# Macroeconomic effects of public investment in South-East Europe

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**Abstract**

This paper provides the first cross-country study of the macroeconomic effects of public investment in South-East Europe. We construct a unique dataset of exogenous changes in public investment and use them with Jordá (2005) local projections method to estimate their dynamic effects on the main macroeconomic aggregates, the unemployment rate and debt-to-GDP ratio. Our results show significant multiplicative effects of public investment on GDP (multipliers are on average above two), delivered primarily through crowding in of private investment. While we are not able to confirm positive effects on the unemployment rate (with exception of Croatia), public investment seems not to increase the debt-to-GDP ratio. Our analysis also shows that such macroeconomic effects cannot be observed for total governments spending, which confirms that also in South-East Europe (as in advanced economies) public investment can be seen as a catalyst of positive spill-over effects to other sectors of the economy and thus contribute to productivity growth, while social transfers deliver only weak or no multiplicative effects.

*JEL-Codes:* E61, E62, H62

*Keywords:* capital spending, fiscal multiplier, local projections, transport infrastructure, growth driver, South-East Europe, SEE countries

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## 1. Introduction

Structural policies are in focus of the policy debate on how to boost countries' macroeconomic outlook, especially in the aftermath of the crisis when most of the economies exhibit a productivity slowdown. The European Commission (EC) pinpoints the importance of public investment to stimulate productivity growth, but in need of fiscal consolidation it is often the case that capital spending is the first to be cut for fiscal adjustment.

South-East European countries have recently scaled up public (transport) infrastructure investments to raise growth productivity while improving connectivity and promoting economic cooperation among countries in the region. The European Commission (2016) emphases the importance of the TEN-T corridor construction, since rail, road, air and sea transport links are seen as key drivers not just for closer integration between Member States and South-East Europe, but also for increasing economic competitiveness of the region. Moreover, the European Commission emphasises that further efforts in the implementation of comprehensive structural reforms in transport (among other sectors) are needed to ensure sustainable growth (European Commission, 2017). However, in need for fiscal consolidation some of the investment projects in Montenegro and Macedonia have been delayed in the process of fiscal consolidation.

The main motivation of this study is to assess the macroeconomic effects of public capital spending in South-East Europe economies and, in particular, whether increasing (cutting) public investment can have positive (adverse) economic effects on output and growth in the long run. There is ample empirical evidence in the literature about macroeconomic effects of infrastructure investment in developed countries (IMF, 2014a; Abiad et al., 2015; Ganelli and Tervala, 2016, among others). In the aftermath of the crisis, special attention has been devoted to identifying potentially non-linear or state-contingent effects of fiscal expenditure shocks. In this respect, several authors find multiplicative effects of fiscal spending in general and infrastructure investment in particular to be significantly higher in economic downturns (Auerbach and Gorodnichenko, 2013a,b; de Jong et al., 2017, among others). In such circumstances not only are the fiscal multipliers significantly higher than one (primarily due to crowding in of private investment and spending), but fiscal stimulus also appears to affect positively the overall indebtedness of the economy (measured by the debt-to-GDP ratio).

Moreover, all South-East European countries from our sample, except for Croatia, take also part of the group of EU accession (or enlargement) countries, while Croatia is the last country joining EU in 2013. That is why this study is important also from the cohesion perspective and shows the eventual speed and patterns of economic convergence through public investment. Even in time before the crisis and need for fiscal adjustments, the South-East European countries lagged behind the rest of Europe on the two main macroeconomic grounds, growth and labour market developments, while also struggling in competitiveness. Data for 2016 show that the average Euro Area GDP per capita is six times larger than the average GDP per capita in sampled South-East European countries, the unemployment rate is nine percentage points above the Euro Area average[2], while according to the 2016-2017 Global Competitiveness Report the competitiveness rank difference between Euro Area and South-East Europe is 50 positions[3]. The main question

[2]Refer to Appendix B for a detail view of the development of these two macro aggregates across South-East European economies in the 2005-2016 period.

[3]The group of South-East European countries rank as $86^{\text{th}}$ in the world (ranging from Macedonia as the most competitive country in the region ranked $68^{\text{th}}$, and Bosnia and Herzegovina ranked $107^{\text{th}}$), while the Euro Area countries on average rank $36^{\text{th}}$.

in this respect is whether South-East European countries can use public investment to narrow such gap in the upcoming decades. Empirical evidence for developed economies show that public investment can significantly increase the speed of convergence of catching-up countries (Fournier, 2016, among others).

The empirical evidence on macroeconomic effects of public infrastructure spending in South-East European countries is almost inexistent. The scarce literature mainly refers to the effect of total government spending (and revenue)[4], providing thus single country studies and not a comprehensive multi-country treatment of the region. One of the main reasons for such lack of studies is insufficient data for application of modern estimation techniques, which require the identification of the exogenous changes in fiscal spending. In this respect, our study makes an attempt at filling the gap in the literature and presents an analysis of the macroeconomic effects of public infrastructure investment in South-East European countries for the following countries: Croatia, Bosnia and Herzegovina, Serbia, Macedonia and Albania[5]. To asses public investment (and government spending) multipliers we employ the linear projection method introduced by Jordá (2005), but, given the importance of expectations in identifying fiscal shocks for the purpose of this analysis, we also follow the seminal works of Auerbach and Gorodnichenko (2013a,b). The measure of capital government spending (fiscal) shocks, is obtained as the difference between actual (outturn) capital spending for period $t$ and expected (planned) capital spending as in the plan of the budget made in period $t-1$ for year $t$. Such approach singles out unanticipated changes as capital spending forecast errors (FE), while on the same time removing the "fiscal foresight bias" (Leeper et al., 2012; Ben Zeev and Pappa, 2014, among others) and circumventing the problem of endogeneity in the estimates of fiscal policy effects. Above that, this study encompasses the effects on a larger set of macroeconomic aggregates. Beside the impact on national account data (output, private consumption and private investment) it investigates also the effects of public investment on unemployment and public debt.

Our main results reveal significant multiplicative effects of public investment on GDP in South-East European region. Point estimates of medium-term multipliers are on average above two. The main channel through which public investment delivers such multiplicative effects appears to be crowding in of private investment. While we are not able to confirm positive effects on unemployment rate (with exception of Croatia), public investment, which is primarily debt financed, seems to marginally increase the debt-to-GDP ratio only in Serbia. Our analysis also shows that such positive macroeconomic effects cannot be observed for total governments spending, which is an indication that also in South-East Europe public investment can be seen as a catalyst of positive spill-over effect to other sectors of the economy and thus contribute to productivity growth, while social transfers deliver only weak or no multiplicative effects.

The paper is structured as follows: Section 2 reviews the importance of government capital investment for economic growth from a policy and empirical perspective. Section 3 explains the empirical strategy and used data. Section 4 presents the results of the analysis while concluding remarks are pinpointed in Section 5.

[4]Deskar-Škrbić and Šimović (2017) provide multipliers for Croatia and Serbia, Grdović Gnip (2014, 2015) for Croatia while Filipovski et al. (2016) for Macedonia. These work mainly employ the (S)VAR framework and access total spending (and tax) multipliers, except the work of Grdović Gnip (2014) that employs a non-linear setup and disentangles capital from current spending multipliers.

[5]We omit Montenegro and Kosovo due to data unavailability.

## 2. Literature review

During the recent financial crisis policymakers, almost consensually, used fiscal stimuli to boost economic growth. Special attention was devoted to public investment packages as a potential countercyclical tool. Both developed and developing economies incorporated public investment in their fiscal stimuli packages, but to a smaller extent relative to tax cuts or other (current) government spending increases.

