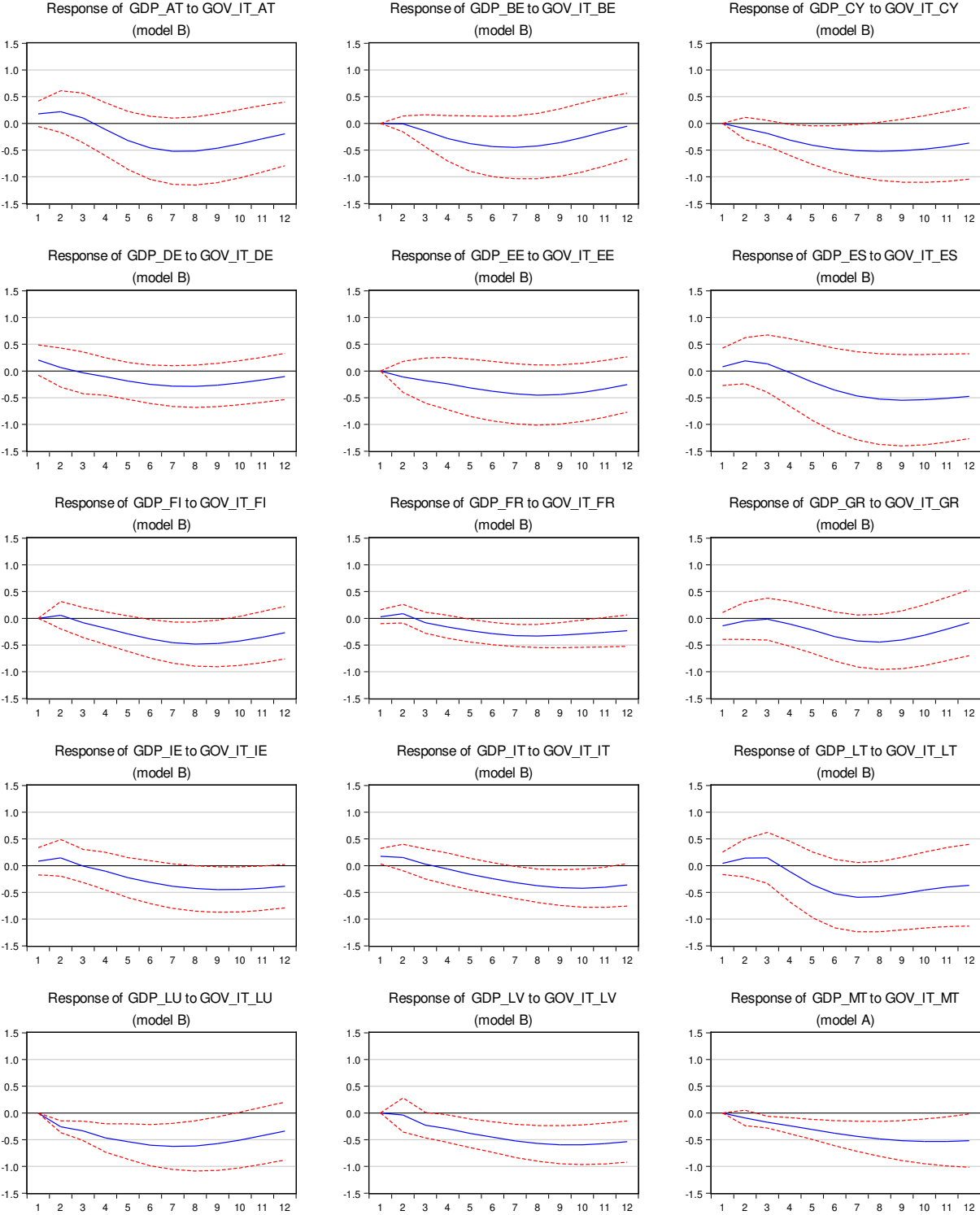


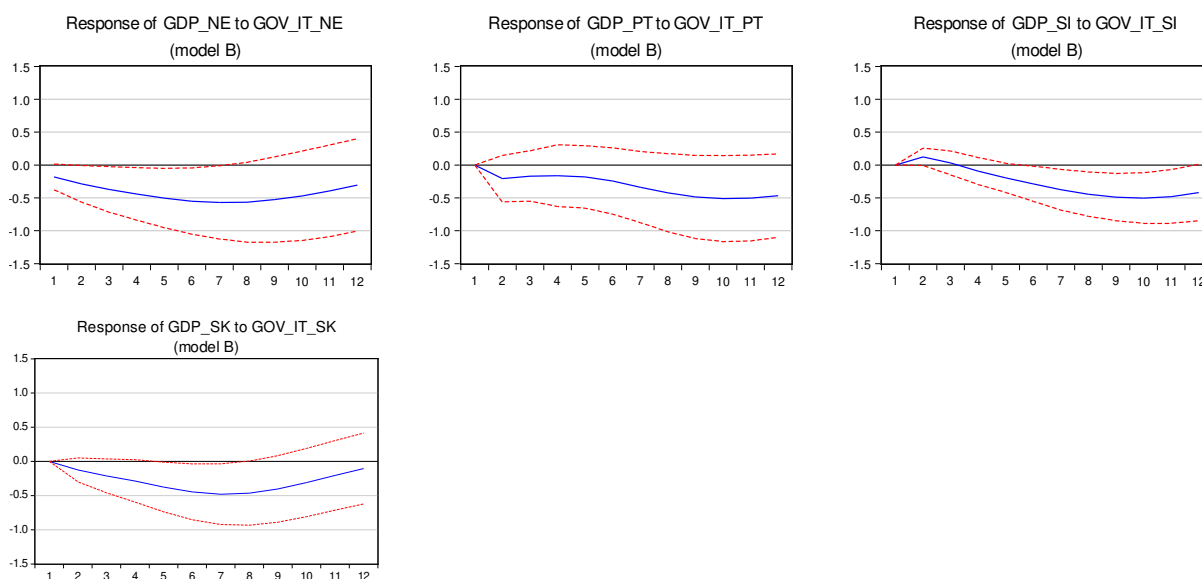
Source: Author's calculations.

Responsiveness of the real output to the positive (increase in) direct tax revenues shock during the extended period increased in all Euro Area member countries. We suggest that the crisis period increased the overall vulnerability of the real output to the direct tax revenues based adjustment in terms of both the (longer) durability of the deteriorating effect as well as its (larger) size. Similarly to our results from the pre-crisis period we have observed that the overall effect of the shock was neutral in the long run as its effect died out till the end of the third year in all countries from the group. As a result, real output became more vulnerable (as of intensity as well as durability of the effect) to direct tax based fiscal adjustments during the crisis period. Higher negative responsiveness of the real output to the direct tax increase during the second year since the shock corresponds to the idea that tax multipliers are higher in the medium term and long term (i.e. Coenen et al., 2012; Bousard, De Castro and Salto, 2012; Erceg and Lindé, 2012) that is why we suggest that direct tax based fiscal consolidations are more appropriate for one-year fiscal episodes of improving fiscal discipline and maintaining fiscal sustainability.

In the figure 13 we summarize responses of the real output to the positive one standard deviation shock of indirect tax revenues for the model with time series for the extended period (model B1) in the Euro Area member countries.

