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THRESHOLD EFFECTS OF PUBLIC DEBT ON THE TAX BURDEN: EVIDENCE FROM EU MEMBER STATES

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Abstract

Purpose: The aim of our research is to assess the impact of public debt on tax burden within the member countries of the European Union (EU) during the period from 1995 to 2021.

Methodology: The assessment of the impact of the public debt on the tax burden was implemented in two stages. Each of them uses two modifications of the model. Our methodology is based on multiple regression models.

Findings: Our research findings suggest a dual impact of public debt on the tax burden: a reduction in the current period followed by an increase in future periods. Additionally, our study has unveiled that the influence of public debt on the tax burden is contingent upon the specific level of public debt being considered. Our findings confirmed that when public debt reaches a critical threshold of 55.88 percent of the GDP, any further government

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borrowing is associated with a consequent augmentation of the tax burden.

Originality/value: Our analysis includes lagged variables to empirically examine whether public debt can possibly result in a higher tax burden in the future. In our study, we explore whether there exists a particular level of public debt at which the influence of public debt on the tax burden fundamentally changes direction.

Keywords: *public debt, tax burden, threshold, European Union*

JEL Codes: *H20; H63; O52*

Introduction

Public debt is currently intensively analyzed in scientific literature and at the political level, as the total world debt is growing rapidly. In recent years, researchers have analyzed the negative consequences of debt on economic growth quite extensively (Puonti, 2022; Fannoun & Hassouneh, 2019; Boitani & Perdichizzi, 2018; Chudik et al., 2018) and the significance of foreign debt on the country's economy (Hoti et al., 2022; Butkus et. al., 2021a,b). Scientists analyze how public debt negatively influences economic growth through various channels. Butkus et al. (2021a,b) state that the negative consequences of borrowing on economic growth, consumption, investments, and productivity are associated with market participants' expectations that the tax burden will increase in the future due to growing debt. On average, the public debt of EU countries increased by 20.43 percent from 2018 to 2021. The current looming financial crisis and uncertainty may further accelerate government borrowing and negatively impact other macroeconomic indicators.

As the economies of the EU experience new challenges that require financial resources, the topics of public debt and tax revenue become extremely relevant. Some scholars argue that the causal relationship between tax burden and public borrowing runs in both directions (Ostry et al., 2015). The number of studies that have analyzed the inverse relationship between tax burden and public debt is quite limited and the authors do not agree on the direction of the effect. Otaki (2015) and Alawneh (2017) claim that public debt affects the tax burden in a positive direction. Meanwhile, Ogawa and Ono (2010), Leão (2015), and Ewaida (2017) found that public debt will not increase the tax burden, and the results of a study by the authors Cassou and Shadmani (2018) showed that in periods of economic downturn, the tax burden decreases when debt to GDP ratio increases.

Currently, when EU countries face economic threats, governments tend to borrow instead of raising taxes to mitigate the consequences of economic recession. However, when indebtedness reaches an unsafe level, the risk of state insolvency is faced, costs increase and there is a risk of negative consequences for the country's economic condition in the future, which the government may have to make decisions to increase the tax burden to improve. An increasing tax burden can reduce consumption in the country, so production volumes

would also decrease, and companies would face a decrease in sales revenue, which would directly affect the country's GDP. In light of the scarcity of previous empirical investigations concerning the influence of debt dynamics on the tax burden and taking into consideration the omission of crucial time periods pivotal to comprehending the relationship between public debt and the tax burden, notably the COVID-19 pandemic and coupled fluctuations in international resource and commodities markets, it is imperative to undertake rigorous and up-to-date research in this problem. So, our research aims to assess whether the growing public debt, including data for these significant periods, leads to a higher tax burden. Our model incorporates lagged variables to empirically examine whether public debt can effectively mitigate the tax burden in the present period while potentially leading to an elevated tax burden in subsequent periods. In our analysis, we investigate the presence of a specific threshold level of public debt, at which point the impact of public debt on the tax burden undergoes a fundamental shift in direction.

This paper is organized as follows: Section 2 provides empirical evidence on the impact of public debt on tax burden; Section 3 presents the applied methodology, including the model, estimation strategy, and data; Section 4 discusses the main results; and the final section concludes the paper.

