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# **Relationship Between Public Revenues and GDP for Countries in the European Union (2000–2017)**

## **Abstract**

*In this paper we seek the relationship between public revenues and GDP after the consequences of the 2010 economic crisis for two groups of EU countries: “memorandum” versus “no memorandum”. In the EU, following the financial crisis and the imposition of varied and intensified budgetary discipline for both groups of countries, the collection of public revenues is not dictated by a strict provision. In both groups of countries, income from taxes occurs at lower forecasts or is higher than forecast. The application of the ARIMA model in our study verified that the tax burden for each citizen for the purpose of collecting tax revenues continues for the countries of our study; it has not been interrupted after the outbreak of the economic crisis and it can be predicted that it is going to continue.*

**Key words:** ARIMA model, Tax Burden, Budget Data, International Comparisons, Economic Sociology, Memoranda governments.

**JEL Classification:** C10, H22, H66, Z13.

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## Introduction

The accomplishment of fiscal stability in the EU became more crucial for some member states which found themselves mired in negative fiscal circumstances after the 2010 financial crisis. The consequences of the economic crisis within the institutional framework of European treaties compelled each one of the eight European states involved in the research (Austria, Belgium, France, Greece, Italy, Portugal and Spain) to face the crisis within the spirit of “fiscal stability”. This happened despite the different gravity of the causes and consequences for each state.

Public revenues in relation to GDP were shaped by the economic circumstances in conjunction with a continuously changing tax system which operates under these extreme conditions. Concurrently, fiscal prediction became linked to each state’s obligation to face the necessary fiscal policy changes, i.e. to impose medium-term financial objectives based on speculation regarding the macroeconomic development of the global economy and based on that to specify decisions and measures affecting public expenditures and tax revenues.

For the study, the aforementioned eight member-states were divided into two groups based on their terms of fiscal monitoring and control following the financial crisis. The standards of compliance to the terms as well as the administrative and legislative abilities of each state refer to good governance practices. On the other hand, non-compliance to these standards creates the conditions for the transition from “fiscal compliance” to “memorandum administration” of their budgets with all administrative and legislative consequences. The long-term analysis of tax revenues (1965–2017) for each group of the studied member states and their comparison aims at pointing out the categories of taxes for achieving the budgetary policy aims of one or more states.

In our analysis the prediction of tax revenues for each state or group of states of the EU, taking into consideration the changes of the GDP, is analysed through the autoregressive integrated moving average (p, q, d) the ARIMA (p, q, d) model. The application of this model through the repetitive transformation of the first differences leads to the production of a fixed time series. Following the “Box-Jenkins” method (Box, Jenkins 1976) we adopt and enter the given facts for analysis in the StatGraphics program. Thus, we arrive at the results that determined which EU countries were entered into a “memorandum” or a state of budgetary oversight in order to cope with the consequences of the global economic crisis of 2007 and the

post 2010 developments in the European Economy (Greece, Italy, Portugal, Spain) and which were not (Austria, Belgium, France, Netherlands). This analysis leads to the evaluation that for the countries in a state of deeper economic crisis the tax burden per capita is not going to be reduced in the following years. The progression of each Member State in terms of improving the living conditions of its residents will be linked to its effective governance and budgetary organization in order to minimize violent budgetary changes and regulate the mining of public resources.

## The Public Revenue from Taxes

The reliable production of data, i.e. the systematic observations that are collected at fixed time intervals and following international standards, is based on the new reality of the European Union in the 21<sup>st</sup> century. It is mandated by the need to counter the production of inaccurate data from member-states. The imperative need for reliable data leaves national statistical practices and especially systematic observation of Public Revenue of individual member-states in the past. Relevant studies reveal that the sources of Public Revenues (and their ranking) as well as the prioritization of taxation policy within the E.U. are determined by legislation and administrative acts which each Member-State should take into consideration regarding their production, as well as verification of fiscal compliance (European Commission 2017a, 2017b).

This is in regard to the transition from an older method of applying budgetary policy by parliamentary governance to a modern form of governance with “levels of austerity”. These levels of austerity are determined by mid-term fiscal programming and take the form of national provisions (European Commission 2017c).

Taxation remains the fundamental, constitutional budgetary tool of each government; however, its regulatory aspect is shaped within the goals and functions of the EU as well as the influence of globalization. One of the greatest sources of influence, as was made evident by the recent financial crisis of the EU countries, is the management of public debt. The growth of such debt gives rise to political perceptions and management techniques whose primary goal is to find a taxation formula which can safely cover public expenditures without helping economic growth.

The common regulations among Member States aiming at a good taxation operation towards the collection of taxes serve the imposed budgetary targets but remain problematic. Due to a variety of causes there are deviations among the Member States; these are the administration and effectiveness of a state, the

synthesis of the public revenues, the transparency and the extent of corruption. The procurement of public resources through taxation now goes beyond national borders and its performance is a subject of research and evaluation of international organizations.

The financial policy of a growing number of states has been conducted through numerical indicators with surveillance of the fiscal policies since the 1980's. One side of this coin is the creation of a "database" of fiscal regulations for the member states of the EU ("Numerical fiscal rules in EU member countries") and the other is the creation of independent budgetary instruments. The creation of independent budgetary instruments for the first time in the global post-war economy gives rise to catalytic changes in the financial process and its performance, as well as the dynamic of constant increase in public resources from taxation and predictions that go beyond national borders.

The measures that are imposed on economies (as in the case of Greece) and the "European Support Mechanism" test the limits of the classic tools of the constitutional class and the well-known arena of "Public Economics", especially the relationship between state and economy, and economic policy and constitution. They also influence sociological fields such as "fiscal sociology" and "sociology of taxation" (Fournari 2016).