Figure 13 Responses of Real Output to the Positive Indirect Tax Revenues Shock (2000Q1-2015Q2) (Model B)





Source: Author's calculations.

Examination of the real output responsiveness to the positive (increase in) indirect tax revenues shock during the extended period in the Euro Area countries revealed very similar pattern in the results in comparison with the real output vulnerability to the direct tax revenues shock. Our results indicate that despite increased deterioration in the real output, all countries from the group have also experienced higher time persistence of the deteriorating effect of the shock. As a result, the negative effect of the tax revenues shock on the real output persisted around 3-4 years and thus slightly extended side effects of the indirect tax (revenue) based fiscal adjustments during the crisis period. Similarly to our results from the figure 12 we suggest that indirect tax based fiscal adjustments are more suitable for one-year fiscal consolidations due to less deteriorating effect on the real output during the first year of fiscal episode. Moreover, as the periphery economies are more focused on indirect taxes on the revenue side of their public budgets (Alesina and Ardagna, 2009; Zai, 2012), indirect tax increase may be more efficient for improving the fiscal stance (Bildirici and Cosar, 2005) provided that governments manage to reduce associated negative side effects on the real output during the subsequent years (Princen and Mourre, 2013) and keeps (or reduces) the size of tax evasion and avoidance (Tagkalakis, 2014).

