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AKADÉMIAI KIADÓ

# The long-term impact of public expenditures on GDP-growth

GÁBOR KUTASI* and ÁDÁM MARTON

Research Institute of Competitiveness and Economy National University of Public Service, Budapest, Hungary

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**ABSTRACT**

Are governments able to continuously boost economic growth by spending for decades? Can the state be a more efficient user of income by improving the structure of public spending? The paper analyses the correlation between various types of public expenditures and GDP growth in different countries of the EU. The database was composed from the Classification of the Functions of Government (COFOG) classification of public spending, which contains data of 25 EU economies in the period 1996–2017. Three econometric models were applied in accordance with the empirical practice found in the literature: first-differences general method of moment (GMM), fixed effects panel and ordinary least squares (OLS) models. The expenditures on social protection proved to have a negative, statistically significant and robust impact on GDP growth. The results are similar for general public spending, and while spending on public order also has a significant and robust coefficient, its sign is ambiguous. The novelty of the article relate to the findings on lagged education and health spending, which have a positive impact on GDP growth.

**KEYWORDS**

public expenditures, economic growth, EU, GMM, OLS, fixed effects

**JEL CODES**

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* Corresponding author. E-mail: kutasi.gabor@uni-nke.hu

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## 1. INTRODUCTION

The 20th century resulted in increasing volumes of public spending and expanding fields of government activity. This may have been due to increasing wariness of economic crises experienced in the past, or voters' growing demand for social services, or to political decision makers' inclination to increase the public budget rather than to reduce social benefits. However, this also led to a policy dilemma of whether more public or more private control over spending of the national income would result in higher future income. The economic theory about aggregate demand assumes that public finances have an additional impact on economic output. The general GDP equation in aggregate demand or national expenditure form explicitly includes government expenditures as a component of income. This correlation between economic growth and expenditure structure is assumed by economics. The impact of public finances is measured by fiscal multipliers (Both tax and expenditure multipliers can be calculated. In this case, the latter of these is important.) One of the major dilemmas in macroeconomic analysis is whether public spending and tax revenue can support economic growth, help recovery, counteract downturns, or, on the contrary, limit growth. For example, research in the 2010s has reinterpreted the effectiveness of the fiscal activity of the state, clearly altering the assessment of whether the financial activity of the general government may generate growth surpluses. There appears to be an assumption that the answer is independent from the composition and quality of public revenue and expenditure. Just how much this assumption is valid remains questionable, and it is therefore worth analysing the composition of tax revenues and the structure of government expenditures.

Halmai (2015) outlines the growth challenges confronting European economies, including their fiscal structure and imbalances. He established that the European model faced a challenge originating in the absence of a convergence mechanism, and this is why the integration mechanism became dysfunctional. He claimed that the "*rebirth of convergence is both a challenge to and a precondition of European renewal and reform*." Among other things, Halmai concluded that the imbalances of public finances and a need for sustainable public finances are the sources of conflicts. Benczes (2010) collected and synthesised successful approaches in the European cases of fiscal consolidation, such as reforms and growth factors.

An examination of the expenditure structure reveals which areas dominate fiscal policy. It is worth examining the proportion of expenditure on human capital and infrastructure, which secure long-term sustainable economic growth and competitiveness in high value-added, knowledge-intensive sectors (For example, Darvas et al. (2018) sought the optimal level of health spending.) A structural analysis of public finances highlights the importance of the composition of fiscal austerity, the distribution of surpluses and the shift in winners' and losers' income levels by redistribution.

Empirical calculations on fiscal multipliers indicate that different types of appropriation can be of different intensities. This phenomenon implies that the structure of the public budget (both on the tax and expenditure side) has a significant impact on the volume of GDP. This study works on the basis of this assumption, and aims to quantify the impact of the structure of public expenditures on growth of per capita GDP.

The methodology of the study is built on a panel regression analysis of EU countries. Based on the literature review, it was necessary to use more than one model to analyse the impact of spending on different areas on GDP-growth: ordinary least squares (OLS), fixed effects panel and first-differences general method of moment (GMM) model tests were executed in EViews on a dataset for 25 EU countries covering 1996–2017. The research question was as follows: Do the various appropriations (i.e. public spending by function) accelerate or slow down the speed of economic growth? An exact hypothesis is not formulated as the significance, the intensity and the (positive/negative) sign can differ for each type of appropriations.