Literature review

The topic of public debt is widely analyzed in scientific literature, especially at the time when the countries of the EU are facing various crises and doubts about economic stability, the topic of public borrowing becomes extremely relevant. Public borrowing is often associated with financing accumulated budget deficits (Afonso & Ibraimo, 2018; Slav'yuk & Slaviuk, 2018). According to Ostry et al. (2015), the causal relationship between the tax burden and public borrowing runs in both directions: high public debt creates the need for changes in economic activity (labor, capital) to cover the public debt, which is limited by increasing tax rates and/or by reducing productive government spending. Authors also argue that the upfront price of debt reduction needs to be paid today to lay the foundations for sustainable growth in the economy. Similar insights are provided by Robbins and Simonsen (2012), who argue that, at constant economic conditions, persistent budget deficit and borrowing means that citizens use public services today in exchange for a combination of higher taxes and reduced spending later. Hence, today's budget deficit and increasing public debt maintain or improve the current financial situation of consumers but worsen it in the future. Reinhart and Rogoff (2010a) noted that a high public debt burden leads to higher future taxes or lower government spending in the future when the government is expected to repay its debts. In both cases, consumption is adversely affected. Tax increase and government spending decrease directly or indirectly reduce consumers' disposable income, so fewer goods and services are purchased, demand decreases, and therefore production volumes decrease – the country's GDP shrinks. Alesina and Passalacqua (2016)

argue that the longer the government delays raising taxes to stem debt growth, the higher the interest burden will be, making the process of economic stabilization increasingly difficult. Therefore, it is important to borrow responsibly, and if the level of borrowing or its price reaches a risky level, choose other options for reducing the cost. This insight is supported by Pouzo and Presno (2022), who argue that with extremely high public debt and limited borrowing capacity, the state has to look for other sources of revenue generation, such as tax increases. Alawneh (2017) found that public debt increases the tax burden. Silimar results were confirmed by Kalaš (2020). Cassou and Shadmani (2018) also found a positive effect of public debt on the tax burden. However, the authors' study showed that the tax revenue response to delinquent debt is positive only during periods of economic stability. Meanwhile, increased public debt statistically significantly reduces the tax burden in periods of economic crisis.

Also, it is important to note that the influence of public debt on the tax burden is contingent upon the specific level of public debt being considered. Adam (2011) found that when the level of the public debt reaches 100 per cent of GDP, a debt that continues to increase from GDP leads to higher taxes, and when the debt reaches 200 per cent of GDP, tax rates are increased particularly significantly. Similar insights are provided by Hansen and İmrohoroğlu (2016) who argue that any debt-to-GDP ratio is sustainable at a steady state as long as sufficient tax revenue is collected to finance government spending and pay interest on the debt. However, according to the authors, there is a debt ceiling beyond which taxes are raised, and tax increases eventually reduce the debt-to-GDP ratio to a long-term 60 per cent. Reinhart and Rogoff (2010a), who conducted a study in 44 countries over the period from 1970 to 2009, state that when the debt reaches 90 percent of GDP, it becomes risky, although the relationship between public debt and real GDP growth is weak. The researchers noted that tax increases are ultimately needed to ensure debt sustainability once public debt reaches risky levels. Reinhart and Rogoff (2010b) also noted that a high public debt burden means higher future taxes (inflation is also a tax) or lower future government spending if the government is expected to repay its debts. A similar effect of public debt on the tax burden was found by Otaki (2015) based on the Keynesian approach to public debt. The author analyzed how the issuance and redemption of bonds affected the welfare of the generations of that period and he argues that as public debt financed public spending increases, so does the current generation's disposable income (even though the value of the multipliers varies depending on whether the spending is directly transferred to individuals or not) and increases its economic well-being. The author examined the two-period generation (OLG) model with an infinite period when monopolistic competition prevails in production markets. The results of the study showed that public borrowing becomes a burden for future generations, as more taxes must be paid to recover the same disposable income received from borrowing. Ewaida (2017) found that there is no statistically significant relationship between public debt and the tax burden. However, the author found that the negative impact of debt on economic growth occurs when the debt reaches 60 per cent of GDP. Meanwhile, researchers Butkus et al. (2021a) analyzing the breaking point of the

relationship between public debt and growth, in terms of the tax burden, identify that low taxes (below the threshold level of 16.5 per cent of GDP tax revenue) are related to positive but insignificant effect of debt on economic growth. Leão (2015) found that very high public debt will not result a high tax burden or default because the central bank can keep government bond yields as low as necessary to make debt servicing negligible. Thus, according to the research public debt does not increase the burden on future generations in the absence of demand. This statement is also supported by Ogawa and Ono (2010), who found that according to the Diamond model, issuing bonds does not worsen the situation of future generations. Government purchases and transfers to the current generation, financed by bond issues, impose additional taxes on future generations, making them worse off as long as full employment persists. However, if there is a lack of demand and forced unemployment during bond issuance and redemption periods, the future generations that are taxed to redeem the bonds earn enough wage income to cover the additional tax burden. So there is no debt burden for future generations. This result holds even when deficit-covering bonds are issued and additional taxes are levied on unborn generations.

