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Lessons Learned from Tax vs. Expenditure Based Fiscal Consolidation in the European Transition Economies

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Lessons Learned from Tax versus Expenditure Based Fiscal Consolidation in the European Transition Economies

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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 ten European transition economies 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 policy 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

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 - Penc 2010).

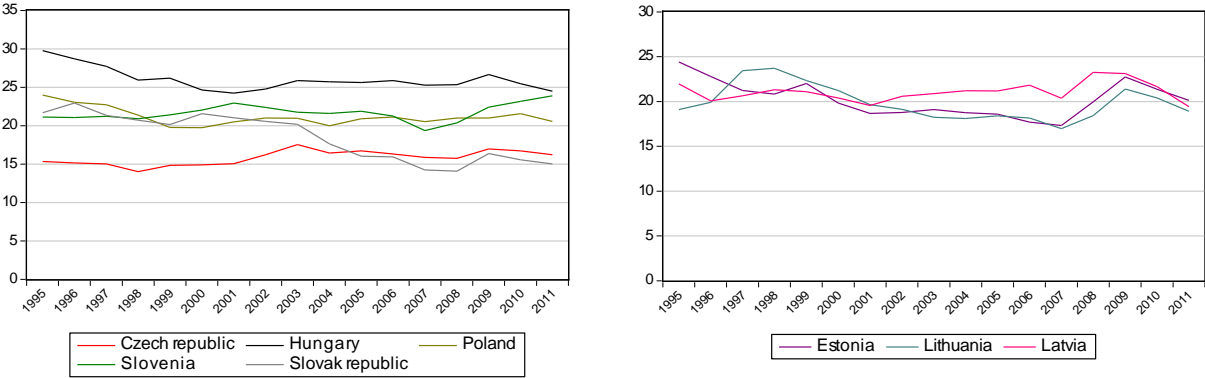
In the paper we provide an overview of main trends in public budgets and sovereign debts in ten European transition economies during last two decades. We identify episodes of successful and unsuccessful (cold showers versus gradual) fiscal (expenditure versus revenue based) consolidations by analyzing 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 (fall) 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.

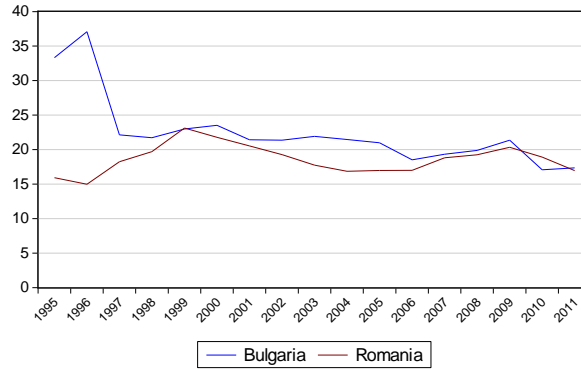
Following the introduction, we provide some stylized facts about fiscal stance in the European transition economies over the period of last two decades. We emphasize main trends in the evolution of government consumption, rate of secondary redistribution, total expenditures and total revenues, fiscal 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 European transition economies. 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 European transition economies 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 (1995-2011)





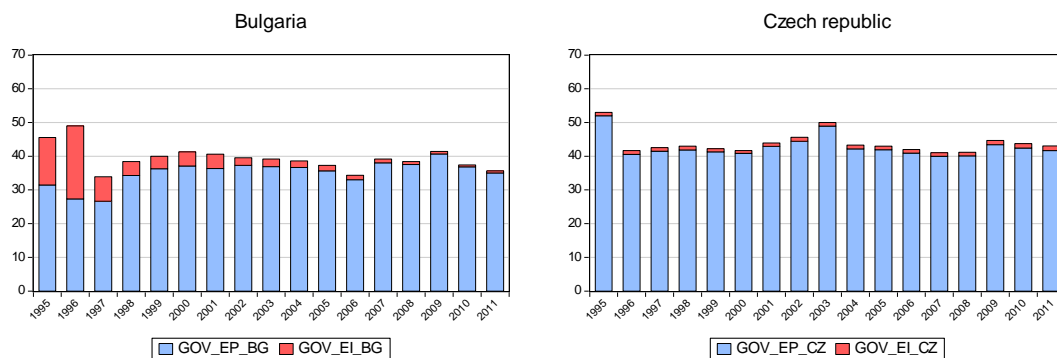
Note: General government consumption is expressed as a percentage shares on GDP.

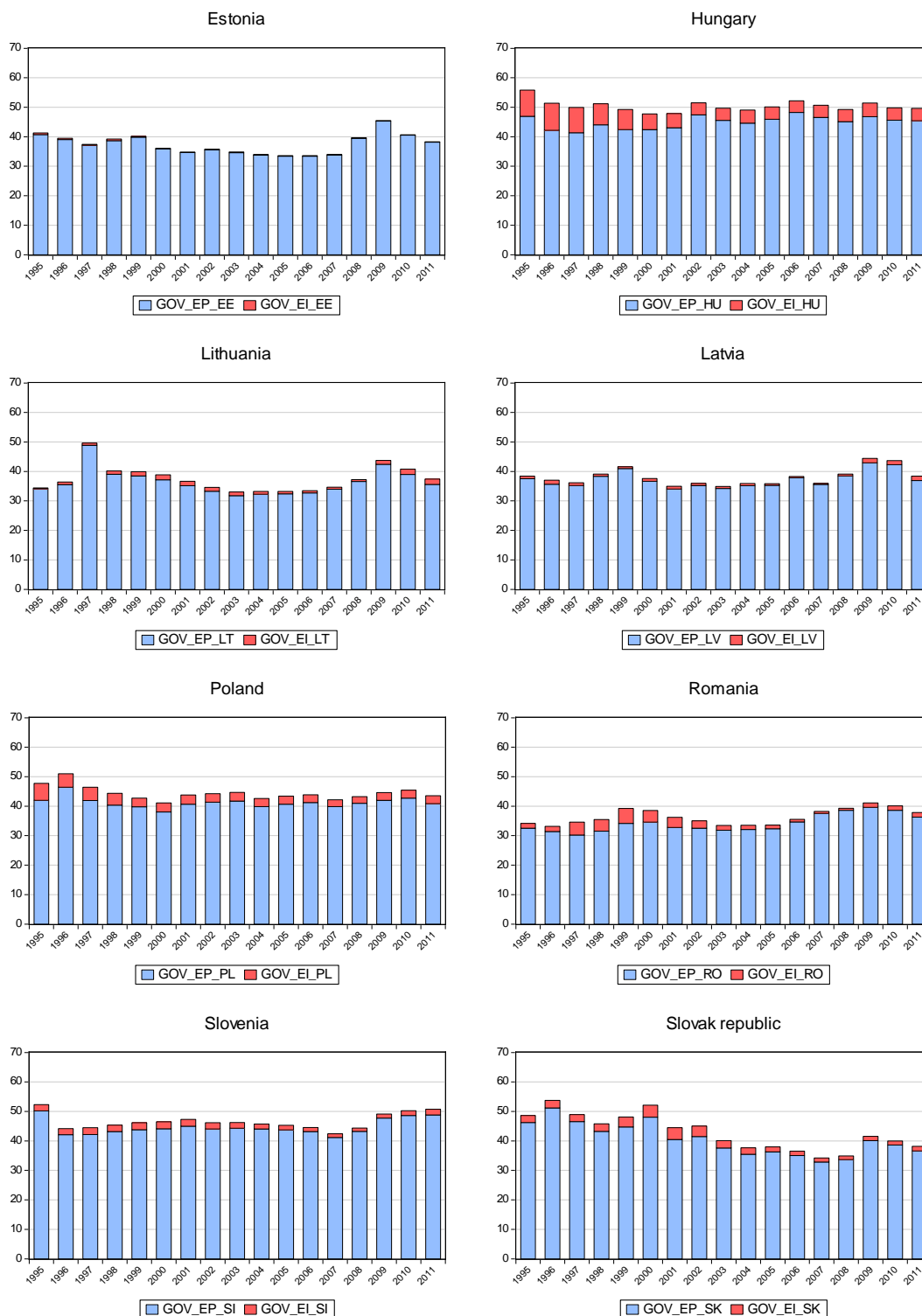
Source: Compiled by author based on data taken from Eurostat - Government Finance Statistics (October 2012) and IMF - International Financial Statistics (March 2013).

