Empirica (2014) 41:687–712
DOI 10.1007/s10663-013-9232-0

ORIGINAL PAPER

Discretionary fiscal policy and economic activity in Greece

Athanasios O. Tagkalakis

Published online: 27 August 2013

Abstract This paper investigates the effects of discretionary fiscal policy changes on economic activity and its subcomponents in Greece in the period 2000–2011. Changes in government spending and net taxes have Keynesian effects. An increase in government consumption has the most pronounced positive effects on output growth, private consumption and non-residential investment, while it reduces residential investment. Cuts in the public investment programme crowd in private investment, but are associated negatively with the net exports ratio. Both indirect and direct tax hikes lower private consumption, private investment and output growth. However, higher direct taxes by lowering disposable income they reduce import demand, thus, improving the trade balance.

Keywords Discretionary fiscal policy · Economic growth · Consumption · Investment · Net exports

JEL Classification E62 · O52 · H30

1 Introduction

Fiscal and external imbalances accompanied by sovereign debt financing problems have put Greece under joint EU–IMF surveillance since May 2010.[1]

[1] See Belke (2013) for an interesting discussion on the debt mutualization in the on-going Eurozone crisis, analyzing both the so-called 'North' and 'South' perspectives.

Electronic supplementary material The online version of this article (doi:10.1007/s10663-013-9232-0) contains supplementary material, which is available to authorized users.

A. O. Tagkalakis (✉)
Economic Research Department, Bank of Greece, 21 El. Venizelos Av., 10250 Athens, Greece
e-mail: atagkalakis@bankofgreece.gr

In the context of the EUI–MF financing agreement Greek authorities implement since May 2010 the Economic Adjustment Programme (EAP) for Greece (IMF 2010). Despite mixed or limited progress in structural reforms and the privatization agenda the Greek authorities did rather well in terms of the fiscal adjustment program. The structural budget balance was reduced from −14.8 % of GDP in 2009 to an estimated −1.0 % of GDP in 2012 (European Commission 2013).

Although the fiscal consolidation is considered successful, it has come at a cost of a dramatic and continuing output contraction. The initial programme[2] foresaw that from a −2.0 % growth rate in 2009 Greece will reach a trough point in 2010 and start recovering thereafter, with the growth rates being −4.0 % in 2010, −2.6 % in 2011 and 1.1 % in 2012. However the latest European Commission forecasts (European Commission 2013) reveal that the recession was deeper and more protracted i.e., −3.1 % in 2009, −4.9 % in 2010, −7.1 % in 2011, −6.4 % in 2012 and is expected to continue in 2013 (−4.2 %). A mild recovery of 0.6 % is postponed for 2014. Though, the OECD (2013) recently announced that it projects a contraction of 1.2 % of GDP in 2014.

This dramatic output contractions reflects negative developments in private consumption, the biggest GDP sub-component,[3] which declined in real terms by 6.2 % in 2010, 7.7 % in 2011, and 9.1 % in 2012, and is expected to decline by 6.9 % in 2013 and 1.6 % in 2014 before recovering in 2015 (see European Commission 2013). In addition, gross fixed capital formation declined by 15.0 % in 2010, 19.6 % in 2011, 19.2 % in 2012, and is projected to continue falling at a slowing pace in 2013 (by 4.0 %), while a strong recovery is expected in 2014 (8.4 %).[4]

Up until recently the main reasons for this dramatic output contraction was considered to be reform fatigue, political problems and a delays in the privatization process (European Commission 2012a; IMF 2012a). However, recent IMF research (IMF 2012c; Blanchard and Leigh 2013) showed that fiscal multipliers have been underestimated by a factor of 2–3, implying that fiscal consolidation had much deeper recessionary effects. However, both the European Commission (2012b) and the ECB (2012) expressed concerns on the validity of the IMF approach and findings suggesting that they might be driven by outliers, with one of them being Greece.

[2] See European Commission (2010).

[3] The average share of private consumption to GDP in 2000–2011 is 72 %.

[4] At the same time on account of fiscal and macroeconomic developments there is a positive contribution from the external sector. The external balance of goods and services improved in 2009–2012 having a positive contributions on the change of GDP (due to falling imports and rising exports). It contributed 2.9 p.p. in 2010, 2. p.p. in 2011, 4.0 p.p. in 2012 and is expected to continue having a positive effect i.e., 2.7 p.p. in 2013 and 1.8 p.p. in 2014 (see European Commission 2013), i.e. dampening the fall in GDP driven by final domestic demand. Nevertheless in the initial programme a bigger positive contribution was projected in the years 2010–2011 and a lower one later on, i.e. 3.5 p.p. in 2010, 3.2 p.p. in 2011, 1.7 p.p. in 2012 and 1.4 p.p of GDP in 2013 (see European Commission 2010).

Driven by this discussion and need for continued fiscal consolidation in Greece in the years ahead,[5] this paper investigates the effects of fiscal policy on economic activity and its key sub-components. We intent to investigate the effect of discretionary fiscal policy changes on real GDP, private consumption, private residential and non residential investment and net exports in the period 2000–2011.

To extract the exogenous discretionary fiscal policy component we follow the fiscal policy rule literature e.g., Bohn (1998), Gali and Perotti (2003). According to Gali and Perotti (2003) the residuals of the fiscal policy rule correspond to the shock or exogenous discretionary component of fiscal policy. The extracted discretionary fiscal policy components are then inserted in GDP growth, private consumption and private (residential and non-residential) investment growth, and net exports regressions in order to assess their effects on each individual GDP component (while controlling for other relevant factors). Analogous exercises have been performed by Perotti (1999), Fatas and Mihov (2003, 2006), Tagkalakis (2008), Afonso et al. (2010) and more recently by Agnello et al. (2013).

According to our findings discretionary fiscal policy changes have Keynesian type of effects. Government spending cuts have no particular effect on the trade balance but decrease domestic demand components, lowering output growth, whereas, tax hikes lower disposable income and private spending. Cuts in government consumption has the most pronounced negative effects on output growth, private consumption and non-residential investment, while they have positive effects on residential investment (in line with the crowding out argument).

A reduction in the government wage bill lowers private consumption and output growth, but is associated positively with residential investment. Cuts in net transfers are associated with a fall in private investment and output growth. Cuts in the public investment programme crowd in private investment, but are associated negatively with the net exports ratio. Both indirect and direct tax hikes lower disposable income and discourage spending, in particular they lower private consumption, private investment and output growth. However, higher direct taxes by lowering disposable income they reduce import demand, thus, improving the trade balance.

The remainder of the paper is organised as follows. The next section reviews the reverent literature on the effects of fiscal policy on economic activity. A subsection is devoted to studies referring to Greece. Section 3 presents data information and discusses in more detail the econometric methodology. In Sect. 4 we present the main empirical findings. The last section includes a brief summary of the results and concluding remarks. An "Appendix" provides additional data information and more details about the models that have been estimated.[6]

[5] The Medium Term Fiscal Strategy 2013–2016 of the Greek government unveiled in Autumn 2012 includes consolidation measures amounting to 7.2 % of GDP for the period 2013–2014 and an additional 2.5 % of GDP measures for 2015–2016 (European Commission 2012c).

[6] A supplementary material appendix provides additional data information and the full set of empirical estimates.

2 Relevant literature

There have been two strands in the literature that examine the growth effects of fiscal policy. First, the literature that investigates the short run effects of fiscal policy on economic activity, and second, the literature that examines the effects of fiscal policy on long term growth.

2.1 Short run effects

According to the first strand of the literature the key issue is the identification of fiscal policy shocks. Several studies rely on the so-called "narrative" approach of fiscal policy of Ramey and Shapiro 1998, Edelberg et al. (1999), Burnside et al. (2004), Romer and Romer (2010) and Ramey (2011). Fiscal policy shocks are identified based either on the military build up of the Korean and Vietnam wars (defence budget expansions) or on announced and implemented changes in tax legislation ("narrative" of Presidential speeches and Congressional records). In the SVAR approach of Blanchard and Perotti (2002) fiscal shocks are identified based the assumption that discretionary fiscal policy does not respond to output within the quarter, while also estimating elasticities of fiscal variables with respect to some macroeconomic variables in order to net out the automatic effects of fiscal policy. Mountford and Uhlig (2009) identify fiscal policy shocks by imposing sign restrictions on the way fiscal and macroeconomic variables would have to behave.

Analogous studies have been undertaken for individual European countries (France, Spain, Italy and Germany) in most cases the effects point to a positive short run effect on GDP following a government spending shock and negative, but small, effect following a tax shock. See Biau and Girard (2005), Castro-Fernadez and Cos (2006), Giordano et al. (2007), Tenhofen et al. (2010).[7]

A series of other papers in the same strand of the literature focus on the impact of fiscal policy in open economies. Under flexible exchange rates an increase in government spending cannot stimulate demand because the exchange rate appreciates and capital inflows prevent interest rate from rising leading to lower net exports. Under fixed exchange rates fiscal policy is more effective, because real exchange rate appreciation pressures are offset by monetary policy. Moreover it is shown that changes in government savings should lead to changes in the current account, along with the twin deficits concept.

