

Kechagia, Adamantia; Kyriazi, Foteini

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Structural Funds and Regional Economic Growth: the Greek experience

ADAMANTIA KECHAGIA

*University of Peloponnese **

FOTEINI KYRIAZI

University of Peloponnese

The impact of structural funds of the European Union (EU) on regional economic growth is a matter of both political and economic importance. The large and regular payments made across the EU to countries and regions within them were and are meant to promote various aspects of growth and development and to encourage structural changes that foster investments and economic reforms. But how much of these aims have they been achieved? In this paper we provide considerable empirical evidence that Greek regions have, for the most part, benefited by the various disbursements of EU structural funds. We shed partial light on where this funding went to and to how it potentially contributed to Greek growth but we also raise a number of questions about the viability of the current productive structure of the Greek economy and its over-reliance on tourism. Our results provide support on the efficacy of the payments but leave open the problem of where these payments should be allocated, the monitoring of their absorption and the end impact in the economic cycle within a country.

Keywords: economic growth, European Union, Greece, regional development, production structure, structural funds, structural reforms

JEL Classifications: 61, H40, O43, R11, R58

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1 Introduction

1.1 The EU structural fund case

Cohesion policy is the EU's main investment policy (Giurescu, 2019). This policy is addressed to all regions and cities in the European Union. Structural Funds and the Cohesion Fund are the most important economic policy measures adopted by the European Commission to positively influence the economic development of the states and support Europe's poorest regions. The primary goal of the EU through these funds is to harmonize the levels of the economic development between states in order to reduce the existing gaps between developed and less developed regions (Hagen & Mohl, 2016). These funds were created for the regions whose development is lagging behind in order to reduce the differences and create a better economic and social balance within and between member states. Their main objective is to transform and modernize the structure of the relatively poor economies in order to prepare them for competition within the single market and the eurozone. Together with the Common Agricultural Policy, the Structural Funds and the Cohesion Fund are the largest part of the total EU financing and the bulk of total EU expenditure. For the period 2014-2020, new objectives have been determined, with a total budget amounting to euro 351.8 billion at current prices (Giurescu, 2019). Cohesion policy objectives are achieved through the following main funds (Mohl and Hagen, 2010):

- The European Regional Development Fund (ERDF): The ERDF concerns programs related to regional development, economic change, improved competitiveness and cross-border co-operation across Europe. The funding priorities refer to research, innovation, environmental protection and risk prevention, while infrastructure investments retain an important role, particularly in the less developed regions.
- The European Social Fund (ESF): The ESF focuses on four key areas: increasing adaptability of workers and enterprises, improving access to employment and the labor market, reinforcing social inclusion by combating discrimination and facilitating access to the labor market for disadvantaged people, promoting cooperative spirit for reforms in the fields of employment and inclusion.
- The Cohesion Fund (CF): The funding from the CF is addressed to member states with a gross national income per capita below 90% of the Community's average. The Cohesion Fund contributes to the interventions in the field of environment and trans-European transport networks.

- The European Agricultural Fund for Rural Development (EAFRD): The rural development measures reinforce the market measures and income supports of the Common Agricultural Policy (CAP) with strategies and funding to strengthen the EU's agri-food and forestry sectors, environmental sustainability and the wellbeing of rural areas in general.
- The European Investment Fund (EIF) supports Europe's small and medium-sized businesses by enhancing their access to finance. EIF designs and develops venture capital and guarantee instruments which specifically target this market segment.
- The Common Fisheries Policy (CFP) aims to ensure that fishing and aquaculture are environmentally and socially sustainable and they provide a source of healthy food for the EU citizens. Its goal is to foster a dynamic fishing industry and ensure a fair standard of living for fishing communities.

Structural Funds, comprise, as we noted, the main instrument of the EU regional policy (Leonard, 1998) with the aim to promote economic and social cohesion, as well as balanced and sustainable development of the European Union. They develop actions in the fields of infrastructure improvement, education and training, environmental protection, diversification of activities in rural areas, business modernization, industrial restructuring and in the development of new business activities that create jobs. Structural Funds, as well as all regional policy forms prior to the current form of the regional policy, operate under rules specified in the relevant regulations. These regulations determine the eligibility of specific regions (the GDP per capita of which, in terms of purchasing power parity, does not exceed 75% of the EU's average), the method of processing, approval, monitoring and funding of projects (percentage of Community, state participation and private participation), and the duration of these programs (Becker, Egger and Von Ehrlich, 2010). The regions that receive aid of this type must be either lagging behind in development terms or regions in industrial decline or rural areas other than the two previous sets (Moussis, 2007).

The design and implementation of the Structural Operations takes place in cooperation of the EU, the national and regional authorities, as specified by the broader partnership and subsidiarity principles, after the Member States prepare the development plans which are submitted to the Commission. Based on these plans, the Commission draws up the Community Support Framework (CSF) for the specific period. In this plan the actions of the Structural Funds and the Cohesion Fund are coordinated. Then, the operational programs are prepared, some that refer to sectors and apply to the entire country and others that have a regional character (Regional Operational Programs). The programs are implemented and monitored by provided committees with the participation of representatives of the community,

the national and regional bodies, and many times for the more efficient management of these programs special bodies are created and dedicated for that purpose such as the Management Organization Unit in the Second CSF, and the Managing Authorities per operational program in the Third CSF (Mohl and Hagen, 2010).