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. At the beginning of the observed period the overall share of the government consumption in Bulgaria and Hungary nearly doubled the share in the Czech republic and Romania, leaving remaining countries somewhere in the middle. While in Bulgaria the overall share of government expenditures dropped dramatically soon after 1996-1997 financial crisis as a result of implemented reforms, the situation in Hungary improved gradually and slow. 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 Estonia, Lithuania, Romania and the Slovak republic, especially since the beginning of the 2000s till the end of the pre-crisis period.

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 (1995-2011)





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 2012) and IMF - International Financial Statistics (March 2013).

The size of the government in the European transition economies seems to be quite stable with the generally positive (decreasing) long-term trend during last two decades. However, we have also observed few sub-periods of relatively sharp decreasing trend in the rate of secondary income redistribution in each particular country: Bulgaria (1996-1997) and

2004-2006), the Czech republic (1995-1996, 2003-2004), Estonia (1999-2001), Hungary (1995-1997 and 2002-2004), Latvia (1999-2001), Lithuania (1997-1998 and 2000-2003), Poland (1996-2000), Romania (2000-2003), the Slovak republic (1997-1998, 2001-2007) and Slovenia (2006-2007). At the same time we have experienced a sub-periods of relatively sharp increase in primary government expenditures share only in Bulgaria (1995-2000).

Alongside mostly positive development of the government presence in domestic economies in the selected group of countries that we have observed from the analysis of the public expenditures ratio, a sovereign debt to GDP ratio did not provide clear information. While in in the Czech republic, Hungary, Poland and Slovenia the ratio steadily rose (though at different rates) since the beginning of the previous decade till the end of the pre-crisis period reflecting persisting pressures in the fiscal stance as a result of prevailing mismatch in government expenditures and revenues, in the rest of countries from the group the ratio remained stable or steadily decreased (most notably in the Slovak republic). We suggest that the main cause of this negative trend is associated with the structural inconsistency between shares of expenditures and revenues on the GDP in the public sector (Table 1) reflecting frequent changes in fiscal stance originated in discrete adjustments quite sensitive to changes in the political cycle.

Table 1 Total Revenues and Total Expenditures (1995-2011)

	Total expenditures				Total Revenues			
	1995-1998	1999-2002	2003-2006	2007-2011	1995-1998	1999-2002	2003-2006	2007-2011
Bulgaria	41.72	40.34	37.34	38.42	37.44	40.20	38.43	37.09
Czech republic	45.05	43.34	44.56	42.72	38.96	38.51	40.78	39.38
Estonia	39.33	36.71	34.00	39.62	39.88	35.84	35.85	39.37
Hungary	52.08	49.08	50.25	50.16	45.48	43.72	42.48	47.45
Latvia	37.68	37.55	36.24	40.31	37.56	34.83	35.35	35.14
Lithuania	40.14	37.50	33.24	38.76	35.26	34.65	32.30	33.46
Poland	47.38	42.97	43.65	43.81	42.83	39.01	38.83	38.63
Romania	34.34	37.25	34.04	39.33	31.05	33.60	32.51	33.33
Slovak republic	49.27	47.44	38.08	37.76	43.03	38.84	35.30	32.86
Slovenia	46.59	46.55	45.46	47.37	43.05	43.27	43.52	43.36

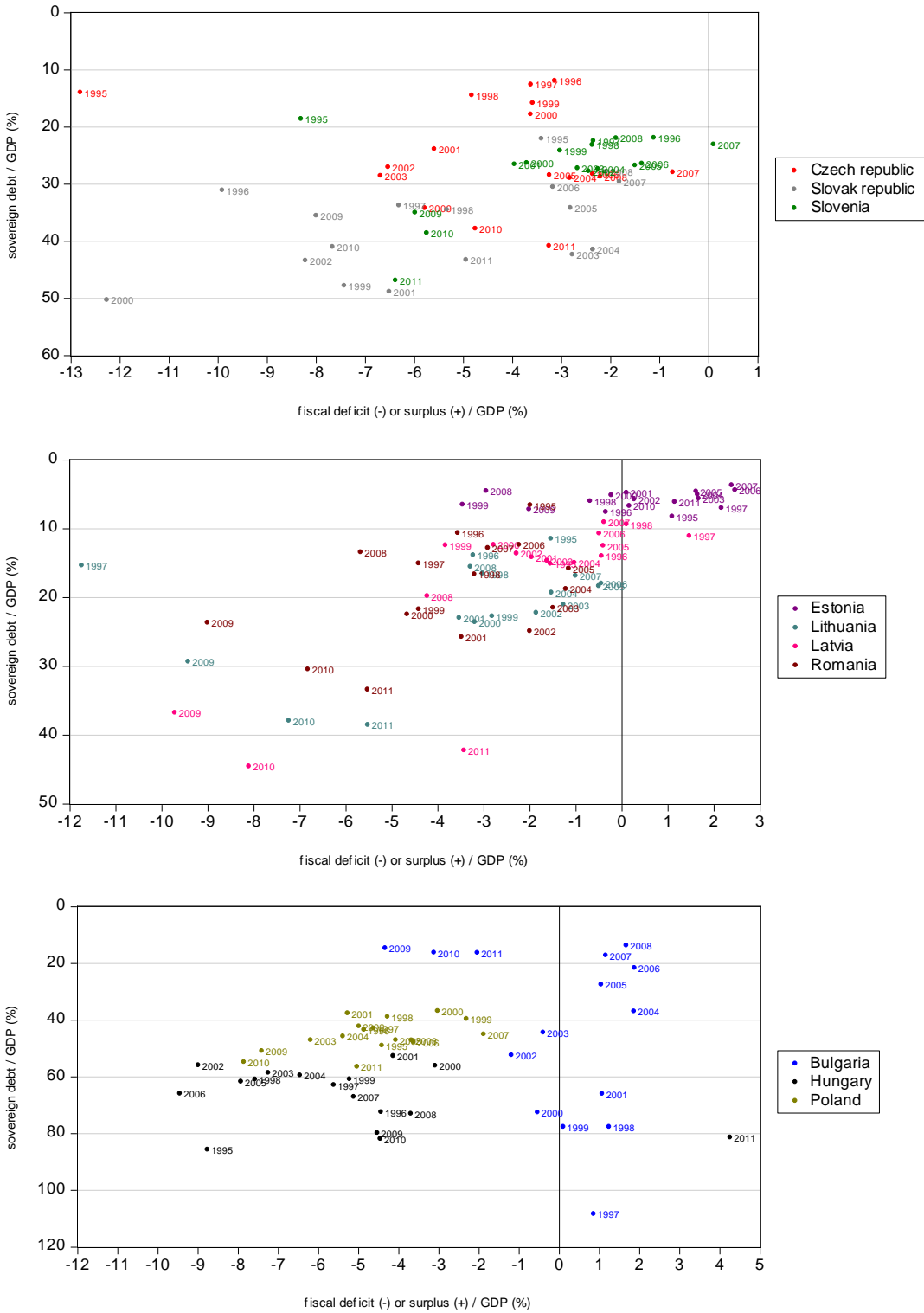
Note: Fiscal indicators are expressed as percentage shares on GDP.

