

IMPACT OF TAXES ON ECONOMIC GROWTH: AN EMPIRICAL STUDY IN THE EUROZONE³

This paper analyzes the effects of types of taxes on economic growth in Eurozone countries. Three of the largest types of taxes are taken into analysis, namely personal income tax (PIT), corporate income tax (CIT), and value-added tax (VAT). The data for the independent variables (types of taxes) and the dependent variable (Gross Domestic Product – GDP) from 2002 (since the creation of the currency union) until 2019 have been taken into consideration. A total of 306 observations are entered into the panel model and analyzed using a fixed effect regression. The purpose of this paper is to highlight which types of taxes can affect growth and the magnitude of their effect. Results reveal that personal income tax, social security contribution, and customs duties and excises have a negative effect on GDP in the Eurozone countries. Whereas corporate income tax and value-added tax have a positive effect. We also find that as the share of tax income in GDP increases, their impact on economic growth deteriorates. Based on the empirical findings, we recommend that policymakers should focus on Value Added Tax and corporate income tax in order to have an impact on economic growth. Extra care should be taken in personal income tax revenues and customs and excise revenues, revenues that negatively affect economic growth.

Keywords: Tax revenue; Economic Growth; Value Added Tax; Personal Income Tax; Corporate Income Tax

JEL: C50; E62; F43; H20; P10

1. Introduction

Fiscal policy can be considered one of the most important economic policies of policymakers. The relationship between taxation and economic growth has been one of the most important and studied issues in economics (Cashin, 1995). Taxes occupy an important place in the economic policy of every economy. Governments need to be aware that any tax increase can have a negative impact on key economic indicators. Taxes are the main source of income for any economy, they can be a powerful tool that affects economic growth. Since economic growth represents one of the most important concepts in economic theory and achieving a sustainable gross domestic product is the main goal of any country, then special attention

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should be paid to what types of taxes a government should focus on (Prillaman & Meier, 2014). It is important to identify the main taxes and optimize their structure in order to have a positive impact on economic growth.

Besley and Persson (2013) argue that tax systems can minimize the losses that are imposed by taxes and positively affect economic growth. According to these authors, low-income countries have tax revenues between 10% and 20% of gross domestic product, while the average tax revenue in high-income countries is more than 40%. Governments usually manipulate government spending and taxes in order to carry out their policies (Rosen, 2004). Theoretical models predict that higher levels of taxes reduce economic activity (Karras & Furceri, 2015). However, the extant research examining the effect of taxes on economic growth falls short in providing consensus on whether increases in taxes increase or retard economic growth (Alinaghi, 2017). The countless empirical studies of the effects of taxation report very inconsistent results, ranging from positive to negative effects of tax variables (Mofidi & Stone, 1990).

The art of taxation consists in determining the kind of tax rates to provide the greatest possible income with the minimum taxpayer response (Jean-Baptist Colbert, as cited in Becker & Mulligan, 2003). Okun (1978) suggests that the choice of the best taxation system lies in the balance between “honesty or equality” and efficiency. Both neoclassical and Keynesian theoretical models predict that higher taxes reduce economic activity, even though there is considerably less agreement on the exact mechanisms of how this plays out. On the other hand, taxes may be beneficial for the economy because taxes are the basic source for financing public goods and services, and hence, increase the living standards and wealth of the whole society (Szarowska, 2013).

The tax system must be flexible in order to respond in a timely manner to changing economic circumstances. How do taxes affect economic growth? In this paper, we demonstrate which types of taxes have a negative impact on economic growth and which types of taxes have a positive impact on economic growth in the eurozone member states. Although there are many studies that have studied the impact of taxes on economic growth, to the best of our knowledge, no previous paper has included only Eurozone countries. The main reason why we studied these countries has to do with the use of the same currency (EURO) by many different countries with different fiscal policies. Also, in the Eurozone member states, there are countries that apply the linear tax to personal income tax and corporate income tax. Countries such as Estonia, Latvia, Lithuania and Slovakia apply linear taxation, while other countries apply progressive taxation.

The first country in Europe to apply the linear tax is Estonia, as of 1994 (Ellis & Peter., 2012). Following Estonia, other Baltic states like Latvia and Lithuania applied the linear tax rate. A justification for the application of linear taxation may be investment growth, employment growth, and growth of production (Schratzen-staleer, Wagener, & Kohler-Toglhofner, 2005).

The time period which is taken in the study has to do with the time period when the EURO was used for the first time (2002) until the end of 2019 (before entering the COVID-19 pandemic). Not every member state of the Eurozone adopted the common currency Euro in 2002. Slovenia adopted the Euro currency in 2007, followed by Slovakia in 2009, Estonia in 2011, and Latvia and Lithuania in 2015. The main objective of this paper is to show us which

type of tax should be given the greatest importance. After analyzing the data, eurozone member states can react through their fiscal policies in regulating tax revenues. In our model, we have included: tax revenues in personal income, corporate income tax, and value-added tax and we have added other types of tax revenues that have a smaller share in GDP. Our analyzes, in detail, are specified in the findings and discussions, where we show their effect on economic growth.