1.2 Greece and its EU structural funding background

In this paper we closely examine the case of EU structural funding for Greece. Beyond being a special case due to its highlighting role in the sovereign debt crisis a decade ago, Greece still presents a thorny issue within the EU: on the one hand, Greece has a thriving tourism industry but not much else of a competitive advantage - for a lot of regulations exist that do not allow the growth of other productive forces such as higher education and scientific outsourcing; on the other hand, Greece owes a tremendous amount of debt and for its repayment it needs growth, lots of it. Thus, understanding whether Greece has benefited and how it has benefited from EU structural funds is important, not only for the country itself but for the policies of the EU as a whole. In the 1960s Greece was way behind the average European per capita income, but at least its economy was growing faster and the gap was quickly reduced over time. However, in the 1970s the speed of convergence slowed down and in the 1980s Greece was diverging from the other European economies in terms of per capita income. Since 1981, Greece has received economic assistance through the EU funds (European Regional Development Fund, Cohesion Fund and structural support for agriculture). It is only during the half of the 1990s that Greece has overtaken the average growth pattern in the EU and thus the prosperity gap with the other European states started shrinking again. This particular growth has been attributed to the CSF actions. Since the late 1980s until today it is estimated that more than 80 billion of the EU contribution and 30 billion of the national contribution in six consecutive programs have supported the regional development policies (mainly the policy of infrastructure development, business and investment subsidies, human capital development and institutional reform) (Topaloglou et al. 2019).

EU structural funds were always important for improving the performance of the Greek economy in terms of GDP, employment, productivity, investment and the trade balance. Since Greece is in the middle of an unprecedented fiscal and economic crisis, EU structural funding is more critical than ever. EU structural funds are an indispensable tool for boosting economic growth without causing extra fiscal burden. Structural funds are channeled to Greece mainly through the CSF of the EU and to a lesser extent through the Cohesion Fund, with the main purpose of financing infrastructure projects. The Greek

CSF is designed to finance large scale development projects and investment in physical and human capital, aiming to gear the economy onto a sustainable path of growth and prosperity. Up to date, there have been six programming periods for the structural funds, for the period (1989-2020). In the period between 1986 and 1993 the Mediterranean Integrated Programs (MIPs) “pushed” the available funds to small infrastructure projects in Greece. Moreover, in 1994-1999 CSF, gave the incentives to the country to implement the major infrastructure projects of national character. These infrastructures (railway network, ports, highways) helped Greece not only to connect with other countries but also to be prepared to enter the Economic Monetary Union. In the period 2000-2010, net transfers, from the EU to Greece were on average 2.15% of GDP. These transfers include not only structural funds but also agricultural subsidies. The largest part of these funds is channeled to public investment. Annual expenditure funded by EU structural funds (EU contribution) averaged in Greece 1.22% of GDP annually in the period 2000-2009. For 2007-2013, Greece has been allocated 20.4 billion euro in total Cohesion Policy funding: 9.6 billion euro under the Convergence Objective, 635 million euro under the Regional Competitiveness and Employment Objective and 210 million euro under the European Territorial Cooperation Objective (Andreou, 2010).

Structural policy can be studied in three phases: the budgetary envelope, programming and policy implementation. In period 1989-1993 the stage of planning involved the compilation of the Regional Development Plan (RDP), the establishment of the CSF and finally the creation of Operational Programs (OPS). By the time that commission approved the OPS, the CFS became operational. In that period, the First Greek CSF comprised 25 highly complex OPS and was managed by the central government and administration. For the period 1994-1999, EU member states drew up an RDP, which included specific economic programmes. After a negotiation of the CFS with the Commission a Single Programming Document (SPD) was established. Thus, member states brought detailed plans rather than general statements. During the second CSF (1994-1999), financial support was doubled compared to the first CSF (1989-1993). There were 16 sectoral OPS and 13 regional OPS (Andreou, 2010).

During the first and the second CSF, the implementation of the structural funds has been described as “causing turbulence to the Greek administrative system, an external shock and a treat to the pre-existing institutional arrangements” (Vamvakas, 2012). Most of the efforts aimed at the increase of the absorption rates, ignoring the issue of implementation. The entry of Greece in the European Union increased the resources of the country. In that time EU was not aware of the fact that these extra resources were very difficult to exploit fully, as it demands time for the capacity of the

country to rise, in order to create business equivalent to the budget that it has available. The effectiveness of European structural and cohesion funds has long been a contradictory topic, both for European institutions and researchers. This matter is particularly interesting for in-depth exploration, because of the lack of unambiguous evidence regarding the effect of these funds on beneficiary regions and countries. Greece has remained the main beneficiary of CSF since 1989, however, data on GDP growth and labour market in the country is extremely contradictory.

In the rest of the paper we present our analysis on the impact of EU structural funding for Greek regions. Greece has always been among the countries that have taken advantage of the European funding channeling the economic help in the field of public investment in periods of serious financial and of ongoing crisis. The existed European Union studies are occupied with the impact of the structural funds and usually focus their research on specific programmes, evaluating the short-term microeconomic impacts. On the other hand, the existed academic studies explore the long-term macroeconomic impacts of structural funds on the economy of the recipient country. However, in the end many are still unexplored related to the political economic implications of the European structural funds. Thus, our aim is not just to see the impact of various funding packages on growth and investment but also to understand how this impact passes through to the economy, whether it is just a push-up on private and government spending or whether it boosts investment, how did it affect disposable income and also how did it interact with Greece's staple industry, tourism. In the next section, we follow with a brief literature review on the concepts of regional growth and related issues that pertain to our analysis. In section 3, we present our data and empirical methodology. Section 4 contains our discussion of our results and their policy implications. Section 5 offers our concluding remarks and suggestions for future research. All tables are to be found in the Appendix.

2 Brief Literature Review

Economic growth has been one of the most important economic issues in the literature since 1980s and it is conditioned by many factors which act over time. The knowledge about which factors account for economic growth, contribute to the form of efficient and sustainable economic policies. A great number of empirical studies that focus on economic growth have been published in both advanced and developing countries. However, the results of the studies have varied across the countries due to the different levels of socio-economic development, the time of periods analyzed and the research methods used.

The “growth” approach is particularly appropriate to study the impact of structural funds, since these are designed to enhance the accumulation of production factors that affect the growth rate of the recipient economies. Economists have spent decades debating, without resolution, the cross-country relationship between foreign aid receipts and economic growth. Some find that aid robustly causes positive economic growth on average, others cannot distinguish the average effect from zero, while others find an effect only in certain countries. According to this last case structural funds can be effective only under conditions, which usually are: the institutional condition of the recipient country, the good policy environment, the climate-related circumstances, the level of education of workforce and the level of government, the absorptive capacity and a set of controlled variables. Moreover, the fungibility of aid, which generally as a term describes a situation when aid intended to finance public investment is diverted to government consumption, is a factor which effects negatively the result of the aid given in the recipient country, Marc (2017).