Economic theory suggests that public investment has likely a positive effect on output and growth but the magnitude of the impact depends on the degree of the crowding out effect and on the specificities of investment. In principle, governments should pursue those public investments that have larger social benefits than private benefits, i.e. should address those sectors and activities that create positive externalities. Such public investment crowd in investments, improve productivity of the production factor and are called "productive" public spending.

It is the work of Kneller et al. (1999) that pioneered the separation of productive from unproductive (or less productive) government spending. They find a positive effect on economic growth after an increase in productive spending, whereas unproductive spending do not exercise such an effect on output. Kneller et al. (1999) put forward four main categories of productive public spending: public infrastructure investment, education and training, R&D and health care. Everaert et al. (2014, p. 4) show on a panel of OECD countries that *there is a clear consensus in the literature that an increase in, or a shift towards, more productive expenditures raises output and/or growth*, inducing thus a shift in the total factor productivity[6].

If analysing the effects of (total) public investment then such a clear cut consensus on significant positive long-run effects is not straightforward. Estimates considerably differ over countries, time span, measures of capital spending and estimation method[7]. Using country specific VAR models for 22 OECD countries, Kamps (2005, 2006) show that in the majority of countries public and private investments are complementary, i.e higher public investment stimulate private investment. Using the same set of countries but in a VECM framework Jong-A-Pin and De Haan (2008) find mixed evidence of the effects of public investment on output, from significantly positive to significantly negative in some cases.

More unambiguous (positive) effects emerged in light of the latest economic crisis and monetary accommodation with low borrowing costs. In line with Kamps's empirical strategy, de Jong et al. (2017) carry out a country specific VAR analysis for 12 EU economies. They provide evidence of a positive effect on output and no crowding out of private investment. The robustness of these findings is confirmed using structural model-based simulations, while pinpointing that an increase in public investment has the strongest short-term demand effects with an anticipated accommodative monetary policy.

Using two empirical approaches (panel estimates and model simulations) on a panel of 17 advanced OECD economies, the IMF (2014a) concludes that increased public infrastructure investment significantly increase output in the short- and long-run. Again, these effects are particularly strong in case of an economic downturn with monetary accommodation. Abiad et al. (2015) and Ganelli and Tervala (2016), although using different methodological approaches (model simulations on a set od 17 OECD economies and DSGE model, respectively), also find supportive

[6]Refer to Gemmell et al. (2014) and references therein for a deeper discussion and literature review on the effects of education, R&D and health care investments.

[7]Refer to Pereire and Andraz (2013) for an extensive literature review.

evidence to IMF's conclusions and show that public investment not only raises output but also crowds in private investment, with the effects being more pronounced in case of economic slack and monetary accommodation as well as when public investment efficiency is high[8]. Additionally, Fournier (2016) pinpoints that public investment can increase the speed of convergence of catching up countries, while Ganelli and Tervala (2016) emphasize that a public infrastructure shock not only increases output but also welfare overall.

All these studies confirm the recognition of positive effects of public investment not only in the short-, but also, more importantly, in the long-run. The bulk of literature that emerged during or in the aftermath of the crisis shows additional evidence of particularly strong positive effects given the accommodative monetary conditions. However, when evaluating potential fiscal stimuli packages, European Union (EU) prioritized fiscal consolidation and rationalization of fiscal spending. That is why most of the European countries reduced the growth in spending by cutting capital investment. The provisions within the EU fiscal framework to support public investment, especially in times of low growth, is very weak (Barbiero and Darvas, 2014). Therefore, it is often the case that when pursuing fiscal consolidation as the utmost fiscal goal, EU countries cut public investment spending.

Although South-East European countries do not need to fully adhere to EU fiscal rules and provisions, during the pre-accession phase they are strongly monitored. Namely, as of 2016 South-East European countries are obliged to submit Economic Reform Programmes (ERPs) that contain a structural reform agenda on how to boost competitiveness and improve conditions for growth and job creation. To revive the catch-up (convergence) process, all South-East European economies rely on public investment, and public transport infrastructure investment in particular. The European Commission (2016, 2017) emphasize the importance of the TEN-T corridor construction, since rail, road, air and sea transport links are seen as key drivers not just for closer integration between Member States and South-East Europe, but also for increasing economic competitiveness of the region[9].

Rail and motorway construction in South-East Europe started in the 1990s with a much stronger momentum in the last decade. Nevertheless, the network density is still very low when compared to the EU average. Data in Table 1 show that the road network density in EU is 1.1 kilometre per square kilometre ($km^2$) of total area.

[8]Important to note is the work of Berg et al. (2015). They show that the magnitude of a positive effect of public spending on output does not depend upon public investment efficiency, as pinpointed by previous studies (Pritchett, 2000; IMF, 2014b), and that public investment increases lead to strong positive output effects also in countries with lower efficiency.

[9]Refer to SEETO (2015.) for a comprehensive list of road and rail building projects across the South-East Europe, that altogether make a 7.7 billion EUR large investment package.

**Table 1:** *Density of transport networks in South-East Europe in 2015*

| | Roads excluding motorways | | Railways | |
|---|---|---|---|---|
| | m per km$^2$ | km per 1000 inhabitants | m per km$^2$ | km per 1000 inhabitants |
| Albania | 137 | 1.4 | 13.2 | 0.13 |
| Bosnia & Herzegovina | na | na | 20.1 | 0.27 |
| Croatia | 446 | 5.9 | 3.6 | 0.05 |
| Macedonia | 554 | 6.9 | 27.2 | 0.34 |
| Serbia | 573 | 6.3 | 48.6 | 0.53 |
| Kosovo | 185 | 1.1 | 30.6 | 0.19 |
| Montenegro | 624 | 13.8 | 18.1 | 0.40 |
| EU | 1070 | 9.5 | 49.4 | 0.44 |

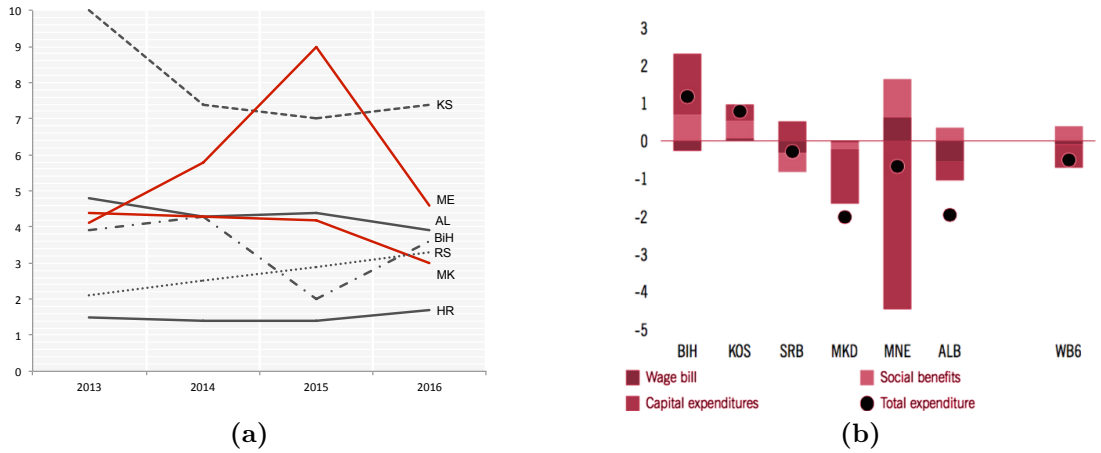
*Notes: na* - not available.
*Source:* European Commission (2016)

Although Montenegro has the highest road density among South-East European economies it stands at half of the EU average, i.e. 0.6 kilometre per square kilometre (km$^2$). The alternative measure of network density (per 1000 inhabitants) show the road network in Montenegro about twice as dense as in any other South-East European economy, with an average of 13.8 km of road per 1 000 inhabitants in 2015, which is also higher than the EU average (9.5 km per 1 000 inhabitants).