Source: Compiled by author based on data taken from Eurostat - Government Finance Statistics (October 2012) and IMF - International Financial Statistics (March 2013).

As a one the most crucial aspects representing key features of the general government financial stance overview we emphasize risks of increasing sovereign debt burden associate with fiscal deficits that European transition economies are experiencing during the whole period of last two decades (Figure 3).

Relatively high rates of the real output growth (especially since the beginning of the 2000s) helped European transition economies (with exception for Hungary and Poland) to stabilize shares of severing debt and nearly to stop its increasing burden till the end of pre-crisis period. However, a positive trend in the fiscal deficit reduction during the near pre-crisis period was associated with significantly improved ratio of sovereign debt to GDP only in Bulgaria, the Slovak republic and Lithuania. At the same time, Baltic countries (with exception for Lithuania during the period 1999-2003) were able to maintain generally low level of sovereign debt (under 20 percent) during whole pre-crisis period. As a result, 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 (1995-2011)



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 2012) and IMF - International Financial Statistics (March 2013).

Fiscal implications of the economic crisis vary across European Union member countries provided quite differing 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 common conjunction affects overall costs of fiscal consolidation (European Commission, 2012).

The problem of say about a permanent deficiency of general government budgets stresses many “old” (Austria, France, Greece, Germany, Great Britain, Italy, Portugal) as well as “new” (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.

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 Pensch (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 filter¹ 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

¹ 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.

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):

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

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 European transition economies. 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 $\varepsilon_t \sim I(0)$ 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.

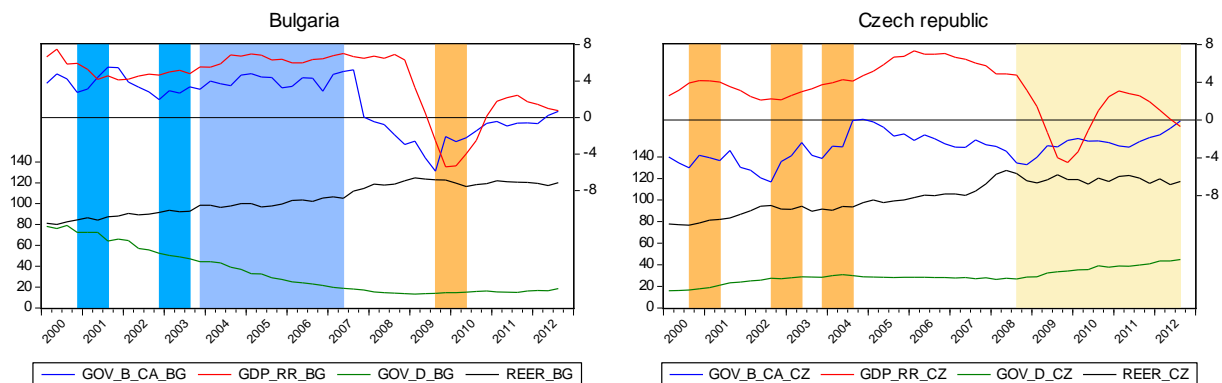
Provided that time series for direct tax revenues, indirect tax revenues, social contributions, unemployment related transfers and real output are $I(1)$ ² we estimate four different VEC models employing quarterly data for the period 2000Q1-2012Q3 (51 observations) for government expenditures, real output, inflation, tax revenues and short-term interest rates drawn from Eurostat - Government Finance Statistics (October 2012) and IMF database (International Financial Statistics, March 2013). 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.