The remainder of the paper is organized as follows. The next section presents the literature review. Section 3 describes the data set, variables, period, and sources, as well as the econometric methodology applied. Section 4 presents the results and analyses the estimations and draws policy implications, while Section 5 presents results for an exercise in which we estimate. Finally, Section 6 presents the conclusions.

2. Literature Review and Hypothesis Development

2.1. Prior literature

The breadth of empirical literature studying the effect of taxes on economic growth across countries is overwhelming. Depending on the countries surveyed, results differ. Previous research focusing on different time periods and country data observation has shown different results regarding the impact of taxes on economic growth. However, according to almost all authors, taxes have impacted economic growth.

Tanzi and Zee (1997) analyzed the relationship between economic growth and other factors such as taxes, government spending, macroeconomic stability and income distribution. Authors show that government taxes and expenditures have an impact on GDP growth. The same effect was evidenced by Atkinson and Stern (1980), who studied Great Britain between 1973 and 1979. They came to the conclusion that taxes have a very small impact on economic growth in the long run. They present the relationship between theory and econometric results for public policy analysis. Along with the same line Fu et al. (2003), analyzing data from the USA and utilizing types of taxes, concluded that they have an impact on GDP growth. These authors showed the correlation between fiscal policy and economic growth in the US, as well as the correlation between taxes, government spending and deficit. These results are achieved using the econometric VAR model.

Another stream of research finds negative effects of taxes on economic growth. (Blanchard & Perotti, 2002) find that increasing total revenues, including tax revenues, has a negative impact on investment and GDP. The authors studied the United States, but the period of time that was studied was shortly after World War II. Similar findings are shared by Fölster & Henrekson (2001), who studied only rich countries, from 1970 to 1995, Holcombe & Lacombe (2004), studied by the US, from 1960-1990 and Bania, et al. (2007), who also studied the US. Bleaney, Gemmell, and Kneller (2001) studied direct taxes and indirect taxes in OECD countries from 1970 to 1995 and concluded that increasing tax revenues reduce GDP growth. According to these authors, the increase in tax revenues has a negative correlation with GDP growth.

2.2. Hypothesis development

2.2.1. Personal income tax and economic growth

A large number of studies have tried to identify the link between personal income tax and economic growth. Most of the scientific papers have been conducted in or using data from developed countries, members of the OECD. Bleaney et al. (2001) studied the OECD member countries from 1970 to 1995 and used the panel as an econometric model, concluding that personal income tax reduces (reduces) economic growth. Gemmell et al. (2011) have come to the same conclusions, where they have used the same states but with a greater extension of the years (1970-2004) as well as the same econometric model, Personal income tax has a negative impact on economic growth. Widmalm (2001) also studied the OECD countries from 1965 to 1990, and came to the same results, personal income tax has a negative impact on economic growth. The econometric model used was the Panel Section Data. Elshani and Ahmeti (2017) have analyzed European OECD member countries. They came to the same conclusions as the above authors using the Panel data econometric model. That personal income tax has a negative impact on economic growth in OECD countries (Schwellnus et al., 2008; Arnold et al., 2011). The most widely used econometric model is the Data Panel, as the best econometric model when dealing with many countries for many years.

Mertens and Ravn (2013) studied the changes in personal income tax and corporate income tax in the United States of America after the Second World War. They concluded that personal income tax has a negative impact on economic growth. A reduction in personal income tax of 1% causes GDP growth from 1.4% in the first quarter to 1.8% in the fourth quarter. Canavire-Bacarreza, et al. (2013) have studied Latin American countries. GDP has been taken as a dependent variable, while one of the independent variables has been the personal income tax. The econometric model used was the Panel model. They concluded that personal income tax has a negative impact on economic growth in Latin American countries. Therefore, we propose the following hypothesis:

H1: Personal Income Tax has a negative impact on economic growth in the Eurozone countries

2.2.2. Corporate income tax and economic growth

Goolsbee (2004) has analyzed how corporate income tax influences economic growth, studying 70 developed countries around the world. The author concluded that a higher corporate income tax rate is associated with a lower economic growth rate. The econometric model used was time data series. Lee and Gordon (2005) came to the same conclusions when they also included in the study of 70 developed countries. The reduction of corporate income tax by 1% affects economic growth from 0.1 to 0.2 points. The reduction of corporate income tax by 1% affects economic growth from 0.1 to 0.2 points (Ergete & Dahlby, 2012). The authors have considered data from Canada from 1977-2006. Mertens and Ravn (2013), studied the US after World War II and concluded that CIT has a negative impact on economic growth. According to these authors, a 1% reduction in corporate income tax causes an increase in GDP from 0.4% in the first quarter, to 0.6% after the other three quarters.

Canavire-Bacarreza et al. (2013) studied Latin American countries and concluded that CIT has small negative effects on economic growth. The authors took GDP as the dependent variable, while PIT, CIT, and VAT were taken as independent variables.

All authors who studied the OECD member states came to the same conclusions. Corporate income tax has a negative impact on economic growth and, in the long run, undermines economic development in OECD countries from 1970 to 2004 (Gemmell et al., 2011). CIT negatively affects economic growth in OECD countries, studied from 1996 to 2004 (Arnold et al., 2011). Padovano & Galli (2001), in their study of 23 OECD member countries, from 1951 to 1990, concluded that the marginal rate of CIT has a negative correlation with GDP growth. All of these authors have used the econometric data panel model.

