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ESTIMATION OF THE EFFECT OF TAXES AND GROSS FIXED CAPITAL FORMATION ON ECONOMIC GROWTH OF EURO AREA

There have been considered theoretical grounds of the impact of direct, indirect taxes and gross fixed capital formation on economic growth as well the empirical results of recent studies. There has been revealed that tax shift from direct to indirect taxes resulted positively on economic growth of the Euro Area from 2002q1 to 2017q4. The research has shown that direct taxes negatively influenced economic growth of the Euro Area, whereas indirect taxes and gross fixed capital formation had positive influence.

Key words: *direct taxes, indirect taxes, gross fixed capital formation.*

У статті виявлено вплив як прямих, так і непрямих податків, а також важливого фактора економічного зростання – валового нагромадження основного капіталу – на економічне зростання країн Єврозони за період з 2002 по 2017 рр. в рамках однієї регресійної моделі.

У наукових працях, опублікованих у ХХ ст., вчені недостатньо розглядали вплив змін податкових ставок на економічне зростання. Передбачалося, що податкова політика та різні види податків суттєво визначають темпи зростання та обсяг інвестицій, але насправді їх вплив на економічне зростання виявився незначним. У ряді досліджень вивчався взаємозв'язок між ставками податків та економічним зростанням, використовуючи моделі регресії за різні періоди, але не було зроблено певних висновків. Багато економістів вважали, що більш високі податки негативно впливають на економічне зростання, але, з іншого боку, вони призводять до вищих рівнів державних витрат. Згідно з дослідженнями домінуюча точка зору сприяє непрямому оподаткуванню і передбачає зміну фіскального навантаження на непрямі податки, особливо на споживання.

Низькі податкові ставки призводять до зменшення державних витрат і збільшення обсягу ресурсів, виділених у приватному секторі, що позитивно впливає на ефективність інвестицій. У середньому ринково дисциплінований приватний сектор сприяє більш адекватному використанню ресурсів, ніж неринковий політичний розподіл у державному секторі. Але деякі податки негативно впливають на економічний добробут. Серед них особливе місце займають податки на прибуток. І податки з продажу роблять менше шкоди економіці. Згідно з даними дослідження податки з доходів фізичних та юридичних осіб є найбільш шкідливими для зростання, тоді як податки на споживання, навколишнє середовище та майно менш шкідливі. Крім того, податки призводять до збільшення доходів бюджету, але збільшують загальний профіцит. Втрата загального надлишку перевищує податкові надходження, що призводить до непоправних втрат для суспільства.

У проведених дослідженнях були протестовані такі гіпотези:

Гіпотеза 1. Податкові надходження від прямих податків мали негативний вплив на ВВП у зоні євро (19) протягом 2002–2011 рр.

Гіпотеза 2. Податкові надходження від непрямих податків негативно вплинули на ВВП у зоні євро (19) протягом 2002–2011 рр.

Гіпотеза 3. Валове нагромадження основного капіталу мало позитивний вплив на ВВП у зоні євро (19) протягом 2002–2011 рр.

Емпіричні результати виявили проблему колінеарності між значеннями прямих і непрямих податків, що підвищує загальну значущість моделі. Проблема колінеарності полягає в загальній тенденції, яку мають як податки, так і подібність їх зведених статистичних значень. Беручи до уваги, що ця модель продемонструвала загальну адекватність, можна спиратися на отримані результати. Крім того, з економічної точки зору, модель підтвердила гіпотези 1 і 3. Наше дослідження продемонструвало, що нинішня тенденція перенесення податкового тягара з прямих податків на непрямі податки дійсно має позитивний вплив у зоні євро.

Ключові слова: *прямі податки, непрямі податки, валове нагромадження основного капіталу.*

Problem statement. According to the conventional economic theory taxation causes distortions and impacts harmfully on economic growth. When regarding a simple production function, it could be concluded that taxation can have an impact on growth through its impact on (1) physical capital, (2) human capital and (3) through its effect on the total factor productivity. With regard to the first and second channel, taxation increases the cost of capital and decreases motives to invest. To the extent that higher taxes depress investment, economic growth will be negatively affected. Moreover, by providing privileged incentives to different sectors, taxation can distort capital allocation and decrease the investment productivity. The third channel through which taxation influences negatively economic growth is through its harmful influences on total factor productivity. Taxes contribute to distortions of factor prices and provoke efficiency loss in resource allocation. This negative effect of taxes on efficiency diminishes total factor productivity. At the same time empirical results have revealed that the shift from direct to indirect taxation may positively influence economic growth of the countries due to that fact that indirect taxes do not cause distortions in the market to such extent as direct taxes.

Capital accumulation is recognised as a significant factor of economic growth. This allegation is revealed both in theoretical and empirical literature. According to Solow [1], physical capital accumulation contributes to boost in the level of production. The endogenous growth theory established mainly by Romer [2], Lucas [3], Romer [4] and Barro [5] considers this allegation by adding other factors (infrastructure, human capital, research and development) which hasten gross capital formation.