For example, Beetsma and Giuliodori (2011) examining 10 EU countries find that an increase in government purchases raises output, consumption and investment and reduces the trade balance. The stimulating effect is weaker and the trade balance reduction is larger for more open economies due to the trade leakage effects. As shown by Corsetti et al. (2012) an increase in government spending has a

[7] Belke (2009) highlights the important role that the prevailing uncertainty in times of crisis has in reducing the effectiveness of fiscal stimulus, which implies that option of waiting with discretionary fiscal policies in times of crisis may be valuable. According to the study of Belke (2009) the fiscal multiplier should be formulated endogenously with respect to the degree of political and economic uncertainty.

small positive effect on output, no significant effect on consumption and a fall in investment and the trade balance.

However, studies like Kim and Roubini (2008) and Corsetti and Müller (2008) find evidence that fiscal shocks identified through short run restrictions in SVARs do not lead to twin deficits. Instead, fiscal expansion and increases in budget deficits lead to real exchange rate depreciations and current account surpluses (or no impact). As Kim and Roubini (2008) point out the change in government savings appears to go both to changes in private savings and changes in investment.

Lane and Perotti (1998) find that the composition of fiscal policy and the exchange rate regime matter for the impact on trade balances. Higher wage government consumption lowers exports and deteriorates the trade balance under flexible exchange rates. Under fixed exchange rates there is no real exchange appreciation so the trade balance is not affected. Non wage government consumption has limited effects on the trade balance. Monacelli and Perotti (2008) and Ravn et al. (2007) find that an increase in government spending raises output and consumption and deteriorates the trade balance, while the real exchange rate depreciates (in Australia, Canada, UK and the US). Benetrix and Lane (2010) find a real effective exchange rate appreciation following a positive government spending shock.

Alesina et al. (2000) in a panel of OECD countries find a sizeable negative effect of public spending—and in particular of its wage component—on profits and on business investment. The findings present evidence in favor of the "non-Keynesian" or expansionary effects of fiscal adjustments.[8]

2.2 Long run effects

The second strand of the literature focuses on the effects of fiscal policy on long-term growth. According to neoclassical growth theory fiscal policy cannot affect the steady state or long-run growth rate, which is driven by the exogenous factors of population growth and technological progress (Chamley 1986). Fiscal policy can only affect the transition path to the steady-state growth. However, the endogenous growth theory, based on contributions by Barro (1990), Barro and Sala-i-Martin (1992, 2003) and Mendoza et al. (1997), by allowing for distortionary taxes and productive government spending implies that fiscal policy can affect long run growth. The conventional wisdom goes as follows: shifting the revenue stance away from distortionary forms of taxation and towards non-distortionary forms has a growth-enhancing effect, whereas switching expenditure from productive, and towards unproductive, forms is growth-retarding.

The predictions of these models is very important in the current juncture when considering the need for continuous fiscal consolidation. It could have direct

[8] These effects are due to the wage and labor costs pressures that government employment creates on the private sector. Taxation has negative effects on profits and investment, however the effect of government spending on investment is larger than that of taxes.

negative effects on growth, if in particular is targeted to productive spending components, like e.g., public investment or to increasing distortionary taxation (see Kneller et al. 1999; Bleaney et al. (2001), Gemmell et al. 2011; Égert et al. 2009).

According to Kneller et al. (1999) an increase in productive expenditures, when financed by some combination of non-distortionary taxation and non-productive expenditure, significantly enhances growth, and an increase in distortionary taxation significantly reduces growth. The authors suggest that increasing productive expenditure or reducing distortionary taxes by 1 % of GDP can modestly increase the growth rate (by between 0.1 and 0.2 % per year). More recently, Katsimi and Sarantidis (2012) find that productive expenditures such as capital expenditures, as well as transport and communication expenditure are associated with higher profits, while unproductive ones like government spending on wages and salaries has negative effects on profits. Both direct and indirect taxations reduces profits. Égert et al. (2009) show that there is positive impact of infrastructure investment on growth (although this effect varies across countries and sectors and over time).

At the same time fiscal consolidations can be expansionary as relevant theory has shown (see Giavazzi and Pagano 1990; Alesina et al. 1998; Alesina and Ardagna 2010; Alesina 2010). According to these studies fiscal adjustments could affect positively demand through confidence and wealth effects and offset the usual growth reductions following an increase in taxes and a decrease in government expenditure (i.e., the so-called Keynesian effects). This in turn improves long-term refinancing conditions, the return (i.e., the crowding-in) of private investment and, thus, the prospects of long term growth.[9] However, this non-Keynesian effects are more likely to occur if the debt to GDP ratio is very high and/or if firms and consumers are not credit constrained.

This non-Keynesian effects of fiscal consolidation have highlighted that the composition of fiscal consolidation matters. Adjustments efforts targeted more on unproductive public spending rather taxes appear to have more long lasting effects on the consolidation effort itself and on growth recovery (see e.g., Alesina and Perotti 1995; Alesina and Ardagna 2010). Blöchliger et al. (2012) points out that successful consolidation was driven by spending cuts and to a lesser extent by revenue increases. Nevertheless, Molnar (2012) finds that in large consolidation efforts multiple instruments (revenue and spending) should be used to ensure a successful outcome.

According to Sutherland et al. (2012) and Hagemann (2012) consolidation programs should target spending programmes more effectively trying to increase the efficiency and effectiveness of spending (e.g., health and education spending and spending on social policies) and eliminate distortions in taxation and re-orientate taxation to minimise distortions (broaden tax base, cut tax expenditures reduce labour taxes, increase property taxes and environmental taxes). Similarly Arnold

[9] In case of euro area countries in EU–IMF programmes the medium to long term benefis on non-Keynesian effects of fiscal policy would be the return to capital markets. However, Perotti (2012) challenges the views that fiscal consolidations will be expansionary in euro—area EU–IMF programme countries because currency depreciation is not an available option in their policy toolkit.

et al. (2011) shows that policies that could boost recovery and future growth involve increasing the tax base by paying more emphasis on consumption taxes and immovable property, at the same time they argue that reduction on income taxes and social security taxes on low incomes could accelerate recovery.[10]

Nevertheless, in cases of high debt countries such as Greece, fiscal consolidation can have positive medium and long terms effects on growth because it reduces fiscal risk premiums and long term interest rates. This in turn boosts investment, increase capital deepening and raise long term potential growth (see Kumar and Woo 2010; Cecheritta and Rother 2010; Reinhart and Rogoff 2010). In addition, spending or debt based fiscal rules contribute to improving economic growth (Afonso and Jalles 2013).

2.3 Recent studies on Greece

There haven't been many empirical studies investigating the effects of fiscal policy in Greece. This is due to the post 2000 statistical troubles in fiscal data and the subsequent data revisions. The existing studies rely mostly on pre-2000 data.[11] Angelopoulos and Philippopoulos (2007) examining the period 1960–2000 found that a smaller public sector would be good for growth in Greece. This refers in particular to government consumption and wage spending, whereas public investment is good for growth. Taxes do not seem to matter for growth. Lockwood et al. (2001) examining the period 1960–1997 find strong evidence of interaction between politics and fiscal policy in Greece. After democracy was restored in 1974, a period of fiscal laxity started which became worse in the late 1970s and continued until the early 1990s. Since 1993 there have been efforts to reverse this process and stabilize the public finances so as to gain entry into the European Monetary Union. The authors find strong evidence of pre-election fiscal euphoria under all administrations during 1960–1992. That is, during that period, immediate pre-election years are characterized by higher government expenditures and debt, and lower taxes. Such opportunistic policies have become weaker since 1993.

[10] According to Keen and Syed (2006) an increased reliance on VAT revenue tends to be associated with a sharp reduction in net exports that quickly fades. The authors attribute this to unrelated movements in consumption, and conclude that there is no trade effects of the VAT in either the short or the long run. Moreover, Mooij and Keen (2012) report that a 'fiscal devaluation' which involves shifting from social contributions to the VAT as a way to mimic a nominal devaluation could improve the trade balance in the short-run (by reducing the price of exports and increasing the price of imports), but the effects eventually disappear because the exchange rate and nominal wages adjust in the long run. Even if the exchange rate is fixed domestic wages will adjust, because workers realizing that their real wage is reduced by the increased VAT rate, they (or their unions) will aim to increase their nominal wages, moving the real producer wage back towards the pre-reform equilibrium (a process that any wage indexation, of course, would accelerate). Due to this wage adjustment fiscal devaluation will have no long run impact on product or labor market outcomes.

[11] Hence, the current study aims at fixing that missing link by studying the post 2000 effects of fiscal policy using quarterly data.

More recently and in view of Greece's sovereign debt financing problems and the need for ambitious fiscal consolidation effort there have been a couple of OECD and IMF studies including empirical estimates on the effects of fiscal policy in Greece (see OECD 2011; Ivanova and Weber 2011). In addition, the IMF in its successive reviews of the Economic Adjustment Programme of Greece made public that it has revised upwards the overall fiscal multiplier to around 1 (IMF 2013a) from its previously assumed value of 0.5 in IMF (2012a).

Turning to the links between Greece's fiscal and external imbalances, Brissimis et al. (2012) find that in the period 1960–2007 current account determinants in Greece are affected by factors such as fiscal balances, competitiveness, real convergence, private investment and macroeconomic uncertainty and financial liberalization. An increase in fiscal deficit is only partially offset by an increase in private saving, thus widening the current account deficit and providing evidence in favor of the twin deficit hypothesis and against the Ricardian equivalence.