Other authors have not found any correlation between CIT and GDP. Widmalm (2001) studied the OECD countries from 1965 to 1990, using the Panel section data econometric model, and concluded that the CIT has no impact on economic growth. Mendoza et al. (1997) studied 18 OECD member countries from 1965 to 1991, using the panel and model as a model, and concluded that CIT affects investment, but the effect on GDP is not significant. But, based on subsequent studies, some authors have found a positive effect of CIT on economic growth. Elshani & Ahmeti (2017) have studied the European OECD countries, from 2002 to 2015, with panel data and have found a positive correlation between CIT in GDP. Drawing from the literature review, we set forth the following hypothesis:

H2: Corporate Income Tax has a negative impact on economic growth in the Eurozone countries.

2.2.3. Value-added tax and economic growth

Kneller et al. (1999) examined the OECD member states between 1970 and 1995, GDP as dependent variables, while direct taxes and VAT were taken as independent variables, while the econometric model used was Panel data. They concluded that VAT has a positive impact on economic growth. Authors conducted a similar study with data from 1970 and 2004, with panel data, and came to the same conclusion (Gemmell et al. 2011).

Elshani and Ahmeti's (2017) study analyzed European countries and members of the OECD, and came to the same conclusions as the aforementioned authors. So, value-added tax has a positive impact on economic growth in OECD countries from 2002 to 2014. Several other authors (Chiricu, 2019; Canavire-Bacarreza et al., 2013; Olufemi et al.; 2018; Martinez-Vazquez et al., 2011; Jinill & Henry Kim, 2003; Nikoloski, 2020); Stoilova (2017) came to the same conclusion. All of these authors have used the econometric data panel model.

Contrary to the previous stream of research, Emran and Stiglitz (2005) have studied tax reforms in developing countries, and find that VAT has a negative impact on economic growth. While, according to Harberger (1962), that the United States has studied, VAT does not have any impact on economic growth. Given the discussion of previous studies, we propose the following hypothesis:

H3: Value-added tax has a positive impact on economic growth in the EUROZONE countries.

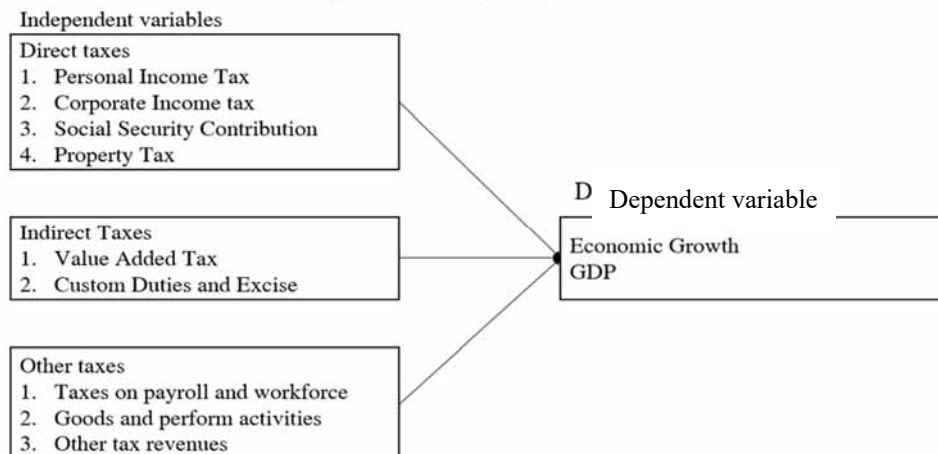
Based on the above data, we can conclude that the findings of the authors differ from each other and the reasons for these may be: different periods taken into analysis, different countries, regions or constituencies analyzed, etc. This study is of particular importance because it includes countries that use the common currency (EURO), although they are different countries with different fiscal policies.

3. Methodology and Conceptual Framework

In this section, we present a standard model of tax revenue and economic growth. Some recent paper has used a Panel Data model approaches for evaluating the comparison between these two variables. The use of panel data enables the evaluation of changes in time, but also differences between states (Hsiao, 2007; Petranov et al., 2022). Through the application of the Panel Model, it is possible to control the variables that, in reality, are very difficult to measure. Our Panel data is strongly balanced. GDP growth is the dependent variable obtained from the World Bank database. This variable was also taken by most researchers (Martinez-Vazquez et al., 2011; Canavire-Bacarreza et al., 2013; Kneller et al., 1999; Padovano & Galli, 2001; Widmalm, 2001; Schweltnus, 2008; Arnold et al., 2011; Romer & Romer, 2010; Lee & Gordon, 2005; Mendoza et al., 1997; Elshani & Ahmeti, 2017). Independent variables taken in the study are: Revenues from Personal Income Taxes, Corporate Income Taxes, Value Added Tax, Customs and Excise, Social Security Contribution, Property Tax, taxes on payroll, goods perform activities and other tax revenues. All independent variables show their share in Gross Domestic Product (GDP) as a percentage. All data from independent variables are collected from the OECD database.

Figure 1 presents the conceptual framework of this study. Independent and dependent variables are outlined as well as the relationships studied are presented.