Therefore, the tax rules with their "fiscal rule strength index" (Fiscal Rule Strength Index, FRSI), become restrictions for the government in exercising its fiscal policy. The laws are formulated with criteria such as "the statutory base of the rule", "the room for revising objective", "the mechanisms of monitoring compliance and enforcement of the rule" *etc.* (European Commission 2007: 240).

The usual restrictions, which go beyond the national governmental policy and concern all the Member States or the EU, are the rules of fiscal balance (Eyraud *et al.* 2018). The conditions of a country being incorporated into the European system and the global system in general are not as easy as they were in the 20<sup>th</sup> century. The long period of countries doing as they saw fit in the management of Public Income is long past. The emaciation of the disintegrating political autonomy is furthered by tax rules which "are broadly utilized to limit the purview of fiscal policy and to promote fiscal discipline" (Venizelos 2019).

The number of countries that adopt and utilize fiscal regulations worldwide exceeds 90. This trend is supported by the realization that the main goal is the arbitrary limitation of tax policy and fiscal policy in general. Additional goals include the bolstering of fiscal viability, transparency, and the indication of the course of the country's fiscal policy to financial markets (Eyraud *et al.* 2018).

## Tax Revenue

The relationship between the categories of tax revenue and the GDP shapes the field of taxation sociology. Some of the issues at hand are the modernization of fiscal rules, the connection between the tax climate and social justice, the prediction, quantification and confrontation of social inequalities especially in times of national crisis and violent social and technological transformation.

A necessary condition to this analytical spirit is the availability of reliable data and predictions as “(...) providing quality data is a must if we want to develop robust and effective tax policies for the future” (European Commission 2018). Between countries there is a search for different tax structures and their consequences on the tax ratio with regard to the GDP. The prediction of revenue depends on the evaluation of the tax elasticity, the assessment of the volatility of the financial conditions and their impact of prices and inflation (Jenkins *et al.* 2000: 15).

Empirical studies on these subjects have shown two different approaches: one concerns the assumption that the level of taxation influences financial growth and the other promotes the discussion surrounding the consequences of the tax structure on financial growth. This involves the size of the public sector with its negative consequences, meaning the distortion it causes to financial growth. The antithesis to this position supports the idea that higher taxation and its dissemination via public expenditure can promote economic growth. Post 1980 this discussion has been fortified by the comparison between countries which adopt different financial growth models (Stoilova 2017).

The connection with the public sector has widened the difference of opinion regarding the nature of the relationship between taxation and economic growth. This controversy is rooted in the tension caused by the distinction between developed and developing countries, viewed either individually, comparatively, or in groups of countries belonging to one or more international organizations.

In developing countries there remains a disagreement, no one has yet formulated a “Magical tax recipe” which would encourage economic growth (Nantob 2014): some countries with high levels of taxation have high rates of economic growth and some countries with low taxation have lower rates of economic growth.

Another component to this disagreement is the connection drawn between taxation and democratic organization. Countries with high incomes vs. those with medium and low incomes are distinguished by the ways in which they expand their

tax revenue during the growth phase as well as the importance placed on certain tax means.

It has been shown that the total of tax revenue for governments is linked to the growth index. Their relation to the GDP groups countries by tax rate. Those countries where taxation is between 5–15% of national wealth show very weak growth. Countries with a higher tax rate of 15–30% show an intermediate growth rate, and finally countries where taxation is greater than 1/3rd of the GDP have a high index of growth.

The ratio also has to do with the level of democracy, as has been shown by a large sample size of countries. Countries where the tax to GDP ratio is relatively weak (lower than 12–15%) are often governed in a dictatorial fashion. Countries where the tax burden is higher (between 12–15% and 25%) are characterized as relatively democratic countries and finally countries whose tax burden exceeds 28% are considered fully democratic. Taxation is the most important piece of internal revenue policy since it represents more than 80% of total revenue for more than 50% of the countries in the world (Fournari 2016, 2019).

## Taxation Act and Policy

“Tax revenues in advanced economies have continued to increase, with taxes on companies and personal consumption representing an increasing share of total tax revenues, according to new OECD research” (OECD 2018). This change is accompanied by the relationship between “harmonization” vs. “following of rules” of the tax systems of different countries. The harmonization of tax systems (no need for an across the board harmonization of Member States’ tax systems) recedes from these rules with a better coordination (COM/2006/823) of national policies by the member states of the EU.

Member States, based on the principles of “subsidiarity” and “proportionality” (the principles of subsidiarity and proportionality) (European Commission 2017d, e), are free and in accordance with their preferences to choose the most appropriate tax systems for them. The need for tax harmonization in the EU includes “good governance” in the tax area (i.e. more transparency, exchange of information and fair tax competition) (European Commission 2009) and has added to the fight against harmful tax competition (OECD 1998). The change in tax revenues of each Member State is linked to the demand for “unanimity” in tax decisions that remains pending,

despite the recognition that Member States' tax coordination (European Commission 2004) is linked to the future of Europe (COM/2003/548).

This quick reference to three concepts crucial to tax policy decision making in EU member states ("harmonization", "rule compliance", "unanimity") encapsulates two matters which are linked to the transition from a historical analysis of the data to a prediction of public revenue from taxes from the two groups of countries.

### **Extract Taxation and Tax Resistance**

At the crux of central power, taxation is a mechanism of evolution from the earliest years that today depicts the ways in which a country moves to a centralized and compulsory system of taxation, with the parliamentary role ever changing (Besley, Persson 2014, Dinecco 2011). The connection between taxation and GDP influences property rights through which revenue collection strengthens the mechanisms of market economy, solidifying market relations as a basis for the productivity of a state.