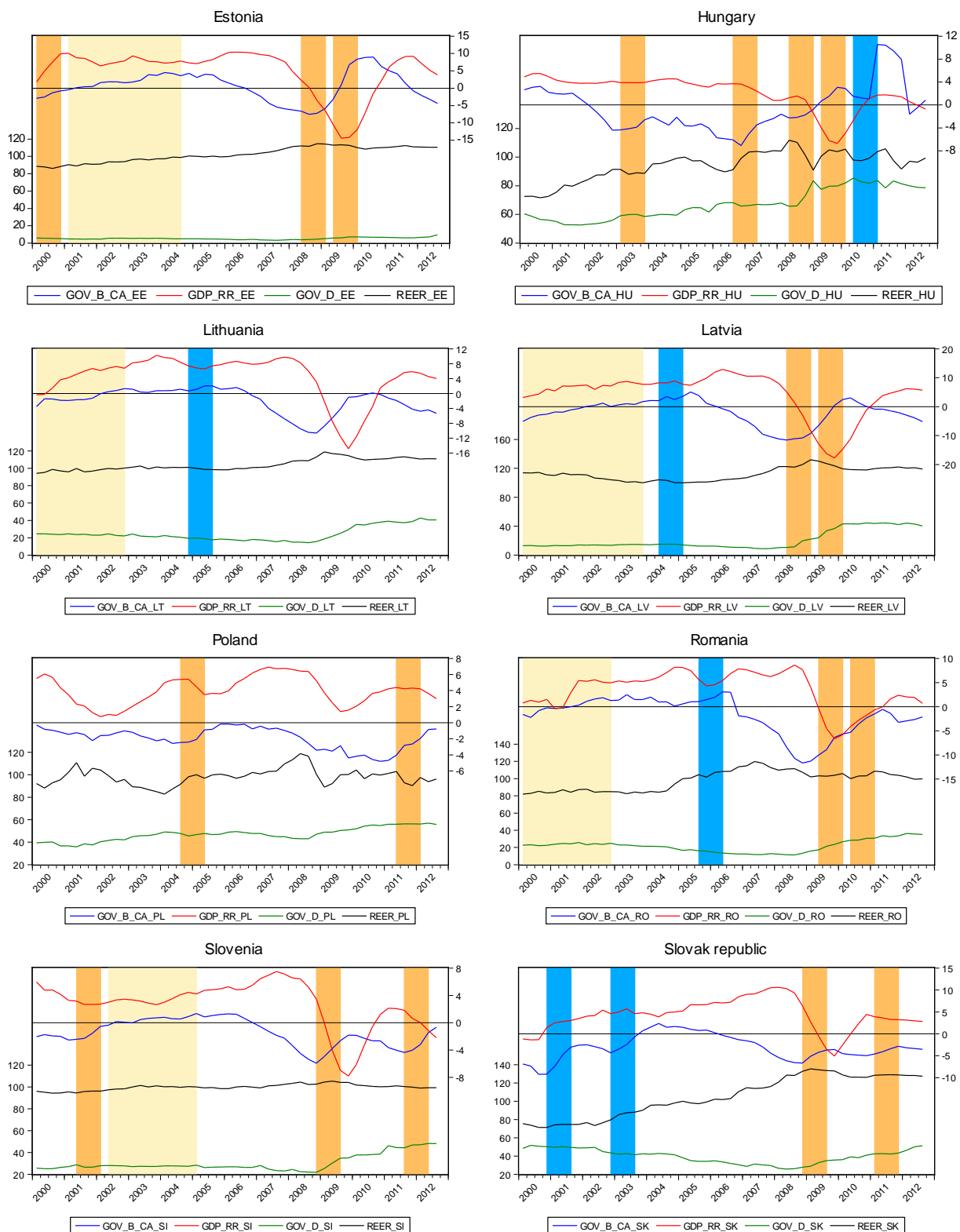
4.4 Episodes of Fiscal Consolidation

The figure 4 reveals identified episodes of fiscal consolidation in the European transition economies as well as the degree of their success since 2000. Individual countries have experienced several episodes of fiscal consolidation that in total represents 37 episodes of both types - one year consolidation (30) and gradual consolidation (7). However, we have assessed only 27 percent success in one year episodes of fiscal consolidations (8 *cold showers* succeeded). We have investigated only one successful gradual consolidation (14 percent degree of success). 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. At the same time, none of six gradual consolidations (only one of them was successful) undertaken during the pre-crisis period was associated with deteriorating effects on the overall macroeconomic performance, revealing wasted chance of potentially effective fiscal consolidation.

Figure 4 Fiscal Consolidation Episodes (2000Q1-2012Q3)



² 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) (2005 = 100)

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

Source: Author's calculation.

Bulgaria experienced four fiscal consolidations. *First*, one-year successful consolidation (2000Q4-2001Q3) seems to be revenue based, as it was associated with sharp increase in budgetary revenues (revenues (especially from direct taxes) rose faster than expenditures³). 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 weakening consolidation effort. *Second*, one-year successful consolidation (2002Q4-2003Q3) seems to be both revenue and expenditure based and main contribution refers to an increase in indirect taxes and minor decrease in the government consumption. 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. *Third*, gradual successful consolidation (2003Q4-2007Q2) seems to be revenue based and main contribution refers to an increase in indirect taxes. It also seems to be effective because the rate of a real GDP growth during this period slightly increased. During this period REER followed appreciation trend and thus not contributed to the consolidation effort. *Forth*, one-year consolidation (2009Q3-2010Q2) seems to be unsuccessful despite a decrease in government expenditures as well as government consumption, revenues from direct and indirect taxes also decreased. During this period the real output growth rate decreased (not effective) and REER depreciated (contributive).

Czech republic experienced four fiscal consolidations. *First*, one-year consolidation (2000Q3-2001Q2) seems to be unsuccessful despite a slight decrease in government expenditures as well as government consumption, while revenues from both direct and indirect taxes also decreased. During this period the real output growth rate increased (effective) and REER appreciated (not contributive). *Second*, one-year consolidation (2002Q3-2003Q2) seems to be also unsuccessful as it was associated with an increase in government expenditures as well as government consumption, while revenues from both direct and indirect taxes increased. During this period the real output growth rate increased (effective) and REER slightly depreciated (contributive). *Third*, one-year consolidation (2003Q4-2004Q3) seems to be also unsuccessful though it was associated with a decrease in government expenditures as well as government consumption and revenues from both direct and indirect taxes slightly increased. During this period the real output growth rate increased (effective) and REER appreciated (not contributive). *Forth*, gradual consolidation (2008Q3-2012Q3) seems to be also unsuccessful as it was associated with an increase in government expenditures, though government consumption decreased and revenues from direct taxes decreased, while revenues from indirect taxes slightly increased. During this period the real output growth rate significantly decreased (ineffective) and REER depreciated (contributive).

Estonia experienced four fiscal consolidations. *First*, one-year consolidation (2000Q1-2000Q4) seems to be unsuccessful despite a decrease in government expenditures as well as government consumption, while revenues from direct taxes slightly decreased and revenues from indirect taxes slightly increased. During this period the real output growth rate significantly increased (effective) and REER did not change (neutral). *Second*, gradual consolidation (2001Q1-2004Q3) seems to be also unsuccessful though it was associated with a slight decrease in government expenditures as well as government consumption and revenues from direct taxes slightly increased, while revenues from indirect taxes decreased. During this period the real output growth rate decreased (ineffective) and REER appreciated (not contributive). *Third*, one-year consolidation (2008Q2-2009Q1) seems to be also unsuccessful as government expenditures and government consumption increased, while revenues from direct taxes slightly increased and revenues from indirect taxes slightly decreased. During this period the real output growth rate significantly decreased (not

³ Development of budgetary components in this section is evaluated according to their share in GDP.

effective) and REER slightly appreciated (not contributive). *Fourth*, one-year consolidation (2009Q2-2010Q1) seems to be also unsuccessful as government expenditures slightly increased though government consumption decreased and revenues from both direct and indirect taxes increased. During this period the real output growth rate slightly decreased (ineffective) and REER slightly depreciated (contributive).

Hungary experienced five fiscal consolidations. *First*, one-year consolidation (2003Q1-2003Q4) seems to be also unsuccessful despite a decrease in both government expenditures and government consumption, while revenues from direct taxes slightly decreased and revenues from indirect taxes slightly increased. During this period the real output growth rate almost did not change (neutral) and REER depreciated (contributive). *Second*, one-year consolidation (2006Q3-2007Q2) seems to be also unsuccessful despite a decrease in government expenditures as well as government consumption, while revenues from both direct and indirect taxes slightly increased. During this period the real output growth rate decreased (ineffective) and REER significantly appreciated (not contributive). *Third*, one-year consolidation (2008Q2-2009Q1) seems to be also unsuccessful as government expenditures slightly increased though government consumption slightly decreased, while revenues from direct taxes slightly increased and revenues from indirect taxes slightly decreased. During this period the real output growth rate decreased (ineffective) and REER significantly depreciated (contributive). *Fourth*, one-year consolidation (2009Q2-2010Q1) seems to be also unsuccessful despite a slight decrease in government expenditures though government consumption increased, while revenues from direct taxes decreased and revenues from indirect taxes increased. During this period the real output growth rate decreased (ineffective) and REER appreciated (not contributive). *Fifth*, one-year consolidation (2010Q2-2011Q1) seems to be successful and especially revenue based though government expenditures slightly decreased too, while government consumption slightly increased. Despite revenues from both direct and indirect taxes decreased, overall government revenues significantly increased (due to nationalization of private pension-fund assets). During this period the real output growth rate significantly increased (effective) and REER appreciated (not contributive).