Figure 1. Conceptual framework



The paper includes European states and members of the EUROZONE, which apply EURO currency and are in a total of 17 states. The countries that are surveyed are Austria, Belgium, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Latvia, Lithuania, Luxembourg, Netherlands, Portugal, Slovakia, Slovenia, and Spain. The study has included a total of 18 years, from 2002 to 2019. The year 2002 was the first year of study, the year in which the application of the common euro currency has begun. Eurozone countries since the creation of the currency union (Afonso & Leal, 2019). Not all countries have accepted the Euro currency in 2002. Through Dummy variables, we will show, for each country, how the observed variables evolve, before and after the acceptance of the Euro currency. With D0 are marked the years before the introduction of the Euro currency and with D1 are marked the years after the acceptance of the Euro. During this analysis, it turns out that Slovenia had greater economic growth before entering the Eurozone by 2.37% compared to the years after it accepted the Euro; followed by Slovakia with an economic growth of 4.45% compared to the years after the adoption of the Euro. While in the Baltic countries, the situation was as follows. Lithuania has had an increase of 0.93%, Latvia with 0.62%, while the only country that has had an economic decline is Estonia with -0.36%. If we analyze these countries in more detail, we find that their economic growth was 1.60% greater before entering the Eurozone. Therefore, these data did not affect the final result. While the independent variables have not had any major changes that could affect our results. It is important to note that all these countries, with the exception of Slovenia, until 1991 were Eastern Bloc countries.

In the table below (Table 1), we show the share of revenues in GDP, as well as economic growth in percentage. The data were taken from the respective databases of the OECD and the World Bank and processed by the authors.

Table 1. Total tax revenue (% of GDP) vs GDP growth (average 2002-2019)

Country	Total Tax Revenue	GDP growth
AUT	41.28	1.55
BEL	43.60	1.62
EST	31.87	3.60
FIN	42.29	1.37
FRA	43.80	1.27
DEU	36.28	1.27
GRC	32.11	(0.07)
IRL	27.39	4.72
ITA	40.85	0.12
LVA	29.15	3.59
LTU	28.99	4.09
LUX	37.50	2.85
NDL	36.36	1.37
PRT	32.33	0.68
SVK	30.77	3.97
SVN	37.74	2.36
ESP	33.46	1.55
Average	35.63	2.11

Source: OECD⁴ and World Bank, processed by authors.

⁴ Data extracted on 10 Jan 2022 10:00 UTC from data world bank and OECD.

In the table above, we have presented the average share of tax revenues in GDP, and at the same time, we have presented the GDP growth. Based on the above data, it turns out that the states that have had the lowest share of tariffs have a predisposition to have greater economic growth. Based on the table, it can be seen that the country with the largest economic growth was Lithuania, with 4.09% and which had a share of tax revenues of 28.99%. After Lithuania, the largest economic growth was Slovakia, with 3.97% and a share of tax revenues of 30.77%, followed by Estonia, with GDP growth of 3.60% and a share of tax revenues of 31.87%. It is important to note that countries that have had the greatest economic growth, such as Lithuania, Slovakia and Estonia, apply linear taxation to personal income tax and corporate income tax. The countries that apply the linear tax have greater economic growth than the countries that apply the progressive tax (Elshani et al., 2018). On the other hand, the country with the largest share of tax revenues in GDP is France, but it has had a very small economic growth (1.27%), followed by Belgium, which has had a share of GDP revenues of 4.60% with economic growth of only 1.62%. From the analyses, it can be concluded that the higher the share of tax revenues in GDP, the lower the economic growth. This finding is supported by many authors (Bania et al., 2007; Tanzi & Zee, 1997; Atkinson & Stern, 1980; Fu et al., 2003; Blanchard & Perotti, 2002; Fölster & Henrekson, 2001; Holcombe & Lacombe, 2004; Padovano & Galli, 2001; Kneller et al., 1999).

Table 2. Revenue of taxes in % in Gross Domestic Product (2002-2019 average) by states⁵

Nr	Country	P.I.T.	C.I.T.	SSC	TPW	TP	V.A.T.	CDE	GPA	Other
1	AUT	9.41	2.20	14.18	2.76	0.55	7.63	3.33	0.94	0.29
2	BEL	12.46	3.22	13.75	0.00	3.08	6.89	3.54	0.66	0.01
3	EST	5.65	1.59	11.09	0.00	0.29	8.52	4.32	0.42	0.00
4	FIN	12.70	2.75	11.93	0.00	1.20	8.63	4.59	0.45	0.04
5	FRA	7.94	2.42	16.12	1.36	3.72	7.50	3.50	0.31	0.92
6	DEU	9.21	1.74	13.88	0.00	0.91	6.78	3.16	0.60	0.00
7	GRC	4.80	2.16	10.86	0.00	2.46	6.96	3.72	1.15	0.00
8	IRL	8.63	2.87	4.37	0.18	1.76	5.95	2.94	0.67	0.00
9	ITA	10.78	2.41	12.62	0.00	2.42	5.92	4.08	0.69	1.94
10	LVA	5.85	1.63	8.52	0.02	0.95	7.79	3.81	0.58	0.00
11	LTU	5.07	1.63	10.55	0.00	0.33	7.71	3.44	0.26	0.00
12	LUX	8.02	5.48	10.67	0.00	3.09	6.23	3.79	0.16	0.05
13	NDL	7.04	2.92	13.44	0.00	1.53	6.67	3.49	1.13	0.14
14	PRT	6.00	3.03	8.70	0.00	1.19	8.10	4.59	0.44	0.27
15	SVK	3.08	2.88	13.08	0.00	0.44	6.83	3.77	0.69	0.00
16	SVN	5.44	1.91	15.28	0.61	0.61	8.25	4.86	0.77	0.00
17	ESP	7.12	2.65	11.74	0.00	2.48	5.78	2.92	0.77	0.01
	average	7.60	2.56	11.81	0.29	1.59	7.18	3.75	0.63	0.22