Cerqua and Pellegrini (2018), suggest a positive effect of EU’s transfers on regional growth by supporting that the estimated conditional intensity-growth function is concave and presents a maximum value. They emphasize that the larger the per capita transfers are, the smaller the regional growth rate is. Therefore, these funds could have been allocated in other regions. Melecky (2018), shares the above statement as according to his survey most countries with lower amount of funding achieve higher efficiency, especially countries in a group of so called “old EU members”. Pinho et al. (2015), in their research using a neoclassical growth model studying 12 EU countries also find a positive effect of structural funds on growth but they claim that the impact is bigger in richer, high educated and innovative regions.

A significant literature in econometrics is concerned with the ex post estimations of the casual effects of transfers on investments and per capita income, since the development and growth of a country depends on them. Becker et.al. (2013), estimate the effects of the transfers by analyzing objective 1 transfers of the EU to regions below a certain income level. Only about 30% and 21% of the regions -those with sufficient human capital and good enough institutions- are able to turn transfers into faster per capita income growth and per capita investment respectively. Afonso and Aubyn (2019), study the macroeconomic effects of public and private investment in 17 OECD economies through a VAR analysis with annual data from 1960 to 2014. They find that public investment has a positive growth effect in most countries, and a contractionary effect in Finland, UK, Sweden, Japan, and Canada. Public investment led to private investment crowding out in Belgium, Ireland, Finland, Canada, Sweden, the UK and crowding-in effects in the rest of the countries. Private investment has a positive

growth effect in all countries; crowds-out (crowds-in) public investment in Belgium and Sweden (in the rest of the countries). The partial rates of return of public and private investment are mostly positive.

The tourism sector is seen as a key factor for economic growth in many developed and emerging economies. Thus the argument is whether tourism can help countries to accomplish sustainable economic growth or vice versa. Eleftheriou and Sambrakos (2018), reconsider the tourism growth nexus by accounting for spill-over effects between regional tourism development and regional growth. Studying 49 NUTS 3 regions of Greece in the period 2010-2015, their findings indicate strong short-run and long-run spillover effects, suggesting that policymakers should consider regional tourism development as a key factor for boosting national economic growth. For the US, Sharif et.al. (2017), use monthly data over the period 1996-2015 and show that there is a significant long-run relationship that occurs between tourism development and economic growth. Thus, it can be recommended that government needs to increase and promote tourism demand and further providing and nurturing the expansion of tourism supply with the advancement of economic growth. Antonakis et.al. (2015), based on monthly data for 10 European countries over the period 1995-2012, find that the tourism-economic growth relationship is not stable over time in terms of both magnitude and direction, indicating that the tourism led economic growth and the economic driven tourism growth hypotheses are time dependent. This relationship is also highly economic event dependent, as it is influenced by the Great Recession of 2007 and the ongoing Eurozone debt crisis that began in 2010. Finally, the impact of these economic events is more pronounced in Cyprus, Greece, Portugal and Spain, which are the European countries that have witnessed the greatest economic downturn since 2009. Risso (2018), using panel data, analyzed the relationship between tourism and economic growth for a worldwide dataset of 179 countries during 1995–2016. He finds that a 100% increase in number of arrivals, tourism receipts, and tourism expenditure increases per capita GDP by 9%, 7% and 10% respectively. In contrast, a 100% increase in real per capita GDP increases number of arrivals, receipts, and expenditure by 54%, 94%, 101% respectively. Control variables such as human capital and gross capital formation as a percentage of GDP play an important role in tourism and economic growth.

According to the literature, two are the main reasons that help us to explain why different studies reach different conclusions. Both traits relate to how these studies treat the timing of causal relationships between aid and growth. First, the most cited research has focused on measuring the effect of aggregate aid on contemporaneous growth, while many aid-funded projects can take a long time to influence growth.

Funding for a new road for example might affect economic activity in short order, funding for a vaccination campaign might only affect growth decades later, and humanitarian assistance may never affect growth. Second, because current growth is likely to affect current aid, these studies require a strategy to disentangle correlation from causation. They have tended to rely on instrumental variables, but the instruments that have been used are of questionable validity and strength. When these issues are addressed, the divergence in empirical findings is greatly reduced (Clemens et al. 2012). In order to evaluate the result of the funds, it is important to have in mind that the main aim of the cohesion policy is to improve the long-term growth of the supported areas. No less than one-third of the EU budget is spent on a wide range of programs that primarily aim to develop infrastructure, industries or modernize education. The EU not only distributes the funds, but also is directly involved in how the funds should be spent. The data show that cohesion policy fulfils a necessary condition for its effectiveness: poor regions tend to receive more support than rich regions: nevertheless, each member state, however, affluent, succeeds in drawing at least some funds to its regions (Ederveen et al. 2003).

3 Data and Empirical Methodology

3.1 Data and Descriptive Statistics

We consider a rather reliable panel dataset stemming from two different sources. The first one is from the Eurostat website and contains the main European Funds, including the European Regional Development Fund (ERDF), the European Stability Fund (ESF), the European Agricultural Fund (EAF) and the European Cohesion Fund (ECF). This dataset pertains to European support and does not involve any national financing. As Cerqua and Pellegrini (2018), describe in their study, national co-financing tends to be proportionate to EU funding and therefore may not substantially change the relative amount of funding distributed to different regions. The second source of our data is the official website of the Greek Statistical Authority (ELSTAT), a national independent organization of Greece, which is responsible—among other operations—for the construction and the provision of various economic statistical reports. Due to this responsibility of ELSTAT we use from its reports the following economic variables, the real Gross Domestic Product (GDP), Gross Fixed Capital Formation (GFCF), Tourist Arrivals (TAR), Tourist Establishments (TE), Disposable Income (DIN) and Employment (EMP). All the above time series contains annual observations which span the period from 2000 to the end of 2017, that is before, during and after the financial crisis which effected Greece. Our panel dataset is linked with thirteen major

prefectures in Greece, Attica, North and South Aegean, Crete, East Macedonia and Thrace, Central Macedonia, West Macedonia, Epirus, Thessalia, Ionian Islands, West Greece, Continental Greece and finally the Peloponnese.