Lithuania experienced two fiscal consolidations. *First*, gradual consolidation (2000Q1-2002Q4) seems to be unsuccessful though it was associated with a significant reduction in government expenditures, while government consumption increased and revenues from both direct and indirect taxes also decreased. During this period the real output growth rate significantly increased (effective) and REER appreciated (not contributive). *Second*, one-year consolidation (2004Q4-2005Q3) seems to be successful and both revenue and expenditure based as it was associated with a slight reduction in government expenditures and government consumption slightly increased and revenues from both direct and indirect taxes slightly increased too. During this period the real output growth rate almost did not change (neutral) and REER depreciated (contributive).

Latvia experienced four fiscal consolidations. *First*, gradual consolidation (2000Q1-2003Q4) seems to be unsuccessful though it was associated with a significant reduction in government expenditures, while government consumption increased and revenues from direct taxes almost did not change, while revenues from indirect taxes decreased. During this period the real output growth rate significantly increased (effective) and REER depreciated (contributive). *Second*, one-year consolidation (2004Q2-2005Q1) seems to be successful and revenue based as it was associated with a slight increase in government expenditures and government consumption, while revenues from direct taxes slightly increased and revenues from indirect taxes slightly decreased. During this period the real output growth rate slightly decreased (not effective) and REER depreciated (contributive). *Third*, one-year consolidation (2008Q2-2009Q1) seems to be unsuccessful as government expenditures significantly

increased though government consumption slightly decreased, while revenues from direct taxes slightly increased and revenues from indirect taxes increased. During this period the real output growth rate significantly decreased (ineffective) and REER appreciated (not contributive). *Fourth*, one-year consolidation (2009Q2-2010Q1) seems to be also unsuccessful as government expenditures slightly increased though government consumption decreased and revenues from direct taxes decreased while revenues from indirect taxes increased. During this period the real output growth rate decreased (ineffective) and REER depreciated (contributive).

Poland experienced two fiscal consolidations. *First*, one-year consolidation (2004Q3-2005Q2) seems to be unsuccessful as government expenditures slightly increased though government consumption slightly decreased, while revenues from both direct and indirect taxes increased. During this period the real output growth rate decreased (ineffective) and REER appreciated (not contributive). *Second*, one-year consolidation (2011Q2-2012Q1) seems to be also unsuccessful though government expenditures slightly decreased, while government consumption slightly increased and revenues from both direct and indirect taxes slightly decreased. During this period the real output growth rate decreased (ineffective) and REER depreciated (contributive).

Romania experienced four fiscal consolidations. *First*, gradual consolidation (2000Q1-2002Q4) seems to be unsuccessful, though it was associated with a significant reduction in government expenditures, while government consumption increased and revenues from both direct and indirect taxes also decreased. During this period the real output growth rate significantly increased (effective) and REER appreciated (not contributive). *Second*, one-year consolidation (2005Q3-2006Q2) seems to be successful and revenue based as it was associated with a slight increase in government expenditures, though government consumption slightly decreased and revenues from direct taxes increased, while revenues from indirect taxes decreased. During this period the real output growth rate increased (effective) and REER appreciated (not contributive). *Third*, one-year consolidation (2009Q2-2010Q1) seems to be unsuccessful as it was associated with an increase in government expenditures, while government consumption decreased and revenues from direct taxes increased, while revenues from indirect taxes decreased. During this period the real output growth rate decreased (ineffective) and REER appreciated (not contributive). *Fourth*, one-year consolidation (2010Q2-2011Q1) seems to be also unsuccessful, though government expenditures and government consumption slightly decreased, while revenues from direct taxes decreased and revenues from indirect taxes increased. During this period the real output growth rate increased (effective) and REER appreciated (not contributive).

Slovenia experienced four fiscal consolidations. *First*, one-year consolidation (2001Q2-2002Q1) seems to be unsuccessful, though government expenditures decreased, while government consumption slightly increased and revenues from direct taxes did not change, while revenues from indirect taxes increased. During this period the real output growth rate decreased (ineffective) and REER appreciated (not contributive). *Second*, gradual consolidation (2002Q2-2005Q1) seems to be unsuccessful, though it was associated with a reduction in government expenditures, while government consumption increased and revenues from direct taxes increased, while revenues from indirect taxes slightly decreased. During this period the real output growth rate increased (effective) and REER appreciated (not contributive). *Third*, one-year consolidation (2008Q4-2009Q3) seems to be unsuccessful as it was associated with an increase in government expenditures and government consumption, while revenues from both direct and indirect taxes decreased. During this period the real output growth rate significantly decreased (ineffective) and REER appreciated (not contributive). *Fourth*, one-year consolidation (2011Q3-2012Q2) seems to be unsuccessful, though it was associated with a decrease in government expenditures and government

consumption, while revenues from both direct and indirect taxes decreased. During this period the real output growth rate decreased (ineffective) and REER slightly depreciated (contributive).

Slovak republic experienced four fiscal consolidations. *First*, one-year consolidation (2000Q4-2001Q3) seems to be **successful** and expenditure based as it was associated with a significant decrease in government expenditures, though government consumption slightly increased and revenues from direct taxes slightly increased, while revenues from indirect taxes decreased. During this period the real output growth rate increased (effective) and REER appreciated (not contributive). *Second*, one-year consolidation (2002Q4-2003Q3) seems to be also **successful** and both revenue and expenditure based as it was associated with a decrease in government expenditures and government consumption and an increase in revenues from both direct and indirect taxes. During this period the real output growth rate did not change (neutral) and REER significantly appreciated (not contributive). *Third*, one-year consolidation (2008Q4-2009Q3) seems to be **unsuccessful** as it was associated with an increase in government expenditures and government consumption, while revenues from both direct and indirect taxes decreased. During this period the real output growth rate significantly decreased (ineffective) and REER slightly appreciated (not contributive). *Fourth*, one-year consolidation (2011Q1-2011Q4) seems to be **unsuccessful**, though it was associated with a slight decrease in government expenditures and government consumption, while revenues from both direct and indirect taxes slightly increased. During this period the real output growth rate decreased (ineffective) and REER did not change (neutral).

5. Fiscal Policy Shocks

5.1 Econometric Model

Understanding effects of fiscal policy shocks (negative government expenditure shock, positive direct and indirect tax revenue shock) on real output would help us to assess 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 particular fiscal adjustments feasibility.

Approach we use in our analysis to estimate effects of 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 selected group of transition economies.