Source: OECD, processed by authors.

In the table above (where the averages of the states are presented), it is seen that the states that have higher tax rates have even higher revenues from these types of taxes. The more developed countries have a larger share of direct taxes, such as PIT and CIT, while those less developed countries depend on indirect tax revenues, such as VAT. Finland has the largest share of PIT revenues in GDP with 12.7%, followed by Belgium with 12.46% and Italy with

⁵ Data extracted on 10 Jan 2022 18:45 UTC (GMT) from OECD.Stat

10.78%. While the lowest share of revenues from PIT is evidenced in Slovakia with 3.08%, followed by Greece with 4.80% and Lithuania with 5.07%. In terms of the share of revenues from CIT in GDP, Luxembourg leads with 5.48%, followed by Belgium with 3.22% and Portugal with 3.03%. Estonia has the lowest share of revenues from CIT with 1.59%, followed by Latvia and Lithuania with 1.63%. Finland has the highest share of VAT revenues as a percentage of GDP with 8.63%, followed by Estonia with 8.52% and Slovenia with 8.25%. While Spain has the lowest share of VAT with 5.78%, followed by Ireland with 2.94% and Germany with 3.16%.

The total number of observations in this grouping is 17 states for 18 years, a total of 306 observations. The econometric model used in this case is the Fixed Effects Model.

Table 3. Details and description of the variables

Variable	Abbreviation	Calculation	Source
Gross Domestic Product	GDP growth	Annual growth rate	Worldbank
Personal Income Tax	PIT	Percentage share of GDP	OECD
Social Security Contribution	SSC	Percentage share of GDP	OECD
Taxes on payroll and workforce	TPW	Percentage share of GDP	OECD
Property tax	TP	Percentage share of GDP	OECD
Value Added Tax	VAT	Percentage share of GDP	OECD
Excise and Custom Duties	CDE	Percentage share of GDP	OECD
Goods and perform activities	GPA	Percentage share of GDP	OECD
Corporate Income Tax	CIT	Percentage share of GDP	OECD
Other tax revenues	OTH	Percentage share of GDP	OECD

Source: Illustration by authors.

To prove hypotheses 1, 2 and 3 the following model is used:

$$Y_{it} = \alpha + \beta_1 pit + \beta_2 ssc + \beta_3 tpw + \beta_4 tp + \beta_5 vat + \beta_6 cde + \beta_7 gpa + \beta_8 cit + \beta_9 oth + \mu_i + \epsilon_{it}$$

Where:

- Y_{it} represents a growth of GDP;
- PIT – personal income tax;
- SSC – social security contribution;
- TPW – taxes on payroll and workforce;
- TP – property tax;
- VAT – Value Added Tax;
- CDE – excise and customs;
- GPA – goods and perform activities;
- CIT – Corporate Income Tax;
- OTH – other tax revenues.

Hausman Test – When using the panel model, we also used the Hausmann test, so that the results obtained are as accurate as possible. Using the Hausman test, we come to the conclusion that a fixed effect should be used, which is more accurate (in our case) than the random effect. The formula is:

$$H = (b-B) (Var (b) - Var (B)) (b-B)$$

4. Results and Discussion

Descriptive statistics were used to describe and summarize the ratios of the variables in the study, including GDP growth, personal income tax, corporate income tax, social security contribution, taxes on payroll and workforce, property tax, value-added tax, excise and custom duties, goods and perform activities and other tax revenues. They are presented in Table 4.

Table 4. Descriptive statistics

	GDP	PIT	CIT	SSC	TPW	TP	VAT	CDE	GPA	Oth
Mean	2.112	7.600	2.558	11.809	0.29	1.589	7.184	3.755	0.628	0.216
Stand.Dev.	3.860	2.734	1.049	2.836	0.7302	1.099	1.109	0.701	0.310	0.509
Minimum	-14.837	0	0	3.69	0	0.21	0	0.20	0	0
Maximum	25.176	14	7.68	16.91	2.94	4.39	9.29	5.57	1.91	2.44
Obs.	306	306	306	306	306	306	306	306	306	306

Source: Own analysis.

This table provides descriptive statistics used in the analyses. The table shows that the Social security contribution has a very high average value (11,809). While the paper is focused on personal income tax, corporate income tax, and value-added tax, then here we note that Personal income tax has a very high average value (7.60), followed by value-added tax with an average value of 7,184. While corporate income tax has an average value of 2,558. In the following table, we present the correlation analysis.