Our results indicate that effects of the fiscal policy shocks on the real output during the crisis period slightly increased. As a result, consolidation efforts associated with sizeable fiscal adjustments are followed by more deteriorating effect on the economic activity that is why the overall composition of fiscal consolidation is crucial for improving both fiscal discipline and fiscal sustainability while reducing its negative side effects.

Provided that the overall success of consolidating efforts during the crisis period is reduced due to excessive pressures on both revenues and expenditure sides it seems that increased durability of real output responsiveness, followed by tax and/or revenue based adjustments, significantly reduced a degree of success to perform an effective (without side effects on real output) fiscal consolidation.

6. Conclusion

Recent debt crisis and economic recession put governments of the Euro Area member countries under pressure to preserve fiscal discipline and get fiscal deficits and sovereign debts under the control. However, a significant reduction of growth potential due to deterioration in the overall demand resulted in designing an appropriate duration (one-year versus several years lasting fiscal adjustments) and composition (expenditure or/and revenue based fiscal adjustments) of consolidating efforts that would reduce associated negative side effects on the economic activity and still improve fiscal sustainability.

Our results indicate that the rate of success of consolidation efforts significantly decreased during the crisis period. Most of fiscal consolidations were conducted on the one-year basis that indicates a lack of intention to improve fiscal discipline over longer horizon of their political cycle. However, most of them were unsuccessful during the crisis period. At the same time, most of one-year consolidations were associated with revenue based adjustments (or combined with expenditure cuts) and had mainly deteriorating effect on the real output favoring expenditure based adjustments that were generally less harmful on the real output.

Estimated responsiveness of the real output to the fiscal policy shocks in the Euro Area member countries revealed interesting implications about the time distribution of the side effects of unexpected fiscal adjustments on the economic activity. While the effects of expenditure based adjustments were more significant within the first year since the shock (and had less distortionary effect on the real output), effects of both direct and indirect tax based adjustments generally dominated during the second and third year since the shock. We suggest that expenditure based fiscal adjustments are more appropriate for episodes based on the gradual fiscal consolidations provided that (negative) distortionary effects on the real output is reduced during the years following the large consolidating fiscal adjustment conducted in the first year of the episode. On the other hand, revenue based fiscal adjustments seem to be more appropriate for episodes of one-year fiscal consolidations due to less deteriorating effect on the real output during the first year of fiscal episode provided that governments manage to reduce associated negative side effects on the real output during the subsequent years.

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References

- AFONSO, A., GRÜNER, H.P., KOLERUS, C. (2010) Fiscal Policy and Growth Do Financial Crises Make a Difference?, [European Central Bank Working Paper No. 1217/2010], Frankfurt am Main, European Central Bank, 40 p.
- ALTĂR, M., NECULA, C., BOBEICĂ, G. (2010) Estimating the Cyclically Adjusted Budget Balance for the Romanian Economy. A Robust Approach, *Romanian Journal of Economic Forecasting*, 13(2): 79-99
- ALESINA, A., PEROTTI, R. (1997) Fiscal Adjustments in OECD Countries: Composition