Monokroussos and Thomakos (2012) find that the trend deterioration in the country's external imbalance in 1999–2008 is explained by: (a) accumulated loss of economic competitiveness against main trade-partner economies. (b) pronounced fiscal policy relaxation following the euro adoption—in line with the "twin deficit" hypothesis, and (c) domestic financial deepening post the euro adoption.

3 Empirical methodology

3.1 Discretionary fiscal policy

In order to extract the exogenous discretionary component of fiscal policy variables we rely on the fiscal policy rule literature (see e.g. Bohn 1998; Gali and Perotti 2003; Tagkalakis 2011). As stated by Gali and Perotti (2003) the residuals of the fiscal policy rule correspond to the shock or exogenous discretionary component of fiscal policy. Moreover, Perotti (1999) and Tagkalakis (2008) have followed an approach resembling to this one, i.e., by extracting fiscal shock from estimated quasi—VARs, which were then used to estimate the effect of fiscal policy on private consumption. More recently Afonso et al. (2010) and Agnello et al. (2013) based on Fatas and Mihov (2003, 2006) used a similar technique to obtain the discretionary component of government spending. The typical fiscal policy rule used to extract the exogenous discretionary component of fiscal policy is the following:

$$G_t = \alpha^* G_{t-1} + \beta^* Y_t + \gamma^* pb_{t-1} + \delta^* debt_{t-1} + \zeta^* \mathrm{X}_{t-1} + \eta^* EDP_t + \mu + \varepsilon_t \qquad (1)$$

G stands for the dependent (fiscal) variable,[12] Y is the real GDP growth rate, pb is the primary balance to GDP ratio, and debt is the debt ratio. Each fiscal variable is

[12] The dependent variables used are:, the change (Δln) in real government spending, the change (Δln) in real government consumption spending, the change (Δln) in real government gross fixed capital formation, the change (Δln) in real net government transfers the (Δln) change in real government compensation to employees. In the case of the government revenue related fiscal rules the following dependent variables were used: the change (Δln) in real net taxes, the change (Δln) in real current taxes on income and wealth, and the change (Δln) to real VAT revenues.

assumed to be determined by previous period decisions or persistence effects (G_{t-1}), by real economic developments and by initial fiscal conditions. EDP is the dummy variable taking value 1 in the quarters that Greece was in periods of enhanced surveillance, i.e., under the Excessive Deficit Procedure and in the context of the EAP and zero otherwise;[13] μ is a constant term, ε is a well behaved error term.

X stands for the additional control variables used, such as the change in private non-residential investment to GDP ratio, the unemployment rate, the change in the ratio of the population of working age to total population, and the change in the ratio of total employment to population of working age (see "Appendix" for data information). These additional control variables are used only in some of the regressions because we consider that the fiscal policy maker takes them into account when forming his or her policy decision. Specifically, the change (Δln) in private non-residential investment/GDP is inserted in the two public infrastructure regressions (the one expressed as a percent of GDP and the one in real percentage changes). This implies that the fiscal policy maker takes into account the behaviour of private investment when deciding public investment for the coming years (e.g., there might be co-financing in some projects from the private and the public sector). The unemployment rate is incorporated in the fiscal policy rules for net transfers and public employment. This implies that the policy maker is taking into account labour market developments when designing the government transfer programmes for the years to come and when adjusting public employment. There is anecdotal evidence that differed layers of the public sector in Greece used to provide employment on a part time, contract-based, or even on a permanent basis in times of distress (but also in good times).

The change (Δln) in the ratio of the population of working age/total population is included in the two net government transfers equations to control for the fact that fiscal transfers could increase when a bigger fraction of the population is either young or old and therefore cannot work. The change (Δln) in the ratio of total employment/population of working age is incorporated in the taxes related fiscal rules and controls for the fact that net tax revenues could behave in a different manner when a bigger rather than a smaller fraction of the population of working age is employed.

In addition, the tax revenue regressions include the change (Δln) in real share prices and the change (Δln) in real house prices. As has been shown by relevant literature (see e.g., Eschenbanch and Schucknect 2002; Tagkalakis 2011; Agnello et al. 2012) share and house prices could impact on tax revenues and primary balance developments. Hence, an increase in asset prices could boost tax revenues. If this is not controlled for in the fiscal policy rule, then the resulting increase in tax revenues will be (mistakenly) perceived as a positive tax shock.

Moreover, in the case of the tax revenue fiscal rules we control for the unemployment rate. It could be the case that an increase in unemployment reduces taxes revenues above and beyond the effect of the growth rate of real GDP. Last but not least, in all fiscal policy rules we incorporate an election dummy taking value 1 in the quarters that national elections were held (2002 Q2, 2004 Q1, 2007 Q3, and 2009 Q4) and zero otherwise. As is well established in the literature (e.g.,

[13] Greece has been in excessive deficit procedure from 2004 Q3 till 2007 Q2 and from 2009 Q1 till today. Moreover, since 2010 Q2 the Greek economy is under enhanced surveillance by the EU and the IMF.

Lockwood et al. 2001) during election times revenue collection is reduced, government spending spikes and primary balances go off track. Therefore, in order to extract the true unanticipated discretionary fiscal policy change we have to control for the effect of elections.

The fiscal policy rule is estimated by means of instrumental variables where the contemporaneous value of the growth rate of real GDP is instrumented by its first and second lagged values. We do that in order to control, to the extent possible, for reverse causation effects relative to economic activity. Reverse causation is not an issue for spending variables, because spending variables are hardly responding within the quarter to economic activity changes. This is more likely to be the case for tax revenues (i.e., revenues responding to economic activity) even with quarterly variables as have been discussed by Blanchard and Perotti (2002). Nevertheless, by instrumenting the real GDP growth rate variable with its lagged values we correct for endogeneity and automatic (within the quarter) cyclical effects. We correct for cyclical effects because the direct and automatic link between contemporaneous quarterly fiscal and economic activity variables breaks when we incorporate lagged (instead of contemporaneous) values of economic activity.[14]

3.2 The macroeconomic effects of the discretionary components of fiscal policy

To analyse the effects of discretionary fiscal policy changes on economic activity on each GDP component we use the partitioned regression analysis described in Greene (2003) and Hayashi (2000), i.e., first we formulate our output growth (private consumption, private investment and net exports) regressions. Next we partial out any contemporaneous (and lagged) effects between the right-hand-side variables (including the discretionary fiscal policy component). This allows us to obtain the true partial effect of discretionary fiscal policy on each macroeconomic variable (i.e., the discretionary fiscal component is independent of any influence from the other right-hand-side variables).

Starting from real per capita GDP we estimate a growth equation (as in Arnold et al. 2011; Cecchetti et al. 2011; Easterly and Rebelo 1993; Furceri and Zdzienicka 2011; Gemmell et al. 2011, Kneller et al. 1999, Kumar and Woo 2010) augmented with the fiscal policy components extracted from the aforementioned fiscal rules. Hence, our preferred specification resembles more to the aforementioned studies, rather that the SVAR literature.[15] The baseline specification includes no fiscal

[14] The empirical findings are not presented here due to space limitations but the relevant discussion and empirical estimates can be found in the supplementary material appendix (see section II and Table II.1).

[15] We abstract from the SVAR methodology of Blanchard and Perotti (2002) on the following grounds: given the short dataset we would have to consider at a maximum a (2 lag) 4–5 variable VAR, where we would have to alternate each GDP component in the analysis. Although the SVAR setting allows us to treat all variables as endogenous, the current specification allows studying each GDP component separately, including more relevant short as well as long term determinants. This would not be possible in the SVAR setting, unless we consider 5 different SVARs, one for each macroeconomic variable. In addition, the current setting allows us having estimates that are comparable to earlier studies focusing on the pre-2000 Greek data. As more quarterly macroeconomic and fiscal data become available both the SVAR and the current specification (as in Agnello et al. 2013) would provide better estimates. This is left for future research.

variables and was used in order to identify the appropriate lag length. The chosen lag length is 2 and reflects the presence of well behaved error term.We start from an empirical specifications of the form:[16]

$$\Delta \ln Y_t = \mu + trend + \alpha^* \Delta \ln Y_{t-1} + \beta^* \Delta \ln Y_{t-2} + \sum_{j=1}^{Nc} \gamma_{js}(L)^* \Delta \ln \Phi_{j,t} + \sum_{j=1}^{Nf} \delta_{js}(L)^* \Delta \ln G_{j,t} + \varepsilon_t \quad (2)$$

where $\gamma_s(L) = \sum_{k=0}^{2} \gamma_{sk} L^k$ and $\delta_s(L) = \sum_{k=0}^{2} \delta_{sk} L^k$ are second-order polynomials in the lag operator (L), Y stands for the growth rate (Δln) of real GDP per capita, μ is the constant term and trend refers to the time trend and ε is a well behaved error term. The vector Φ includes the independent variables affecting the real per capita GDP growth rate, where $N_c = 5$. These variables are the change (Δln) in the ratio of total employment to population of working age, the change (Δln) in the ratio of population of working age to total population, the change (Δln) in trade openness, the private debt of households and non financial corporations to GDP, and the change (Δln) in the ratio of export prices to import prices (the terms of trade).

Hence, the baseline specification follows both neoclassical and endogenous growth models.