Catching-up in terms of higher transport density not only facilitates the mobility of people and goods, but also exercises an indirect effect on the economy through its multipliers. Since infrastructure investments are labour intensive, much of the spending channels back into the economy directly through wages and increase in firms' productivity due to better connectivity. Being aware of the latter the EC strongly recommends (and finances) different TEN-T projects in the South-East Europe, while at the same time dampening public investments to achieve fiscal adjustment no matter of the favourable investment conditions (low costs of borrowing, short-run need to boost demand). European Parliament (2016), Barbiero and Darvas (2014) and Jong-A-Pin and De Haan (2008), among others, show that public investment in the EU has decreased since the beginning of the crisis in many member states, especially those in need of fiscal consolidation. Same conclusions hold also in case of South-East European economies.

Left panel of Figure 1 shows the most recent developments in capital spending in South-East Europe. It is possible to note that Montenegro, Macedonia and Albania face a decline in public investment in 2016 with respect to 2015. World Bank (2017) points out that the size of the capital spending reductions in Montenegro, Albania and Macedonia amount to 3.7, 2 and 1.7 % GDP, respectively (right panel of Figure 1). All these reductions are undertaken to undergo fiscal consolidation, and are in line with previously mentioned trends for EU economies (cut in public spending to achieve fiscal adjustment). However, it is important to emphasize that in case of Montenegro and Macedonia this public investment cut is picturing the delay in the execution of (transport) infrastructure projects. At last, it is important to note that capital spending in left panel of Figure 1 is expressed as share in GDP and therefore an increase in the share is not always an indicator of an increase in the level of public investment. A good example of this is Serbia. Left panel of Figure 1 shows a positive trend in the amount of capital spending in % GDP in Serbia from 2013 to 2016, but due to shrinking of GDP in some of the observed years, in reality public investment decreased.

**Figure 1:** *Capital spending developments in percent of GDP in 2013-2016 (left panel) and contribution to change in total public spending in percent of GDP in 2016 (right panel)*




**(a)** **(b)**

*Source:* World Bank (2017).

The economic benefits and costs of transport investments can and often do spill over into geographic areas different from those in which the infrastructure is located. Transportation networks are provided and renewed to link populations and economic activities that are separated by distance, so by its very nature, transport infrastructure is likely to bring benefits and costs to communities different from those in which it is located.

Therefore, public investments addressed to infrastructure projects, as the one in South-East Europe, have significant potential for additional growth and add-up speed to the convergence process with remaining EU economies.

## 3. Data and methodology

In the evaluation of macroeconomic effects of public investment and total government spending it is important to identify exogenous variation in fiscal components while controlling for expectations. To identify fiscal shocks, this study follows the seminal works of Auerbach and Gorodnichenko (2013a,b) who use real time forecasts to control for expectations. Therefore, the measure of public investment shocks is obtained as the difference between actual (outturn) capital spending for period $t$ and expected (planned) capital spending as in the plan of the budget made in period $t-1$ for year $t$. Such an approach singles out unanticipated changes as capital spending forecast errors (FE) and has two main advantages (Abiad et al., 2015). On one hand, such a strategy removes the so called "fiscal foresight bias" (Leeper et al., 2012; Ben Zeev and Pappa, 2014, among others) by effectively aligning the information set of economic agents and econometricians (Auerbach and Gorodnichenko, 2013a,b). Economic agents become acquainted with changes in capital spending in time $t-1$ and have time to adjust their consumption and investment behaviour in time $t$. Therefore, using only the information contained in the change of actual (outturn) capital spending dated in time $t$ would mean relying on a smaller information set and lead to inconsistent estimates of the effects of capital spending.

On the other hand, forecast errors constructed as in Auerbach and Gorodnichenko (2013a,b) circumvent the problem of endogeneity in the estimates of fiscal policy effects. Although capital spending shocks are unanticipated they may depend on business cycle conditions. For example, it is not uncommon for capital spending projects to be postponed in case of significant revenues decrease, or to be accelerated in case of weak growth. There is a significant time lag between the quarter policy makers get information about economic conditions and the quarter eventual adjustments are implemented. Since our shocks refer to fiscal plans in time $t-1$ that capture information about both capital spending and economic conditions available up until time $t-1$, it is reasonable to consider them exogenous.

Although this analysis focuses on the effectiveness and efficiency of capital spending in South-East European countries, for comparison purposes and robustness check, our analysis includes also the effects of total government spending on main macroeconomic aggregates. In case of the latter, the same approach is followed to construct and motivate total spending forecast errors.

These forecast errors (of capital and total spending) are used to estimate the effect of fiscal shocks on a set of macroeconomic aggregates, that include: GDP, private consumption, private investment, public debt, and unemployment. Data definitions, transformations and sources are detailed in Appendix A.

The effects of fiscal shocks are estimated using local projections, a method proposed by Jordá (2005) and advocated by Stock and Watson (2007) and Auerbach and Gorodnichenko (2013a) for the study of fiscal multipliers. The main advantage of the method is that it does not impose the dynamic restrictions embedded in vector autoregression (VAR) specifications (Auerbach and Gorodnichenko, 2013a, p. 4). Jordá (2005) estimation of impulse responses by linear projections can be summarized in the following way. We are interested in estimating the effects (impulse responses) to exogenous changes in public capital spending. An impulse response can be defined as the difference between two forecasts:

$$IR(t,s,d_i) = E(y_{t+s}|v_t = d_i; X_t) - E(y_{t+s}|v_t = 0; X_t), s = 1,2,3,... \tag{1}$$

where the operator $E(\cdot|\cdot)$ denotes the best, mean squared error predictor; $y_t$ is the variable of interest (GDP, for example) vector; $X_t \equiv (y_{t-1}, y_{t-2}, \dots)$; $v_t$ is the reduced-form disturbance; and $d_i$ is the relevant experimental shock. In our case, it is a fiscal shock.

Expression (1) shows that the estimation of impulse responses is obtained via mean squared, multi-step predictions. These can be calculated by recursively iterating on an estimated model optimized to characterize the dependence structure of successive observations. A more convenient way to estimate multi-step predictions is by direct forecasting models that are reestimated for each forecast horizon. In this respect, consider projecting $y_{t+s}$ onto the linear space generated by $X_t \equiv (y_{t-1}, y_{t-2}, \dots)$:

$$y_{t+s} = \alpha^s + B_1^{s+1} y_{t-1} + B_2^{s+2} y_{t-2} + \cdots + B_p^{s+p} y_{t-p} + u_t^s, s = 1,2,...,h \tag{2}$$

where $\alpha^s$ is a constant, the $B_i^{s+i}$ are matrices of coefficients for each lag $i$ horizon $s+i$. Estimating (2) essentially involves estimating $h$ regressions, which can be seen as local projections (Jordá, 2005). According to definition (1), the impulse responses from the local- linear projections in (2) are:

$$IR(t,s,d_i) = B_1^s d_i, s = 1,2,\dots,h \tag{3}$$

with the normalization $B_1^0 = I$. Jorda (2005) shows that the impulse responses $B_1^s$, estimated by least squares, are consistent and asymptotically normally distributed. Because the error-terms of

the linear projections $u_t^s$ are a moving-average of projection errors between $t$ and $t+s$, they are orthogonal to regressors $y_{t-1}, y_{t-2}, \ldots$ Moreover, the confidence intervals of impulse responses $B_1^s$ can be estimated via heteroscedasticity and autocorrelation robust standard errors using the Newey-West estimator.