Besides being a necessary power, taxation, through its reforms, is a change agent to the ways in which this necessity is distributed into the construction of a law-abiding state. The functionality of the markets of such a state and its financial performance depend upon a stable budget and restrict expropriation and other violent forms of resource collection (Besley, Persson 2014). Taxation with stable rules is a strength which influences the level and layout of taxes, with the hope of long-term financial growth (Dackehag, Hansson 2012).

The relationship between taxes and the rate of growth of the real per capita GDP can be interpreted through the analysis of time series. G.D. Myles observes that "in most developed countries, the level of taxation has steadily increased over the last century. An increase from approximately 5–10% of the GDP to 20–30% is characteristic. Such important increases to taxation create serious questions regarding the impact it had to economic growth" (Myles 2000). In this analysis, the correlation between taxation and growth is quite strong. Thanks to short-term theoretical models, this theory observes that taxation distorts decision making and creates incorrect distribution of resources regarding the more uncertain long-term effects. Governmental taxation policy is ineffective as a mechanism to influence long-term economic growth, contrary to the short-term effects on per capita GDP.

Later, economists will highlight the effects of taxation on the rate of technological advancement and its potential influence on motivation for innovation and entrepreneurship (Dackehag, Hansson 2012). Furthermore, tax returns on

investments or expected profitability seem to have a positive impact on the rate of economic growth (Myles 2000).

The level of Resource gathering by means of taxation is a question to be answered through long term analyses. Is there a minimum analogy of tax to the GDP linked to the acceleration of development and development? (Gaspar *et al.* 2016). The experts have an empirical answer to the question whether there might be a point to turn over the analogy of tax to GDP, and ended up with two analyses of different time spans: the first and more recent concerns the data of 139 states for the period 1965–2011 and the second and older, concerns the data of 30 more advanced economies or the 1800–1980 period.

This approach showed that the estimated points for an overthrow to take place are similar to almost the 12% of the GDP. For the contemporary sum of data it is noted that for a state just above the median there will be a 7,5% GDP *per capita* after 10 years (Gaspar *et al.* 2016).

### **Taxation: a Basic Tool of the National Economy**

The whole issue of tax payments is connected with the economic development; or contrary to this, a category of chosen taxes shapes the tax structure and enforces economic growth; this is a question which has already been addressed: i.e. the rise of taxes on consumption with simultaneous decrease of taxes on work and capital, can give rise to the development of the economy (Stoilova 2017).

The other category of studies shows that economic activity between different countries is influenced by the combination of “tax burden” and “tax structure”. Starting with the impact of taxation on the economic development of the 28 member states of the EU for the 1996–2013 period, we can evaluate the proposals for taxation that could lead to economic development.

For the needs of our study we took a pool of countries divided into two groups. One of the groups includes the countries characterized by a Memorandum of Understanding. The political conversation has been met with the confluence of factors which lead to an optimized tax system, which interprets causes and differences in the performance of tax revenue from country to country in the EU.

Planning includes reform (OECD 2017) so that its observation in Member States of the EU can determine the challenges of the tax policy they face for the improvement of their tax systems. It has been observed that these challenges, which become increasingly important during times of slow growth and budgetary purging (European Commission 2013) are owed to the potential contribution of taxation to



the purging of public economics – besides the restriction of expenditure – as well as to a friendliness to an enlargement of the tax structure.

The “descriptive analysis” of the differences between the 28 Member States, as it arises from the computation of the total tax burden and the planning of the tax structure and the empirical analysis lead to the impacts of taxation on economic growth (Stoilova 2017). Selective consumer taxes as well as income tax and property tax bolster financial growth when they help shape the tax structure of a state.

In this way, the hypothesis that taxation is a basic tool for the management of a national economy is further disseminated. The recent trend towards globalization and the older trend of internationalization both reinforce the practice of tax collection and its connection to economic growth. The analyses spread beyond country or group of countries to a regional level in order to analyse the causality between maximization of tax revenue and maximization of GDP.

The discussion centred on national economies with special circumstances focuses on the proposition that “high taxes do not help economic growth” in order to disprove this correlation (Yi, Suyono 2014). Of all the public revenue components of the GDP, tax revenue has the greatest impact on its progress. Moreover, there is a search for the degree of independence of economic growth from taxation in both developed and developing countries.

The sources of uncertainty regarding the prediction of tax revenue in certain countries (i.e. Israel) show that tax revenue that is delayed in relation to the GDP volatility gives rise to inaccuracy and potential errors. Finally, treatment of economic and institutional factors which apply pressure to the fiscal functions of member-states of the EU (Molina-Morales *et al.* 2014) shows that the economic model improves with the introduction of factors such as financial freedom or institutional and geopolitical variables.

## Tax Revenues: from the Past to the Forecast

### Historical Data

The public revenues coming from taxes for the two groups of states in our research (G.I.G. II), are distinguished by their common origin (the data base of OECD 1965–2017) and the different way of enforcing the budgetary stability; being member states

of the EU in the group G.II, measures of “memorandum of understanding” were enforced (Memorandum of Understanding, MoU).

The MoU is the unofficial contract, which is an integral part -the most important- of a series of decisions, acts, declarations, decrees or acts of the European Council, the ministers of the Eurogroup, the International Monetary Fund, the European Commission, the European Central Bank and the member-states of the Eurozone. The need for fiscal balance through data analysis intensifies the application of laws for the confrontation of the budgetary problem which is especially important for countries such as Greece (an EU member and member of OECD) which find themselves in a crisis post 2010. G. II falls from independent management of its budget to unilateral acts or decisions as well as international contracts or agreements of international justice and unitary justice with distinct goals (Manitakis 2017).