The ratio of total employment to population of working age is included in the regression to control for the impact of the increased labor input on output growth. When the ratio of the population of working age to total population increases so does the availability of working age labor input which can boost growth.[17] At the same time an increase in the number of working age population if it is linked to higher fertility rate can be associated negative with GDP growth if it implies lower resources for the production of goods. An increase in trade openness and improved terms of trade are usually associated with higher output growth. In case of trade openness this is can be the outcome of easier access to knowledge and technological developments, exploitation of scale economies and comparative advantage in exportable sectors. While in case of terms of trade the increase in the relative price of exports implies a transfer of income to the domestic economy raising output growth. The private debt to GDP ratio reflects in part past investment decisions which can be associated with higher future capital and higher growth. At the same time it reflects improved access to credit which contributes to higher output growth.[18,19] According to IMF(2013b) real private sector credit growth has been

[16] The empirical specifications for the growth rate of private consumption, private non-residential and residential investment, and net exports are presented in the "Appendix".

[17] However, an increase in old-age means also increased saving and increased physical capital which can boost growth.

[18] Due to the small time spanned by our analysis and the quarterly data set used we abstract (as e.g., Furceri and Zdzienicka 2011) from including explicit human capital measures which are more relevant for analyzing the effect on growth in yearly data sets that cover several decades.

[19] There might be other factors that improve the growth performance, such as improvements in institutions, these are captured by the time trend.

declining since 2011 in Greece and is expected to remain in negative territory till 2015, putting at risk the soundness of the projected economic recovery (from 2014 onwards).

The vector G includes fiscal variables, i.e., the innovations extracted from the fiscal policy rules. In line with Kneller et al. (1999), Gemmell et al. (2011), Perotti (1999) and Tagkalakis (2008) we incorporate in the analysis simultaneously both spending and revenue variables to better control their possible interaction and impact on economic activity (i.e. $N_f = 2$). For example, the effect of a government spending increase is different when it is followed by a tax hike in order finance increased spending.[20]

As stated beforehand we want to extract the true partial effect of discretionary fiscal components in Eq. (2), i.e. we want to ensure that any correlation (contemporaneously and with lags) between the right-hand-side (RHS) variables is netted out. In order to do that following earlier studies (see Greene 2003; Hayashi 2000; Konstantinou and Tagkalakis 2011), we implement a partial regression analysis in Eq. (2). For example, to estimate the effects of the change of government spending on real per capita GDP growth rate, we first partial out from both the linear effects of current and lagged values of the rest of RHS variables including the time trend; letting the English alphabet letter a, b, and c denote the coefficient estimates of these new "pure" variables, we then estimate:

$$\Delta \ln Y_t = \mu + a^* \Delta \ln Y_{t-1} + b^* \Delta \ln Y_{t-2} + \sum_{j=1}^{Nc} c_{js}(L)^* \Delta \ln g_{j,t} + \eta_t \qquad (3)$$

where again $c_s(L) = \sum_{k=0}^{2} c_{sk} L^k$ is second-order polynomials in the lag operator (L).[21]

4 Empirical findings

In this section we summarize the estimated effects of discretionary fiscal policy changes on economic activity (real GDP) and its subcomponents, i.e., private consumption, private non residential investment, housing investment, and net exports. The results are shown in Tables 1, 2, 3, 4 and 5.[22]

An increase in real government spending boosts output growth (see Table 1). More specifically, a 1 % increase in real government spending raises the growth rate

[20] More specifically, when we include in the analysis analysis the change (Δln) in various real spending categories we control for revenue developments by including the change (Δln) in real net taxes. Similarly, in the case of taxes when we include the change in various real tax categories, we control for the change in real government spending.

[21] The short-run effects are estimated as the total short-run impact of the variable of interest, namely for each variable *s* as: $c_{s,t} + c_{s,t-1} + c_{s,t-2}$, whereas the long-run effects are estimated as the total long-run impact of the variable of interest, namely $[(c_{s,t} + c_{s,t-1} + c_{s,t-2})/(1-a-b)]$. By construction of the partition regression estimates there is no issue of generated regressors. The same applies for the private consumption, private residential and non residential investment and net export equations presented in the "Appendix".

[22] The full set of findings is not reported here due to space limitations but is available in the supplementary material appendix.

Table 1 The effects of fiscal policy on the growth rate of real per capita GDP (partitioned regression results)

Regressors	SR	LR	Regressors	SR	LR
Change in real government spending	0.104 (2.24)**	0.145 (2.04)**	Change in real government net taxes	−0.026 (−0.66)	−0.026 (−0.67)
Change in real government consumption spending	0.196 (3.30)***	0.222 (3.24)***	Change in real government net taxes	−0.059 (−1.82)*	−0.052 (−2.01)**
Change in real government gross fixed capital formation	−0.028 (−1.24)	−0.053 (−1.12)	Change in real government net taxes	−0.007 (−0.17)	−0.018 (−0.17)
Change in real government net transfers	0.148 (1.71)*	0.204 (1.65)	Change in real government net taxes	−0.027 (−0.73)	−0.049 (−0.80)
Change in real government compensation of employees	0.137 (1.91)*	0.166 (1.95)*	Change in real government net taxes	−0.028 (−0.72)	−0.029 (−0.76)
Change in real government current taxes on income and wealth	−0.111 (−1.78)*	−0.102 (−1.44)	Change in real government spending	0.106 (2.21)**	0.140 (1.83)*
Change in real VAT	−0.162 (−2.37)**	−0.121 (−3.40)***	Change in real government spending	0.139 (3.21)***	0.134 (3.29)***

The table reports the estimated partial effects of each variable on the respective dependent variable, i.e., the "pure" marginal effects of the regressor on the dependent variable, having partialed out the linear effect of the rest of controls form both the dependent and the explanatory variable. The R^2 and the other reported statistics refer to the multiple correlation coefficient of the original regression specification

***,**,* Significance at 1, 5 and 10 % level of significance, respectively. Robust t-statistics are reported in parenthesis

of real per capita GDP by about 0.10–0.15 % (respectively, in the short and long run). Turning to the economic activity sub-components we see that (as for output growth) it has positive effects on private consumption and net exports, but it has negative effects on both investment components (with the crowding out effect being at play here). However, in all four cases the coefficient estimate of real government spending is not particularly significant (see Tables 2, 3, 4, 5).

A simultaneous net tax hike, controlling for government spending, has negative effects on output growth and all its subcomponents. However, the effect is statistically significant only in the case of private consumption and housing investment. A 1 % increase in real net taxes lowers the growth rate of private consumption per capita by about 0.15–0.20 % (or 0.11–0.14 p.p. of GDP taking into account that the average share of private consumption to GDP is 72 %) and the growth rate of housing investment per capita by about 0.26–0.48 % (or 0.02–0.03 p.p. of GDP taking into account that the average share of housing investment to GDP is 7 %), respectively, in the long and short run (see Tables 2, 3, 4, 5).

Note that a tax hike leads to two opposing effects. First, the income effect lowers domestic incomes and reduces domestic demand and demand for imports,

Table 2 Effects on the real private consumption per capita (partitioned regression results)

Regressors	SR	LR	Regressors	SR	LR
Change in real government spending	0.059 (0.72)	0.042 (0.73)	Change in real government net taxes	−0.196 (−3.08)**	−0.145 (−3.99)***
Change in real government consumption spending	0.334 (3.13)***	0.198 (3.75)***	Change in real government net taxes	−0.086 (−1.03)	−0.060 (−1.12)
Change in real government gross fixed capital formation	−0.043 (−1.34)	−0.026 (−1.54)	Change in real government net taxes	−0.183 (−2.95)***	−0.137 (−3.55)***
Change in real government net transfers	−0.099 (−1.27)	−0.072 (−1.13)	Change in real government net taxes	−0.147 (−2.09)**	−0.118 (−2.21)**
Change in real government compensation of employees	0.482 (4.70)***	0.235 (5.41)***	Change in real government net taxes	−0.112 (−1.68)	−0.068 (−1.90)*
Change in real government current taxes on income and wealth	−0.341 (−2.07)**	−0.316 (−2.08)**	Change in real government spending	0.119 (0.82)	0.113 (0.85)
Change in real VAT	−0.295 (−3.67)***	−0.185 (−4.69)***	Change in real government spending	0.197 (1.84)*	0.142 (1.88)*

The table reports the estimated partial effects of each variable on the respective dependent variable, i.e., the "pure" marginal effects of the regressor on the dependent variable, having partialed out the linear effect of the rest of controls form both the dependent and the explanatory variable. The R^2 and the other reported statistics refer to the multiple correlation coefficient of the original regression specification

***,**,* Significance at 1, 5 and 10 % level of significance, respectively. Robust t-statistics are reported in parentheses

improving the trade balance. Second, increases in taxation imply higher labour costs and higher tax burden in general (the cost effect), which translate into lower competitiveness that worsens export performance and deteriorate the trade balance. The second effect dominates in the case of net exports (but the coefficient estimate is not particularly significant).

An increase in real government consumption boosts the growth rate of real per capita GDP. Namely, a 1 % increase in the government consumption leads to a 0.20–0.22 % increase in growth rate of real per capita GDP. The increase in real government consumption has positive effects on private consumption and non residential investment, and negative effects on housing investment, whereas net exports are not affected. In more detail, a 1 % increase in the government consumption raises real private consumption per capita by 0.20–0.33 % (0.14–0.24 p.p. of GDP), and private non residential investment by 1.3 % in the short run (or about 0.013 p.p. of GDP taking into account that the average share of private non-residential investment to GDP is 10 %), while reducing housing investment by 1.8–3.4 % (or about 0.13–0.24 p.p. of GDP), respectively in the long and short run.