All our variables enter in the analysis as annual growth rates of GDP, GCFC, TAR, TE, DIN and EMP. We name these transformations by using the letter G at the end of each variable's name, (i.e., GDPG for real Gross Domestic Product growth). Since we seek to investigate the casual effect of Structural Funds on the country's development overall, we use as our core dependent variable the annual growth of real GDP and then the other variables as dependent as well and in turn. The explanatory variables are the main structural funds as they are mentioned above with their lags and the lags of dependent variables and the other control variables as they appear in our equations – the maximum number of lags is set to be up to 4. The variable nomenclature is given in Table 1 and 2, while descriptive statistics are given in Table 3. From the descriptive statistics (which are computed over all observations) we can easily see that there exists considerable variation in the data and that there is also considerable heterogeneity on the variables that have larger/smaller variation. For example, we note that (looking at the coefficient of variation) the largest comes from the European Regional Development Fund, and the second largest from the Cohesion Fund; from the economic variables the largest variation is (not unsurprisingly) in disposable income and the second largest is in employment growth – both the latter results are reflective of the differential impact that the financial crisis had on Greek households.

Table 1: Variables

Abbreviation	Variables	Units
DIN	Disposable Income	thousand euro
EAF	European Union Agricultural Fund for Rural Development	million euro
EMP	Total Employment	member
ERDF	European Union Regional Development Fund	million euro
ESF	European Union Social Fund	million euro
GDP	Gross Domestic Product	million euro
GCFC	Gross Fixed Capital Formation	million euro
TAR	Tourist Arrivals	thousands
ECF	European Union Cohesion Fund	million euro
TE	Tourist Establishments	number
TOP	Sum of Structural Funds	million euro

Table 2: Prefecture Numbers

Number	Region
1	Attica
2	North Aegean
3	South Aegean
4	Crete
5	East Macedonia and Thrace
6	Central Macedonia
7	West Macedonia
8	Epirus
9	Thessalia
10	Ionian Islands
11	West Greece
12	Continental Greece
13	Peloponnese

Table 3: Descriptive Statistics

Variable	Mean	Median	Min	Max	SD	CV
DIN	0.65	0.85	-10.40	10.3	6.78	10.36
EAF	19.72	6.33	-41.78	88.36	49.43	2.51
EMP	-0.26	-0.03	-4.60	3.48	2.49	9.48
ERDF	0.92	1.58	-46.10	48.77	36.31	39.47
ESF	11.17	21.76	-37.41	49.56	33.02	2.96
GDP	0.94	1.02	-7.54	9.3	5.66	6.03
GFCF	83.25	1.34	-88.4	727.48	248.48	2.98
TAR	2.92	1.41	-8.29	18.14	8.03	2.75
ECF	2.84	-13.46	-58.25	78.22	54.1	19.04
TE	0.82	0.37	-1.42	4.18	1.66	2.03
TOP	-3.71	0.04	-51.92	40.37	34.5	9.29

We can also note that there appears a drastically larger impact across prefectures on gross fixed capital formation than on real GDP growth - although their medians are estimated to be very close. On the tourism side, we see similar characteristics on arrivals and establishments in terms of variation but (again not unsurprisingly) a higher mean and median in arrivals than establishments – in fact the mean and median of tourist arrivals is about 3 times larger than that of establishments.

3.2 Empirical Methodology

Our empirical methodology is dictated by the nature of our data: relatively short number of years but with a constant number of cross-sections (prefectures), the latter being ideal in theory to consider lagged structures in our panel that can be estimated with fixed effects.¹

Our methodology has two parts. The first part, on the suggestion of one of the referees, examines the differential impact of the fund variables into the main variable of interest, that is real GDP growth, controlling for investment (gross fixed capital formation) and employment and having only the lag of the dependent variable as a lag. These models were deemed necessary for (a) testing the presence and need of fixed effects, (b) assessing the convergence based on the autoregressive coefficient of the models and (c) examining which of the fund variables has a larger impact on economic growth. The model estimated is thus:

$$y_{it} = \alpha_i + \rho y_{i,t-1} + \mathbf{z}_{it}^T \boldsymbol{\gamma} + \mathbf{f}_{it} \delta + u_{it} \quad (1)$$

where the parameter vector $\boldsymbol{\gamma}$ contains the estimates for the gross fixed capital formation and employment growth and the scalar parameter δ measures the impact of the corresponding fund variable that enters into the model. This model is estimated by fixed effects and tested for the null hypothesis of no fixed effects – we further discuss the specification in the results section that follows.

In the second part of our methodology, we follow a consistent model reduction approach using three estimation methods (fixed effects, random effects and weighted least squares) and then perform on the resulting models some robustness checks with panel GMM for the case where economic variables are used on the right hand side and we should address problems of endogeneity. Admittedly we could have performed our model reduction with a GMM approach but as we will see the results do not change qualitatively. We note that the methodology we followed below provided a total of more than 350 estimated models before achieving our final results – and we stress that since our approach was general to specific we have completely avoided problems of data mining and stepwise regression.

¹ The fixed nature of the prefectures on an expanding time frame gives us, in principle, complete freedom on using just fixed effects and dynamic models. We performed all sorts of estimations for robustness including, as described in the text, random effects and instrumental variables.