## 2. LITERATURE REVIEW

The literature on the impact of the structure of public finances on economic growth is clearly split into tax and expenditure analyses. In this study, only the literature related to expenditure is relevant. Barro (1990) laid the foundations of models of public finance structure by extending the endogenous growth models with the addition of tax-financed government services that affect production. He found that growth rates initially rise with productive government expenditures but subsequently fall when there is an increase in utility-type expenditures. However, it is not easy to be conclusive about the relationship between expenditure structure and economic growth. Barrios and Schaechter (2008) refer to Gerson (1998), Avila and Strauch (2003) and Afonso and Furceri (2008), whose results are inconclusive about the impact of expenditure structure. Their experience is that, principally, public transfers and consumption are typically estimated to have a negative impact on growth. However, Avila and Strauch (2003) estimate that EU countries' public investments have had a positive influence on growth, while Afonso and Furceri (2008) do not find EU and OECD economies' public investments to be significant in determining growth.

Several types of econometric models have been proposed in empirical studies of the correlation between public expenditures and economic growth. Kneller et al. (1999) applied econometric models to time series panel data for 22 OECD countries for the period 1970–1995. They considered five different forms of panel data estimator for each regression: pooled OLS, one-way (country dummies) fixed (by OLS), random (by GLS) and two-way (country and time effects) fixed, and random effects models. They also distinguished between productive and non-productive expenditures. Productive government expenditure was defined as spending which enhanced growth, while non-productive expenditure did not. The expenditures classified as non-productive were proved to have equal coefficients, and consequently these variables had a zero impact on growth. An increase in productive expenditures was found to significantly enhance economic growth. Both of these results were consistent with the Barro (1990) model. Kneller et al.'s paper reached an important methodological conclusion about lagged impact: the magnitudes of the estimated impacts of productive expenditures are sensitive to the process of 5-year averaging of the data, which suggests that considerable caution should be exercised in predicting the precise effects of changes in public finances on growth.

Boldeanu and Tache (2015) is the methodological forerunner of the current study, as it analysed the correlation between public expenditure and economic growth for 30 European countries in the period of 1991–2012 with OLS, LSDV and GMM econometric models on the Classification of the Functions of Government (COFOG) database. It thus served as a specific methodological pattern, and the conclusion was that most of the sub-areas of public spending affected economic growth negatively. Fölster and Henrekson (2001) analysed the OECD countries in the period of 1970–1995 with several panel regression models and measured the negative relationship between expenditure and economic growth. To quantify this, a 10 percentage point increase of the expenditure-to-GDP ratio resulted in a 0.8 percentage point decrease in the growth rate. Shijaku and Gjokuta (2013) based their empirical analysis on the GMM model. The impacts of expenditure on growth were analysed by categorising state spending into productive and non-productive expenditure. Their first finding was that government revenue growth had a higher effect on economic growth than government expenditure. The second finding was that, predictably enough, growth was affected positively by productive expenditure and negatively by non-productive expenditure.

Macek (2014) conducted a panel regression analysis of the crowding out effect on the structure of total government spending where unproductive spending (e.g. funding of the welfare state and social security) predominates, which lowers the GDP growth ratio. The analysis found that government expenditures affect economic growth negatively. He concluded that this phenomenon can probably be linked to the crowding out effect on the structure of total government spending where unproductive expenditure constitutes the majority share. Bania et al. (2007) used a GMM model to analyse the impacts on growth of taxes and government expenditures, and concluded that Barro model-style “growth hills” are present for U.S. states, which means that the incremental effect of tax-financed expenditures on productive government activities is non–monotonic and initially positive (a positive linear effect), but eventually negative. The explanation is the same as that later given by Macek (2014), that is, the decline originates from the crowding out effect of rising taxes, which reduces the net return to private capital.

Beyond OLS and GMM, the application of the VAR model can also be found in the paper of Sever et al. (2011). The VAR model is not relevant to the current study, but its results can confirm our conclusions. This VAR model resulted in the following: capital expenditures have a positive effect on economic growth in the short and long term; the impact of expenditures on goods and services are positive in the long term, with greater fluctuations in the short term; the current consumption, compensation of employees and subsidies in all cases indicated a negative effect on GDP in the long term; the subsidies in all specifications in the short term increase GDP, while in the long run they affect it negatively.

Barrios and Schaechter (2008) confirmed the negative correlation between public spending and economic growth, although they indicated a weak positive correlation between government investments and economic growth, or between education spending and education quality indicators such as functional literacy results. Such phenomena may suggest that even though in the short term the expenditure types have a negative coefficient with economic growth, a very long-term positive effect should not be excluded. Since students spend several years in the education system, spending on education has a long lagging impact. In the current analysis, the lags are used in the case of spending variables, but models and time series limited the length of these lags (for education spending, lags range between 1 and 10 years in the analysis). Fournier and Johansson (2016) concluded that larger governments were significantly and negatively associated with long-term growth, while the mix of spending affected the impact on GDP growth, and, according to these two determinants, the Swedish mix of public expenditures seemed to be the most growth-friendly among the OECD countries.