We can thus state that there is a lack of studies analyzing the impact of public debt on tax burden, and it was found that it is not clearly defined which effect of borrowing (positive or negative) manifests itself more strongly. The impact of public debt on tax burden can be different in different countries. The estimates of previous research (Reinhart & Rogoff, 2010a; Adam 2011; Woo & Kumar, 2015; Ewaida 2017) also indicate that the level of public debt plays a pivotal role in explaining the impact of public debt on tax burden.

Methodology and the data

The EU is an economic and political union with a common market guaranteed by the free movement of persons, goods, services, and capital and strengthened by uniform laws. 20 EU countries (Austria, Belgium, Croatia, Cyprus, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Portugal, Slovakia, Slovenia, and Spain) use a common currency. To join the eurozone, all countries must meet the convergence criteria outlined in the Maastricht Treaty, which establishes the thresholds of various macroeconomic indicators and other requirements that indicate that the country has achieved a high degree of sustainable economic convergence with the Eurozone. Eurozone membership increases the economic interdependence of member countries. Countries that have joined the Eurozone share a common monetary policy set by the European Central Bank (ECB). A common currency and monetary policy promote closer trade and financial relationships. Increasing economic integration allows for more effective coordination of common economic policies applied not only in the euro area but throughout the EU, which is particularly important at present, considering the changes in key interest rates at the ECB to control negative macroeconomic processes in countries. The EU countries are thus united by a certain economic integrity, which makes it possible

to evaluate data from all 27 EU countries in the panel model when assessing the impact of public debt on the tax burden. All data used for the study was obtained from Eurostat, the World Bank, and the International Monetary Fund. The period 1995-2021 was chosen to determine the impact of public debt on the tax burden. Studies (Reinhart and Rogoff, 2010a,b; Otaki, 2015) often find a lagged effect of public debt on tax burden, so looking at this relationship for as long as possible is important. Therefore, the longest period for which data on all variables needed to conduct the study are publicly provided and available was chosen to conduct the study.

The aim of our research is to assess the impact of public debt on tax burden, therefore, in the research model, the dependent variable is the tax burden. Tax burden can be defined in different ways and accordingly can be represented by different indicators, i.e. total revenue from taxes and social contributions (% of GDP); tax revenue (% of GDP, certain compulsory transfers such as fines, penalties, and most social security contributions are excluded). For evaluation of the tax burden, we chose the tax revenue (% of GDP) indicator, which does not include the effect of most social security contributions. The selected indicator has a more limited scope and social contributions are also classified as taxes in a broad sense, but in this study, we assume that the budget revenues collected from social contributions are allocated to a very precise and specific purpose, primarily directed towards servicing the public debt and facilitating its repayment. This may be attributed to the limitations of this study, as employing alternative indicators in the model might yield slightly different outcomes. However, it is probable that the general trends in the relationship between public debt and the tax burden would persist. Expanding the study duration and encompassing a more extensive range of countries could also result in somewhat altered findings.

The main independent variable is the public debt, which we chose to measure as a percentage of GDP. This indicator includes debt of central and local government as well as debt of social funds. Public debt as a percentage of GDP makes it possible to eliminate the influence of country size and population and to study all EU countries together. Since we chose a percentage indicator to measure the state debt level, the non-logarithmic value of this indicator is included in the econometric model. The model is complemented with control variables: the growth rate of real GDP, openness of the economy, unemployment rate, industrial production, and interest paid on public debt. Kong and Hoek (2008) in their research focused on China from 1984 to 2004, found GDP growth as the primary factor contributing to the present tax revenue and the rise in the tax burden. Authors (Adam & Kammas, 2007; Adam et al., 2015) find the level of a state's international trade activity can influence the tax burden. Celikay (2020) indicates that variables such as GDP per capita, foreign trade transactions, employment capacity, unemployment rate, and the size of the industry sector on the tax burden. Author also states that GDP, trade openness, and unemployment had a positive and statistically significant effect on tax burden in 34 OECD member countries for the 1993-2016 period. Consequently, it is anticipated that, in response to unemployment, the government will increase public spending what eventually causes the increase of burden. The share of the industry sector in an economy can impact

the tax burden through its contribution to tax revenue, job creation, and economic growth. As Tanzi and Lutz (1991) state pressure on increasing tax burden is related to interest payments on public debt. Persistent budget deficits resulting from interest payments may lead to further borrowing or tax increases, impacting both current and future taxpayers. Excessive interest payments can also hinder economic growth, reducing overall tax collections and necessitating tax adjustments. Additionally, the level of interest payments can influence investor confidence, potentially leading to higher borrowing costs and more pressure on taxpayers. Table 1 shows the variables used in the model and their measurement.