The empirical model to which we apply the above methodology can be specified as follows:

$$y_{t+h} = \alpha^h + \gamma(L)X_t + \beta^h FE_t + \epsilon_{t+h} \tag{4}$$

where $y_{t+h}$ is the variable of interest among macroeconomic aggregates i.e. the response of the variable of interest after $h$ quarters to a fiscal shock that occurs in $t$. $\alpha^h$ is a vector of constants; $X_t$ represents a set of control variables that comprise growth rates of output, inflation (GDP deflator) and growth rates of fiscal variables. These enter the model contemporaneously and with two such that the polynomial $\gamma(L)$ is of order two. $FE_t$ is the forecast error of government capital (total) spending as a share of GDP.

The data sample is 2005Q1 - 2016Q4 for all countries except Serbia, which has a time span of 2006Q1 - 2016Q4. As previously mentioned, details about the data used in the analysis are provided in Appendix A. We set the order of polynomial $\gamma(L)$ to 2, which implies and effective estimation sample of $46-H$ (Serbia: $42-H$), where $H$ is the horizon for impulse responses.

In our baseline specification, equation (1) is estimated for $H = 12$, i.e. $h = 1, ..., 12$, generating a collection of $h$ regressions where $y_{t+h}$ is projected onto the linear space generated by $FE_t$ and controls. The impulse responses are thus estimated on a 3-year horizon. Estimated coefficients $\beta$ are used to retrieve the impulse response functions with 90% confidence interval obtained using the estimated Newey-West standard errors, i.e. estimates robust to presence of heteroscedasticity and autocorrelation.

As a robustness check we also consider $H = 8$, which delivers a longer estimation sample, $H = 16$ and $H = 20$, which allows us to obtain the impulse responses and fiscal multipliers at a longer, 4-year and 5-year horizon[10]. The cost of the latter is a shorter effective estimation sample.

Our sample includes five South-East European economies: Albania, Bosnia and Herzegovina, Croatia, Macedonia and Serbia. Worth noting is that Kosovo and Montenegro are countries that form the South-East European group, but are not included in our analysis. Both were discarded due to a too short time span of available data.

Table 2 shows the mean and volatility of data used in the analysis. Although national account data enter among variables of interest $y_{t+h}$ in levels, for comparison purposes the following Table shows them in relative terms (as % of GDP). It is possible to note that in the 2005-2016 period Albania exhibits the highest growth rate of output on average, but also with the highest volatility. Bosnia and Herzegovina has the highest share of private consumption in GDP (82%) while on average private investment has the highest contribution to GDP in Albania (28%). If we compare fiscal data it is possible to observe that all countries from the sample on average run fiscal deficits, except Bosnia and Herzegovina that also shows the lowest level of debt-to-GDP ratio (29%). Moreover, the size of government is largest in the case of Serbia (44%) and smallest in the case of Albania (30%). The latter country nevertheless exhibits on average the highest share of capital spending in GDP in our sample, followed by Macedonia (5.5 and 3.6%, respectively).

[10]The cumulative impulse responses after a capital spending shock in these (robustness checks) setups are presented in Appendix E.

**Table 2:** *Descriptive statistics*

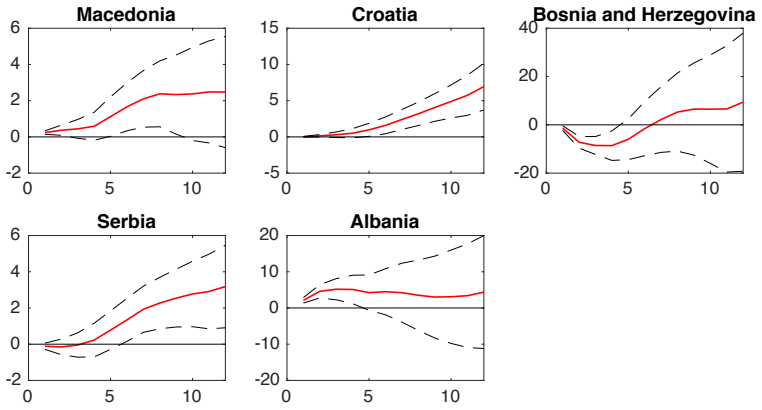
| Data | Y | $\frac{C}{Y}$ | $\frac{I}{Y}$ | $\frac{TR}{Y}$ | $\frac{TE}{Y}$ | $\frac{CapE}{Y}$ | $PD$ | $UR$ |
|---|---|---|---|---|---|---|---|---|
| Albania | | | | | | | | |
| Mean | 1.93 | 80.19 | 28.03 | 25.70 | 29.86 | 5.48 | 48.93 | 14.54 |
| St. dev | 11.35 | 1.76 | 2.33 | 1.89 | 3.13 | 2.16 | 24.67 | 1.58 |
| Bosnia and Herzegovina | | | | | | | | |
| Mean | 1.71 | 81.84 | 20.36 | 36.72 | 35.77 | 3.20 | 28.99 | 28.5 |
| St. dev | 10.16 | 3.66 | 3.51 | 1.78 | 2.17 | 0.47 | 8.12 | 1.4 |
| Croatia | | | | | | | | |
| Mean | 0.19 | 58.37 | 23.40 | 32.91 | 34.92 | 1.82 | 59.72 | 16.97 |
| St. dev | 1.24 | 1.09 | 3.56 | 1.10 | 2.22 | 0.50 | 19.55 | 2.37 |
| Macedonia | | | | | | | | |
| Mean | 0.76 | 75.28 | 26.51 | 30.22 | 32.36 | 3.55 | 34.76 | 31.29 |
| St. dev | 6.46 | 4.22 | 5.32 | 2.23 | 2.04 | 0.95 | 5.97 | 3.97 |
| Serbia | | | | | | | | |
| Mean | 0.61 | 75.07 | 20.39 | 41.99 | 44.04 | 3.39 | 49.19 | 15.92 |
| St. dev | 7.68 | 1.73 | 2.32 | 1.62 | 2.58 | 0.90 | 16.39 | 1.15 |

*Notes:* GDP growth ($Y$), share of private consumption in GDP ($\frac{C}{GDP}$), share of private investment in GDP ($\frac{I}{GDP}$), share of total government revenue in GDP ($\frac{TR}{GDP}$), share of total government spending in GDP ($\frac{TE}{GDP}$), share of capital government spending in GDP ($\frac{CapE}{GDP}$), public debt as percent of GDP ($PD$) and unemployment rate ($UR$)..

## 4. Results

Our baseline results on a 3-year horizon basis are presented in Figures 2 - 6. The impulse responses of GDP after a public investment shock provide evidence of a generally positive effect of capital spending shocks on GDP in South-East Europe (see Figure 2). The responses appear positive in Macedonia, Croatia, Albania and Serbia throughout the whole response horizon, while we observe a positive response for Bosnia and Herzegovina only with a delay of about 2 years. Given short samples, these responses come with fairly large confidence intervals, but nevertheless, significant positive multiplicative effects are observed for all countries except Bosnia and Herzegovina. The multiplicative effects are the strongest in Croatia, exhibiting also the highest level of statistical significance. For other countries the multipliers after 3 years exceed 2 (refer to Table C1 in Appendix C for point estimates of fiscal multipliers). When a longer projection horizon is considered, the multiplier gets closer to 5 in 5 years, and the positive effect of public investment on output becomes statistically significant also i the case of Bosnia and Herzegovina (see Figures E.2-1 and E.3-1 in Appendix E).