- and Macroeconomic Effects. [*International Monetary Fund Staff Paper* No. 44/1997] Washington, D.C., International Monetary Fund, pp. 297-329
- ALESINA, A., ARDAGNA, S. (2009) Large Changes in Fiscal Policy: Taxes vs. Spending. [*National Bureau of Economic Research Working Paper* No. 15438], New York, National Bureau of Economic Research, 37 p.
- ANTONESCU, M., MANEA, S., ANTONESCU, L. (2008) Fiscal Aspects Regarding Taxing The Incomes Of Non-Residents in Romania, *Journal of Applied Economic Sciences*, 3(4): 359-364
- AUERBACH, A., GORODNICHENKO, Y. (2011) Fiscal Multipliers in Recession and Expansion [*National Bureau of Economic Research Working Paper* No. 17447] New York, National Bureau of Economic Research, 36 p.
- BARRIOS, S., LANGEDIJK, S., PENC, L. (2010) EU Fiscal Consolidation after the Financial Crisis. Lesson from Past Experience, [*European Economy Economic Paper* No. 418/2010] Brussels, European Commission, 47 p.
- BENČÍK, M. (2008) Analysis of Fiscal Policy Impacts of the Business Cycle, [*National Bank of Slovakia Working Paper* No. 2/2009], Bratislava, National Bank of Slovakia, 30 p.
- BILDIRICI, M., COSAR, N. (2005) Budget Deficits and Indirect Taxes During the Political Instability Periods in Turkey: Cointegration Analysis and EC Model Estimation, 1985-2003, *International Journal of Applied Econometrics and Quantitative Studies*, 2(1): 69-88
- BLANCHARD, O.J., PEROTTI, R. (2002) An Empirical Characterization of the Dynamic Effects of Changes in Government Spending and Taxes on Output, *Quarterly Journal of Economics* 117 (4): 1329-1368
- BOUSSARD, J., DE CASTRO, F., SALTO, M. (2012) Fiscal Multipliers and Public Debt Dynamics in Consolidations, [*European Economy Economic Paper* No. 460/2012] Brussels, European Commission, 33 p.
- BOUTHEVILLAIN et al (2001) Cyclically Adjusted Budget Balances: An Alternative Approach, [*European Central Bank Working Paper* No. 77/2001], Frankfurt am Main, European Central Bank, 73 p.
- BRIOTTI, M.G. (2002) Fiscal Consolidation in EU Countries in the Nineties: New Facts and Policy Implications, VI. International Conference in Economics, September 11th-14th, Ankara, Turkey, 52 p.
- BRUCKNER, M., TULADHAR, A. (2011) The Effectiveness of Government Expenditures during Crisis: Evidence from Regional Government Spending in Japan 1990-2000, [*School of Economics Research Paper* No. 2011-10], Adelaide, University of Adelaide, School of Economics, 21 p.
- BURNSIDE, C., EICHENBAUM, M., FISHER, J. (2003) Fiscal Shocks and their Consequences, *Journal of Economic Theory*, 115(1): 89-117
- CALDARA, D., CAMPS, C. (2008) What are the Effects of Fiscal Policy Shocks, [*European Central Bank Working Paper* No. 877/2008], Frankfurt am Main, European Central Bank, 47 p.
- COENEN, G., ERCEG, C., FREEDMAN, C., FURCERI, D., KUMHOF, M., LALONDE, R.,

- LAXTON, D., LINDÉ, J., MOUROUGANE, A., MUIR, D., MURSULA, S., DE RESENDE, C., ROBERTS, J., ROEGER, W., SNUDDEN, S., TRABANDT, M., IN'T VELD, J. (2012), Effects of Fiscal Stimulus in Structural Models, *American Economic Journal: Macroeconomics*, 4(1): 22-69
- CORSETTI, G., KUESTER, K., MEIER, A., MÜLLER, G.J. (2010) Debt Consolidation and Fiscal Stabilization of Deep Recessions, *American Economic Review: Papers & Proceedings* 100: 41-45
- CORSETTI, G., MEIER, A., MÜLLER, G.J. (2012) What Determines Government Spending Multipliers?. [International Monetary Fund Staff Paper No. 150/2012] Washington, D.C., International Monetary Fund, 45 p.
- COURNÈDE, B., GONAND, F. (2006) Restoring Fiscal Sustainability in the Euro Area: Raise Taxes or Curb Spending?, [*Organization for Economic Cooperation and Development Economics Department Working Paper* No. 520/2006] Paris, Organization for Economic Cooperation and Development, 37 p.
- ERCEG, C.J., LINDÉ, J. (2012) Fiscal Consolidation in an Open Economy, *American Economic Review*, 102(3): 186-191
- EUROPEAN COMMISSION (2014), Report on Public Finances in EMU - 2014, [*European Economy* No. 9/2014], Brussels, European Commission, 159 p.
- FEDELINO, A., IVANOVA, A., HORTON, M. (2009) Computing Cyclically Adjusted Balances and Automatic Stabilizers. [*International Monetary Fund Technical Notes and Manuals* No. 5/2009] Washington, D.C., International Monetary Fund, 15 p.
- GIROUARD, N., ANDRÉ, CH. (2005) Measuring Cyclically-Adjusted Budget Balance for OECD Countries, [*Organization for Economic Cooperation and Development Working Paper* No. 21/2005] Paris, Organization for Economic Cooperation and Development, 42 p.
- GIULIODORI, M., BEETSMA, R. (2004) What are the Spill-overs from Fiscal Shocks in Europe? An Empirical Analysis, [*European Central Bank Working Paper* No. 325/2004], Frankfurt am Main, European Central Bank, 43 p.
- GÜNAYDIN, E., UĞRAŞ ÜLKÜ, Z. (2002) Cyclically Adjusted Primary Balance: The Case of Turkey, VI. International Conference in Economics, September 11th-14th, Ankara, Turkey, 52 p.
- JOHANSEN, S. (1988) Statistical Analysis of Cointegrating Vectors, *Journal of Economic Dynamic & Control*, 12(2-3): 231-254
- JOHANSEN, S. (1991) Estimation and Hypothesis Testing of Cointegrating Vectors in Gaussian Vector Autoregressive Models, *Econometrica*, 59(6): 1551-1580
- KICKERT, W., RANDMA-LIIV, T., SAVI, R. (2013) Fiscal Consolidation in Europe: A Comparative Analysis, COCOPS Trend Report, 79 p.
- LAMBERTINI, L., TAVARES, J. (2003) Exchange Rates and Fiscal Adjustments: Evidence from the OECD and Implications for EMU, [*Boston College Working Papers in Economics* No. 576/2003], Boston College Department of Economics, 25 p.
- LARCH, M., TURRINI, A. (2008) Received Wisdom and Beyond: Lessons from Fiscal Consolidation in the EU, [*European Economy, Economic Paper* No. 320/2010] Brussels,