Table 1. Model variables and their measurement

Variable	Indicator	Measurement	Abbreviation for variable	Data source
Tax Burden	Tax revenue	Percentage of GDP	Tax_burden	World Bank
Public debt	Public debt level	Percentage of GDP	Debt_GDP	Eurostat
Real GDP growth rate	Average annual growth of real GDP	Percentage	GDP_growth	Eurostat
The openness of the economy	The ratio of the amount of exports and imports of goods and services to GDP	Percentage of GDP	Openness	World Bank
Unemployment	The part of the labor force that does not have a job, but is available and looking for work	Percentage of total labor force	Unemployment	Eurostat
Industry output	Ratio of industry output to GDP	Percentage of GDP	Industry_GDP	Worldbank
Interest	Interest paid for public debt	Percentage of GDP	Interest_paid	Eurostat

The assessment of the influence of the public debt on the tax burden was implemented in two stages. Each of them uses two modifications of the model. In the first stage, we tested the effect of public debt on the tax burden both in the current period and in subsequent periods (modification of model 1):

$$Tax\_burden_{i,t} = \alpha + \beta_1 Debt\_GDP_{i,t-n} + \beta_2\ GDP\_growth_{i,t} + \beta_3 Openness_{i,t} + \beta_4 Unemployment_{i,t} + \\ + \beta_5 Industry\_GDP_{i,t} + \beta_6 Interest\_paid\_GDP_{i,t} + td1995 + ... + td2021 + u_{i,t} \quad (1)$$

In the second stage, we tested the existence of the certain public debt level, from which the effect of public debt to the tax burden changes its direction (model modification 2):

$$Tax\_burden_{i,t} = \alpha + \beta_1 Debt\_GDP_{i,t} + \beta_2 Sq\_Debt\_GDP_{i,t} + \beta_3\ GDP\_growth_{i,t} + \beta_4\ Openness_{i,t} + \\ + \beta_5 Unemployment_{i,t} + \beta_6 Industry\_GDP_{i,t} + \beta_7 Interest\_paid\_GDP_{i,t} + td1995 + ... + td2021 + u_{i,t} \quad (2)$$

where: – public debt as a percentage of GDP, in country *i* in period *t*; – length of lagging in years (ranging from 0 to 5); – real GDP growth rate, percentage, in country *i* in period *t*; – square of public debt in country *i* in period *t*; – the ratio of the amount of exports and imports of goods and services to GDP, percentage, in country *i* in period *t*; – the part of the labor force that does not have a job, but is available and looking for work, percentage of the total labor force, in country *i* in period *t*; – ratio of industry output to GDP, percentage, in country *i* in period *t*; – interest paid for public debt, percentage of GDP, in country *i* in period *t*; – time dummies; – error term;

The first modification of the model is made by including the lagged variable of public debt to test whether public debt can reduce the tax burden in the current period but increase it in the future (as found by Barro, 1996, Reinhart and Rogoff, 2010b, Nautet and Meensel, 2011, Otaki, 2015). Mittone and Tomaselli, 2019). It tests 5-year lags of the impact of public debt. We do not deny the possibility that the effect of the current level of public debt may have an effect after an even longer period, but it is believed that 5-year lags are sufficient to assess the impact of lagging public debt. Thus, it should be noted that data time series also limit the use of longer lags. The second modification of the model is made by including the square of public debt to test whether the effect of public debt does not change direction after reaching a certain level.

In order to determine which panel data model to choose, Hausman and Breusch–Pagan LM tests were performed. Fixed effects models were found to be more appropriate. White's test was used to evaluate heteroskedasticity, multicollinearity was evaluated using the correlation matrix, and autocorrelation was evaluated according to the Wooldridge and Durbin Watson tests. Heteroskedasticity and multicollinearity were not detected, but positive autocorrelation was found for both models. Once autocorrelation was detected, the models were modified with the Arellano function, which allows us to control for the autocorrelation problem.

Results

In line with Woo and Kumar (2015), a discernible detrimental effect on economic growth is predominantly observed in instances characterized by heightened debt levels 90

percent of GDP. Such countries often face a slowdown in economic development, loss of investor confidence, and problems in the financial system, it becomes increasingly difficult for them to service their debts, which increases the risk of insolvency, and it becomes increasingly difficult to control the increase in debt obligations, so the government often has to increase the tax burden to avoid even higher levels of debt. The results of the debt and tax burden dynamic analysis of selected EU countries are presented in Table 1 (the data of other countries is provided in Appendix 1).