**Figure 2:** *The effect of capital spending on GDP in 3 years (cumulative)*




Figures 3 and 4 provide additional evidence of the underlying sources of positive multiplicative effects on GDP. In general we can observe some degree, albeit mostly statistically insignificant, of crowding out of private consumption. The effect of public investment on private investment, on the other hand, results to be positive. Public investment thus act as a catalyst and crowds in private investment. The only exception to this rule is Serbia. As previously mentioned in Section 2 the relationship between public investment and growth (components) depend on the productive level of capital spending. In Serbia, an important part of public capital spending supports the broad function of governments like provision of social services or redistribution (World Bank, 2017), which only indirectly alter the factor that influence productivity growth and investment (gross capital formation). Theoretically, in such (mainly) indirect effect cases the impact of public investment on productivity can be seen only in a longer-term perspective. Our results on a 4- and 5-year projection horizon presented in Sections E.2 and E.3 of Appendix E confirm such theoretical insights. Namely, Figures E.2-1 and E.3-1 show that the positive effect of public spending on output becomes larger and more significant the longer the time span of the responses.

**Figure 3:** *The effect of capital spending on private consumption in 3 years (cumulative)*

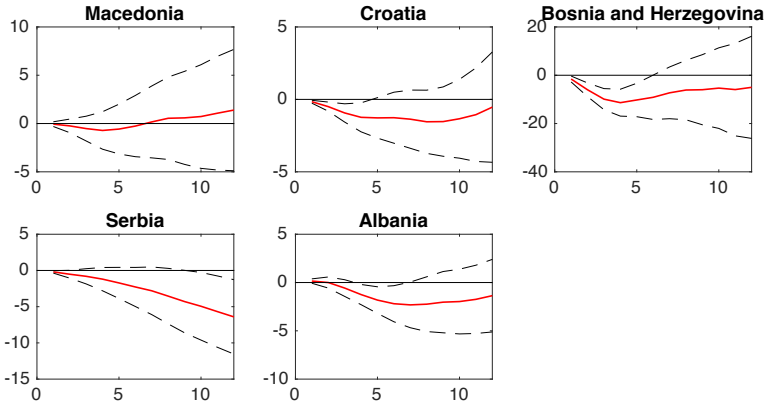
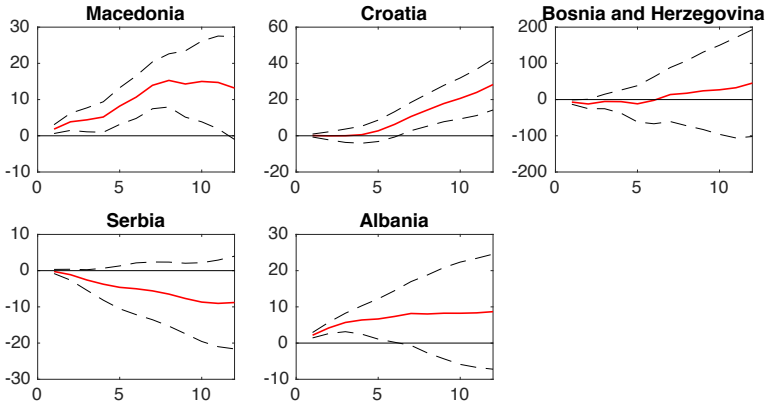


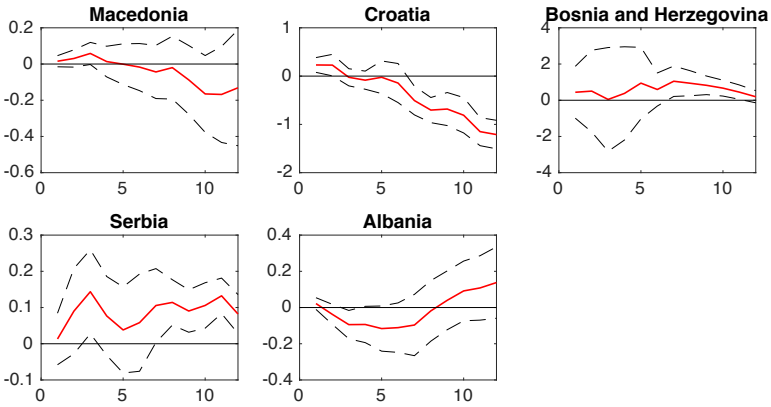
**Figure 4:** *The effect of capital spending on private investment in 3 years (cumulative)*




If we contrast our baseline results with responses of GDP to shocks to total government spending, presented in Figure D1 in Appendix D, we can observe that the sizes of corresponding multipliers are generally lower, below 1 and insignificant at the 3-year horizon. Fully in line with such an observation are the responses of private investment to shock to total government spending (see Figure D2 in Appendix D). They are broadly in line with responses to shocks to public investment, which implies absence of crowding out, but of considerably smaller magnitude. For responses of private consumption it is interesting to note that shock to total government expenditure do not crowd out spending in Macedonia, Croatia and Albania, in line with the fact that total spending is dominated by transfers to households and social security related outlays.

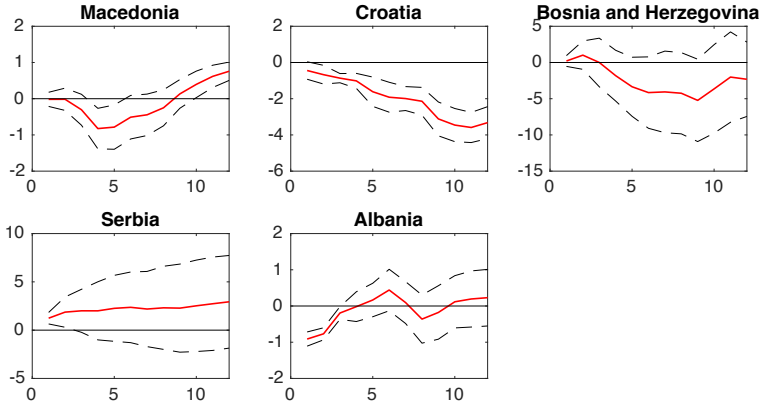
The effects of public investment shocks on unemployment rate are less clear cut across countries under analysis. A pronounced and significant decrease with a delay of about a year is observed only for Croatia. A temporary but insignificant decline is evident also for Albania, and a gradual persistent, but insignificant improvement also for Macedonia. For Serbia and Bosnia and Hercegovina public investment does not seem to reduce the unemployment rate as our estimates show even a small increase.

**Figure 5:** *The effect of capital spending on unemployment in 3 years*



Finally, we turn our attention to the effects on indebtedness. Since public investment is primarily debt financed, it is interesting to investigate whether the positive multiplicative effects on GDP are sufficient to decrease the share of public debt in GDP. From Figure 6 it follows that this is clearly the case for Croatia. After an exogenous increase in public investment of 1 % of GDP, debt-to-GDP ratio falls by more than 1 percentage point on 3-year horizon. For other countries we cannot observe similar effects. The decrease in debt-to-GDP for Albania, of about 0.1 percentage points, is only temporary. The level of indebtedness does not increase in Macedonia. For the other two countries, marginally an significantly increases in the medium term. However, the results are comparable to those in Abiad et al. (2015). On a sample of advanced OECD economies they find that higher public investment is typically followed by a reduction in the debt-to-GDP ratio but the decline in debt is statistically significant only in the short term.