This is due to the fact that the “technical agreement memorandum” is a supporting document for the “Memorandum of Understanding” according to which the indices which are subject to specific quantitative goals and in which performance criteria are included and indicative goals are defined. It outlines the methods that should be followed and which are used for the assessment of program performance as well as the information needed to secure sufficient goal monitoring. This group includes Austria, Belgium, France and the Netherlands.

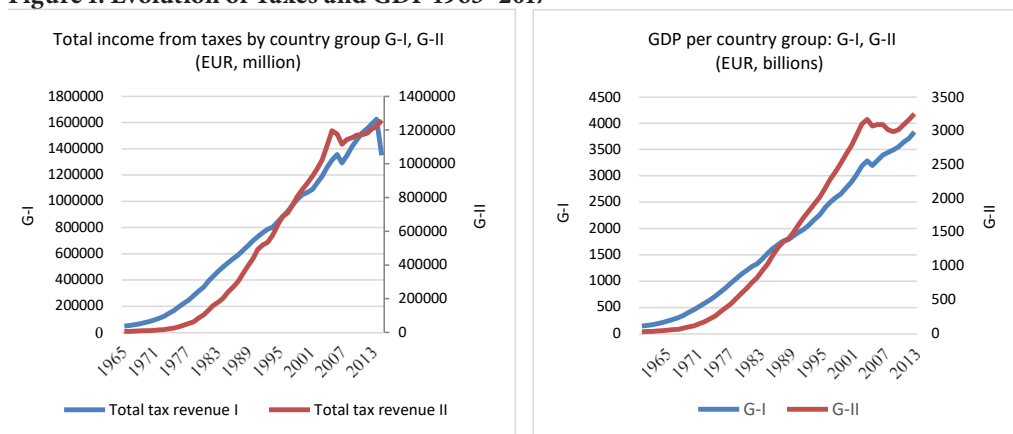
The historical analysis of tax revenues is based upon the use of the time series 1965–2017. Within this time span the period 2000–2017 is defined by very intense reforms and talks so as to estimate the rate of economic growth and the changes of the public revenues (Engen, Skinner 1996). Another question is how much “the consent of the method of taxation”, a major issue for those member states that are within the ‘memorandum’, affects the economic growth so that we may investigate the issue of the “minor” influence (Myles 2000).

Finally, the crisis of public finances strengthened the attention on the reliability of the data (as it has been manifested by the Greek case among others) and the tax revenues were placed in the centre of attention due to their relation to the economic activity (taking in consideration that they are modified faster as the tax indices and levels of income change).

## Comparisons of Group I and II Countries: Historical Data, 1965–2017

The historical data (Figure 1) demonstrate that the changes of the tax rates become an additional burden for the citizens of the two groups of the member states by increasing their taxes during the period 1965–2017. A critical question to be answered is which group of taxes, out of the entire body of tax revenue, maintains the long-time tendencies and their effect regarding the modification of the GDP.

**Figure 1: Evolution of Taxes and GDP 1965–2017**



Source: OECD. *Details of Tax Revenue*. <https://stats.oecd.org/Index.aspx?DataSetCode=REVAUT> [accessed on: 23.03.2019].

The long-term increase of the sum of tax revenues indicates a variation of tax behaviours that expresses social and economic concerns of the citizens of each state for the funding of public expenses. Concerns arise as to the way the tax rates affect the living standards of the people (Johanson *et al.* 2008).

The nomenclature of tax revenues with the individual sections of taxes of each country and their categories show the evolution of the structure of the taxation system of each country. Within the period of our analysis, the five categories (plus one more for the “miscellaneous” taxes) of OECD’s data show in the statistical nomenclature 282 sections for France, 211 for Austria, 194 for Italy, 179 for Belgium, 162 for Spain, 147 for the Netherlands, 124 for Portugal, and 97 for Greece; all these fully agree with the width and modifications of the economic activity and effectiveness of each country.

It has been demonstrated that countries with a relatively high level of taxation can have different tax structures from one another. However, the reaction of the economy to a change in the tax structure can vary from country to country or from one tax level to another (Johansson *et al.* 2008).

The categorization of long-term quantitative data demonstrates the relationship between the cost of compliance of the tax base and the administrative cost that each government incurs for the performance of their tax system. For the countries in the first group (Austria, Belgium, France and the Netherlands) the tax burden ranged from 30% to 47% during the 1965–2017 time period. For the countries in the second group (Spain, Portugal, Italy and Greece) the tax burden ranged from 12% to 37%.

The breadth of the tax burden gives rise to the type of decisions made for the design of the tax mediums in order to achieve the total tax revenue (Figure 1) and for each state to accept the per capita tax burden. The tax burden encompasses the tax structures and social choices that are adopted with political evaluation by governments in order to shape their tax policy (Figure 3). Finally, with regard to the decisions made by a group of countries in order to collect tax revenue in a socially acceptable manner and in accordance to tax structures, the comparison between the two groups of countries shows that:

1. Even in times of crisis, it is difficult to distinguish the consequences from the changes to the tax structure for economic performance due to changes to tax revenue of the GDP
2. The general trend of increase in public revenue through taxation is parallel among the two groups of countries (I and II) in the categories “Income tax, profit and capital profit”, “Real estate tax” and “Goods and Services tax”. Conversely, there are great differences between the two groups regarding tax revenue from “Social Security Revenue” and “Payroll and workforce tax”. This general trend during the long period of 1965–2017 seems to have been altered a bit during the period following the 2010 crisis.