Current paper contributes to identifying the effects of both direct and indirect taxes along with important factor of economic growth – gross fixed capital formation – on economic growth of Euro Area for available period from 2002q1 to 2017q4 in terms of one regression model.

Analysis of recent studies. Previous works have revealed the influence of taxes on economic growth is very little. Harberger, A. [6] in the sixties studied the relation between taxation policy and economic growth. He supposed that taxation policy and structure of direct and indirect taxes, had a very significant determinant of growth and investments in theory, but its effect on economic growth was negligible in reality. A number of studies have researched the relationship between the level of taxation (or of public spending) and economic growth using cross-country growth regression models for different periods and different patterns of countries, but no established conclusion about the nature and significance of such a link has emerged from the exploration works. As Stoilova, D.[7] has mentioned “on the one hand, higher taxes cause potentially higher distortions and impact negatively on economic growth, but on the other hand, higher taxes suppose higher levels of public expenditure, some of which may foster economic growth”.

According to the studies the dominating view favours indirect taxation, and suggests a shift of the fiscal burden to indirect taxes, especially those on consumption. In particular, Myles, G.[8] has revealed that a move from income taxation to consumption taxation will increase the rate of growth. In the table below we have provided the main findings from the analysis of the impact of taxes on economic growth of the countries.

Relationship between taxes and economic growth of the countries

Authors	Object of the research	Subject of the research	Main findings
Kneller, R., Bleaney, M., & Gemmell, N.[9]	Panel of 22 OECD countries	The effect of distortionary taxes, which include taxes on income and property for 1970-1995	Depressing long-run effect of distortionary taxes on economic growth
Lee, Y., & Gordon, R.[10]	70 countries	The effect of statutory corporate tax rates on economic growth during 1970-1997	Negative correlation between statutory corporate tax rates and economic growth
Dackehag, M., & Hansson, A.[11]	25 rich OECD countries	The effect statutory tax rates on corporate and personal income affect economic growth for the period 1975–2010	Both taxation of corporate and personal income negatively influence economic growth
Schwellnus& Arnold[12]	Datasets of firms and industries across OECD countries	The effect of corporate tax on productivity and investment	Negative effect of corporate taxes on the productivity and investment
Widmalm, F.[13]	Pooled cross-sectional data from 23 OECD countries between 1965 and 1990	The effect of personal income tax on economic growth	The proportion of tax revenue raised by taxing personal income has a negative correlation with economic growth
Szarowska,I.[14]	Panel data for EU-24 member states during the period 1995–2010	The influence of consumption taxes on GDP growth	Positive effect of consumption taxes on GDP growth
Tanchev, S.[15]	Bulgaria, during 2004-2012	The impact of the personal income tax on the economic growth	Progressive income taxation has positive impact on growth
Arnold, J.[16]	Panel growth regressions for a sample of 21 OECD countries	The influence of tax structure on economic growth	Property taxes are the most growth-friendly, followed by consumption taxes and then by personal income taxes; corporate income taxes appear to have the most negative effect on growth
Bernardi, L.[17]	Euro Area (EA-17) member countries, during 2000-2014	The influence of from a tax shift (from direct to indirect taxes)	Tax shift may exacerbate the economic slump spreading across the European Union, particularly as an effect of the general adoption of restrictive fiscal policies by almost all member countries

Source: constructed by author

Unsolved problems. Many papers are devoted to researching the influence of direct and indirect taxes on economic growth but separately. In current paper we have estimated in terms of one model the influence of both taxes on economic growth of Euro Area.

The **objective** of current paper is to estimate the influence of direct, indirect taxes and gross fixed capital formation on

economic growth of Euro Area from 2002q1 to 2017q4.

Results of the research. Low taxes mean decrease in government spending, and increase in the amount of resources allocated in private sector. This leads to greater savings and investment. At an average, the market disciplined private sector contributes to more sufficient use of resources than the

politically driven non-market distribution in the public sector. Some taxes are more harmful than others from the point of view of the influence on economic wealth. Income taxes are considered to be particularly harmful, especially those ones, which levied on individuals. Sales taxes are perceived to be less harmful, and property taxes are somewhere in the middle [18]. According to OECD study [19] corporate and personal income taxes are the most detrimental to growth, while consumption, environment and property taxes are less harmful.

Tax produces revenue for the government but increases total surplus. The loss in overall surplus exceeds the tax revenue resulting in a deadweight loss to society. Taxes cause dead weight loss to the economy because they provoke people to change their behavior. Since elasticity of demand and supply is a measure of changes in the consumer and producer behavior of in relation to change of prices, it also determines the rate of market distortion. The greater the elasticity of demand or supply or both, the larger the deadweight loss of a tax. Another important factor of the size of dead weight

loss is the rate of a tax. If price elasticity of demand and supply is the same, dead weight loss is low if taxes are low and it grows if they grow. Dead weight loss increases faster than most taxes: the size of dead weight loss grows with the second power of the tax rate.