Table 3 Effects on the growth rate of private investment per capita (partitioned regression results)

Regressors	SR	LR	Regressors	SR	LR
Change in real government spending	−0.405	−0.268	Change in real government net taxes	−1.075	−0.759
	(−0.91)	(−0.93)		(−1.42)	(−1.65)
Change in real government consumption spending	1.325	1.054	Change in real government net taxes	−0.939	−0.678
	(1.90)*	(1.57)		(−1.32)	(−1.58)
Change in real government gross fixed capital formation	−0.523	−0.297	Change in real government net taxes	−0.562	−0.333
	(−4.59)***	(−4.32)***		(−1.08)	(−1.14)
Change in real government net transfers	1.384	0.995	Change in real government net taxes	−1.657	−1.236
	(3.64)***	(3.21)***		(−3.13)***	(−3.29)***
Change in real government compensation of employees	1.153	0.861	Change in real government net taxes	−1.288	−0.846
	(1.48)	(1.41)		(−1.74)*	(−2.22)**
Change in real government current taxes on income and wealth	−0.242	−0.184	Change in real government spending	−0.169	−0.167
	(−0.26)	(−0.27)		(−0.32)	(−0.33)
Change in real VAT	−2.949	−1.938	Change in real government spending	0.527	0.387
	(−3.02)***	(−3.29)***		(0.91)	(0.89)

The table reports the estimated partial effects of each variable on the respective dependent variable, i.e., the "pure" marginal effects of the regressor on the dependent variable, having partialed out the linear effect of the rest of controls form both the dependent and the explanatory variable. The R^2 and the other reported statistics refer to the multiple correlation coefficient of the original regression specification

***,**,* Significance at 1, 5 and 10 % level of significance, respectively. Robust t-statistics are reported in parentheses

Controlling for spending developments in government consumption, we find that an tax hike impacts negatively on real GDP and all economic activity components in line with the Keynesian view. However, the effect is statistically significant only in the case of real GDP and housing investment. A 1 % increase in real net taxes lowers per capita output growth by about 0.05–0.06 % (see Table 1) and housing investment by about 0.87–1.72 % (or 0.06–0.12 p.p. of GDP), respectively in the long and short run (see Table 5).[23]

As a next step we examine several spending subcategories, while controlling for net taxes. An increase in public investment have negative effects on output growth, private consumption, private non-residential investment. However, the coefficient estimates are statistically significant only in the case of private non-residential investment. On the contrary, a pick up in public investment boosts net exports and residential investment (but the effect is significant only in the case of net exports).

[23] In the case of net exports the income effect that lowers import demand (and improves net exports) is outweighed by the cost effect that is associated with higher tax burden for firms which reduces exports (and reduces net exports).

Table 4 Effects on the growth rate of net exports/GDP (partitioned regression results)

Regressors	SR	LR	Regressors	SR	LR
Change in real government spending	0.621 (1.21)	0.389 (1.30)	Change in real government net taxes	−0.437 (−1.55)	−0.276 (−1.63)
Change in real government consumption spending	0.002 (0.000)	0.001 (0.000)	Change in real government net taxes	−0.477 (−1.09)	−0.336 (−1.11)
Change in real government gross fixed capital formation	0.369 (2.94)***	0.223 (2.72)***	Change in real government net taxes	−1.102 (−2.95)***	−0.816 (−2.85)***
Change in real government net transfers	0.227 (0.78)	0.154 (0.76)	Change in real government net taxes	−0.115 (−0.44)	−0.082 (−0.45)
Change in real government compensation of employees	1.029 (1.73)*	0.661 (1.60)	Change in real government net taxes	−0.513 (−1.37)	−0.313 (−1.53)
Change in real government current taxes on income and wealth	0.725 (1.85)*	0.484 (1.87)*	Change in real government spending	0.203 (0.42)	0.150 (0.42)
Change in real VAT	−0.439 (−1.16)	−0.278 (−1.29)	Change in real government spending	0.531 (1.00)	0.373 (1.08)

The table reports the estimated partial effects of each variable on the respective dependent variable, i.e., the "pure" marginal effects of the regressor on the dependent variable, having partialed out the linear effect of the rest of controls form both the dependent and the explanatory variable. The R^2 and the other reported statistics refer to the multiple correlation coefficient of the original regression specification

***,**,* Significance at 1, 5 and 10 % level of significance, respectively. Robust t-statistics are reported in parentheses

In particular we find that a 1 % increase in real gross fixed capital formation lowers private non residential investment growth by about 0.30–0.52 % or 0.03–0.05 p.p. of GDP (in line with the crowding out Keynesian argument), and raises net export to GDP ratio by about 0.22–0.37 p.p. of GDP, respectively, in the long and short run (see Tables 3, 4). Hence, public investments although they crowd out private non-residential investment, they do improve the productive capacity of domestic economy facilitating exports.[24] As previously, controlling for public investment changes, a pick up in real net taxes reduces output growth and all its subcomponents.

An increase in net government transfers raises output growth (by about 0.15 % in the short run), as well as non-residential investment (by about 1.0–1.4 % or 0.1–0.14 p.p. of GDP, respectively in the long and short run). The coefficient estimate in the remaining components is not statistically significant. Hence, increases in net transfers—that are considered as non-productive spending—fail to increase private consumption. Controlling for a net transfers, an increase in net taxes

[24] Alternatively, when spending increases and at the same time new taxes are imposed to finance the expansion the overall effect on net exports ratio is positive.

Table 5 Effects on the growth rate of housing investment per capita (partitioned regression results)

Regressors	SR	LR	Regressors	SR	LR
Change in real government spending	−0.561	−0.411	Change in real government net taxes	−0.476	−0.262
	(−1.41)	(−1.41)		(−2.21)**	(−2.17)**
Change in real government consumption spending	−3.441	−1.811	Change in real government net taxes	−1.716	−0.868
	(−6.42)***	(−9.00)***		(−5.79)***	(−6.87)***
Change in real government gross fixed capital formation	0.186	0.125	Change in real government net taxes	−0.346	−0.228
	(1.58)	(1.78)		(−1.36)	(−1.38)
Change in real government net transfers	−0.028	−0.023	Change in real government net taxes	−0.416	−0.312
	(−0.09)	(−0.09)		(−1.77)*	(−1.77)*
Change in real government compensation of employees	−2.977	−1.512	Change in real government net taxes	−1.360	−0.626
	(−5.95)***	(−9.10)***		(−6.85)***	(−7.20)***
Change in real government current taxes on income and wealth	−0.779	−0.458	Change in real government spending	−0.202	−0.146
	(−1.42)	(−1.47)		(−0.65)	(−0.66)
Change in real VAT	−0.396	−0.224	Change in real government spending	−0.334	−0.243
	(−1.36)	(−1.34)		(−0.81)	(−0.82)

The table reports the estimated partial effects of each variable on the respective dependent variable, i.e., the "pure" marginal effects of the regressor on the dependent variable, having partialed out the linear effect of the rest of controls form both the dependent and the explanatory variable. The R^2 and the other reported statistics refer to the multiple correlation coefficient of the original regression specification

***,**,* Significance at 1, 5 and 10 % level of significance, respectively. Robust t-statistics are reported in parentheses

lowers most economic activity components in a statistically significant manner (see Tables 1, 2, 3, 4, 5).

An increase in the compensation of government employees (wage bill), though the Keynesian channel of higher domestic demand, has a positive and statistically significant effect on real GDP, private consumption, and marginally significant positive effect on net exports. While the effect on residential investment is negative and the effect on non-residential investment is not significant. Specifically, a 1 % increase in compensation of government employees can boost output growth by about 0.14–0.18 % (respectively in the short and long run), private consumption by about 0.24–0.48 % or 0.17–0.35 p.p. of GDP (respectively in the long and short run), and net exports by about 1.03 p.p. of GDP (in the short run). While housing investment declines by about 1.5–2.9 % or 0.1–0.2 p.p. of GDP (respectively in the long and short run).

The positive effect on growth and private consumption is explained by the direct demand effect (increased consumption from public sector workers that spills over to the rest of the economy). However, the positive and marginally significant effect of

net exports is puzzling for two reasons. First, one would expect the trade balance to deteriorate following an expansionary fiscal policy action that boosts domestic demand which subsequently increases the demand for imports. Second, the expansion in the government wage bill, increases the wage pressure in the private sector raising labour costs (Alesina et al. 2000; Lane and Perotti 1998, 2003) which in turn worsens competitiveness and reduces exports.

However, net exports could increase if the better employment opportunities in the public sector could provide incentives to private sector employees to exert effort in order to achieve similar wage contracts something that could improve productivity and the quality of exports. Moreover, it could also induce exportable firms to improve employment conditions in the private sector in order to keep the most productive workers in place, which in turn leads to a productivity improvement, and in the enhancement of the quality exports and the likely increase in the net export ratio.

Alternatively, an increase in the government wage bill could be followed by higher future taxation and/or future fiscal troubles. This would depress demand and spending reducing import demand and improving the net exports ratio. A pick up in net taxes, controlling for the government wage-bill developments is associated negatively (though not always significantly) with all economic activity components.