Table 1. Debt size and tax burden dynamics 1995-2021, percent of GDP

	EU countries with the highest debt in 2021					**EU countries with the lowest debt in 2021**				
Indicator	**Country**	**in 2021**	**1995 - 2021 the average**	**Max**	**Min**	**Country**	**in 2021**	**1995 - 2021 the average**	**Max**	**Min**
Debt	**Greece**	**194,5**	137,6	206,3	97,4	**Latvia**	**43,6**	26,1	47,6	8,4
Tax burden		26,3	23	27,9	19,2		20,5	20,3	22,5	18,1
Debt	**Italy**	**150,3**	121,1	154,9	103,9	**Czech Republic**	**42**	29,3	44,4	11,6
Tax burden		29,6	28,4	30	26,1		19,2	19,3	20,4	18,1
Debt	**Portugal**	**125,5**	91,7	134,9	54,2	**Denmark**	**36,6**	40,5	52,4	27,3
Tax burden		24,7	23,3	25,3	21,2		48,2	46,3	49,6	44,6
Debt	**Spain**	**118,3**	72,3	120,4	35,8	**Sweden**	**36,3**	46,9	69,1	35,2
Tax burden		24,5	21,5	24,5	17,6		39,9	41,3	44,5	39,1
Debt	**France**	**112,8**	78,6	115	56,1	**Luxembourg**	**24,5**	14,7	24,5	7,4
Tax burden		30,3	27,8	30,7	24		27,7	24,8	27,7	23,2
Debt	**Belgium**	**109,2**	105,9	131,3	87,3	**Bulgaria**	**23,9**	34,3	96,2	13
Tax burden		30,1	30	31,4	28,7		21,6	20,7	23,5	13,5
Debt	**Cyprus**	**101**	72,7	113,5	45,5	**Estonia**	**17,6**	7,8	18,5	3,8
Tax burden		24,5	22,9	28,9	17,6		21,7	21	23,1	19,4

Source: compiled by the author based on Eurostat and World Bank data

EU countries were ranked from the highest to the lowest debt ratio according to 2021 data. Due to the large number of countries, only seven countries with the highest and seven lowest debts are presented in the table for comparison. It can be stated that in 2021 out of all 27 EU countries, only 7 exceeded 90 percent of GDP. Countries with debt in 2021 exceeded 90 percent of GDP – Belgium, Greece, Spain, Italy, Cyprus, Portugal, and France. Considering these findings, it is evident that the borrowing levels in these nations carry inherent economic risks, potentially impeding their future borrowing capacity and exerting a more pronounced influence on the tax burden borne by their citizenry.

During the analyzed period, EU countries faced several crises – in the 2009 financial crisis, in 2019 the coronavirus pandemic crisis, and the energy resource crisis caused by the war in Ukraine. These types of shocks increase countries' revenue needs. Since most EU countries have not accumulated enough reserves to mitigate the effects of crises, states had to borrow and/or raise taxes to cover the revenue shortage. Although crisis periods show certain regularities in the analyzed indicators, after performing a dynamic analysis of the indicators, we cannot determine the impact of public debt on the tax burden, since the tax burden is also determined by other factors. Estimation results based on Eq. 1 and 2 of the public debt impact on tax burden is presented in Table 2.

Table 2. Results of regression analysis of public debt impact on tax burden

	Model 1	**Model 2**
The equation	**(1)**	**(2)**
cons	30.1360***	35.3099***
Debt_GDP	-0.0380*	-0.0436**
Sq_Debt_GDP		0.0004***
GDP _growth	-0.1270***	0.0183
Openness	-0.0023	-0.0066
Unemployment	-0.0874	-0.0783
Industry_GDP	-0.2431**	-0.3330***
Interest paid	-0.6416**	0.0364
Debt_GDP_1	0.0644***	
Debt_GDP_2	0.0250***	
Debt_GDP_3	-0.0079	
Debt_GDP_4	-0.0017	
Debt_GDP_5	0.0029	
N	586	716
R^2	0.9649	0.9563
(* - significance level 90 percent, ** - significance level 95 percent, *** - significance level 99 percent)		

Source: Compiled by authors

Based on the results of the multiple regression models presented in Table 2, it can be seen that in the case of the first model, the results of the regression analysis model show that public borrowing has a positive and statistically significant effect on the tax burden after the fact of borrowing one and two years later. These results support the findings by Otaki (2015), who states that public debt increases the tax burden in the future. According

to the first model (Eq. 1), public borrowing in the current period reduces the tax burden and increases it in the future. In accordance with our analysis, a one percent increment in state debt during the current year is associated with a decrease in the prevailing tax burden by 0.038 percent. However, it subsequently results in an increase in the tax burden by 0.064 percent in the subsequent year and by 0.025 percent two years hence. Other statistically significant factors affecting the tax burden in the first model are economic growth rate, share of industry in GDP, and interest paid on public debt. An increase in these factors reduces the tax burden. If the economy grows faster than the tax revenue collected by the government, the tax burden ratio is likely to decrease. Such a phenomenon can occur when the government applies policies to stimulate the economy and increase its spending, providing tax offsets and subsidies. Since the countries of the European Union faced more than one crisis during the analyzed period, governments, to reduce the negative impact of crises on the economy, increased their expenses, and provided compensations and subsidies, thus promoting economic growth and the lack of income was covered by borrowing.