Table 1 summarizes the results of the empirical literature.

**Table 1.** Summary of the empirical literature

| Study | Methodology | Database, region, period | Results relevant to the impact of expenditure structure on GDP/capita growth |
|---|---|---|---|
| Barrios – Schaechter (2008) | Statistical analysis | COFOG, 24 industrialized countries, 1980–2005 | –growth can be supported by public expenditure oriented towards investment in human capital (education, health), R&D spending, public infrastructure |
| Avila – Strauch (2003) | Panel unit root, panel cointegration | AMECO, 15 EU countries, 1960–2001 | –coefficient on total expenditures are negative, |
| | | | –total public investment: positive |
| | | | –total transfers: negative |
| | | | –government consumption spending: negative |
| Bania et al. (2006) | GMM (Arellano-Bond style) | U.S. Census of Governments, states of USA, 1962–1997 | –negative impact on growth of the first lag of health and welfare expenditures of local governments (only one type of expenditure was included in the model) |
| Afonso – Furceri (2008) | Cross-section time-series regressions | OECD Economic Outlook, OECD+EU states, 1970–2004 | –sizeable, negative, significant effect on growth of government consumption, subsidies, government investment |
| Kneller et al. (1999) | Pooled OLS, fixed OLS, random GLS | World Bank data, 22 OECD states, 1970–1995 | –negative growth impact of non-productive expenditures |
| | | | –increase in productive expenditures significantly positive for growth |
| Boldeanu – Tache (2015) | GMM, OLS, fixed effects panel (LSDV-estimator) | Eurostat, AMECO, 30 European states, 1991–2012 | –massive negative impact of general services, public debt transactions, economic affairs, environmental affairs, health, recreation and religion (only in GMM), education, social protection (no lag was used) |
| | | | –positive impact of research expenditures, defence (only in GMM), public order and police |
| | | | –minimal positive impact of housing and community amenities, but not significant |
| Fölster – Henrekson (2001) | OLS | OECD data, OECD countries, 1970–1995 | –robust negative relationship between public expenditure and growth in rich countries |
| | | | –0.7–0.8 percentage points decrease in the growth rate caused by 10 percentage points increase in expenditure ratio |

*(continued)*

**Table 1.** Continued

| Study | Methodology | Database, region, period | Results relevant to the impact of expenditure structure on GDP/capita growth |
|---|---|---|---|
| Sever et al. (2011) | VAR | Croatian Ministry of Finance, Croatia,1994–2008 | -positive effects of investment spending, purchases of goods and services, capital expenditures |
| | | | -negative effects of other current spending |
| Shijaku – Gjokuta (2013) | GMM | INSTAT (ALB), Albania, 1998q1-2010q4 | -positive impact of productive expenditures |
| | | | -negative impact of non-productive expenditures |
| | | | -p-value 0.1, weak significance |
| Macek (2014) | panel regression | OECD National Accounts Statistics, OECD countries, 2000–2011 | -lower economic growth by growth of first lag of government spending dominated by unproductive items |
| Fournier – Johansson (2016) | OLS with fixed effect | COFOG, OECD countries, 1987–2014 | -public investment and education support growth |
| | | | -pensions and public subsidies lower growth |

*Source*: compiled by the authors.

# 3. METHODOLOGY AND QUALITY OF DATA

## 3.1. Empirical model

The aim of this paper is to analyse the impact of the structure of public expenditures on GDP per capita growth rate. The empirical analysis of the study is built on econometric models. Three models were used, in accordance with the findings of the literature review: the first-differences panel GMM estimator, the fixed effects panel estimator and the OLS method. Each of these three models had different limitations. The OLS results are published as a control test, but they were not considered to be decisive, since this estimator is not considered to be appropriate for panel data analysis due to the possibility of inconsistent results. To avoid the limitations of the OLS model and to solve causality problems, the two-stage least squares (2SLS) model was also tried. However, when this model was applied, the number of instrument variables proved to be relatively few in comparison to the number of determinants. Thus, the 2SLS estimator was not feasible. In addition, panel data estimation techniques were also used: the fixed and random effects panel models.[1] However, these two analytical methodologies do not address the endogeneity problem posed by each control variable. The instrumental variable or IV technique is

[1]Based on the Hausman test, the fixed effects model was applied.

one of the methods that can be used to solve this problem. GMM is a possible way to implement this technique and eliminate the endogeneity problem, which justified its application (It must be noted that the GMM method has disadvantage as it ignores structural breaks and cross-sectional dependencies). The context and the different types of the GMM method have been extensively considered in the literature, for example by Arellano and Bond (1991), Arellano and Bover (1995) and by Blundell and Bond (1998). The comparison of GMM and fixed effects panel estimator results is an established practice in the empirical literature as demonstrated by Fidrmuc and Degler (2019), among others.