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 short-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:

$$E(u_t) = 0, \quad E(u_t u_t') = \Sigma_u = \begin{pmatrix} \sigma_1^2 & \sigma_{12} & \sigma_{13} \\ \sigma_{12} & \sigma_1^2 & \sigma_{23} \\ \sigma_{13} & \sigma_{23} & \sigma_1^2 \end{pmatrix}, \quad E(u_t u_s') = [0] \quad \forall t \neq s \quad (10)$$

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:

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

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:

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

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 2000Q1-2012Q3 (model B)) to reveal crisis effects on fiscal consolidation efforts. Effects of shocks in each particular fiscal variable (negative (decrease) government expenditure shock ($\varepsilon_{g,t}$) and one standard deviation positive (increase) direct tax ($\varepsilon_{dt,t}$) and indirect tax ($\varepsilon_{it,t}$) revenues shocks) 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 ($Y_t = [g_t, y_{r,t}, p_t, it_t, i_{n,t}]$)

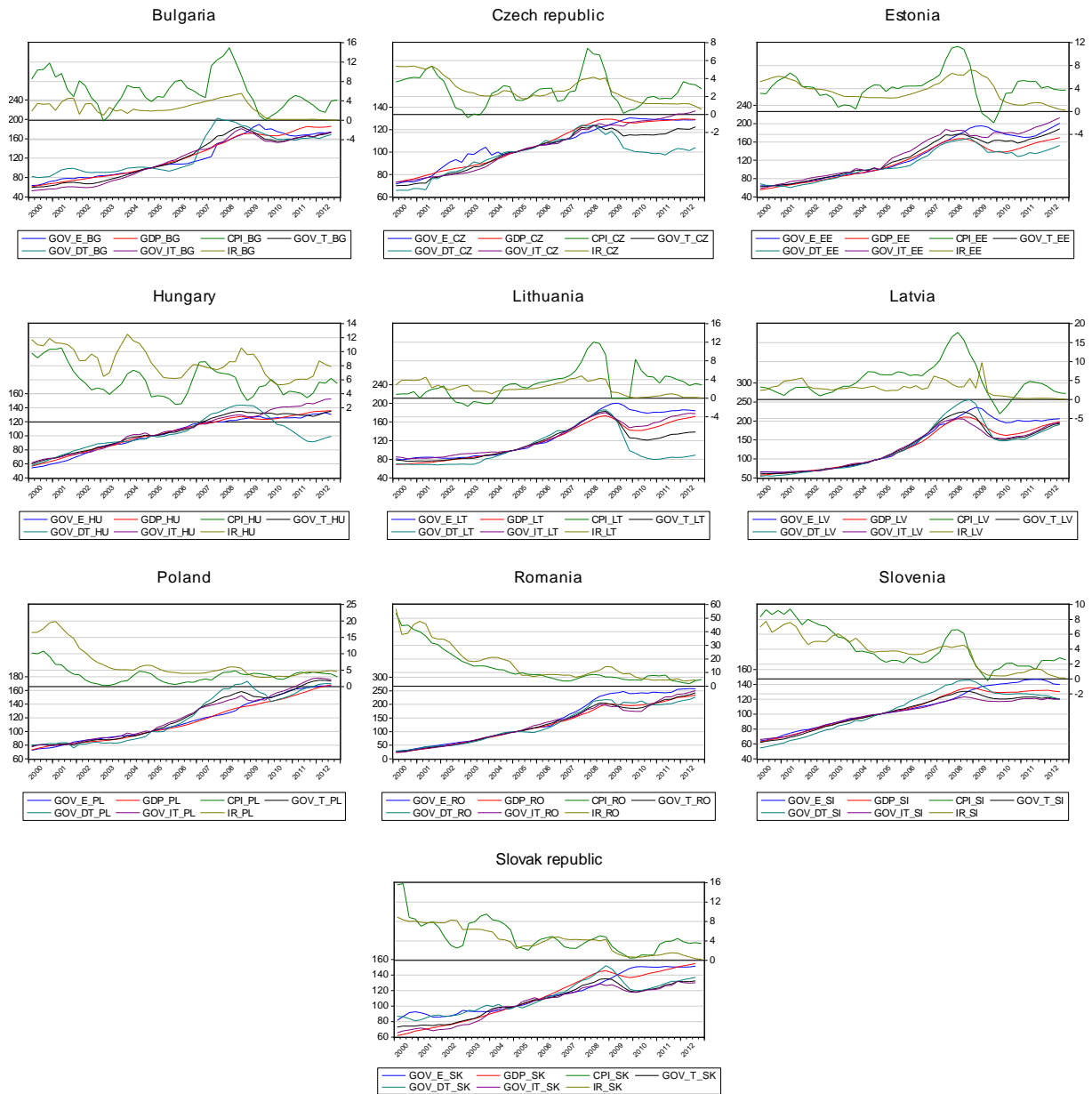
Impulse-response functions calculated from estimated VAR models with true shocks identified employing both identification schemes (based on Cholesky factorization and structural factorization) provided very similar results that is why we present results from structural VAR models (estimated results from 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. 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 country from the group of the European transition economies (Bulgaria, Czech republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovak republic and Slovenia) we employ quarterly data ranging from 2000Q1 to 2007Q4 (32 observations) for model A and quarterly data from 2000Q1 to 2012Q3 (51 observations) for model B for the government expenditures, real gross domestic product, inflation, tax revenues and short term interest rates (figure 5). Time series for endogenous variables were drawn from Eurostat - Government Finance Statistics (October 2012) and IMF database - International Financial Statistics (March 2013).

Figure 5 Government Expenditures, Real output, Inflation, Tax Revenues and Interest Rates in the European Transition Economies (2000Q1-2012Q3)



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 2012) and IMF - International Financial Statistics (March 2013).

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 short-term interest rates indicator we used national interbank offered rates for the deposits with 3 months maturity.

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.

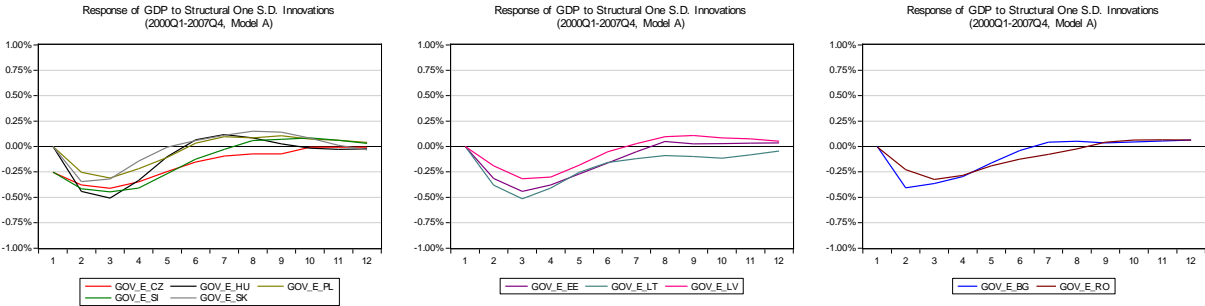
Following the results of the stationarity and cointegration tests we estimate three SVAR models for pre-crisis (2000-2007) and extended period (2000-2012) for each country from the group of European transition economies using the variables in the first differences to calculate impulse-response functions of government expenditures, direct taxes and indirect taxes (responses of the real output to a negative 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 6-8 we summarize the responses of the real output to the negative (decrease) government expenditure shock and positive (increase) direct and indirect tax revenues during the pre-crisis period (model A1 with data 2000Q1-2007Q4) in the European transition economies. In figures 9-11 we summarize the responses of the real output to the negative (decrease) government expenditure shock and positive (increase) direct and indirect tax revenues during the extended period (model B1 with data 2000Q1-2012Q3) in the European transition economies.