Based on the regression analysis (Model 2) results, which are presented in Table 2, were used to calculate the breaking point of the state debt, when a specific threshold value of the public debt is reached, it signifies that the impact of government borrowing on the tax burden turns positive. The obtained value of the breaking point of the state debt is equal to 55.88 % from GDP. Considering the results of the second regression analysis model, it can be stated that when the state debt reaches 55.88%. from GDP, further borrowing will increase the tax burden indicator. Such an effect may occur because a country with low debt faces fewer risks, investors trust it more and it is cheaper to borrow. As the public debt grows, the country faces an increasing probability that further borrowing will negatively affect the country's economy, investors will have less confidence in the country, and therefore borrowing costs will increase. The government, not wanting to face the negative consequences of a debt that has reached a risky limit, once the debt reaches a certain level, will consider compensating for the lack of income not by further lending, but by increasing taxes. The findings of research conducted by researchers Adam (2011), Hansen and İmrohoroğlu (2016), which state that the tax burden increases when the public debt reaches a certain level. Also, in the second model, a statistically significant and negative effect of the share of industry GDP on the tax burden was determined.

The research results align with the conclusions drawn by Otaki (2015), supporting the notion that public borrowing has a propensity to elevate the future tax burden. Conversely, the insights of authors Ogawa and Ono (2010) and Leão (2015), positing that high public debt does not necessarily lead to subsequent tax increases, were not substantiated by the present study. The findings also corroborate the assertions made by authors Adam (2011) and Hansen and İmrohoroğlu (2016), indicating that borrowing exerts a discernible impact on the tax burden primarily when state debt reaches elevated levels, specifically in heavily indebted countries. This observation finds reinforcement in the results of the second model, which indicate that public debt becomes a significant determinant of the tax burden when borrowing levels surpass 55.88 percent of GDP. It is noteworthy that this

threshold value corresponds to the Maastricht criteria, which prescribe a secure limit for public debt at 60 percent of GDP.

However, it is essential to highlight that the determined threshold for public debt, beyond which borrowing influences the tax burden, does not align with the more stringent threshold of risky national debt (90 percent of GDP) posited by authors Reinhart and Rogoff (2010a). While the majority of authors have identified some form of relationship between public debt and the tax burden, it is pertinent to acknowledge that Ewaida (2017) did not ascertain a statistically significant effect of public debt on the tax burden in their research.

Conclusions

In conclusion, the relationship between public debt and tax burden is complex and can be influenced by various factors. The findings from the previous empirical analysis indicate that public borrowing has had a positive and statistically significant effect on the tax burden in subsequent years. This supports previous studies that suggest public debt increases the tax burden in the future. Additionally, factors such as economic growth rate, the share of industry in GDP, the unemployment rate, the degree of economic openness and others were found to have a significant impact on the tax burden.

Furthermore, the analysis revealed a specific threshold level of public debt, beyond which the impact of public debt on the tax burden undergoes a fundamental shift in direction. This breaking point of public debt was found to be equal to 55.88% of GDP.

These findings have important implications for policymakers, as they highlight the potential consequences of increasing public debt on the tax burden. When public debt reaches an unsafe level, there is a risk of negative consequences for the country's economic condition in the future, which may necessitate decisions to increase the tax burden. This can have a detrimental effect on consumption, production volumes, and overall economic growth. Given the limited number of studies on the influence of debt dynamics on the tax burden, particularly in the context of significant events such as the COVID-19 pandemic, further research in this domain is crucial. Understanding the relationship between public debt and tax burden is essential for formulating effective fiscal policies and ensuring the long-term economic stability of countries.

Overall, this study contributes to the existing literature by providing empirical evidence on the impact of public debt on the tax burden and identifying a specific threshold level of debt at which the relationship changes direction. It underscores the importance of prudent fiscal management and the need to carefully consider the consequences of increasing public debt on the tax burden.

Our future research deepens our understanding of the relationship between public debt and tax burden, Investigating the role of political and institutional factors in shaping the relationship between public debt and tax burden would provide a more comprehensive

understanding. This could include analyzing the impact of factors such as political stability, corruption levels, and institutional quality on the tax burden in the presence of public debt. As well conducting comparative studies across different country groups, such as developed versus developing economies or countries with different levels of debt sustainability, would help identify potential variations in the relationship between public debt and tax burden. This could provide insights into the specific challenges and policy implications for different country contexts.