The dependent variable in our model is the annual change of real GDP per capita in constant prices, expressed as a percentage. The independent variables were distributed into two groups for methodological reasons. The first group – related to the research question – contains the different types of expenditure variables. The data source is the Eurostat's COFOG database about general government annual expenditure by function as a percentage of GDP, at the two-digit level as follows:

- GF01 General public service
- GF02 Defence
- GF03 Public order and safety
- GF04 Economic affairs
- GF05 Environmental protection
- GF06 Housing & community amenities
- GF07 Health
- GF08 Recreation, culture, religion
- GF09 Education
- GF10 Social protection

The other group of determinants contain factors of GDP which were treated as so-called instrument variables in the GMM model version. Some of these variables relate to the short-term utilisation of GDP, from Eurostat's "GDP and main components" annual database, taken as a percentage of GDP. The variables include:

- Household Consumption (HC) (Eurostat: P31_S14 Final consumption expenditure of households)
- Investment (GFCF) (Eurostat: P51G Gross fixed capital formation)
- Net Export (NX) (Eurostat: P6–P7 Exports of goods and services – Imports of goods and services)

Other determinant and instrument variables are long-term factors, related to the Solow-Swan model of economic growth:

- Population change (POP) – Population growth (annual) - percentage (The World Bank Data)
- Total Factor Productivity (TFP) – percentage changes (OECD)

The change of GDP is assumed to be determined by the initial level of development (Barro 1991). To incorporate this economic thesis into the model, the lagged logarithmic value of GDP per capita ($GDP\_PC_{t-1}$) is included as a determinant, calculated in international dollasr on purchasing power parity base, constant prices (2017=100). The data was imported from the World Bank's Data website (https://data.worldbank.org/).

Finally, a dummy variable was introduced to take into account and test the impact of monetary integration, which is relevant in the EU. In the period from 1996 to 2017, eleven of the 28 EU countries introduced the euro in 1999–2001, and eight others after 2009. As the literature on integration economics attributes a growth effect to participation in the single currency zone, it is reasonable to apply this variable. The EURO Dummy ($D_{eur}$) is 1 if the country was a euro zone member in the given year, and 0 if not.

Based on the above variables and grouping system, the basic equation of the OLS and fixed effects panel model is as follows:

$$\begin{aligned} gpd\_pc\_gr_{i,t} = {} & \alpha + \beta_1 \ln gdp\_pc\_cons_{i,t-1} + \beta_2 GF01_{i,t} + \beta_3 GF02_{i,t} + \beta_4 GF03_{i,t} + \beta_5 GF04_{i,t} \\ & + \beta_6 GF05_{i,t} + \beta_7 GF06_{i,t} + \beta_8 GF07_{i,t} + \beta_9 GF08_{i,t} + \beta_{10} GF09_{i,t} + \beta_{11} GF010_{i,t} \\ & + \beta_{12} HC_{i,t} + \beta_{13} GFCF_{i,t} + \beta_{14} NX_{i,t} + \beta_{15} POP_{i,t} + \beta_{16} TFP_{i,t} + \beta_{17} Deur_{i,t} + u_{i,t}, \end{aligned} \tag{1}$$

where $i$ denotes each country, $t$ is a time horizon, while $t-1$ is a lagged version of the given variable, and $u_{i,t}$ is the error term.

The basic equation of the GMM model including independent and instrumental variables is thus:

$$\begin{aligned} gpd\_pc\_gr_{i,t} = {} & \beta_1 \ln gdp\_pc\_cons_{i,t-1} + \beta_2 GF01_{i,t} + \beta_3 GF02_{i,t} + \beta_4 GF03_{i,t} + \beta_5 GF04_{i,t} \\ & + \beta_6 GF05_{i,t} + \beta_7 GF06_{i,t} + \beta_8 GF07_{i,t} + \beta_9 GF08_{i,t} + \beta_{10} GF09_{i,t} + \beta_{11} GF010_{i,t} \\ & + u_{i,t}\,. \end{aligned} \tag{2}$$