In the figure 6 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 European transition economies.

Figure 6 Responses of Real Output to the Negative Government Expenditures Shock (2000Q1-2007Q4) (Model A)

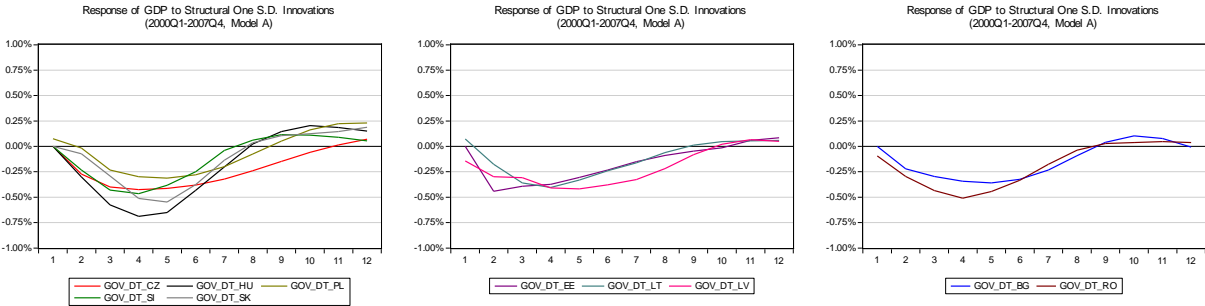


Source: Author’s calculations.

Negative shock (decrease in) government expenditures shock was followed by the real output decline in all countries from the group. Despite some differences in the intensity of the shock it seems that the negative effect culminated within first year after the shock and steadily died out with next two years. Government expenditures shock seems to be neutral in the long-run and not affecting leading path of the real output.

In the figure 7 we summarize responses of the real output to the one standard deviation shock of direct tax revenues for the model with time series for the pre-crisis period (model A1) in the European transition economies.

Figure 7 Responses of Real Output to the Positive Direct Tax Revenues Shock (2000Q1-2007Q4) (Model A)

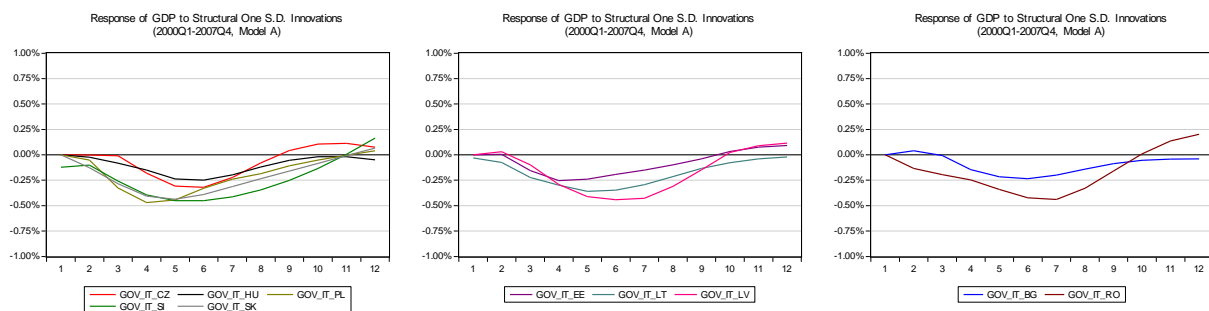


Source: Author’s calculations.

Positive (increase in) direct tax revenues shock had negative impact on the real output in all countries from the group. In comparison with government expenditures shock it seems that negative effect of the shock was slightly higher and reached its peak with little time shift. As a result, the negative shock in direct revenues caused a real output decline during 4-6 quarters following initial impulse. Negative effect of the shock died out during the third year after the shock and as a result, the shock seems to be neutral in the long run. Despite quite similar features of the real output responses in all countries from the group we have revealed some differences in intensity as well as durability of the shock.

In the figure 8 we summarize responses of the real output to the one standard deviation shock of indirect tax revenues for the model with time series for the pre-crisis period (model A1) in the European transition economies.

Figure 8 Responses of Real Output to the Positive Indirect Tax Revenues Shock (2000Q1-2007Q4) (Model A)



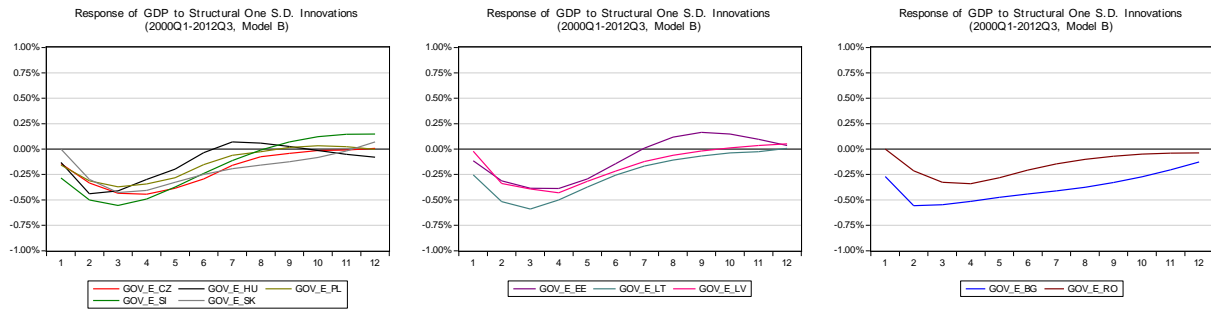
Source: Author's calculations.

It seems to be clear that the positive (increase in) indirect tax revenues shock was followed by the real output decline. However, we have observed a slightly delayed negative response of real economic activities. Despite some differences identified across individual countries it seems that a negative effect of the shock culminated during the second year after the shock. At the same time, initial response of the real output is mostly weak and moderately increase over the time. 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.

Analysis of effects of fiscal policy shocks during the pre-crisis period revealed interesting implications about side (macroeconomic) effects of fiscal adjustments associated with tax and expenditure based fiscal consolidation in the European transition economies. Both, government expenditures reductions and tax revenues increases were followed by real output declines. However, effects of expenditure based adjustments seem to be more significant within the same fiscal year (effects of the shock culminated during first four quarters). As a result, expenditure based approach seems to be more convenient (effective) for episodes of gradual fiscal consolidations provided that distortionary effects on the real output tend to be reduced during the year following fiscal adjustment. On the other hand, effects of adjustments in both direct and indirect tax revenues were largely distributed across several years (with slightly reduced deteriorating effect during the first year in most countries) and thus revenue based fiscal adjustments seem to be more appropriate for episodes of one-year fiscal consolidations.

In the figure 9 we summarize responses of the real output to the one standard deviation government expenditures for the model with time series for the extended period (model B1) in the European transition economies.