The general structure α_t of our primary unrestricted model is given by an autoregressive distributed lag model where the initial group of the explanatory variables, differ. That is, letting y_{it} denote the respective dependent variable and let z_{it} denote the set of all explanatory variables, a vector of dimension K . Let $x_{it}^{M(K)}$ be a subset of the variables in z_{it} , a vector of dimension M ($K < K$), that is obtained by considering a different starting set of fund variables to enter the model plus the relevant control variables, i.e. other economic variables that we put on the right hand side and their lags - the maximum number of lags is restricted to 4 years. Finally, let M denote the number of combinations of fund and control variables that can be obtained by the choice of the x_{it} vector. Then, we write the representative model standard form as in:

$$y_{it} = \alpha_i + x_{it}^{M(K),T} \beta^{M(K)} + u_{it} \quad (2)$$

which is then estimated by one of the three methods noted above. Once the initial model is estimated we perform sequential model reduction of the variables in the model, removing the insignificant ones one-at-a-time, starting with the highest p-value and continuing until all estimates are significant at or below the 5% level of significance. To ensure against the well known drawback of having highly correlated variables (which may impact on the order of variable elimination), but still preserving the top-down approach we use, we perform an additional step where in every three variables² eliminated we perform a joint F -test for their significance; if the test accepts the null hypothesis that they are jointly insignificant (at the 5% level) then we proceed to the next step, if the test rejects the null hypothesis then we leave the variables in place and continue - this extrastep proved, however, unnecessary as we had no incidence of an F test rejecting the corresponding null hypothesis.

We repeat the same procedure *ab initio* for each estimation procedure we use, thus ensuring that the remaining variables are not a by-product of the estimation method. Finally, as an additional robustness check, all models that remain after model reduction are re-estimated via panel GMM – our results were qualitatively either identical or very similar and available on request.

² We select three variables in an attempt to balance size and power of the test under the premise that we would not want to perform another test on many potentially correlated variables.

4 Discussion of Results

4.1 Estimation results

We start our discussion with the results on the impact of the several structural funds on real GDP growth GDPG. The results of our model reduction approach for this variable appear in Tables 4 through 7. Our discussion will of necessity focus on the various fund variables and their impact and not on their statistical significance – because of our methodology we are left only with significant variables in the tables of our results.

We start our discussion with the results on Table 4, the baseline models of equation (1). Here the interest lies in the quality and magnitude of the various estimates.

Table 4: Impact of Structural Funds on Gross Domestic Product - Control Models
Dependent variable: Gross Domestic Product (Growth) - GDPG

Estimation Method	FE	FE	FE	RE	RE	FE	FE	FE
Const	0.88	1.570***	1.549***	0.479	1.391***	1.501***	1.429***	1.341**
GDPG_1	0.043	-0.168***	-0.185***	0.237***	-0.181***	-0.178***	-0.172***	-0.212***
GFCFG		0	0	0	0	0	0	0
EMPG		1.391***	1.423***	0.873***	1.396***	1.428***	1.469***	1.411***
TOPG			0.021**					
TCFG				0.0170**(a)				
CFG					0.0380**(b)			
ERDG						0.016**		
ESFG							0.016	
EAFG								0.023***
n	195	195	195	179	194	195	195	182
l	-670.1	-635	-632.3	-508.3	-629.6	-632.2	-633.7	-588.5

Notes: 1. FE refers to estimation by fixed effects. 2. All variables are expressed in growth rates and GDPG_1 is the first lag of the dependent variable. 3. TOPG is the sum of all payments and TFCG is the 3-year moving sum of the cohesion fund variable. 4. (a) and (b) indicate that original estimates are multiplied by 100. 5. n is the number of usable observations and l is the maximum likelihood criterion.

First, we alert the reader that while all our models were estimated by fixed effects in none of them did we find the need for them; the corresponding F -test for a common constant term accepted the null hypothesis for using pooled least squares instead of fixed effects. On this first set of results we kept the estimation by fixed effects in this table but also in all subsequent tables. Thus, the presence of a single constant term might be a first indication of potential convergence. Turning next to the estimates of the autoregressive parameter ρ of equation (1) we see that is highly statistically significant and almost everywhere negative and around -0.20 – the exception being the model using the 3-year moving sum of the cohesion fund variable, which has the highest autoregressive estimate which is positive. Be that as it may, the autoregressive estimates show a range of half lives between 0.4 and 0.5, values that are small enough to clearly suggest a convergent path for regional growth. Thus, the autoregressive estimation results coupled with the presence of a single constant term do suggest that, conditional on the models we are using, the fund variables are important in the convergence of regional growth. Next, we notice two significant results from the rest of our estimates. First, the predominant impact in these models, is that of employment and not of investment; not only are the estimates of employment growth significant while those of gross fixed capital formation are not, they are also many times larger in magnitude. This is not a surprising result given that Greece was never free from mild to high unemployment. Second, all structural fund variables when entering individually, or as a sum, are significant with only the ESF variable not being significant; furthermore, we note that the highest magnitude of these variables goes to the EAF variable, the one that pertains to agriculture. The collective impact on regional real growth of the fund variables is clearly positive and significant but there is one lingering policy question, based on our results: what if structural funds directly supported employment instead of going for this in a round-about way? We further discuss the findings of this table at the policy implications section that follows. To summarize, from Table 4 we can assess that structural fund variables had a positive, and statistically, significant impact on regional growth which appears (on the models examined) here to be compatible with a convergence argument.