Since the GMM model includes the intuition that health and education spending can impact economic growth with a time lag, various alternative lag specifications were tested. The lagged version of the estimated equation has the following form in case of applying the second lag of these two variables (GF07 and GF09), while other variables continue to enter the model contemporaneously:

$$\begin{aligned} gpd\_pc\_gr_{i,t} = {} & \beta_1 \ln gdp\_pc\_cons_{i,t-1} + \beta_2 GF01_{i,t} + \beta_3 GF02_{i,t} + \beta_4 GF03_{i,t} + \beta_5 GF04_{i,t} \\ & + \beta_6 GF05_{i,t} + \beta_7 GF06_{i,t} + \beta_8 GF07_{i,t-2} + \beta_9 GF08_{i,t} + \beta_{10} GF09_{i,t-2} \\ & + \beta_{11} GF010_{i,t} + u_{i,t} \end{aligned} \tag{3}$$

The GMM model separated the variables into independent and instrumental variables, while the fixed effects panel and the OLS model considered all of them to be determinants (independent and control variables). The components of GDP were used as instrumental variables, including household consumption, net exports, gross fixed capital formation (GFCF), population change and total factor productivity, since these variables are potentially endogenous. Furthermore, according to the Arellano-Bond version of GMM, a first lag of the dependent variable ($GDP\_PC\text{-}GR_{t\text{-}1}$) was inserted among the instrument variables to improve the significance of the results and to address the endogeneity problem.

In the GMM model, the spending on education and health (GF07 and GF09) were tested with and without lags. The rationale for the lagged GMM model version is a simple economic intuition that the educational programs, vocational trainings, medication and healing has a delayed effect, because productivity and capacity advantages can be realized after students finish the school or patients leave the hospital. This can have a longer lagging positive impact from a

**Table 2.** Descriptive statistics of variables

| Variable | Obs. | Mean | St. Dev. | Min | Max | Data source |
|---|---|---|---|---|---|---|
| GDP per capita (%) at constant prices | 550 | 2.46 | 3.61 | −14.6 | 23.9 (Ireland – 2015) | Eurostat |
| GDP per capita (PPP, constant 2017 international dollar) | 550 | 34,030.80 | 12,480.41 | 9,492.154 | 73,034.51 | World Bank |
| Gen. Public Service, % of GDP | 550 | 6.82 | 2.35 | 2.8 | 18.0 | Eurostat |
| Defence, % of GDP | 550 | 1.39 | 0.57 | 0.3 | 3.6 | Eurostat |
| Public order, % of GDP | 550 | 1.79 | 0.45 | 0.5 | 3.8 | Eurostat |
| Economic affairs, % of GDP | 550 | 4.97 | 1.74 | 1.3 | 25.0 | Eurostat |
| Environment, % of GDP | 550 | 0.71 | 0.35 | −0.3 | 1.9 | Eurostat |
| Housing, % of GDP | 550 | 0.82 | 0.48 | 0.0 | 2.9 | Eurostat |
| Health, % of GDP | 550 | 5.85 | 1.48 | 1.8 | 8.9 | Eurostat |
| Culture, % of GDP | 550 | 1.15 | 0.41 | 0.3 | 3.5 | Eurostat |
| Education, % of GDP | 550 | 5.19 | 1.03 | 2.8 | 7.5 | Eurostat |
| Social protection, % of GDP | 550 | 15.92 | 4.22 | 7.5 | 25.6 | Eurostat |
| Household Consumption/GDP | 550 | 76.76 | 6.54 | 44.0 | 91.7 | Eurostat |
| Net Export/GDP | 550 | 0.29 | 6.68 | −20.6 | 30.4 | Eurostat |
| GFCF/GDP | 550 | 22.33 | 4.17 | 4.5 | 37.3 | Eurostat |
| Population change (%) | 550 | 0.19 | 0.75 | −2.25 | 2.89 | World Bank |
| Total Factor Productivity change (%) | 540 | 2.14 | 2.93 | −14.4 (Bulgaria – 1997) | 20.2 (Ireland – 2015) | OECD |

*Source*: authors' calculations, based on COFOG, Eurostat, OECD, and World Bank Data.

human resource perspective, similar to the J-curve effect related to current account adjustment policy.

### 3.2. Data

The database is based on the annual time series data of 25 EU countries from 1996 to 2017. Of the 28 EU countries, the following three had to be omitted because of missing data or because they were outliers: Slovenia, Croatia and Luxemburg. Data sources for Slovenia were incomplete for some variables. Croatia was not part of the European Union for the majority of the period examined, which resulted in a lack of available data. Luxembourg, due to its size, would have caused a significant positive bias in the estimates of our models. The descriptive statistics of the variables are shown in Table 2.