**Figure 6:** *The effect of capital spending on public debt in 3 years*




Similarly to the observations we made for main GDP components, the comparison of impulse responses to shocks to total government spending presented in Figure D3 (see Appendix D) show either no positive effects on the level of indebtedness or (insignificant) increases. These results confirm our initial hypothesis that the macroeconomic effects of public investment are fundamentally different and operate through different channels than other components of government expenditure.

Additional to these results, Appendix E presents three sets of robustness check that are primarily motivated by the limited length of time series we work with. Firstly, we repeat our analysis by computing the impulse responses 8 quarters ahead, allowing us to estimated the response coefficients on longer time series. Secondly, we compute the impulse responses at a 4-year horizon, which limits the estimation sample further, but delivers longer term estimates of public investment multipliers. Finally, the projection horizon is extended to 5 years.

It can be observed that our main findings presented above are robust to these two alterations of the estimation samples. The estimation results for the 2-year projection horizon are fully in line with those for the 3-year horizon. The notable exception at 4-year and 5-year horizons is that at these two projection horizons we can observe significant positive multiplicative effects on GDP and private investment also fro Bosnia and Herzegovina, which we interpret as additional evidence that positive spill-over effects of public investment transmit through the economy with significant time lags.

## 5. Conclusion

This study contains a comprehensive analysis of macroeconomic effects of public investment for the group of South-East European countries. While at the centre of policy debate, the effectiveness of public investment in South-East European region have only scarcely analysed in the literature. The primary reason for this is lack of data both along the time dimension (short time series) and data on official budget projections that are needed to identify fiscal spending shocks. While short time series remain a challenge for present analysis, we screened budget documents (budget laws and plans) for five countries in the region to construct a unique database of exogenous innovations to public investment and total government spending.

Our main results reveal significant multiplicative effects of public investment on GDP in the South-East European region. Point estimates of medium-term multipliers are on average above two. The main channel through which public investment delivers such multiplicative effects appears to be crowding in of private investment. While we are not able to confirm positive effects on unemployment rate (with the exception of Croatia), public investment, which is primarily debt financed, seems to marginally increase the debt-to-GDP ratio only in Serbia. Our analysis also shows that macroeconomic effects of total governments spending are weaker than those of capital spending, which is an indication that also in South-East Europe public investment can be seen as a catalyst of positive spill-over effect to other sectors of the economy and thus contribute to productivity growth, while social transfers deliver only weak or no multiplicative effects.

These results can inform the policy discussion of structural policies in the region. These countries, with exception of Croatia, are in the process of EU accession seeking boost their macroeconomic outlook, especially in the aftermath of the crisis when most of the economies suffered from a productivity slowdown. The issue of public investment became even more pronounced because capital spending very often is the first to be cut in the process of fiscal consolidation. Our results show that public investment can provide important stimulus to the economies of South-East Europe and is an important factor in their catching up process.

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## Appendix A Description of data

**Table A1:** *Data definition and sources*

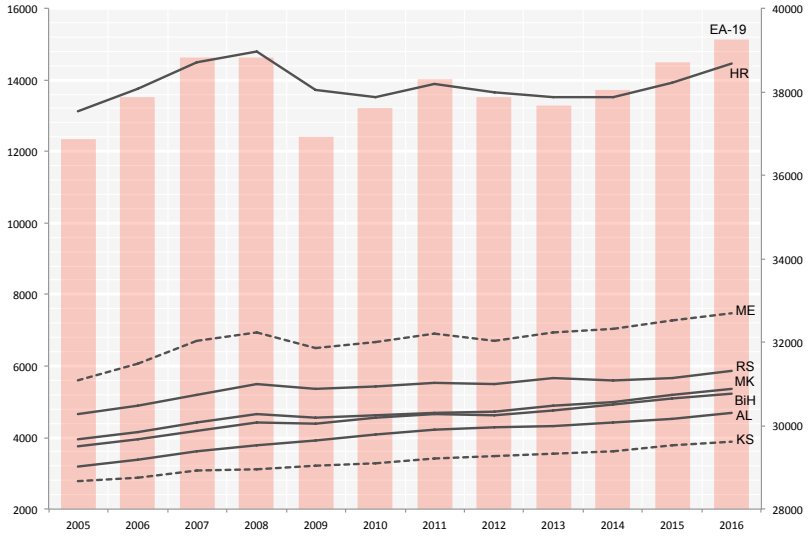
| Name | Details |
|---|---|
| **GDP** | |
| *Definition*: | Gross domestic product in millions local currency units, chain-linked volumes, reference year 2010. |
| *Transformation*: | Seasonally adjusted; logs. |
| *Source*: | National statistical offices; National central banks. |
| **Private consumption** | |
| *Definition*: | Household final consumption including NPISHs in millions local currency units, chain-linked volumes, reference year 2010. |
| *Transformation*: | Seasonally adjusted; logs. |
| *Source*: | National statistical offices; National central banks. |
| **Private investment** | |
| *Definition*: | Gross capital formation in millions local currency units, chain-linked volumes, reference year 2010. |
| *Transformation*: | Seasonally adjusted; logs. |
| *Source*: | National statistical offices; National central banks. |
| **Prices** | |
| *Definition*: | Prices measured by GDP deflator, reference year 2010. |
| *Transformation*: | - |
| *Source*: | National statistical offices; National central banks. |
| **Total budget revenues** | |
| *Definition*: | Total budget revenues, general government level, consolidated data. For Bosnia and Herzegovina data refer to the consolidated budget of the Federation of Bosnia and Herzegovina. |
| *Transformation*: | Seasonally adjusted; deflated in real terms; logs. |
| *Source*: | National ministries of finance; National central banks. |
| **Total budget spending** | |
| *Definition*: | Total budget expenditure, general government level, consolidated data. For Bosnia and Herzegovina data refer to the consolidated budget of the Federation of Bosnia and Herzegovina. |
| *Transformation*: | Seasonally adjusted; deflated in real terms; logs. |
| *Source*: | National ministries of finance; National central banks. |
| **Capital budget spending** | |
| *Definition*: | Capital budget spending, general government level, consolidated data. For Bosnia and Herzegovina data refer to the consolidated budget of the Federation of Bosnia and Herzegovina. |
| *Transformation*: | Seasonally adjusted; deflated in real terms; logs. |
| *Source*: | National ministries of finance; National central banks. |

| | |
|---|---|
| **Unemployment** | |
| *Definition*: | Unemployment rate. |
| *Transformation*: | - |
| *Source*: | National statistical offices. |
| **Public debt** | |
| *Definition*: | Total public debt in % GDP. |
| *Transformation*: | Divided by 100. |
| *Source*: | National ministries of finance; National central banks. |
| **FE capital spending** | |
| *Definition*: | Forecast error of capital spending calculated as the difference between outturn in capital spending in million local currency unit current prices and planned capital spending in million local currency unit current prices on annual basis. For Bosnia and Herzegovina data refer to the consolidated budget of the Federation of Bosnia and Herzegovina. |
| *Transformation*: | Divided by nominal GDP; Interpolated to quarterly basis according to the dynamics of general government final consumption, which was assessed as per quarter deviation from annual mean. |
| *Source*: | National ministries of finance. |
| **FE total spending** | |
| *Definition*: | Forecast error of total government spending calculated as the difference between outturn in total government spending in million local currency unit current prices and planned total government spending in million local currency unit current prices on annual basis. For Bosnia and Herzegovina data refer to the consolidated budget of the Federation of Bosnia and Herzegovina. |
| *Transformation*: | Divided by nominal GDP; Interpolated to quarterly basis according to the dynamics of general government final consumption, which was assessed as per quarter deviation from annual mean. |
| *Source*: | National ministries of finance. |

*Source:* Authors' systematisation.