We now turn to the discussion of our results on the model reduction approach in equation (2). These models present a more detailed analysis on the impact of the structural fund variables. In Table 5, we present some of the models for real GDP growth. Two key points are immediately visible, independently of the estimation method: First, there is a consistent negative impact of the European Stability Fund (ESFG), a consistent positive impact of the European Agricultural Fund (EAFG), the

Table 5: Impact of Structural Funds on Gross Domestic Product, Part #1
Dependent variable: Gross Domestic Product (Growth) - GDPG

Estimation Method	FE	FE	RE	RE	FE
const	0.945	-1.679**	0.943*	-1.854**	1.801**
ESFG	-0.048**	-0.044**	-0.049**	-0.053**	
EAFG	0.040**	0.048**	0.041**	0.044**	
ESFG_1		-0.015*		-0.021**	
ESFG_2		-0.016*		-0.016 *	
EAFG_1		0.038**		0.030**	
EAFG_2		0.028**		0.021**	
ERDG				0.020**	
ERDG_1				0.020**	
ERDG_2				0.010 *	
EMPG					1.200**
n	182	156	182	156	208
AIC	1263.547	910.961	1245.089	884.039	1493.789

Notes: 1. FE and RE refer to fixed effects and random effects respectively.
2. the notation XXX i denotes the ith lag of the associated variable. 3. *n* is the number of usable observations and *AIC* is the Akaike Information Criterion

European Regional Development Fund (ERDG) and the Employment (EMPG) on economic growth respectively. Second, we note that the contemporaneous impact of the ESFG and the EAFG are approximately the same but with opposite signs, while the dynamic terms of the ESFG are both negative and of about the same magnitude, in all columns. Furthermore, the dynamic terms of the EAFG and the ERDG are positive and have about the same magnitude also. It is important to note that the models with the structural fund variables estimated by fixed effects or by random effects produce the lowest AIC values among all models in Table 5 and this is critical indicative of their explanatory power. The negative impact of structural funds on economic growth may be explained by three potential admissions. First, support is available to members states when there is co-financing by national tax revenues; in a case where taxation is highly distortionary, the net growth effect may well be negative (Ederveen et al., 2006).

Second, structural funds ensure investment priorities including environmental development (EU 1300/2013); from this perspective these projects can absorb funds for less attractive activities that could otherwise augment domestic economic growth. Third, because structural payments are not solely based on clear criteria and there is room for political bargaining (Mohl and Hagen, 2010), the central management could potentially include counterproductive actions.

Turning on Table 6 we observe that the models containing the impact of the aggregate of the structural fund payments (TOPG) is positive both in contemporaneous and dynamic terms – and therefore on its long-term impact.

This result meets the expectation that structural change refers to long-term shifts in the sectors of an economy (Teixeiraa and Queiros, 2016). Furthermore, we note that for these models the significant control variables tally well with economic theory as what enters is the change in employment with a positive sign as well. What is surprising in this table is the negative impact of the tourist arrivals variable (TARG)

Table 6: Impact of Structural Funds on Gross Domestic Product, Part #2
Dependent variable: Gross Domestic Product (Growth) - GDPG

Estimation Method	FE	RE	FE	FE	RE
const	1.746**	1.205**	1.609**	1.637**	1.545**
EMPG	1.296**	0.998**			
EMPG_1	0.770**	0.534**			
GFCFG_1	0.001**	0.000**			
GDPG_1	-0.271**			0.225**	0.227**
EMPG			0.000**	0.000**	0.000**
TARG				-0.039**	-0.033*
TARG_1				-0.042**	-0.036*
TARG_2				-0.056**	-0.052**
TOPG				0.023**	0.025**
TOPG_2				0.018**	0.018**
n	195	195	208	131	131
AIC	1266.901	1274.489	1514.35	771.71	759.173

Notes: 1. FE and RE refer to fixed effects and random effects respectively. 2. The notation XXX_i denotes the *i*th lag of the associated variable. 3. *n* is the number of usable observations and *AIC* is the Akaike Information Criterion.

with all terms contemporaneous and dynamic being negative. In addition it is worth to note that the models with TARG as the independent variable have the lowest value of the AIC, even lower than the previous ones in Table 5. Thus this result offers additional validity on the significant positive impact of explaining real GDP growth via the payments of the structural funds.

In Table 7 we present some additional models with weighted least squares as our estimation method. This is both to improve the robustness of our results and to account for the possibility of differential uncertainty across the cross-sections of our data.

Table 7: Impact of Structural Funds on Gross Domestic Product, Part #3
Dependent variable: Gross Domestic Product (Growth) - GDPG

Estimation Method	WLS	WLS	WLS	WLS	WLS	WLS	WLS
const	0.63	-1.660**	-0.557**	1.518**	1.760**	1.262**	0.309
ESFG	-0.052**	-0.031**					-0.066**
EAFG	0.045**	0.039**					0.046**
ESFG_1		0.016**					
ESFG_2		0.023**					
ERDG		0.011**					0.017**
ERDG_1							0.015**
GDPG_1		0.228**			0.212**		
EMPG				0.0001**	0.000**		
EMPG_2					0.000**		
TARG					-0.038**		
TARG_1					-0.042**		
TARG_2			-0.216**		-0.056**		
TOPG			-0.040**	0.018**	0.026**		
TOPG_2					0.016**		
TEG			-0.348**				
CFG						0.0005*	
n	182	169	52	208	131	207	182
AIC	521.705	493.243	41.516	593.9999	387.942	590.723	524.792

Notes: 1. WLS refers to weighted least squares with groupwise heteroscedasticity. 2. the notation XXX_i denotes the *i*th lag of the associated variable. 3. *n* is the number of usable observations and AIC is the Akaike Information Criterion.

We can immediately distinguish that the same signs and approximate magnitudes are obtained for the fund variables –where they appear–as in the previous tables. Especially, in Table 7 the signs for the contemporaneous term of ESFG are again negative, but they are turning positive for the dynamic terms. Once more the TARG is negative in all terms and in every estimated model. In this table we have the lowest values for the AIC in contrast with the former tables.³

In Table 8 we have the results on the impact of the structural fund payments on investment, where the gross fixed capital formation GFCFG is our dependent variable.

Table 8: Impact of Structural Funds on Gross Fixed Capital Formation
Dependent variable: Gross Fixed Capital Formation (Growth) - GFCFG

Estimation Method	FE	RE	RE	FE	FE	FE	WLS	WLS
const	199.1**	332.3**	200.4**	221.0**	199.1**	162.7	-9.607*	7.896***
ESFG		-3.422*						
EAFG							0.389**	0.450***
ESFG_1								0.151***
ESFG_2								0.095***
EAFG_1								0.077***
EAFG_2								0.284***
ERDG								0.476***
ERDG_1								0.014***
EMPG_1				52.09*				
GFCFG_1								0.049***
TOPG_2						7.508**		
CFG							0.033**	0.034***
CFG_1								0.003***
CFG_2	0.067**		0.065**	0.058*	0.067**			0.004***
n	181	195	181	208	181	182	194	153
AIC	3101.477	3379.696	3088.829	3099.767	3101.477	3132.873	2875.134	1683.476

Notes: 1. FE, RE and WLS refer to fixed effects, random effects and weighted least squares respectively. 2, 3 – see table 7.