Before the model-based examinations, the stationarity of the data series must be examined. The Levin-Lin-Chu (Levin et al. 2002) panel unit root test was used to examine the stationarity of the time series. Based on the unit root test, three variables (GF08 Culture, Households final consumption, Net exports) cannot be considered as stationary, which was improved by the implementation of first difference values.

In panel regression approaches, fixed and random effect methods can be applied. In order to decide which panel method is relevant to our database, we applied the Hausman test. In this case, the Hausman test decided that the fixed effects panel model is appropriate with 0.0000 probability.

## 4. RESULTS

In the assessment of the results in Table 3, the focus is on the GMM model's coefficients, while the fixed Effects model results are the controls. The OLS model's results are published only because this type of econometric model has been used in the existing literature related to the topic, and although it is not adequate for panel data, it is, however, much more suitable for time series analysis, as previously stated. For the GMM model, the Arellano-Bond (AR) autocorrelation test was applied to exclude the time series correlations between the observations. The Hansen-J test was also used to eliminate over-identification of instruments. The obtained test results were satisfactory, and can be used to interpret the results of the model.

According to the GMM model's coefficients, it can be established that not every COFOG category has an impact on economic growth at a 5% level of significance for the panel of 25 EU countries in the period 1996–2017. Examples of such areas are the spending on Defence (GF02), Economic Affairs (GF04), Environment (GF05), Housing (GF06), Culture (GF08) and Social protection (GF10). Furthermore, Education (GF09) was significant and indicated a very big effect, but had a negative sign. When lagging was considered in case of human resource factors (GF07 and GF09), the parameters estimated turned to plus 1, which is significant at the 5% level. Health (GF07) with a positive sign and Social protection (GF10) with a negative sign are significant at 1%. General Public Service (GF01) was measured to be significant at 1% with a negative sign in both GMM version. This phenomenon was confirmed by the fixed effects panel model, too, although with a smaller coefficient.

The version with lagged spending on human resource factors confirmed the significance of Public order (GF03) and Education (GF09), but resulted in an opposite sign: spending on

**Table 3.** Regression results

| Variables | GMM without lags | GMM lag GF07 (−2) lag GF09 (−2) | Fixed effects panel | OLS |
|---|---|---|---|---|
| log ($GDP\_PC_{t-1}$) | −10.62129*** | −13.32526*** | −1.207927* | 0.061398 |
| Gen. Public Serv. (GF01) | −1.014892*** | −1.185489*** | −0.257978*** | −0.042294 |
| Defence (GF02) | −0.298298 | −1.062589 | −0.074768 | −0.157454 |
| Public order (GF03) | 1.844727** | −2.113140* | 0.742371* | −0.114661 |
| Economic affairs (GF04) | −0.185403 | −0.209788 | −0.217615*** | −0.253853*** |
| Environment (GF05) | 0.603493 | 0.417994 | −0.634368 | −0.667288** |
| Housing (GF06) | −1.866467 | −1.510810 | 0.248707 | −0.719031*** |
| Health (GF07) | 1.204227** | 1.775365*** | −0.098916 | −0.167492* |
| Culture (GF08) | −0.782528 | −0.968098 | 0.066286 | 0.500533 |
| Education (GF09) | −6.629252*** | 1.122787*** | −1.110893*** | −0.147332* |
| Social protection (GF10) | −0.778523* | −1.566842*** | −0.487053*** | −0.112929*** |
| *Instrumental variables in GMM, other determinants in OLS and fixed effects panel* | | | | |
| Household Consumption | – | – | −0.855761*** | −0.908843*** |
| Net Export | – | – | −0.431015*** | −−0.478261*** |
| GFCF | – | – | 0.052971 | 0.124913*** |
| Population change | – | – | −0.891778*** | −0.241925 |
| Total Factor Productivity | – | – | 0.454067*** | 0.507579*** |

*(continued)*

**Table 3.** Continued

| Variables | GMM without lags | GMM lag GF07 (−2) lag GF09 (−2) | Fixed effects panel | OLS |
|---|---|---|---|---|
| Euro Dummy | – | – | −0.326429 | −0.596491*** |
| GDP_PC-GR $_{t-1}$ | – | – | not included | not included |
| Number of observations | 494 | 471 | 517 | 517 |
| $R^2$ | – | – | 0.804290 | 0.758686 |
| Hausman test | – | – | 0.0000 | – |
| Hansen J test | 0.142129 | 0.077807 | – | – |
| Instrument rank | 25 | 25 | – | – |

*Source*: authors' calculations based on COFOG, Eurostat, OECD, and World Bank Data.
*Notes*: significance: *** at 1%, ** at 5%, * at 10%; Hausman test denotes the result of the *P*-value; Hansen J test denotes the result of the *P*-value. $GDP\_PC_{t-1}$ is the first lag of GDP/capita in PPP in international dollars, constant prices.

education turned out positive in the version modified by lagging, thus, the economic intuition previously stated can be confirmed that spending on human resources (health and education) supports economic growth, however it might require longer time. The fixed effects panel model without lagged COFOG variables did not indicate significance at 5% in case of GF02, GF05, GF06, GF07, GF08, while Education (GF09) had a negative sign.