## Comparisons of Group I and II Countries: Forecasts 2016–2023

The forecast of tax performance, taking GDP into consideration, enters our analysis with the Autoregressive Integrated Moving Average (p, q, d) (ARIMA) (p, q, d) model. This model, through the repetition of the transformation of the first

differences, allows for the production of a fixed time series following the Box-Jenkins method (Box, Jenkins 1976). The analytical processing of our data for the eight E.U. countries inputs the available observations into the Statgraphics program so that we may have the evolutionary results and forecasts for the 2000–2023 time period.

The results from the application of the ARIMA model by country show that none of the 24 partial autocorrelation factors (17 partial factors with actual data and 7 factors with predictions) are statistically significant at a confidence level of 95.0%. This covers the non-autocorrelation of the residual data in the per-country forecasts with regard to the *per capita* tax burden as well as the per capita GDP.

In 2008 there is a drop in the annual GDP which coincides with a drop-in tax payment of all types. This change marks the most important event of the global economy: in 2007 a crisis breaks out in the U.S.A. and in 2008 the first effects are seen in countries of the European Union.

In the first group of countries of our analysis, a tendency to increase the per capita tax burden becomes manifest after 2009. This trend does not seem to show signs of slowing down over the next few years, as is evident from the post-2016 forecasts. In the case of the countries in our second group, we observe a tendency to decrease or to maintain a balance up until 2016 and to remain in balance in the forecasts for the following seven years. This conclusion does not seem to be supported by the facts from Portugal, which shows more of the evolutionary characteristics of the first group despite having been forecast with the second group.

Regarding changes in GDP, the countries in the first group display a parallel relationship between the per capita tax burden and the changes in the per capita GDP. In the second country we observe a “perpendicular” correspondence, as the data for Greece and Portugal forecast a stable and possibly downward trend, contrary to Italy and Spain which show an upward trend to their values. Therefore, for the fiscally “healthy” countries of the first group we can hypothesize that the per resident increase in tax burden is accompanied by an increase in per capita income.

However, in the cases of the beleaguered Eurozone countries, their accession into the memorandum regimen rendered them economically weak in the short term. Additionally, the institutional surveillance they are subjected to adds to the vulnerability of the position they found themselves in following their exit from the memoranda for the imposition of budgetary balance.

In Greece the forecast for the tax burden per capita shows a slightly upward trend, in contrast to the progression of the GDP. This indicates that taxation will not come

from economic activity but from changes to the tax burden, such as the category of direct taxation. Portugal's progression appears to be similar.

The situation seems to be very different for Italy and Spain. For these countries we observe a balanced or slightly downward trend in taxation, with a parallel attempt to improve the per capita GDP. It seems to be a result of the goal for improvement of the tax burden for these countries as they leave the economic crisis behind.

## **Drawing on the Impact of the Tax and GDP Crisis**

In order to control the impacts of the crisis on the economies of these countries, regardless of the "memorandum" responsibilities or the "budgetary" controls, we observe the progression of our values up until 2008. As follows, we attempt to forecast the following eight years. Our technique allows us to observe the ways taxation has progressed as a system ("tax system") and the way each country structured itself under economic crisis conditions to face its consequences.

Further, we examine how the progression of economic indices was influenced by the crisis via forecasts and their incorporation in the evaluation of tax revenue and GDP for those years that in the end belonged for a group of countries affected by the crisis, which are a characteristic sample of countries of the 2009–2016 time period (Bank of Greece 2014; Millaruelo, del Rio 2017).

### **Impact on tax burden**

Following this technique for the forecasting in the 2000–2008 period and the 2009–2016 period and comparing it with the forecast that we have dealt with above for the eight countries, it follows that having done all the above comparisons none of the estimations of any country lead to the decline of the collection of tax revenues and national wealth. This situation is overturned after 2009 and a different financial evolution of countries begins (Figure 2).

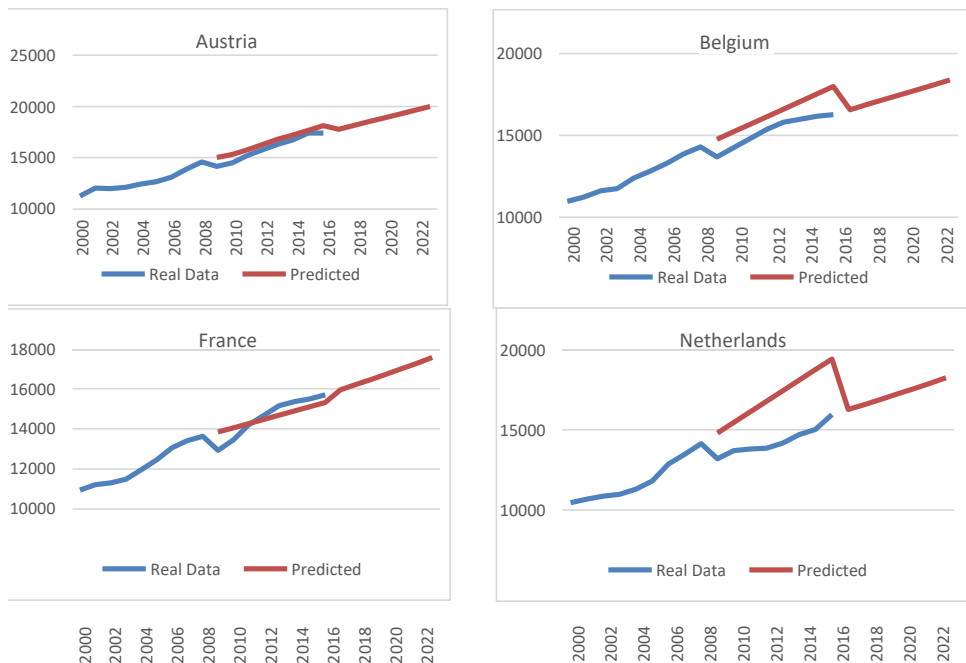
The course of fiscal burden per inhabitant follows the same path for the countries of G. I (Austria, Belgium, France, the Netherlands) excluding the decline of 2009. A more intense instability is noted for the countries of G. II (Greece, Italy, Portugal, Spain) as to the evolution of values throughout the period 2008–2016. From 2017 until 2024 Italy and Spain seem to have the rates that were predicted in 2008 for the years

up to 2016 and to be in equilibrium. The same is true for Portugal as well with one difference: that it follows an upward course in contrast to the other two countries.