³ The AIC values here are based on the weighted data and are thus not directly comparable with Tables 5 and 6 but we can still see that the lowest values are again for the models that involve the presence of the structural fund variables.

We note that for the ESFG explanatory variable there is a negative impact for the contemporaneous term and is approximately 70 times larger than the case when real GPDG was our dependent variable (Tables 5 and 7). All the remaining variables have positive signs, both in contemporaneous and in its dynamic terms. We also note that most of the results are concentrated in models that are estimated by weighted least squares.

In Table 9 we illustrate the results of the impact of several structural funds on tourist arrivals TARG. We observe that the ESFG variable – in its contemporaneous term – has a negative impact on the dependent variable, irrespective of the estimation method we use. This result is consistent with the signs that ESFG variable has in all previous tables. The rest of the variables have positive signs with the exception of the dynamic term of the dependent variable TARG and the contemporaneous of TOPG in most methods, suggestive that we have mixed signs.

Continuing with the next two tables 10 and 11 we have the results of the impact of the structural funds on tourist establishments TEG. In Table 10 we can see that there are mixed signs from the explanatory variables one more time, i.e. there is no consistent positive or negative impact of the structural fund variables on this dependent variable; for example, ESFG has mixed signs through the three different estimation methods. ERDG and TOPG have negative signs in their dynamic terms and all remaining variables have positive signs. In Table 11 we have a similar structure as in Table 10, as we see that ESFG has mixed signs in the contemporaneous term and a positive sign in the dynamic term, EAFG has a positive sign in the contemporaneous term and negative in the dynamic term while ERDG has a consistent positive impact on TEG and CFG has a consistent positive impact. Finally, in Table 11 we see that the TOPG and EMPG have mixed signs in their contemporaneous (positive) and dynamic (negative) terms.

Our last table, Table 12, has the results on the impact of the structural fund variables on disposable income DING. Here all the explanatory variables have a consistent positive impact on the dependent variable with the only exception of the ESFG fund which has a negative impact in its contemporaneous and in its first lagged values. We note that this is the second most positively impacted dependent variable after real GDP growth GPDG and this plays a role in our discussion that follows.

Table 9: Impact of Structural Funds on Tourist Arrivals
Dependent variable: Tourist Arrivals (Growth) - TARG

Estimation Method	FE	FE	FE	RE	RE	RE
const	6.096**	4.418**	6.836***	3.072	4.421**	6.064**
ESFG	-0.091**			-0.102**		
ESFG_2				0.093*		
ERDG_1				0.077**		
EMPG_1						1.209*
EMPG_2			1.780***			
GFCFG_1						1.594**
TARG_1	-0.173**		0.234***			-0.182**
TOPG		-0.053*	0.078**		-0.054*	-0.078**
n	153	176	141	140	176	141
AIC	1379.241	1572.048	1277.323	1257.079	1555.732	1260.19

Notes: 1. FE and RE refer to fixed effects and random effects respectively. 2. the notation XXX_i denotes the ith lag of the associated variable. 3. n is the number of usable observations and AIC is the Akaike Information Criterion.

Table 10: Impact of Structural Funds on Tourist Establishments, Part I #1
Dependent variable: Tourist Establishments (Growth) - TEG

Estimation Method	FE	FE	RE	RE	RE	RE
const	5.264**	1.084**	1.075**	1.280**	1.345**	1.285**
ESFG	-0.096**	0.012*	0.011*			
EAFG_1				0.017**		
ERDG_2				-0.010**		
EMPG					0.312**	
TOPG					0.014**	
TOPG_2						-0.031*
n	52	52	52	52	52	65
AIC	1470.761	1163.686	220.6031	209.004	220.174	386.644

Notes: 1. FE and RE refer to fixed effects and random effects respectively. 2. the notation XXX_i denotes the ith lag of the associated variable. 3. n is the number of usable observations and AIC is the Akaike Information Criterion.

Table 11: Impact of Structural Funds on Tourist Establishments, Part I #2
 Dependent variable: Tourist Establishments (Growth) - TEG

Estimation Method	FE	WLS	WLS	WLS	WLS
const	5.264**	0.620**	1.552**	0.862**	0.279
ESFG	-0.096**	0.006*			
EAFG			0.015**		
ESFG_2			0.043**		
EAFG_1			-0.020*		
EAF_2			-0.049**		
ERDG			0.015**		
ERDG_1			0.023**		
EMPG				0.288**	
EMPG_2					-0.221**
TOPG				0.009**	
TOPG_2					-0.023**
CFG			-0.068**		
TEG_1			-0.266*		
CFG_1			-0.034**		
CFG_2			-0.029**		
n		52	26	52	65
AIC	1470.761	143.582	83.90421	143.09	177.4086

Notes: 1. FE and WLS refer to fixed effects and weighted least squares respectively. 2. the notation XXX_i denotes the ith lag of the associated variable. 3. n is the number of usable observations and AIC is the Akaike Information Criterion.