Next we investigate disaggregated tax components (current taxes on income and wealth and VAT), while controlling for government spending developments. An increase in current taxes on income and wealth (or direct taxes) lowers all economic activity components, and increases of net exports ratio (in line with the conventional wisdom that higher taxes lower disposable income and import demand and hence improve the trade balance).

A 1 % direct tax hike lowers (focusing only on the statistically significant coefficient estimates) output growth by 0.1 % (in the short run), and private consumption by about 0.32–0.34 % or 0.23–0.24 p.p. of GDP (respectively in the long and short run), while raises the net exports ratio by about 0.48–0.73 p.p. of GDP (respectively in the long and short run).[25] Controlling for these tax policy changes, higher government spending increases per capita GDP growth rate (see Table 1).

A VAT tax hike has negative effects on economic activity, private consumption and private non-residential investment, while it has insignificant impact effects on the remaining components. In more detail, a 1 % increase in real VAT revenues reduces output growth by 0.12–0.16 %, private consumption by about 0.19–0.30 % or 0.14–0.22 p.p. of GDP, and private investment by about 1.9–2.9 % or 0.2–0.3 p.p. of GDP (respectively in the long and short run). Controlling for the VAT tax hikes a spending increase raises output growth and private consumption.

[25] A direct tax hike has negative but insignificant effects on both private residential and non residential investment in line with the argument suggested by Alesina et al. (2000), i.e., an increase in labour taxes induces workers to demand higher pre-tax wages, reducing profits and investment spending.

5 Conclusions

This paper investigates the effects that discretionary fiscal policy changes have on economic activity in Greece in the period 2000–2011. It brings together several strands of the literature that investigate the short and long run effects of fiscal policy on economic activity and the literature on fiscal policy rules.

The exogenous discretionary government spending and tax revenue changes are approximated with the residuals extracted from augmented fiscal policy rules. These are then incorporated in the partition regression analysis in order to estimate the effects of various government spending and tax revenue components on real GDP, private consumption, private residential and non residential investment and net taxes.

Overall, what comes out of the analysis is that discretionary fiscal policy changes have Keynesian type of effects. Increases in government spending boost demand components and output growth, while tax hikes lower disposable income and private spending. Government consumption spending has the most pronounced positive effects on output growth, private consumption and non-residential investment, while it has negative effects on residential investment. Increases in the government wage bill boost private consumption and output growth, but lower residential investment. Higher net transfers raise private investment and output growth. Public investment crowd out private investments, but are associated positively with the net export ratio. Both indirect and direct tax hikes lower disposable income and discourage spending, in particular, private consumption, private investment and output growth. However, direct tax hikes by lowering disposable income, they decrease import demand, thus, improving the trade balance.

Hence, given that the fiscal consolidation effort under the EAP has targeted spending cuts in government consumption, the wage bill, and social transfers and was accompanied by both direct and indirect tax hikes our findings verify that it did affect negatively on real per capita GDP. At the same time, in particular the direct tax hikes, have indeed contributed to improving the net export position of the Greek economy.

Overall, based on our findings of this study and the information available there is no support for the expansionary fiscal consolidation hypothesis in Greece. However, Greece must continue improving its fiscal position until it reaches a sustainable footing. This implies that fiscal interventions incorporated in the MTFS 2013–2016 (see European Commission 2012c) will continue putting a toll on economic activity. In addition, according to IMF (2013a) there is high probability that credit growth will take many years to recover, imply that Greece will most likely be faced in the near future with a so-called ‘credit-less recovery’ which are typically periods of very low growth, something that would put at risk debt-sustainability. As pointed out by the IMF (2013b) in such occasion it would be critical to minimize the duration of this credit-less recovery episode by restoring the capital base and balance sheets of the Greek banking system.

According to the EAP economic recovery, is expected to be realized in 2014. In view of the negative growth effects of fiscal consolidation this will have to be supported by other means, namely continued structural reforms, privatizations and

FDI, as well as by safeguarding that a healthy banking system will be able to support economic recovery.[26]

Acknowledgments I would like to thank the Editor Fritz Breuss and the reviewers of Empirica for the very helpful comments and suggestions. The views expressed here are mine and should not be taken to reflect those of the Bank of Greece, the European Central Bank or the Eurosystem. The usual disclaimer applies.

Appendix

Data information

Using quarterly data for the period 2000–2011 we focus on the period that Greece was part of the euro area. Greece became part of the euro area on 1st January 2001 but its euro entry was already decided in 2000, therefore we start out data set in 2000 because expectations for a euro area entry were already formed. Another reason to look at the post-2000 era relates to the fact it is only since 2000 that the statistical authorities of Greece have started the production and dissemination of quarterly non interpolated fiscal and economic activity data.

It should be taken into account that all fiscal and economic activity data have been approved by Eurostat, i.e., the data used in the analysis are not subject to any statistical deficiencies (see Eurostat 2012). The macroeconomic and fiscal data used in the analysis were all taken from the International Financial Statistics of the International Monetary Fund (IMF 2012b), the OECD Economic Outlook and the OECD Quarterly National Accounts (OECD 2012a, b). The house price data are from the Bank of Greece (2012). To correct for seasonal patterns in the quarterly data we have applied the census X12 filter.[27]

Economic activity and subcombonents: empirical specifications

Private consumption

The equation estimated resembles a consumption function augmented with fiscal policy variables extracted from the aforementioned fiscal rules, it is based on earlier studies e.g., Attanasio (1999), Peek (1983), Skinner (1994, 1996), Carroll and Kimball (1996), Carroll et al. (2011), Ludvigson and Steindel (1999), Ludwig and

[26] The internal devaluation objective on which the EU–IMF financed Economic Adjustment Programme for Greece is based implies that, labour, product and services markets reforms will facilitate the downward adjustment of labor costs, profit margins and, eventually, prices. According to European Commission (2013) falling output and comprehensive labour market reform imply that by 2014 Greece will have regained its 1995 labour cost competitiveness position relative to the Euro Area. In addition over the EU–IMF programme horizon (on account of cost competitiveness improvements) export growth has started to pick up, however, from a low base (compared to other euro area countries) and import demand has declined (on account of declining incomes). This has led to a positive contribution from the external sector (net-exports) to growth from 2009 onwards. However, this has been more than compensated by the declining domestic demand (European Commission 2013), thus structural reforms have to be stepped up.

[27] See the supplementary material appendix for additional information on data issues (definitions, descriptive statistics etc).

Sløk (2002), Perotti (1999), Grant and Peltonen (2008) and Tagkalakis (2008). The baseline specification includes no fiscal variables and is used in order to identify the appropriate lag length. The chosen lag length is 2 and reflects the presence of well behaved error term. We start from an empirical specifications of the form:

$$\Delta \ln C_t = \mu + trend + \alpha^* \Delta \ln C_{t-1} + \beta^* \Delta \ln C_{t-2} + \sum_{j=1}^{Nc} \gamma_{js}(L)^* \Delta \ln \Phi_{j,t} + \sum_{j=1}^{Nf} \delta_{js}(L)^* \Delta \ln G_{j,t} + \varepsilon_t \quad (4)$$

where $\gamma_s(L) = \sum_{k=0}^{2} \gamma_{sk} L^k$ and $\delta_s(L) = \sum_{k=0}^{2} \delta_{sk} L^k$ are second-order polynomials in the lag operator (L), C stands for the growth rate (Δln) of real private consumption per capita, μ is the constant term and trend refers to the time trend and ε is a well behaved error term. The vector Φ includes the independent variables affecting the real per capita private consumption growth rate, where $N_c = 5$. These variables are the percentage change (Δln) in real house and real share prices, the percentage change (Δln) in real net disposable income per capita, households' private debt to GDP ratio, and the percentage change (Δln) in domestic credit to private sector.[28]

Private residential and non residential investment

The baseline equation estimated resembles a q type investment equation studied previously in the literature (see e.g., Abel and Blanchard 1986; Alesina et al. 2000; Caballero 1999; Gilchrist and Himmelberg 1998). The dependent variable is the growth rate of private investment per capita. The baseline specification includes no fiscal variables and was used in order to identify the appropriate lag length. The chosen lag length is 2 and reflects the presence of well behaved error term. Our empirical specifications is of the form:

$$\Delta \ln I_t = \mu + trend + \alpha^* \Delta \ln I_{t-1} + \beta^* \Delta \ln Y_{t-2} + \sum_{j=1}^{Nc} \gamma_{js}(L)^* \Delta \ln \Phi_{j,t} + \sum_{j=1}^{Nf} \delta_{js}(L)^* \Delta \ln G_{j,t} + \varepsilon_t \quad (5)$$

where $\gamma_s(L) = \Sigma_{k=0}^{2} \gamma_{sk} L^k$ and $\delta_s(L) = \Sigma_{k=0}^{2} \delta_{sk} L^k$ are second-order polynomials in the lag operator (L), I stands for the growth rate (Δln) of real private non residential investment per capita, μ is the constant term and trend refers to the time trend and ε

[28] Real house and real share prices are included in the regression in order to control for the wealth effect on private consumption (marginal propensity to consume out of wealth); net disposable income controls for the income effect (marginal propensity to consume out of income). Households' private debt to GDP ratio and the growth rate of domestic credit to private sector control for the availability of credit (easiness of monetary conditions) and the impact it had on the increase in private consumption in Greece in the period 2000–2011. The vector G includes fiscal variables. The full set of results and summary of the findings for the control variables is not presented here due to space limitations but is available in the supplementary material appendix.