References

1. Adam, A., & Kammas, P. (2007). Tax policies in a globalized world: Is it politics after all? *Public Choice*, *133*, 321-341. https://doi.org/10.1007/s11127-007-9190-9
2. Adam, A., Kammas, P., & Lapatinas, A. (2015). Income inequality and the tax structure: Evidence from developed and developing countries. *Journal of Comparative Economics*, *43*(1), 138-154. https://doi.org/10.1016/j.jce.2014.05.006
3. Adam, K. (2011). Government debt and optimal monetary and fiscal policy. *European Economic Review*, 55(1), 57-74. https://doi.org/10.1016/j.euroecorev.2010.11.003
4. Afonso, A., & Ibraimo, Y. (2020). The macroeconomic effects of public debt: An empirical analysis of Mozambique. *Applied Economics*, *52*(2), 212-226. https://doi.org/10.1016/j.euroecorev.2010.11.003
5. Alawneh, A. (2017). The impact of public expenditure and public debt on taxes: A case study of Jordan. *Accounting and Finance Research*, *6*(3), 1-10. https://doi.org/10.5430/afr.v6n3p10
6. Alesina, A., & Passalacqua, A. (2016). The political economy of government debt. *Handbook of macroeconomics*, *2*, 2599-2651. https://doi.org/10.1016/bs.hesmac.2016.03.014
7. Barro, R. J. (1996). Reflections on Ricardian equivalence. *NBER Working Paper*, 5502. https://doi.org/10.3386/w5502
8. Boitani, A., & Perdichizzi, S. (2018). *Public expenditure multipliers in recessions: Evidence from the Eurozone*. Working Paper, No.68. Available online: https://dipartimenti.unicatt.it/economia-finanza-def068.pdf.
9. Butkus, M., Cibulskiene, D., Garsviene, L., & Seputiene, J. (2021a). Empirical evidence on factors conditioning the turning point of the public debt–growth relationship. *Economies*, *9*(4), 191. https://doi.org/10.3390/economies9040191
10. Butkus, M., Cibulskiene, D., Garsviene, L., & Seputiene, J. (2021b). The heterogeneous public debt–growth relationship: The role of the expenditure multiplier. *Sustainability*, *13*(9), 4602. https://doi.org/10.3390/su13094602
11. Cassou, S. P., & Shadmani, H. (2018). Do US Government Tax Revenues and Expenditures Respond to Debt Levels and Economic Conditions Asymmetrically over the Business Cycle? *Applied Economics and Finance*, 5(3). https://doi.org/10.11114/aef.v5i3.3004
12. Celikay, F. (2020). Dimensions of tax burden: a review on OECD countries. *Journal of Economics, Finance and Administrative Science*, *25*(49), 27-44. https://doi.org/10.1108/jefas-12-2018-0138
13. Chudik, A., Mohaddes, K., Pesaran, M. H., & Raissi, M. (2018). Rising public debt to GDP can harm economic growth. *Economic Letter*, *13*(3), 1-4.