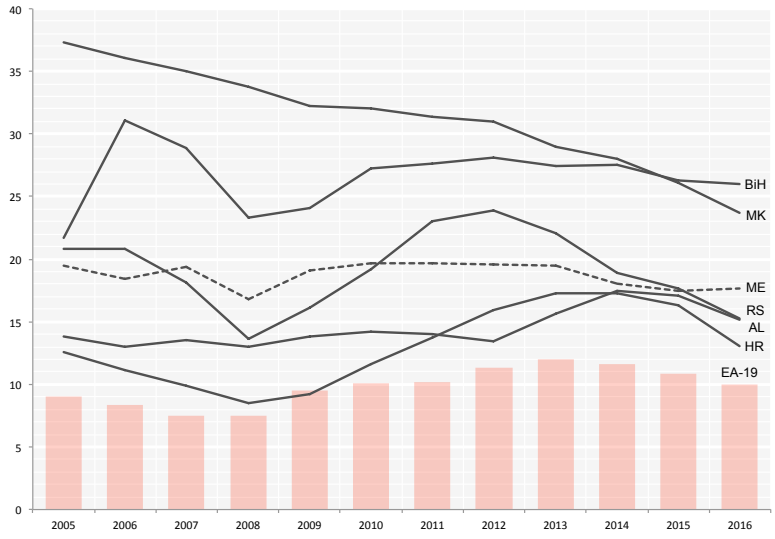
## Appendix B Macro stylised facts

**Figure B1:** *GDP per capita in South-East Europe (lines, left) and Euro Area average (bars, right), in constant 2010 USD, 2005-2015*




Source: World Bank database

**Figure B2:** *Unemployment rates (% labour force, ILO estimate) in South-East Europe and Euro Area average, in percent, 2005-2015*




Note: Unemployment data for Kosovo are unavailable.
Source: World Bank database

## Appendix C Fiscal multipliers of capital spending

**Table C1:** *Fiscal multipliers of capital spending across time in the baseline model (3-year horizon)*

| | | AL | BIH | HR | MK | RS |
|---|---|---|---|---|---|---|
| **Y** | 1y | 5.12 | -8.62 | 0.51 | 0.59 | 0.23 |
| | 2y | 3.52 | 5.29 | 3.18 | 2.37 | 2.27 |
| | 3y | 4.39 | 9.39 | 6.95 | 2.48 | 3.18 |
| **C** | 1y | -1.25 | -11.36 | -1.24 | -0.71 | -1.20 |
| | 2y | -2.25 | -6.12 | -1.55 | 0.54 | -3.54 |
| | 3y | -1.36 | -5.00 | -0.54 | 1.39 | -6.41 |
| **I** | 1y | 6.38 | -5.68 | 0.61 | 5.19 | -3.74 |
| | 2y | 8.04 | 17.51 | 14.24 | 15.29 | -6.48 |
| | 3y | 8.67 | 45.45 | 28.29 | 13.18 | -8.80 |
| **UR** | 1y | -0.09 | 0.61 | -0.08 | 0.01 | 0.08 |
| | 2y | -0.02 | 1.62 | -0.70 | -0.02 | 0.11 |
| | 3y | 0.14 | 0.31 | -1.21 | -0.13 | 0.08 |
| **PD** | 1y | -0.02 | -1.82 | -1.02 | -0.83 | 2.00 |
| | 2y | -0.36 | -4.24 | -2.14 | -0.25 | 2.31 |
| | 3y | 0.23 | -2.32 | -3.32 | 0.76 | 2.94 |

*Notes:* $AL$ - Albania; $BIH$ - Bosnia and Herzegovina; $HR$ - Croatia; $MK$ - Macedonia; $RS$ - Serbia; $Y$ - output; $C$ - private consumption; $I$ - private investment; $UR$ - unemployment rate; $PD$ - public debt.

## Appendix D Cumulative impulse responses of total government spending

**Figure D1:** *The effect of total spending on GDP in 3 years (cumulative)*

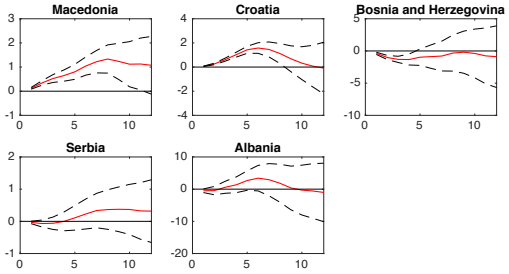



**Figure D2:** *The effect of total spending on private investment in 3 years (cumulative)*

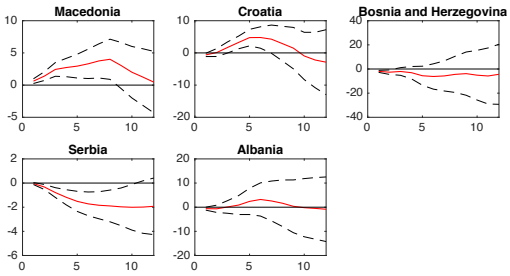



**Figure D3:** *The effect of total spending on public debt in 3 years*

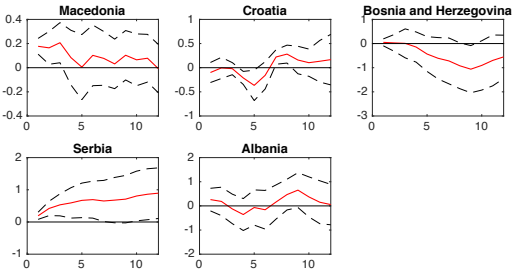



**Figure D4:** *The effect of total spending on private consumption in 3 years (cumulative)*

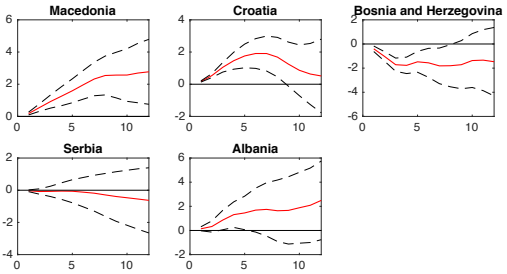
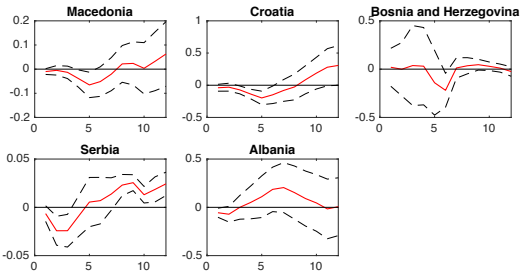