is a well behaved error term. The vector Φ includes the independent variables affecting the real per capita private non-residential investment growth rate, where $N_c = 5$. These variables are: the percentage change (Δln) in real house and real share prices, the percentage change (Δln) in real gross operating surplus per capita, the ratio of private debt of non financial corporations to GDP, and the percentage change (Δln) in domestic credit to private sector.[29]

Turning to residential investment, we estimate two specifications for housing investment analogous to Eqs. (5) and (3) augmented with discretionary components of fiscal policy changes. The dependent variable is the growth rate of housing investment per capita. The control variables used are: the percentage change in real house and real share prices, the percentage change in real net disposable income per capita, private debt of households to GDP, and the percentage change in domestic credit to private sector. The baseline specification resembles housing investment functions studied previously in the literature (see e.g. Egebo et al. 1990; Jacobsen et al. 2007; Donatos 1995 etc.), augmented with fiscal policy variables.[30]

Net exports to GDP

Our preferred baseline specification follows closely studies such as Lane and Perotti (1998, 2003) Keen and Syed (2006), Mooij and Keen (2012) as well as previous studies on Greece, such as Brissimis et al. (2012), Monokroussos and Thomakos (2012). The dependent variable is the change in the net exports to GDP ratio. The baseline specification includes no fiscal variables and was used in order to identify the appropriate lag length. The chosen lag length is 2 and reflects the presence of well behaved error term. We estimate an empirical specification of the form:

$$\Delta \ln NX_t = \mu + trend + \alpha^* \Delta \ln NX_{t-1} + \beta^* \Delta \ln NX_{t-2} + \sum_{j=1}^{Nc} \gamma_{js}(L)^* \Delta \ln \Phi_{j,t} + \sum_{j=1}^{Nf} \delta_{js}(L)^* \Delta \ln G_{j,t} + \varepsilon_t \quad (6)$$

where $\gamma_s(L) = \sum_{k=0}^{2} \gamma_{sk} L^k$ and $\delta_s(L) = \sum_{k=0}^{2} \delta_{sk} L^k$ are second-order polynomials in the lag operator (L), NX stands for the change (Δ) in the net exports to GDP ratio,

[29] Real share prices are included in the regression in order to control, as proxies, for marginal q, while real house prices control for possible interactions with the housing market. Gross operating surplus controls for the effect of profit on investment decisions. Private debt of non financial corporations to GDP ratio and the growth rate of domestic credit both control for the availability of credit (and the easiness of monetary conditions) and the impact that it had on private non residential investment in Greece in the period 2000–2011. The vector G includes fiscal variables.

[30] The housing investment and the net disposable income variables are expressed in per capita terms to net out any population effects on housing investment demand. Real house prices control for house price developments, real share prices are included in order to control for alternative financial type of investments—which could be considered substitutes. The net disposable income controls for the income effect. Private debt of households to GDP ratio controls for the level of households' liabilities, i.e., an overexposed household sector could be associated with lower housing investment. Finally, the growth rate of domestic credit controls for the availability of credit and easiness of monetary conditions; easy access to credit and housing loans facilitate housing investment.

μ is the constant term and trend refers to the time trend and ε is a well behaved error term. The vector Φ includes the independent variables affecting the net exports ratio, where $N_c = 5$. These variables are: the percentage change (Δln) in real effective exchange rate in ULC terms, the growth rate (Δln) of real GDP per working age population, the growth rate (Δln) of real GDP per working age population in the OECD, the ratio of domestic credit to private sector to GDP, and the percentage change (Δln) in crude oil prices in euro terms.[31]

References

Abel A, Blanchard O (1986) The present value of profits and cyclical movements in investment. Econometrica 54(2):249–273

Afonso A, Jalles JT (2013) Do fiscal rules matter for growth? Appl Econ Lett 20:34–40

Afonso A, Agnello L, Furceri D (2010) Fiscal policy responsiveness, persistence and discretion. Public Choice 145(3):503–530

Agnello L, Castro V, Sousa R (2012) How do fiscal policy react to wealth composition and asset prices? J Macroecon 34:874–890. doi:10.1016/j.jmacro.2012.04.001

Agnello L, Furceri D, Sousa R (2013) How best to measure discretionary fiscal policy? Assessing its impact on private spending. Econ Model. doi:10.1016/j.econmod.2012.10.020

Alesina A (2010) Fiscal adjustments: lessons from recent history, Paper prepared for the Ecofin meeting in Madrid, April 15

Alesina A, Ardagna S (2010) Large changes in fiscal policy: taxes versus spending. In: Brown JR (ed) Tax policy and the economy, vol 24. National Bureau of Economic Research, Cambridge

Alesina A, Perotti R (1995) Fiscal expansions and adjustments in OECD economies. Econ Policy 21:207–247

Alesina A, Ardagna S (1998) Tales of fiscal adjustment. Econ Policy 13:498–545

Alesina A, Ardagna R, Perotti R, Schiantarelli F (2000) Fiscal policy, profits, and investment. Am Econ Rev 92(3):571–589

Angelopoulos K, Philippopoulos A (2007) The growth effects of fiscal policy in Greece 1960–2000. Public Choice 131:157–175

Arnold JM, Brys B, Heady C, Johansson A, Schwe C, Vartia L (2011) Tax policy for economic recovery and growth. Econ J 121:59–80

Attanasio O (1999) Consumption. In: Taylor JB, Woodford M (eds) Handbook of macroeconomics, vol 1. Elsevier Science, Amsterdam, pp 741–812

Bank of Greece (2012) Bulletin of conjuctural indicators, vol 144

Barro R (1990) Government spending in a simple model of endogenous growth. J Political Econ 98(5):103–126

Barro R, Sala-i-Martin X (1992) Public finance in models of economic growth. Rev Econ Stud 59(4):645–661

Barro R, Sala-i-Martin X (2003) Economic growth, vol 1, 2 edn. The MIT Press, Cambridge

Beetsma R, Giuliodori M (2011) The effects of government purchases shocks: review and estimates for the EU. Econ J 121(550):4–32

[31] The real effective exchange rate controls for the impact of competitiveness developments on Greece's external accounts. A real appreciation (an increase in the index used) deteriorates competitiveness conditions and lowers net exports. Real GDP per capita captures the impact on the demand for imports—an increase in the variable of interest should decrease net exports. Real GDP per capita in OECD countries controls for foreign demand—higher foreign demand will lead to higher net exports. The ratio of domestic credit to private sector to GDP controls for credit conditions and credit availability. A developed financial sector facilitates trade operations and borrowing. Given that Greece runs persistent trade deficits, it is most likely that the net effect is positive, i.e., it facilitates imports; a finding reported by Brissimis et al (2012). Finally, given Greece's dependence on oil imports, higher oil prices in euro terms will reduce net exports. The vector G includes fiscal variables ($N_f = 2$).

Belke A (2009) Fiscal stimulus packages and uncertainty in times of crisis—The option of waiting can be valuable, though! Econ Anal Policy 39(1):25–46
Belke A (2013) Debt mutualisation in the Ongoing Eurozone crisis—a tale of the 'North' and the 'South', the new Palgrave dictionary of economics. In: Durlauf SN, Blume LE (eds) Palgrave Macmillan, Houndmills, Basingstoke. http://www.dictionaryofeconomics.com/article?id=pde2013_D000273
Bénétrix A, Lane P (2010) Fiscal shocks and the sectoral composition of output. Open Econ Rev 21(3):335–350
Biau O, Girard E (2005) Politique budgetaire et dynamique economique en France: l'approche VAR structurel. Economie et Prevision 169–171:1–24
Blanchard O, Leigh D (2013) Growth forecast errors and fiscal multipliers. IMF, working papers, no. 1
Blanchard O, Perotti R (2002) An empirical characterization of the dynamic effects of government spending and taxes on output. Quart J Econ 117:1329–1368
Bleaney M, Gemmell N, Kneller R (2001) Testing the endogenous growth model: public expenditure, taxation and growth over the long-run. Can J Econ 34(1):36–57
Blöchliger H, Song DH, Sutherland D (2012) Fiscal consolidation: part 4. Case studies of large fiscal consolidation episodes, OECD economics department working papers, no. 935
Bohn H (1998) The behavior of US public debt and deficits. Quart J Econ 113(3):949–963
Brissimis SN, Hondroyiannis G, Papazoglou C, Tsaveas NT, Vasardani MA (2012) Current account determinants and external sustainability in periods of structural change. Econ Change Restruct Springer 45(1):71–95
Burnside C, Eichenbaum M, Fischer J (2004) Fiscal shocks and their consequences. J Econ Theory 115(1):89–117
Caballero RJ (1999) Aggregate investment. In: Taylor JB, Woodford M (eds) Handbook of macroeconomics, vol 1B. North-Holland, Amsterdam, pp 813–62
Carroll CD, Kimball MS (1996) On the concavity of the consumption function. Econometrica 64(4):981–992
Carroll CD, Otsuka M, Slacalek J (2011) How large are housing and financial wealth effects? A new approach. J Money Credit Bank 43(1):55–79
Castro Fernández FD, Cos PHD (2006) The economic effects of exogenous fiscal shocks in Spain: a SVAR approach, ECB working paper, no. 647
Cecchetti SG, Mohanty MS, Zampolli F (2011) The real effects of debt, BIS working paper, no. 352
Cecheritta C, Rother P (2010) The impact of high and growing government debt on economic growth. An empirical investigation for the euro area, European Central Bank, working paper, no. 1237
Chamley C (1986) Optimal taxation of capital income in general equilibrium with infinite lives. Econometrica 54(3):607–622
Corsetti G, Müller GJ (2008) Twin deficits, openness, and the business cycle. J Eur Econ Assoc 6(2–3):404–413
Corsetti G, Meier A, Müller GJ (2012) What determines government spending multipliers? IMF, working paper 12/150
Donatos G (1995) A quantitative analysis of investment in new housing in Greece. Urban Stud 32(9):1475–1487
Easterly W, Rebelo S (1993) Fiscal policy and economic growth: an empirical investigation. J Monet Econ 32(3):417–458
ECB (2012) Monthly bulletin. ECB, Frankfurt
Edelberg W, Eichenbaum M, Fischer J (1999) Understanding the effects of a shock to government purchases. Rev Econ Dyn 2(1):166–206
Egebo T, Richardson P, Lienert I (1990) A model of housing investment for the major OECD economies. OECD Econ Stud 14:151–188
Égert B, Koźluk T, Sutherland D (2009) Infrastructure and growth: empirical evidence. OECD Economics Department Working Papers, No 685
Eschenbanch F, Schucknect L (2002) Asset price booms and monetary policy. ECB working paper, no. 364
European Commission (2010) The economic adjustment programme for Greece, occasional paper 61, May
European Commission (2012a) The second economic adjustment programme for Greece, occasional paper 94, March
European Commission (2012b) Economic forecasts, Spring 2012