Table 5. Correlation analysis

Variables	GDP	PIT	CIT	SSC	TPW	TP	VAT	SGS	GPA	OTH
GDP	1.0000									
PIT	-0.1361	1.0000								
CIT	0.0875	0.1869	1.0000							
SSC	-0.2368	0.1313	-0.1271	1.0000						
TPW	-0.0237	0.1342	-0.1068	0.3685	1.0000					
TP	-0.1330	-0.0122	0.4452	0.1142	-0.0350	1.0000				
VAT	0.0276	-0.0122	-0.2650	0.1302	0.1631	-0.3785	1.0000			
CDE	-0.1693	-0.0294	0.0013	0.1148	-0.1428	-0.1803	0.5901	1.0000		
GPA	-0.1577	-0.0133	-0.2097	0.1441	0.1286	-0.0305	-0.0365	0.069	1.0000	
OTH	-0.1638	0.2752	-0.0029	0.2178	0.1432	0.3186	-0.2126	0.0465	-0.0480	1.0000

Source: Own analysis.

Table 5 shows the correlation between GDP growth and Personal Income tax, Corporate income tax, Social security contributions, taxes on payroll and workforce, Property tax, Value Added Tax, Custom duties and excise, goods and performed activities and other tax revenue in the EUROZONE from 2002 to 2019. Results reflect the positive correlation between Corporate income tax (0.0875), Value Added Tax (0.027,6) and GDP growth. All other variables have a negative correlation with GDP growth, starting from Personal Income Tax (-0.1361), Social security contribution (-0.2368), and Custom duties and excise (-0.1693). Based on the results of the correlation analysis, we conclude that Value Added Tax and Corporate Income Tax are of particular importance in economic growth in

EUROZONE countries. While other types of taxes have a negative impact on economic growth in the EUROZONE.

In this section, we present the results obtained and try to validate Hypotheses H1, H2, and H3.

Testing for autocorrelation in a time series is a common task with time series data. First, we used the autocorrelation test, exactly the Woodridge test for autocorrelation in panel data. The autocorrelation takes values +1 and -1. An autocorrelation of +1 represents a perfect positive correlation, while an autocorrelation of negative 1 represents a perfect negative correlation. In Table 6, we presented the results of Woodridge test for autocorrelation.

Table 6. Estimated results of Woodridge test for autocorrelation

Estimated results	
H0:	no first-order autocorrelation
F(1,16) =	17.938
Prob >F =	0.0006

Source: Own analysis.

Since we did not have autocorrelation, we used the Breusch and Pagan Lagrangian multiplier test $gdp_{growth}[nr,t] = Xb + u[nr] + e[nr,t]$

In statistics, the Breusch–Pagan test, is used to test for heteroskedasticity in a linear regression model. It tests whether the variance of the errors from regression is dependent on the values of the independent variables. In that case, heteroskedasticity is present.

Table 7. Estimated results of Breusch and Pagan Lagrangian multiplier test

Estimated results	Var	sd = sqrt(Var)
GDP _{growth}	14.90047	3.860113
e	10.75901	3.280093
u	.9884065	.9941864
chibar2(01) = 1.41		
Prob > chibar2 = 0.1172		
Prob > chi2 = 0.0000		
Test: Var(u) = 0		

Source: Own analysis

Here we Reject the null and conclude that random effects are appropriate at this stage, meaning that there is evidence of significant differences across countries, therefore, we can not run a simple OLS; hence we proceed to choose between Random Effect Model or Fixed Effect.

Even in this case, we used the Hausman test (Table 8) so that our results are more accurate. The basic hypothesis states that there is no correlation between state effects and regressors in the model. In our case, this hypothesis stands, so the Fixed Effect Model is better than the other Panel models.

Table 8. Hausman test

	Coef.
Chi-square test value	44.69
P-value	0.000

Source: Own analysis.

$$\chi^2(9) = (b-B)'[(V_b - V_B)^{-1}](b-B) = 44.69$$

$\text{Prob} > \chi^2 = 0.0000$ ($V_b - V_B$ is not positive definite). Provided that $\text{Prob} > \chi^2 < 0.05$ we choose the Fixed Effect Model

From the results of the Hausman test ($\text{Prob} > \chi^2 = 0.0000$; provided that $\text{Prob} > \chi^2 < 0.05$) we choose the Fixed Effect Model.

After determining the fixed effects model, we continued with other tests. Modified Wald test for GroupWise heteroscedasticity in a fixed effect regression model. The null is homoskedasticity (or constant variance). Above, we reject the null and conclude heteroskedasticity.

Table 9. Estimated Modified Wald test

H0:	$\sigma(i)^2 = \sigma^2$ for all i
$\chi^2(17)$	864.07
$\text{Prob} > \chi^2$	0.0000

Source: Own analysis.

Before commenting on the findings according to fixed effects, we performed the test for multicollinearity, through the Variance Inflation Factor (VIF).

Table 10. Testing for multicollinearity

Constant	1/VIF (Tolerance)	VIF
P.I.T.	0.783	1.278
C.I.T.	0.641	1.559
S.S.C.	0.767	1.304
T.P.W.	0.695	1.438
T.P.	0.573	1.747
V.A.T.	0.416	2.406
S.G.S.	0.480	2.085
G.P.A.	0.883	1.133
Other	0.686	1.457
Mean		1.601

Source: Own analysis.