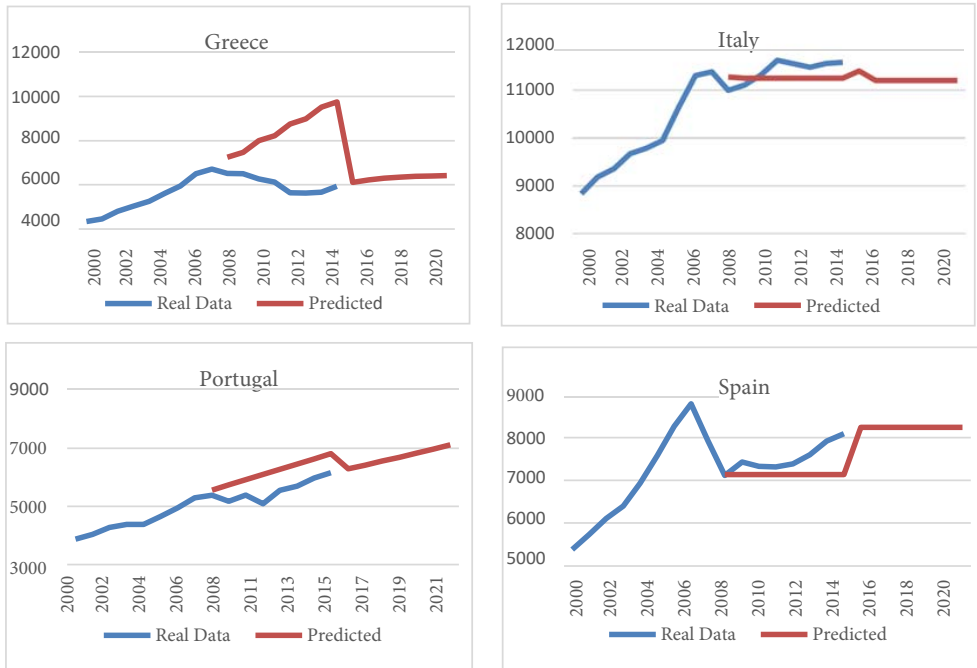
The big difference pertains to Greece: from 2009 up to 2014 the tax burden had a declining tendency. This tendency is linked to the decrease of the GDP *per capita* as well as to the decrease of income and the increase of indirect taxes. The result of this is the decline of purchasing power. The issue is that like the other three countries with an upward trend, Greece also shows a restoration of prices to levels that had been predicted during the period 2009–2016, but its curve is more pronounced in relation to the seven cases under investigation.

**Figure 2: Comparison of Tax projections *per inhabitant* 2009–2016 and real data (EUR)**

**Group I: Austria, Belgium, France, the Netherlands**



### Group II: Greece, Italy, Portugal, Spain



Source: own elaboration.

### Impact on GDP *per capita*

The continuation of the analysis to the per capita evolution of GDP, shows that in the case of the per capita GDP of the inhabitants (for the first group of countries on the whole) the countries follow the evolution that is expected from them based on the predictions. The decrease for the year 2009 is expected, (and it could not have been predicted), but after 2009, especially for Austria, they recovered to almost the same rates that had been predicted for the period 2000–2008.

On the contrary, for the countries of the second group an “internal” distinction appears. It concerns the countries that maintain (even with fluctuations) the forecasting and those with a negative course. Spain and Italy are countries with violent modifications of their curves, but they fluctuate in the patterns that emerge based on the data from 2000–2008 period.

Portugal, after the decreasing range of 2009 and the fluctuations of the per capita GDP of the inhabitants, finally reaches a balance with the prices which had been

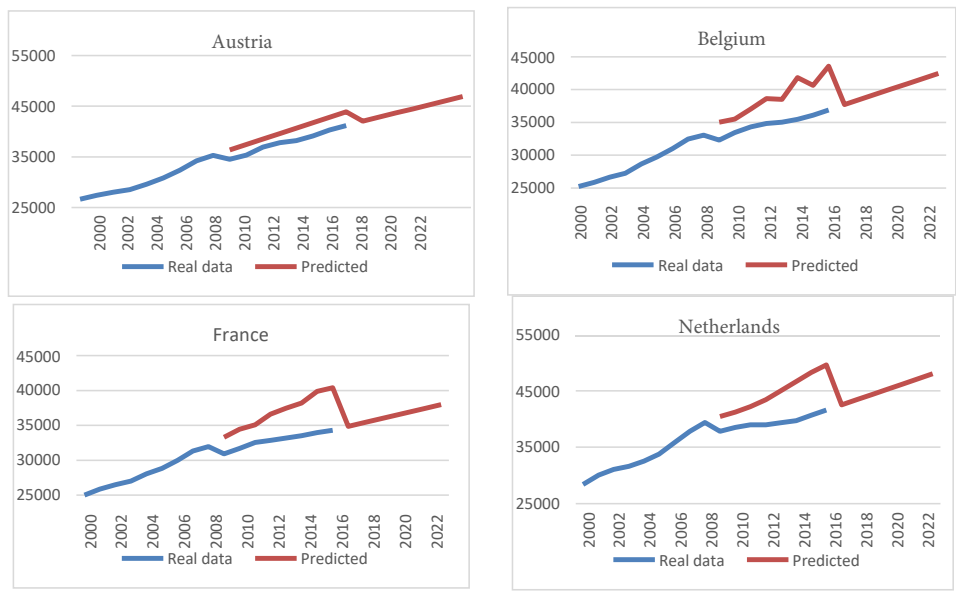


forecast before the crisis. The forecast stabilizes the evolution of the prices, but it has decreasing tendency contrary to what had been predicted before the crisis.