European Commission, 29 p.

MIRDALA, R. (2009) Effects of Fiscal Policy Shocks in the European Transition Economies, *Journal of Applied Research in Finance*, 1(2):141-155

MIRDALA, R. (2011) Stimulation Effects of Fiscal Policies in the European Converging Economies, *Journal of Economics (Ekonomický časopis)*, 59(9): 918-941

MOUNTFORD, A., UHLIG, H. (2008) What are the Effect of Fiscal Policy Shocks? [National Bureau of Economic Research Working Paper No. 14551] New York, National Bureau of Economic Research, 46 p.

PEROTTI, R. (2005) Estimating the Effects of Fiscal Policy in OECD Countries, [European Central Bank Working Paper No. 168/2005] Frankfurt am Main, European Central Bank, 63 p.

PRINCEN, S., MOURRE, G. (2013) The Role of Tax Policy in Times of Fiscal Consolidation, [European Economy, Economic Paper No. 502/2013] Brussels, European Commission, 109 p.

REDŽEPAGIĆ, S., LLORCA, M. (2007) Does Politics Matter in the Conduct of Fiscal Policy? Political Determinants of the Fiscal Sustainability: Evidence from Seven Individual Central and Eastern European Countries (CEEC), *Panoeconomicus*, 54(4): 489-500

ROMER, C.D., ROMER, D.H. (2007) The Macroeconomic Effects of Tax Changes: Estimates Based on a New Measure of Fiscal Shocks, [National Bureau of Economic Research Working Paper No. 13264] New York, National Bureau of Economic Research, 71 p.

TAGKALAKIS, A.O. (2014) Assessing the Variability of Indirect Tax Elasticity in Greece, [Bank of Greece Working Paper No. 171/2014], Athens, Bank of Greece, 19 p.

TSIBOURIS, G.C., HORTON, M.A., FLANAGAN, M.J., MALISZEWSKI, W.S. (2006) Experience with Large Fiscal Adjustments. [International Monetary Fund Occasional Paper No. 246/2006] Washington, D.C., International Monetary Fund, 51 p.

VON HAGEN J. (2002) Fiscal Rules, Fiscal Institutions and Fiscal Performance. *The Economic and Social Review*, 33(3): 263-284

VON HAGEN J., HALLET, A.H., STRAUCH, R. (2002) Budgetary Consolidation in Europe: Quality, Economic Conditions, and Persistence, *Journal of the Japanese and International Economics*, 16(4): 512-535

WARMEDINGER, T., CHECHERITA-WESTPHAL, C., HERNÁNDEZ DE COS, P. (2015) Fiscal multipliers and beyond. [European Central Bank Occasional Paper No. 162/2015] Frankfurt am Main, European Central Bank, 32 p.

ZAI, P. (2012) The Economic Crisis and Fiscal Trends in EU Member States, *Transylvanian Review of Administrative Sciences*, 59(6): 256-268