The table above presents the results of the VIF (Variance Inflation Factor) test in order to test multicollinearity between independent variables. Since none of the variables has a value higher than 5 and we have an average VIF of 1.601, then we conclude that the problem of multicollinearity does not appear in our data.

The results to be commented on are derived from the FIXED EFFECTS model.

From Table 11, we can see which of the types of taxes have an impact on economic growth. Personal Income tax, Social security contributions, custom duties, excise, and other taxes have a negative impact on economic growth. The increase of revenues from PIT by 1% causes a decline in GDP of 0.64% in the Eurozone countries. The increase of revenues from social security contributions by 1% causes a decline in GDP of 1.97% in the Eurozone countries. The increase of revenues from customs duties and excise by 1% causes a decrease of GDP by 2.75% in the Eurozone, while the increase of revenues from other taxes by 1% causes a decrease of GDP by 3.10% in the Eurozone. Corporate Income tax and Value Added Tax have a positive impact on economic growth in Eurozone countries. If revenues from CIT increase by 1%, the economic growth is 1.06% of GDP in Eurozone countries, while if revenues from VAT increase by 1%, the GDP growth is 0.85% in Eurozone countries. From this, we conclude that special attention should be paid to the increase of revenues from CIT and VAT in the Eurozone countries.

Table 11. Results of Regression Analysis of Tax Revenue on GDP

Variables	Coefficient	Std.Error	T-ratio	p-value	
Cons.	29.42053	4.847839	6.07	0.000	
PIT	-0.642619	0.2922797	-2.20	0.029	***
SSC	-1.971522	0.3117381	-6.32	0.000	***
TPW	-0.8772189	1.067146	-0.82	0.412	
TP	1.142473	0.709705	1.61	0.109	
VAT	0.8479974	0.3755657	2.26	0.025	***
CDE	-2.757764	0.5560632	-4.96	0.000	***
GPA	2.416945	1.586837	1.52	0.129	
CIT	1.060962	0.3749135	2.83	0.005	***
OTHER	-3.103018	1.402232	-2.21	0.028	***
R square				0.2364	
Adjusted R square				0.2308	
F				9.63	
P-value (F)				0.000	

Source: Own analysis.

The R-square in our model indicates that our results explain 24 % of the variance. This is above the Falk and Miller (1992) rule of thumb of 0.1 and just below the Cohen (1988) 0.26 benchmark for substantial explanatory power.

In the following section, we comment on our findings, at the same time, we discuss these results and make comparisons with the findings of other authors.

Hypothesis H1 has been confirmed. Personal Income Tax is significant with $p < 0.05$. Personal Income Tax in countries applying the Euro has a negative impact on economic growth. The increase in the share of personal income tax revenues to Gross Domestic Product by 1%, contributes to the reduction of Gross Domestic Product by 0.64%. This is in line with several authors: Bleaney et al. (2001), Mertens & Ravn (2013), Canavire-Bacarreza, et al. (2013), Elshani & Ahmeti (2017), Gemmel et al. (2011), Schweltnus (2008), Mertens & Ravn (2013), Arnold, et al. (2011). When the tax rates are high, consumers pay more taxes and the purchasing power of consumers falls. This affects the gross domestic product to fall (Abu & Mohammed Gamal, 2022).

Hypothesis H2 is rejected. Corporate Income Tax has a positive and significant ($p < 0.05$) impact on economic growth. An increase in Corporate Income Tax of Gross Domestic Product by 1%, contributes to Gross Domestic Product growth by 1.06%. Similar findings are evidenced in Elshani and Ahmeti (2017); authors have analyzed 20 European countries, members of OECD, for the 2002-2014 period. As for corporate income tax, most authors (Goolsbee, 2004; Lee & Gordon, 2005; Ergete & Dahlby, 2012; Mertens & Ravn, 2013) have come to the conclusion that it either has a negative impact or no impact at all. This also depends on the countries that are studied, but also the years that are taken as a base.