The negative effect sign can be interpreted as the spending multiplier of these appropriations being less than one, that is to say, one euro spent results in less than one additional euro in the total absolute income. It is common knowledge in macroeconomics that, on the one hand, the state is not an efficient spender of money, and on the other hand, public services are the result of market failures, as market demand and supply cannot compete with each other in equilibrium price and quantity. That is why the state should perform these services with optimum efficiency and finance them from tax revenue collected from market actors.

Because of the intuition mentioned above about spending on human resources, it was imperative to detect the exact delays of human resource spending on GDP growth. For this reason, the GMM model was fine-tuned with joint lagging of GF07 (Health) and GF09 (Education). The lags went from 1 to 3 years and were shifted. The results of the lagged tests are as follows (see Table 4 for details):

- One lag resulted in a positive coefficient in case of GF07, but, in case of GF09 it was negative and insignificant,
- GF07 lagged by 2, GF09 lagged by 1 resulted in positive coefficients, but GF09 was insignificant,
- GF07 lagged by 1, GF09 lagged by 2 resulted in positive coefficients, GF07 was significant at 1%, GF09 was insignificant,
- Two lags in both variables resulted in a positive coefficient and both of them were significant at 1%,
- GF07 lagged by 3, GF09 lagged by 2 resulted in positive coefficients, and both of them were significant at 1%.
- GF07 lagged by 2, GF09 lagged by 3 resulted in positive coefficients, but significance was 10% in case of GF09, 1% in case of GF07.
- (It should be noted that single lagging of education was also tested from 1 to 7 years, and the result was that the education coefficient was positive and significant at 1% for lags of 1, 2, 3 and 4. Higher lags resulted in insignificant coefficients.)

On the basis of the lagging results above, the analysis included the version with 2 lags of GF07 and 2 lags of GF09, as it proved to be the most significant of the two coefficients.

Despite the endogeneity problem, the fixed effects panel model is useful for checking the short- and long-term assumptions of macroeconomics about economic growth. The GMM model does not result in coefficients related to its instrumental variables, but in the fixed effects panel model these are determinants and thus have coefficients. Household consumption and net exports became significant, but negatively correlated with GDP growth (not only in the fixed effects panel, but also in the OLS model). A significant effect on the GDP growth rate was measurable in case of population change with a negative sign and productivity represented by TFP with a positive sign. The Euro Area membership dummy was not significant in the fixed effects panel. This junction does not belong to the core of the current research, which is why the

**Table 4.** Results of lagged GMM models

| Variables | GMM lag GF07 (−1) lag GF09 (−1) | GMM lag GF07 (−2) lag GF09 (−1) | GMM lag GF07 (−1) lag GF09 (−2) | GMM lag GF07 (−2) lag GF09 (−2) | GMM lag GF07 (−3) lag GF09 (−2) | GMM lag GF07 (−2) lag GF09 (−3) | GMM lag GF07 lag GF09 (−3) |
|---|---|---|---|---|---|---|---|
| log ($GDP\_PC_{t-1}$) | −13.33983*** | −12.75940*** | −11.51632*** | −13.32526*** | −10.65825*** | −13.50013*** | −12.20828*** |
| GF01 | −0.784517*** | −1.076140*** | −0.939667*** | −1.185489*** | −1.176803*** | −1.007974*** | −1.112129*** |
| GF02 | −2.097636** | −1.396016* | −1.774412*** | −1.062589 | −0.911141 | −0.256583 | −1.005562 |
| GF03 | 0.195100 | −1.744950* | −1.513212 | −2.113140* | −3.588397*** | −2.959835** | −2.468463*** |
| GF04 | 0.219487 | −0.089814 | −0.046799 | −0.209788 | 0.148409 | 0.146312 | 0.110446 |
| GF05 | −2.200085 | −0.019266 | −1.380524 | 0.417994 | −1.070933 | −0.290106 | −1.223079 |
| GF06 | −2.978083* | −1.669080* | −2.004202*** | −1.510810 | −2.108145** | −2.107208** | −2.631399** |
| GF07 | 2.341872*** | 2.076491*** | 1.942301*** | 1.775365*** | 1.223433*** | 2.207775*** | 1.376282*** |
| GF08 | −2.542665** | −0.676894 | -1.701550 | −0.968098 | −1.426249 | −0.435982 | −2.420606* |
| GF09 | −0.436156 | 0.234055 | 1.052378 | 1.122787*** | 2.189176*** | 1.044472* | 0.717499 |
| GF10 | −1.790692*** | −1.563376*** | −1.606606*** | −1.566842*** | −1.412330*** | −1.498460*** | −1.428252*** |
| Number of observations | 494 | 471 | 471 | 471 | 448 | 448 | 448 |
| Hansen J test | 0.192523 | 0.070293 | 0.151776 | 0.077807 | 0.130700 | 0.097895 | 0.131079 |
| Instrument rank | 25 | 25 | 25 | 25 | 25 | 25 | 25 |