Figure 9 Responses of Real Output to the Negative Government Expenditures Shock (2000Q1-2012Q3) (Model B)

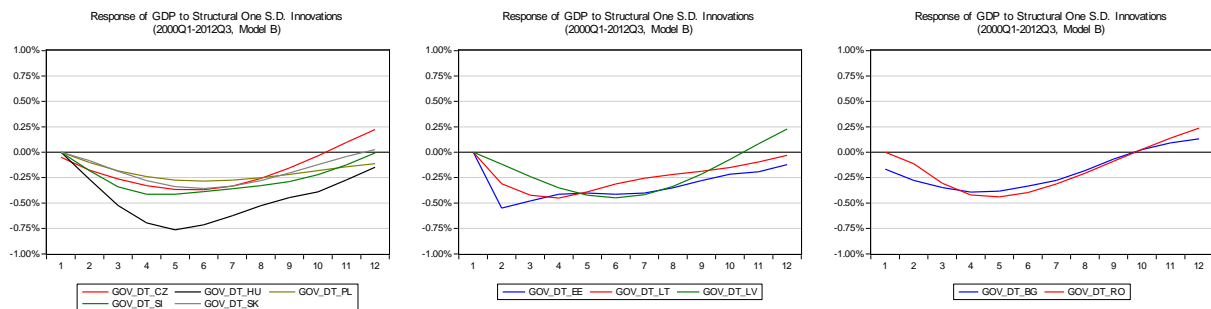


Source: Author’s calculations.

Crisis period affected responses of real output to the negative (decrease in) government expenditures shock across individual countries with a different manner. Despite questionable effects on changes in intensity of the deteriorating impact it seems that durability of the negative real output response slightly increased though overall effect in the long run remained neutral (and effect of the shock died out within three years period). Thus, crisis period seem to extend negative effects associated with government expenditures adjustments. As a result, time vulnerability of real output to expenditure based fiscal adjustments during the crisis period increased.

In the figure 10 we summarize responses of the real output to the one standard deviation shock of direct tax revenues for the model with time series for the extended period (model B1) in the European transition economies.

Figure 10 Responses of Real Output to the Positive Direct Tax Revenues Shock (2000Q1-2012Q3) (Model B)

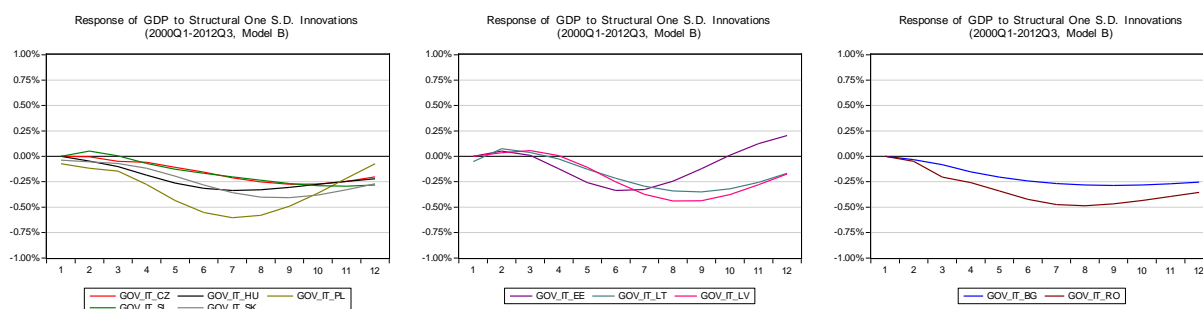


Source: Author’s calculations.

Due to crisis period we have examined slightly changed responses of real output to the positive (increase in) direct tax revenues shock in all countries from the group. It seems that not only increased durability of the deteriorating effects on the real output occurred but also overall drop in the real output increased. Although overall effect of the shock seems to be neutral in the long run, its effect died out till the end of the fourth year. 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.

In the figure 11 we summarize responses of the real output to the one standard deviation shock of indirect tax revenues for the model with time series for the extended period (model B1) in the European transition economies.

Figure 11 Responses of Real Output to the Positive Indirect Tax Revenues Shock (2000Q1-2012Q3) (Model B)



Source: Author's calculations.

Analysis of the real output responses to the positive (increase in) indirect tax revenues shock revealed quite similar results in comparison with effects of the direct tax revenues shock. Despite quite similar intensity of the real output decline, all countries from the group have experienced higher persistence of the deteriorating effect of the shock. As a result, the negative effect of the tax revenues shock on the real output endured around 3-5 years and thus significantly prolonged side effects of the indirect tax (revenue) based fiscal adjustments during the crisis period.

Crisis period accelerated negative side (macroeconomic) effects of fiscal adjustments associated with tax and expenditure based fiscal consolidation in the European transition economies. Generally, we emphasize increased durability of deteriorating effects of fiscal adjustments (both revenue and expenditure based) on the real output. Provided that a degree of success of fiscal adjustments during the crisis period is reduced due to excessive pressures on both revenues and expenditure sides it seems that increased durability of real output deterioration, followed by tax and/or revenue based adjustments, significantly reduced a degree of success to perform an effective (without deteriorating side effects on real output) fiscal consolidation.

6. Conclusion

In the paper we have analyzed main trends in the financial stance of general governments in ten European transition economies during last two decades. Brief overview of main trends in selected fiscal indicators and rapid deterioration in the fiscal policy stance during the crisis period revealed a crucial need of fiscal consolidation as it became urgent almost immediately after the debt crisis contagion flooded Europe.

We have identified 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. Individual countries have experienced several episodes of fiscal consolidation that in total represents 37 episodes of both types - one year consolidation (30) and gradual consolidation (7). However, we have assessed only 27 percent success in one year episodes of fiscal consolidations (8 *cold showers* succeeded). We have investigated only one successful gradual consolidation (14 percent degree of success). 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. At the same time, none of six gradual consolidations (only one of them was successful) undertaken during the pre-crisis period was associated with deteriorating effects on the overall macroeconomic performance, revealing wasted chance of potentially effective fiscal consolidation.

We have also estimated VAR model to analyze effects of fiscal shocks (based on one standard deviation (fall) in total expenditure and (rise) in direct and indirect taxes) to real output. Both, government expenditures reductions and tax revenues increases were followed by real output declines. However, effects of expenditure based adjustments seem to be more significant within the same fiscal year (effects of the shock culminated during first four quarters). As a result, expenditure based approach seems to be more convenient (effective) for episodes of gradual fiscal consolidations provided that distortionary effects on the real output tend to be reduced during the year following fiscal adjustment. On the other hand, effects of adjustments in both direct and indirect tax revenues were largely distributed across several years (with slightly reduced deteriorating effect during the first year in most countries) and thus revenue based fiscal adjustments seem to be more appropriate for episodes of one-year fiscal consolidations.

Crisis period accelerated negative side (macroeconomic) effects of fiscal adjustments associated with tax and expenditure based fiscal consolidation in the European transition economies. Generally, we emphasize increased durability of deteriorating effects of fiscal adjustments (both revenue and expenditure based) on the real output. Provided that a degree of success of fiscal adjustments during the crisis period is reduced due to excessive pressures on both revenues and expenditure sides it seems, that increased durability of real output deterioration, followed by tax and/or revenue based adjustments, significantly reduced a degree of success to perform an effective (without deteriorating side effects on real output) fiscal consolidation.

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