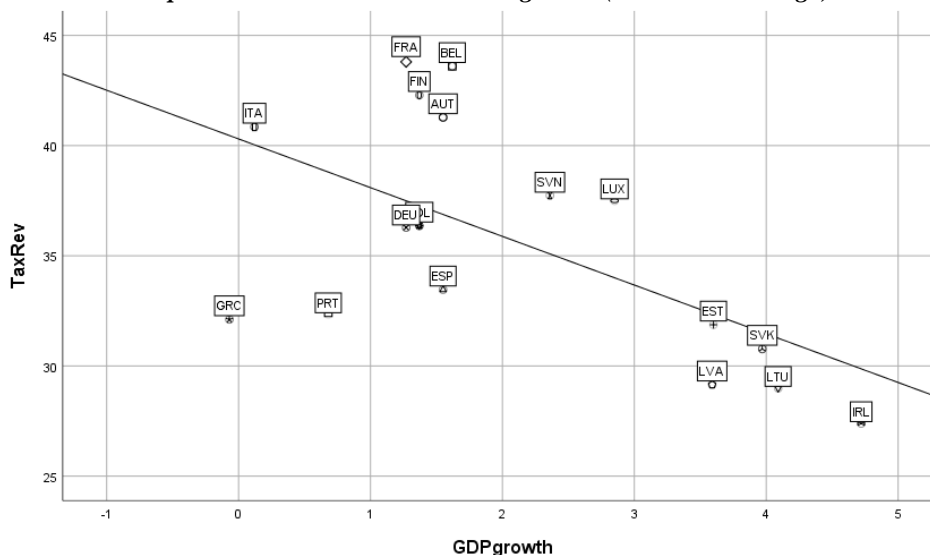
Hypothesis H3 is fully confirmed. Value-added tax is completely significant with $p < 0.05$. From the above results, we can say that: Value Added Taxes in countries applying the Euro have a positive impact on economic growth. The increase in Gross Domestic Product Value Added Tax 1% contribution contributes to Gross Domestic Product growth by 0.85%. The same findings are evidenced by other authors (Chiricu, 2019; Olufemi et al., 2018; Elshani & Ahmeti, 2017; Jinill & Henry Kim, 2003; Martinez-Vazquez et al., 2011; Nikoloski, 2020; Canavire-Bacarreza et al.; 2013; Bleaney et al., 2001; Kneller et al., 1999; Jinill & Henry Kim, 2003). Scholarships to date have observed that VAT has a positive impact on economic growth. The more the state collects this type of tax, the bigger the state's power to invest and increase government spending increases, which is known to have a direct impact on economic growth (Pula & Xhelili, 2022).

In addition to the above-mentioned hypotheses, we can comment on some other indicators that were omitted from our framework. We find that revenue from social security contributions in countries applying the Euro has a negative impact on economic growth. The increase in the share of Social security contribution revenues to Gross Domestic Product by 1%, contributes to the reduction of Gross Domestic Product by 1.97%. This is in line with findings from Olufemi, et al. (2018). Moreover, we find that revenues from Custom and excise duties are significant in countries applying the Euro has a negative impact on economic growth. The increase in the share of custom and excise duties revenues to Gross Domestic Product by 1%, contributes to the reduction of Gross Domestic Product by 2.76%. These findings are in line with Elshani and Ahmeti (2017).

In the graph below, we show the share of revenues in GDP, as well as economic growth in percentage. The data were taken from the respective databases of the OECD and the World Bank and processed by the authors.

Based on the graph, it can be seen that the countries with the highest economic growth have the lowest share of revenues in GDP. Ireland and Lithuania had the highest economic growth during these years, with 4.72% and 4.09%, respectively. Both of these countries had a share of revenues in GDP, the lowest with 27.39%, respectively 28.99%. Based on these data, we conclude that countries that have a share of less than 30% of GDP revenues, also have the highest economic growth (Bania et al., 2007; Tanzi & Zee, 1997; Atkinson & Stern, 1980; Fu et al., 2003; Blanchard & Perotti, 2002; Fölster & Henrekson, 2001; Holcombe & Lacombe, 2004; Padovano & Galli, 2001; Kneller et al., 1999). On the other hand, the countries that had the largest share of revenues in GDP had much lower economic growth. France has the highest share of GDP revenues with 43.8% with economic growth of 1.27%, followed by Belgium with a share of GDP revenues of 43.6% and economic growth of 43.6% respectively, Finland with a revenue share of 42.29% and economic growth of only 1.37%.

Graph. 1 Total tax revenue vs GDP growth (2002-2019 average)



Source: Illustrated by authors'

5. Conclusion, Implications and Future Research

This paper examined the effects of taxes on economic growth in EUROZONE countries. During the literature review, we presented the findings of numerous authors. Based on the findings of the authors, we have also presented the hypotheses which we have tried to prove. Of the three hypotheses raised, two were confirmed, while our findings are opposite from the literature review. This non-confirmation of the hypothesis may have come as a result of the countries being studied. Few authors have studied the Eurozone countries. Moreover, the years taken into analysis have not yet been examined by scholars (from 2002 to 2019). With the collection of more taxes, the marginal cost of each Euro collected becomes more costly.

The empirical results we have gained have given us different effects on economic growth. From the analysis of taxes in Eurozone countries, we find that Personal Income Tax has a negative impact on economic growth, suggesting that countries should keep this tax low to encourage consumption. The obtained results also correspond to the empirical results of many authors who have measured the impact of PIT on economic growth. In the case of Corporate Income Tax, according to the empirical results obtained, we conclude that CIT has a positive impact on economic growth in the countries that are surveyed. The same results are earned concerning the Value Added Tax. VAT has a positive impact on economic growth. According to the results obtained, it appears that VAT is significant and has a great positive impact on economic growth in the countries that are surveyed.

This paper provides important policy implications. The structure of taxes in an economy is a prerequisite for achieving economic growth. Policymakers should pursue optimization of the tax structure to enable economic growth in their countries. Increased income from VAT and

CIT has a positive impact on economic growth. Therefore, policymakers should make sure that these taxes are set to enable the economic growth required.

We introduce Eurozone countries as units of analysis, which provide a viable avenue of research for a multitude of variables in future research. Future research should focus on more complex data to understand better the interplay between tax revenue and economic growth.

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