Table 12: Impact of Structural Funds on Disposable Income
 Dependent variable: Disposable Income (Growth) - DING

Estimation Method	FE	RE	RE	FE	WLS	WLS	WLS	WLS
const	-0.342	1.273*	-1.265	1.372**	1.010*	-2.795**	1.323**	-0.043
ESFG	-0.031*	-0.052**			-0.054**			
EAFG		0.018*			0.022**			
ESFG_1	-0.045**		-0.029*			-0.022*		
ESFG_2						0.032**		
EAFG_1			0.021**			0.027**		
EAFG_2			0.025**			0.028**		
ERDG	0.027**							
ERDG_1	0.030**							
ERDG_2	0.026**							
EMPG				1.304***			1.442**	0.732**
EMPG_1								0.702**
TOPG_1								0.016**
TOPG_2								0.040**
CFG						0.0002*		
CFG_1	0.0006**		0.0005**			0.0003**		
CFG_2						0.0002**		
DING_1	0.257**		0.286**			0.424**		0.269**
n	181	182	181	208	182	166	208	182
AIC	1305.685	1325.376	1275.715	1472.375	1290.124	1097.131	1390.202	1163.686

Notes: 1. FE, RE and WLS refer to fixed effects, random effects and weighted least squares respectively. 2. the notation XXX_i denotes the ith lag of the associated variable. 3. n is the number of usable observations and AIC is the Akaike Information Criterion.

4.2 Policy Implications

In this section we attempt to provide a policy-oriented summary of our results. This is important as there has been considerable discussion about the prospective paths that the Greek economy should take after the 2008 crisis and given the huge debt burden that the Greek economy has. To begin with, we have ample suggestive evidence that, after the exhaustive model reduction approach that has accounted for all possible starting points and combinations of the structural fund variables, there are two main results: (a) the impact of the structural payments is indeed positive for real GDP

growth, gross fixed capital formation and disposable income (b) the impact of structural payments in tourist arrivals and tourist establishments is mixed and not all around conclusive (c) the impact of other control variables sometimes tallies with economic theory (e.g. higher employment growth is positively related to real GDP growth) and sometimes does not (e.g. higher tourist arrivals growth is negatively associated with real GDP growth, after taking into account the presence of all other variables). Given the past status of the Greek economy, the one that was in place when the crisis hit, one might venture to say that these results indicate that the positive effect on real GDP growth and disposable income is a demand-side effect: structural fund payments were directed into consumption (or over-consumption) with little absorption on the supply side, the generation of infrastructure or considerably higher productive investment. Furthermore, the over-reliance (and over-promoting) on tourism cannot be justified in terms of the impact of structural fund payments: on the one hand we know that tourism in Greece is a major industry with little need for advertisement and in good years tourism revenues flow easily, be there is infrastructure or not in the rest of the economy - thus, minimal spending on fixed-cost investment is required and one can safely assume that structural payments were converted into consumption more than they would have been if there was an active need to support the tourist industry. This is reflected on the consistently mixed signs that we obtain for the models on tourist arrivals and tourist establishments (and especially the latter variable).

Our results are well connected with the literature and also with the most recent state of affairs in the Greek economy. Beginning with the null hypothesis, that EU membership has zero impact on economic growth, Andersen et al. 2019 in their research, although unable to reject it, reach the conclusion that membership does not appear to increase prosperity. Moreover, Campos et al. 2014, in their research support that per capita GDP increases with the EU membership in most of the countries of their study, while their evidence shows that only one country - Greece after the EU accession experienced lower per capita GDP, thus the gap between Greek and the EU average GDP has increased. As the literature suggests both fixed investment and tourism are conductors to growth but the question here is more subtle: how to use the structural fund payments to improve conditions for investment and growth - and what we suggest that we find is that while the impact on fixed capital formation and disposable income is positive the impact on tourism variables is mixed, and so is the total effect on the Greek economy. We can judge this by the results of the crisis, where the over-consumption was presented as one of the major structural problems of the Greek economy and, naturally, structural fund payments did help to fuel over-consumption. This over-consumption was a sledgehammer when the crisis hit: not only investment

fall around -15% but the gross domestic savings ratio was much lower than that of the EU, at around 10%, that there were not enough domestic resources to re-finance investment (Soukiazis et al., 2018).

The past problems of the Greek economy cannot be alleviated by further structural fund payments, for the country both has a tremendous debt and tax rates and unemployment that are inordinately high (Monokroussos et al., 2017) and (Anastasatos et al., 2018), if these payments are not directed to productive investment and not income or consumption support. Gunzinger and Sturm 2016, in their research, based on a simple OLS framework, suggest that on average governments without political constraints have implemented stimulus packages that were about 1 to 2.7 percentage points of GDP larger in size than packages enacted by governments that faced political constraints and thus did have to cooperate with the opposition. The problem lies not with the payments but in their use. As income and productivity still remain sluggish, over-taxation and under-investment are still characteristics of the economy we will have that GDP continues to rely on excessively on private consumption (ca 68% of GDP, Karamouzis and Anastasatos, 2019) - this cannot continue forever.

5 Conclusions

The EU has disbursed enormous amounts of structural fund payments to all the countries in the union with, essentially, the same single aim for all of them: promoting long-run economic growth. The recipe is always simple and is the same, use the funds for productive investments, infrastructure and for the sectors that your country has a comparative advantage. Use them for consumption or income support and you jeopardize your long-term growth prospects.

The case of Greece has sparked interest mostly for the public finance problems and the sovereign debt crisis that it faced (still does). On attempting to address these problems post-crisis, a number of other issues came afloat such as the productive structure of the Greek economy, the inefficiencies of the public sector, tax evasion and many others. In this paper we examined the impact of EU structural fund payments on a number of economic variables and our results are aligned both with the literature and these problems just mentioned. EU structural funds are an important policy tool, but a tool is as good as the hand the uses it – that is, domestic economic policy. With the productive structure and the political infrastructure that the Greek economy had in place it would have been a very difficult proposition for the EU fund payments not to contribute to consumption and income support (and thus to the demand side of GDP). We did find that fund payments had a positive impact on real GDP and disposable income and less so on investment but also found that the impact on tourism variables

was mixed – the crisis revealed the structural failures of the Greek economy and thus we have to re-think about the usage of EU fund payments, the debt repayments notwithstanding.

It appears that a more coherent, well-designed and monitored program of EU funds disbursement is required so that future payments reach their ultimate goal, the regeneration of productive investment in Greece, so that the country can be put back in the path of long-term economic growth.

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