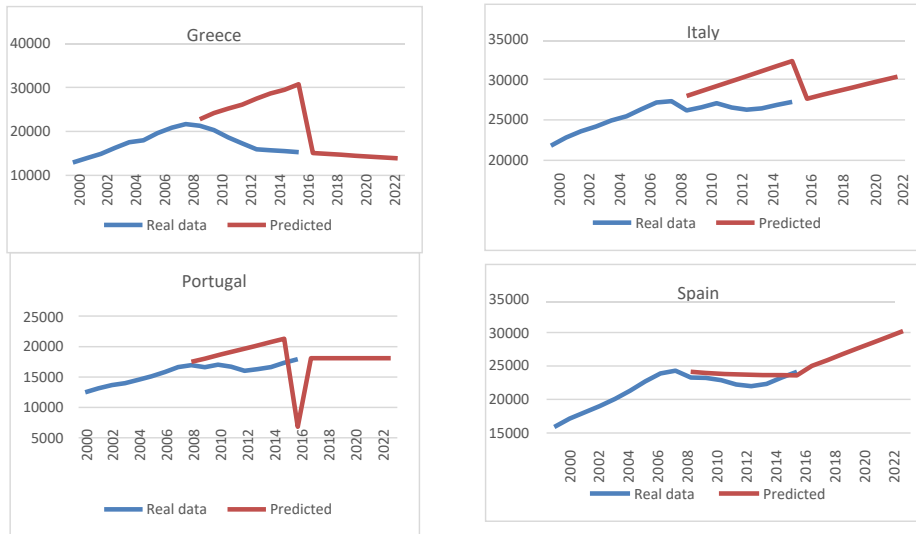
Greece’s situation is the most problematic in this case as well. According to one explanation this might have been the result of the policies undertaken to cope with the crisis on a national and international level. The data of 2000–2008 concerning the evolution of the per capita GDP of the inhabitants showed an increasing tendency. However, from 2009 on the per capita GDP of the inhabitants has a decreasing course, which is verified by the available data.

**Figure 3: Comparison of GDP forecast 2009–2016 and real data (EUR, bmil)**

**Group I: Austria, Belgium, France, the Netherlands**



### Group II: Greece, Italy, Portugal, Spain



Source: own elaboration.

## Conclusions

The tax burden as a means of mining revenues for public funds does not seem to be restricted to the countries of the EU and OECD that are the object of our study. Analysing the taxation revenues of the countries without austere fiscal supervision (countries I) as opposed to the countries with austere fiscal supervision after the outbreak of the financial crisis of 2010, leads to the hypothesis that there are very few basic categories of public funds (“Income tax, profit and capital profits” and taxes on goods and services”) which support the fiscal structure of the public revenues. This is true despite the changes after 2010 in the countries with austere fiscal supervision and memorandum.

Other issues such as that of the decrease of the shares of public revenues from actual people as opposed to legal agents, which appears in certain subperiods do not cancel the strong presence in the total revenues of these two categories of public revenues. The stability that is recorded during this long period and goes beyond the period of crisis shows the tolerance of the citizens to the fiscal structure and the limits of the tax reforms. The stability for the taxation of real estate is in the same spirit.

The application of the ARIMA model in our study verified that the tax burden for each citizen for the purpose of collecting tax revenues continues for the countries of our study; it has not been interrupted after the outbreak of the economic crisis and it can be predicted that it is going to continue with the same intensity.

There seem to be differences in this reform depending on the country and in one case of a country with memorandum the evolution of the tax burden tends to follow that of the countries without austere fiscal discipline despite the fact that for this country the “memorandum” has been applied for fiscal balance. The general tendency to increase the tax revenues instead of limiting public expenses is a principle existing within the EU.

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the Netherlands	2017-2023	ARIMA (1,0,0)	RMSE	456.306	Parameter	Estimate	Std. Error	t	P-value
			MAE	313.939	AR(1)	1.01936	0.007764	131.301	0
			MAPE	2.3775					
			ME	64.9761					
			MPE	0.392288					
	Backforecasting: yes Estimated white noise variance = 219110 with 16 degrees of freedom Estimated white noise standard deviation = 468.092 Number of iterations: 5								
	2009-2016	ARIMA (0,2,0)	RMSE	298.546	Parameter	Estimate	Std. Error	t	P-value
			MAE	222.6					
			MAPE	1.76122					
			ME	62.76					
		MPE	0.533916						
Backforecasting: yes Estimated white noise variance = 89129.7 with 7 degrees of freedom Estimated white noise standard deviation = 298.546 Number of iterations: 1`									