14. Ewaida, H. Y. (2017). The impact of sovereign debt on growth: An empirical study on GIIPS versus JUUSD countries. *European Research Studies Journal*, XX(2A), 607-633.
15. Fannoun, Z., & Hassouneh, I. (2019). The causal relationship between exports, imports and economic growth in Palestine. *Journal of Reviews on Global Economics*, 8. 258-268. https://doi.org/10.6000/1929-7092.2019.08.22
16. Hansen, G. D., & İmrohoroğlu, S. (2016). Fiscal reform and government debt in Japan: A neoclassical perspective. *Review of economic dynamics*, *21*, 201-224. https://doi.org/10.1016/j.red.2015.04.001
17. Hoti, A., Shkurti, A., & Rehman, S. (2022). Impact of External Debt on Economic Growth in Western Balkan Countries. *Academic Journal of Interdisciplinary Studies*, 11(2), 192-192. https://doi.org/10.36941/ajis-2022-0045
18. Kalaš, B., Todorović, J. Đ., & Đorđević, M. (2020). Panel estimating effects of macroeconomic determinants on tax revenue level in European Union. *Industrija*, 48(3), 41-57. https://doi.org/10.5937/industrija48-27820
19. Kong, S., & van der Hoek, M. P. (2008). Is the growth of Chinese annual tax revenues unnatural? *Journal of Public Budgeting, Accounting & Financial Management*, *20*(4), 554-570. https://doi.org/10.1108/jpbafm-20-04-2008-b007
20. Leão, P. (2015). Is a very high public debt a problem?. *Levy Economics Institute of Bard College Working Paper*, (843). Available online: https://www.levyinstitute.org/pubs/wp_843.pdf
21. Mittone, L., & Tomaselli, M. (2019). *Economic growth and public debt: An experimental approach in search of a confidence channel* (No. 2019/18). Department of Economics and Management. DEM Working Papers 2019/18. Available online: https://www.economia.unitn.it/alfresco/download/workspace/SpacesStore/82a47150-da34-4c0a-83ac-006d4871cafd/DEM2019_18.pdf.
22. Nautet, M., & Van Meensel, L. (2011). Economic impact of the public debt. *Economic Review*, *2*, 7-19.
23. Ogawa, T., & Ono, Y. (2010). Public debt places no burden on future generations under demand shortage. *ISER Discussion Paper*, No. 791. http://dx.doi.org/10.2139/ssrn.1680693.
24. Ostry, M. J. D., Ghosh, M. A. R., & Espinoza, M. R. A. (2015). *When should public debt be reduced?*. International Monetary Fund. Available online: https://www.elibrary.imf.org/view/journals/006/2015/010/article-A001-en.xml.
25. Otaki, M. (2015). Public debt as a burden on the future generation: A Keynesian approach. *Theoretical Economics Letters*, *5*(05), 651. https://doi.org/10.4236/tel.2015.55076
26. Pouzo, D., & Presno, I. (2022). Optimal taxation with endogenous default under incomplete markets. *American Economic Journal: Macroeconomics*, *14*(3), 1-41. https://doi.org/10.1257/mac.20160101
27. Puonti, P. (2022). *Public Debt and Economic Growth from the Perspective of Private Investment* (No. 130). The Research Institute of the Finnish Economy. Available online: https://www.etla.fi/wp-content/uploads/ETLA-Raportit-Reports-130.pdf
28. Reinhart, C. M., Rogoff, K.S., (2010a). Growth in a time of debt. *American Economic Review*, 100(2), 573-578. https://doi.org/10.1257/aer.100.2.573
29. Reinhart, C. M., Rogoff, K.S., (2010b). Debt and growth revisited. *MPRA Paper* no. 24376. Available online: https://mpra.ub.uni-muenchen.de/id/eprint/24376.

30. Robbins, M. D., & Simonsen, B. (2012). Do debt levels influence state borrowing costs? *Public Administration Review*, 72(4), 498-505. https://doi.org/10.1111/j.1540-6210.2011.02548.x
31. Slav'yuk, R., & Slaviuk, N. (2018). Government debt management: challenges and perspectives. *Investment Management and Financial Innovations*, 15(3), 143-156. https://doi.org/10.21511/imfi.15(3).2018.12
32. Tanzi, V., & Lutz, M. (1991). Interest Rates and Government Debt. *IMF Working Papers*, 91(6). https://doi.org/10.5089/9781451842227.001
33. Woo, J., & Kumar, M. S. (2015). Public debt and growth. *Economica*, *82*(328), 705-739. https://doi.org/10.1111/ecca.12138

Appendix 1

Debt size and tax burden dynamics 1995-2021, percent of GDP

Indicator	Country	2021	1995 - 2021 the average	Max	Min
Debt	**Austria**	82,3	73,3	84,9	63,5
Tax burden		27,8	27,8	29,7	26,5
Debt	**Croatia**	78,4	52,4	87	22,3
Tax burden		24,5	25	27,2	23,1
Debt	**Hungary**	76,8	69,1	84,1	52,3
Tax burden		23,2	24,9	26,2	23,2
Debt	**Slovenia**	74,5	44	82,6	18,2
Tax burden		21,6	22,4	24	20,5
Debt	**Finland**	72,4	53,2	74,8	34,7
Tax burden		23,2	24,9	26,2	23,2
Debt	**Germany**	68,6	66,4	82	54,9
Tax burden		24,6	22,8	24,6	21,1
Debt	**Slovakia**	62,2	43,6	62,2	21,6
Tax burden		20,2	19	24,8	15,7
Debt	**Malta**	56,3	58,1	71,3	34,2
Tax burden		24,8	23,7	26,8	18,2
Debt	**Ireland**	55,4	60,7	119,9	23,6
Tax burden		17,7	23,5	27,9	16,5
Debt	**Poland**	53,8	47,6	57,2	36,4
Tax burden		23,6	21,5	25,5	19,4

Debt	**The Netherlands**	52,4	57,3	73,1	43
Tax burden		26,1	22,7	26,1	20,8
Debt	**Romania**	48,9	26,3	48,9	6,6
Tax burden		15,9	18	20	15
Debt	**Lithuania**	43,7	27,9	46,3	11,5
Tax burden		21,7	19,2	22,8	15,9

Source: compiled by the author based on Eurostat and World Bank data