**Figure D5:** *The effect of total spending on unemployment in 3 years*



## Appendix E Robustness checks

### *E.1 Cumulative impulse responses with a 2-year projection horizon*

**Figure E.1-1:** *The effect of capital spending on GDP in 2 years (cumulative)*

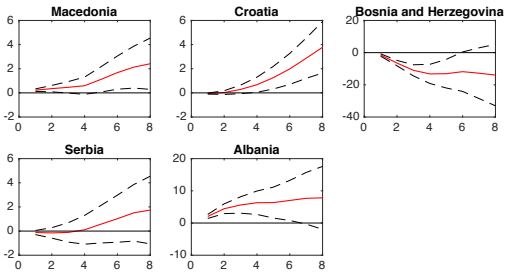



**Figure E.1-2:** *The effect of capital spending on private investment in 2 years (cumulative)*

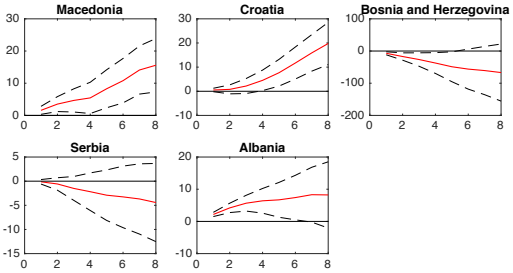



**Figure E.1-3:** *The effect of capital spending on public debt in 2 years*

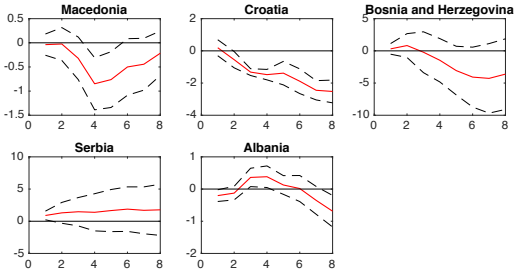



**Figure E.1-4:** *The effect of capital spending on private consumption in 2 years (cumulative)*

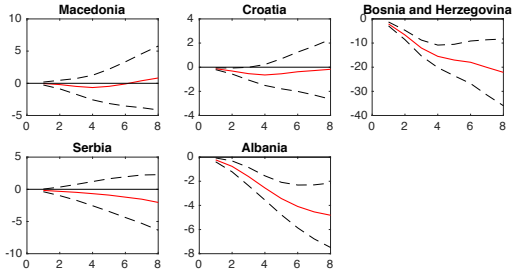
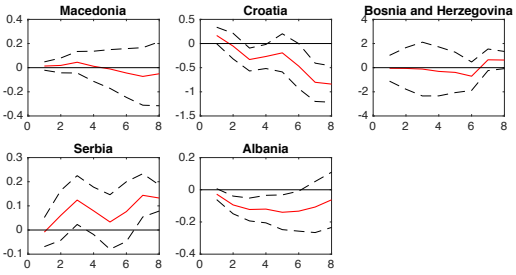



**Figure E.1-5:** *The effect of capital spending on unemployment in 2 years*



*E.2 Cumulative impulse responses with a 4-year projection horizon*

**Figure E.2-1:** *The effect of capital spending on GDP in 4 years (cumulative)*

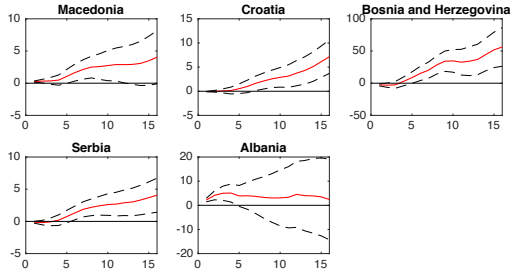



**Figure E.2-2:** *The effect of capital spending on private investment in 4 years (cumulative)*

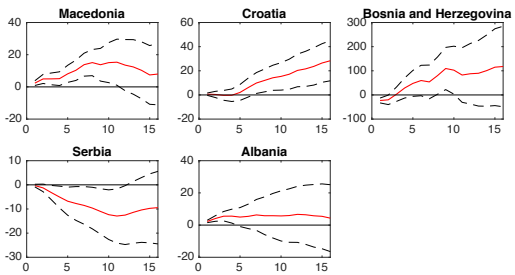



**Figure E.2-3:** *The effect of capital spending on public debt in 4 years*

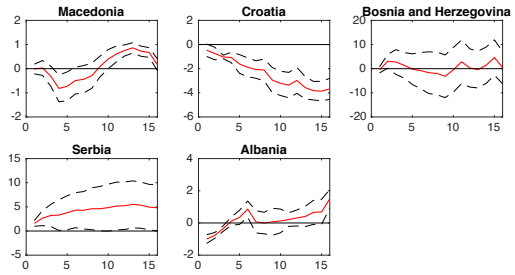



**Figure E.2-4:** *The effect of capital spending on private consumption in 4 years (cumulative)*

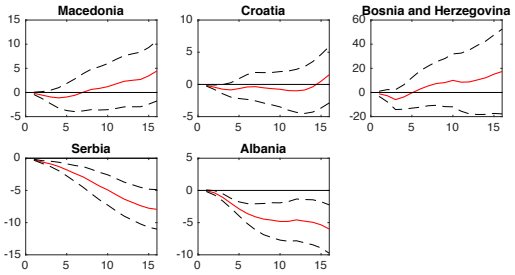
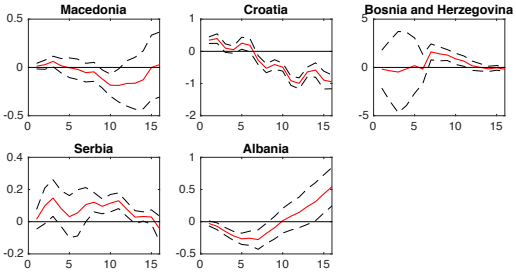



**Figure E.2-5:** *The effect of capital spending on unemployment in 4 years*



*E.3 Cumulative impulse responses with a 5-year projection horizon*

**Figure E.3-1:** *The effect of capital spending on GDP in 5 years (cumulative)*

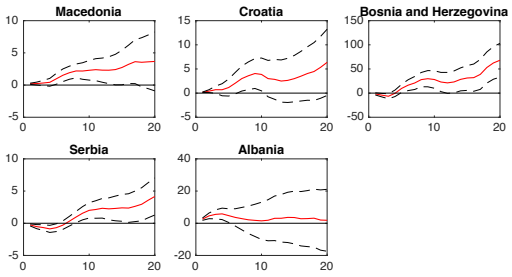



**Figure E.3-2:** *The effect of capital spending on private investment in 5 years (cumulative)*

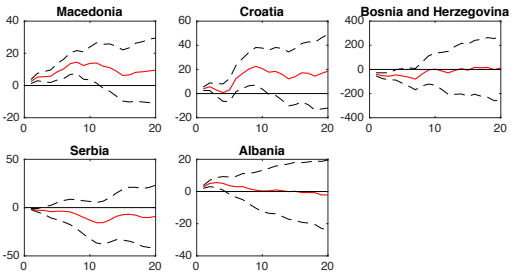



**Figure E.3-3:** *The effect of capital spending on public debt in 5 years*

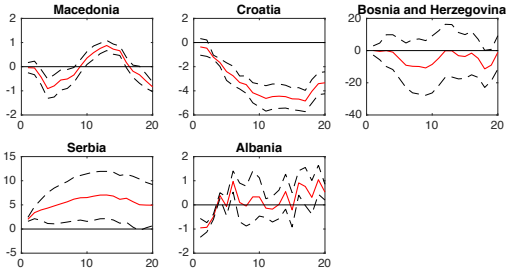



**Figure E.3-4:** *The effect of capital spending on private consumption in 5 years (cumulative)*

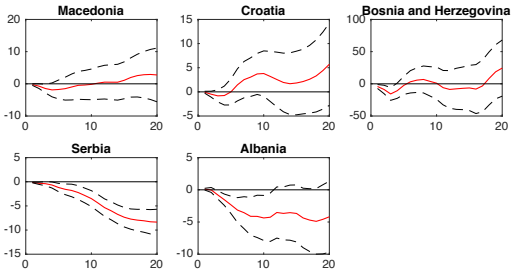



**Figure E.3-5:** *The effect of capital spending on unemployment in 5 years*