Greece	2017-2023	ARIMA (1,1,0)	RMSE	224.931	Parameter	Estimate	Std. Error	t	P-value
			MAE	181.994	AR(1)	0.653403	0.20445	3.19591	0.006014
			MAPE	3.12309					
			ME	42.5965					
			MPE	0.852517					
	Backforecasting: yes Estimated white noise variance = 50738.2 with 15 degrees of freedom Estimated white noise standard deviation = 225.251 Number of iterations: 3								
	2009-2016	ARIMA (1,2,0)	RMSE	138.517	Parameter	Estimate	Std. Error	t	P-value
			MAE	116.87	AR(1)	-0.96534	0.196378	-4.91571	0.002668
			MAPE	1.99847					
			ME	41.2539					
		MPE	0.718306						
Backforecasting: yes Estimated white noise variance = 19224.8 with 6 degrees of freedom Estimated white noise standard deviation = 138.653 Number of iterations: 4									



Spain	2017-2023	ARIMA (0,1,1)	RMSE	361.106	Parameter	Estimate	Std. Error	t	P-value
			MAE	269.852	MA(1)	-0.9392	0.067995	-13.8127	0
			MAPE	3.65613					
			ME	91.7039					
			MPE	1.36119					
	Backforecasting: yes Estimated white noise variance = 130422 with 15 degrees of freedom Estimated white noise standard deviation = 361.14 Number of iterations: 6								
	2009-2016	ARIMA (0,1,1)	RMSE	479.434	Parameter	Estimate	Std. Error	t	P-value
			MAE	354.508	MA(1)	-0.80133	0.155876	-5.14081	0.001338
			MAPE	4.78512					
			ME	107.7					
		MPE	1.67183						
Backforecasting: yes Estimated white noise variance = 239129 with 7 degrees of freedom Estimated white noise standard deviation = 489.008 Number of iterations: 4									



France	2017–2023	ARIMA (0,2,1)	RMSE	561.96	Parameter	Estimate	Std. Error	t	P-value
			MAE	358.193	MA(1)	0.93404	0.063444	14.7223	0
			MAPE	1.15607					
			ME	-21.4305					
			MPE	-0.03711					
	Backforecasting: yes Estimated white noise variance = 322358 with 14 degrees of freedom Estimated white noise standard deviation = 567.766 Number of iterations: 5								
	2009–2016	ARIMA (2,2,1)	RMSE	230,821	Parameter	Estimate	Std. Error	t	P-value
			MAE	126.517	AR(1)	-1.40011	0.35569	-3.93631	0.017012
			MAPE	0.426372	AR(2)	-1.1345	0.274506	-4.13289	0.01446
			ME	96.5858	MA(1)	-0.96522	0.109386	-8.82394	0.00091
		MPE	0.331681						
Backforecasting: yes Estimated white noise variance = 53738.9 with 4 degrees of freedom Estimated white noise standard deviation = 231.816 Number of iterations: 11									

the Netherlands	2017–2023	ARIMA (0,2,1)	RMSE	884.924	Parameter	Estimate	Std. Error	t	P-value
			MAE	589.653	MA(1)	0.995363	0.115719	8.60159	0.000001
			MAPE	1.57208					
			ME	-161.695					
			MPE	-0.40908					
	Backforecasting: yes Estimated white noise variance = 820895 with 14 degrees of freedom Estimated white noise standard deviation = 906.033 Number of iterations: 10								
	2009–2016	ARIMA (2,2,2)	RMSE	265.254	Parameter	Estimate	Std. Error	t	P-value
			MAE	171.327	AR(1)	1.21727	0.26643	4.56881	0.01027
			MAPE	0.494986	AR(2)	-0.79167	0.198199	-3.9943	0.016207
			ME	0.982365	MA(1)	1.15326	0.276358	4.17306	0.013996
		MPE	0.002622						
Backforecasting: yes Estimated white noise variance = 78332.6 with 4 degrees of freedom Estimated white noise standard deviation = 279.88 Number of iterations: 10									



Portugal	2017–2023	ARIMA (0,1,1)	RMSE	423.909	Parameter	Estimate	Std. Error	t	P-value
			MAE	341.13	MA(1)	-0.9255	0.080232	-11.5352	0
			MAPE	2.15987					
			ME	182.264					
			MPE	1.20508					
	Backforecasting: yes Estimated white noise variance = 179761 with 15 degrees of freedom Estimated white noise standard deviation = 423.982 Number of iterations: 11								
	2009–2016	ARIMA (0,2,1)	RMSE	217.582	Parameter	Estimate	Std. Error	t	P-value
			MAE	175.727	MA(1)	0.832117	0.16093	5.17068	0.002073
			MAPE	1.12675					
			ME	22.7298					
		MPE	0.137213						
Backforecasting: yes Estimated white noise variance = 50057.0 with 6 degrees of freedom Estimated white noise standard deviation = 223.734 Number of iterations: 10									

Spain	2017–2023	ARIMA (0,2,0)	RMSE	561.415	Parameter	Estimate	Std. Error	t	P-value
			MAE	428.596					
			MAPE	1.88629					
			ME	-23.9507					
			MPE	-0.09501					
	Backforecasting: yes Estimated white noise variance = 315186 with 15 degrees of freedom Estimated white noise standard deviation = 561.415 Number of iterations: 1								
	2009–2016	ARIMA (1,1,2)	RMSE	181.594	Parameter	Estimate	Std. Error	t	P-value
			MAE	110.962	AR(1)	0.657404	0.228432	2.87789	0.034674
			MAPE	0.524225	MA(1)	-1.85734	0.281838	-6.59008	0.001209
			ME	41.8685	MA(2)	-1.23219	0.342096	-3.60188	0.015513
		MPE	0.234697						
Backforecasting: yes Estimated white noise variance = 75506.5 with 5 degrees of freedom Estimated white noise standard deviation = 274.784 Number of iterations: 14									