*Source*: authors' calculations based on COFOG, Eurostat, OECD, and World Bank Data.
*Notes*: significance: *** at 1, ** at 5, * at 10%; Hansen J test denotes the result of the *P*-value. $GDP\_PC_{t-1}$ is the first lag of GDP/capita in PPP in international dollars, constant prices.

conclusion drawn from the calculation is merely stated here, but not interpreted and analysed further.

## 5. DISCUSSION AND CONCLUSION

The results are closely concordant with the previous studies referred to in the literature review. Public spending on different budget areas in the EU can have either negative or positive effects on the GDP growth rate, according to the literature and the current results. Considering various concrete spending items, our results support the conclusion of papers which identify "productive" and "non-productive" expenditures. Kneller et al. (1999) and Shijaku and Gjokuta (2013) established that productive expenditures are indeed positive for growth. Other studies can be grouped together with them, which found a positive coefficient for education and/or health spending, such as Fournier and Johansson (2016) or Barrios and Schaechter (2008). The COFOG-based results of the present study agree with the positive correlation when estimating with lagged health and education determinants. The current paper does not support the conclusions of Bania et al. (2006) and Boldeanu and Tache (2015) regarding the negative impact of health and education spending.

It is difficult to relate the results of this research to the positive context of public investments and public R&D spending mentioned in these papers, since the COFOG nomenclature hides the total public spending on investments and classifies it in other dimensions. Nevertheless, based on the results of the present study, the category of "economic affairs" could not be confirmed to have a positive impact.

There is an accordance between the current results and the reviewed literature (listed in Table 1) with regard to welfare or non-productive expenditures. All of the authors reviewed formed a negative judgement of the impact of such expenditures on growth. Avila and Strauch (2003) came to such a conclusion about transfers; Bania et al. (2006) about welfare expenditures; Afonso and Furceri (2008) about subsidies; Kneller et al. (1999), Shijaku and Gjokuta (2013) and Macek (2014) about non-productive items; Boldeanu and Tache (2015) about social protection and Fournier and Johansson (2016) pensions and public subsidies. The COFOG classification of social protection was proved to be negative, statistically significant and robust by confirming with all of the applied model versions in the current analysis.

The closest comparison can be made with the study by Boldeanu and Tache (2015), which is based on COFOG data and uses GMM, OLS and fixed effects panel methodology without lagged COFOG variables. Their conclusions and the current results are consistent in relation to the positive impact of spending on public order and defence – but only when there were no lags of spending determinants – and the negative coefficient of expenditures on general public services (which is also confirmed by Sever et al. (2011)), economic affairs and social protection. Examining the effect of environmental spending, our results do not confirm their findings on its significance, robustness and negative nature. In case of culture (recreation and religion), the negative sign is coincident but the significance cannot be confirmed. The two studies came to opposite conclusions about government housing expenditures. Boldeanu and Tache (2015) estimated a minimal but statistically insignificant positive impact, while the current analysis found a negative effect without statistical significance. Analysing the effect of education and health expenditures, Boldeanu and Tache (2015) used only current year determinants, which resulted in a significant negative coefficient. The current calculations confirm it merely in the case of education in the GMM model without lagging, but disagree in case of health spending. However, our economic intuition suggested conducting the test with lagged education and health variables. Finally, the version with a two lags of both variables resulted in the positive effect of human capital investments, contrary to the conclusion arrived at by Boldeanu and Tache (2015).

The novelty of the current article is that lagging of determinants enabled the impact of education and health spending to be fine-tuned, and was able to show the coefficients of these productive expenditures to be both positive and significant, when drawing on the COFOG database. It can be established that certain types of government spending can have a positive, accelerating effect on economic growth, but with a delayed impact. It is reasonable to carry out future research to uncover and explain the delayed multiplier impact on economic growth emerging from different types of public expenditure.

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