European Commission (2012c) Second economic adjustment programme for Greece—first review: December, occasional papers, no. 123
European Commission (2013) The second economic adjustment programme for Greece, second review, occasional paper 148 May
Eurostat (2012) News release, provision of deficit and debt data for 2011—second notification, no 49/2012, 22 Oct 2012
Fatas A, Mihov I (2003) The case for restricting discretionary fiscal policy. Quart J Econ 118:1419–1447
Fatas A, Mihov I (2006) The macroeconomic effects of fiscal rules in the US states. J Public Econ 90:101–117
Furceri D, Zdzienicka A (2011) How costly are debt crises? IMF working papers no 11/280
Gali J, Perotti R (2003) Fiscal policy and monetary integration in Europe. Econ Policy 18(37):533–572
Gemmell N, Kneller R, Sanz I (2011) The timing and persistence of fiscal policy impacts on growth: evidence from OECD countries. Econ J 121:33–58
Giavazzi F, Pagano M (1990) Can severe fiscal contractions be expansionary? Tales of two small european countries. In: Blanchard O, Fischer S (eds) NBER macroeconomics annual 1990. MIT Press, New York
Gilchrist S, Himmelberg C (1998) Investment: fundamentals and finance. In: Bernanke BS, Rotemberg JJ (eds) NBER macroeconomics annual, vol 13. MIT Press, Cambridge, pp 223–262
Giordano R, Momigliano S, Neri S, Perotti R (2007) The effects of fiscal policy in Italy: evidence from a VAR model. Eur J Polit Econ 23(3):707–733
Grant C, Peltonen T (2008) Housing and equity wealth effects of Italian households, by ECB working paper, no. 857
Greene W (2003) Econometric analysis, 5th edn. Prentice Hall, Upper Saddle River
Hagemann R (2012). Fiscal consolidation: part 6. What are the best policy instruments for fiscal consolidation? OECD Economics Department working papers no. 937
Hayashi F (2000) Econometrics. Princeton University Press, Princeton
IMF (2010) Greece: Staff report on request for a stand-by arrangement, IMF, country report no. 10/110
IMF (2012a) Greece: Request for extended arrangement under the extended fund facility, IMF Country report no. 12/57
IMF (2012b) International financial statistics. IMF, Washington
IMF (2012c) World economic outlook. Autumn, IMF, Washington
IMF (2013a) First and second review under the extended arrangement under the extended fund facility, request for waiver if applicability, modification of performance criteria, and rephrasing of access. IMF Country report, no. 13/20
IMF (2013b) Greece-article IV consultations. Selected issues papers, IMF, Washington
Ivanova A, Weber S (2011) Do fiscal spillovers matters? IMF working paper no. 11/211
Jacobsen DH, Solberg-Johansen K, Haugland K (2007) Housing investment and house prices, Central Bank of Norway. Econ Bull 78:33–46
Katsimi M, Sarantidis V (2012) The impact of fiscal policy on profits. Econ Inq 50:1050–1068
Keen M, Syed M (2006) Domestic taxes and international trade, IMF working paper no 06/47
Kim S, Roubini N (2008) Twin deficit or twin divergence? Fiscal policy, current account, and real exchange rate in the U.S. J Int Econ 74(2):362–383
Kneller R, Bleaney M, Gemmell N (1999) Fiscal policy and growth: evidence from OECD countries. J Public Econ 74:171–190
Konstantinou P, Tagkalakis A (2011) Boosting confidence: is there a role for fiscal policy? Econ Model 28:1629–1641
Kumar M, Woo J (2010) Public debt and growth, IMF working papers, no. 10/174, International Monetary Fund
Lane P, Perotti R (1998) The trade balance and fiscal policy in the OECD. Eur Econ Rev 42:887–895
Lane P, Perotti R (2003) The importance of composition of fiscal policy: evidence from exchange rate regimes. J Public Econ 87:2253–2279
Lockwood B, Philippopoulos A, Tzavalis E (2001) Fiscal policy and politics: theory and evidence from Greece 1960–1997. Econ Model 18:253–268
Ludvigson S, Steindel C (1999) How important is the stock market effect on consumption? FRBNY Econ Policy Rev, issue Jul, pp 29–51
Ludwig A, Sløk T (2002) The impact of changes in stock prices and house prices on consumption in OECD Countries, IMF working paper No. 02/1

Mendoza E, Milesi-Ferretti G, Asea P (1997) On the effectiveness of tax policy in altering long-run growth: Harberger's super neutrality conjecture. J Public Econ 66(1):99–126
Molnar M (2012) Fiscal consolidation: part 5. What factors determine the success of consolidation efforts? OECD Economics Department working papers no. 936
Monacelli T, Perotti R (2008) Openness and the sectoral effects of fiscal policy. J Eur Econ Assoc 6(2–3):395–403
Monokroussos P, Thomakos DD (2012) Can Greece be saved? Current account, fiscal imbalances and competitiveness, London School of Economics, Hellenic Observatory on Greece and Southeast Europe, GreeSE paper no. 59
Mooij RD, Keen M (2012) Fiscal devaluation and fiscal consolidation: The VAT in troubled times, IMF working paper, No. 12/85
Mountford A, Uhlig H (2009) What are the effects of fiscal policy shocks? J Appl Econ 24(6):960–992
OECD (2011) OECD economic surveys: Greece 2011. OECD Publishing, Paris
OECD (2012a) Economic outlook, no. 91. OECD, Paris
OECD (2012b) Quarterly national accounts database. OECD, Paris
OECD (2013) Economic outlook, no. 93. OECD, Paris
Peek J (1983) Capital gains and personal saving behavior. J Money Credit Bank 15:1–23
Perotti R (1999) Fiscal policy in good times and bad. Quart J Econ 114(4):1399–1436
Perotti R (2012) The "Austerity Myth": gain without pain? NBER chapters. In: Fiscal policy after the financial crisis, National Bureau of Economic Research, Inc., pp 307–354
Ramey V (2011) Identifying government spending shocks: it's all in the timing. Quart J Econ 126(1):1–50
Ramey V, Shapiro M (1998) Costly capital reallocation and the effects of government spending. Carnegie-Rochester Conference Series on Public Policy 48(1):145–194
Ravn MO, Schmitt-Grohé S, Uribe M (2007) Explaining the effects of government spending shocks on consumption and the real exchange rate, NBER working papers 13328
Reinhart CM, Rogoff KS (2010) Growth in time of debt. Am Eco Rev 100(2):573–578. doi:10.1257/aer.100.2.573
Romer CD, Romer DH (2010) The macroeconomic effects of tax changes: estimates based on a new measure of fiscal shocks. Am Econ Rev 100(3):763–801
Skinner JS (1994) Housing and saving in the United States, NBER chapters, In: Housing markets in the U.S. and Japan, National Bureau of Economic Research, Inc., pp 191–214
Skinner JS (1996) Is housing wealth a sideshow? NBER chapters, In: Advances in the economics of aging, National Bureau of Economic Research, Inc., pp 241–272
Sutherland D, Hoeller P, Merola R (2012) Fiscal consolidation: part 1. How much is needed and how to reduce debt to a prudent level? OECD Economics Department working papers, no. 932
Tagkalakis A (2008) The effects of fiscal policy on consumption in recessions and expansions. J Public Econ 92(5–6):1486–1508
Tagkalakis A (2011) Fiscal policy and financial market movements. J Bank Finance 35(1):231–251
Tenhofen J, Wolff GB, Heppke-Falk KH (2010) The macroeconomic effects of exogenous fiscal policy shocks in Germany: a disaggregated SVAR analysis. J Econ Stat 230(3):328–355