Based on above mentioned theoretical grounds of the influence of taxation and fixed gross capital formation on economic growth of the countries there have been tested the following hypotheses:

Hypothesis 1: Tax revenues from direct taxes had negative influence on GDP in Euro Area (19) during 2002q1-2017q4.

Hypothesis 2: Tax revenues from indirect taxes had negative influence on GDP in Euro Area (19) during 2002q1-2017q4.

Hypothesis 3: Gross fixed capital formation had positive influence on GDP in Euro Area (19) during 2002q1-2017q4.

Testing of the hypotheses has been made with the use of OLS method in Gretl 2017d. We have modified data using logarithms.

The description of the data used for OLS regression analysis is presented in the table 2.

In table 3 the descriptive statistics is presented.

Table 2

Description of variables

Variables	Description of variables	Units	Sources of data	Expected influence of independent variable on dependent variable
GDP	Log of Gross Domestic Product, neither seasonally adjusted nor calendar adjusted data, current prices	Million euro	Eurostat [20]	
GFCF	Log of Gross Fixed Capital Formation, neither seasonally adjusted nor calendar adjusted data	Million euro	Eurostat [20]	+
Direct_mil_euro	Log of taxes on production and imports: Government revenue from indirect taxes, neither seasonally adjusted nor calendar adjusted data	Million euro	ECB[21]	-
Indirect_mil_euro	Log of current taxes on income, wealth, etc.: Government revenue from direct taxes, neither seasonally adjusted nor calendar adjusted data	Million euro	ECB[22]	-

Source: author's elaboration

From the table 3 it could be seen that in case of the use of logarithm values of direct and indirect taxes the meanings of their median, minimum and maximum in both of the models are very similar. In the fig. 1 we can also observe very similar dynamics of the values of both taxes.

Descriptive statistics of direct and indirect taxes provides an evidence of high correlation (table 4).

In the table 5 the results of regression analysis are presented and the results of the overall quality of the model are presented in the table 6.

Table 3

Summary statistics, using the observations 2002:1 - 2017:4

Variable	Mean	Median	Minimum	Maximum
l_GDP	14.668	14.690	14.420	14.877
l_GFCF	11.170	11.168	10.885	11.444
l_Direct_mil_euro	12.541	12.566	12.105	12.932
l_Inderect_mil_euro	12.607	12.618	12.337	12.876
Variable	Std. Dev.	C.V.	Skewness	Ex. kurtosis
l_GDP	0.11205	0.0076390	-0.43854	-0.59624
l_GFCF	0.12449	0.011144	-0.061395	-0.53317
l_Direct_mil_euro	0.19049	0.015190	-0.34446	-0.39960
l_Inderect_mil_euro	0.13199	0.010469	-0.24861	-0.60908
Variable	5% Perc.	95% Perc.	IQ range	Missing obs.
l_GDP	14.455	14.840	0.15838	0
l_GFCF	10.959	11.386	0.19010	0
l_Direct_mil_euro	12.152	12.826	0.27633	0
l_Inderect_mil_euro	12.366	12.821	0.19136	0

Source: constructed by author with the use of Gretl

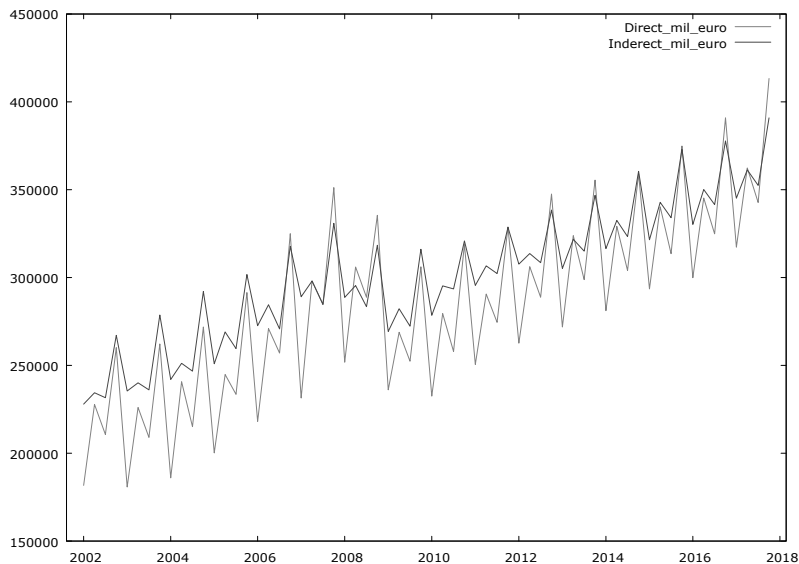


Fig. 1: Time series plot: Taxes on production (indirect) and imports and Current taxes on income, wealth etc.(direct)

Source: constructed by author with the use of Gretl

Table 4

Correlation coefficients, using the observations 2002:1 - 2017:4
5% critical value (two-tailed) = 0.2461 for n = 64

l_GDP	l_GFCF	l_Direct_mil_euro	l_Inderect_mil_euro	
1.0000	0.5288	0.8942	0.9618	l_GDP
	1.0000	0.6123	0.5100	l_GFCF
		1.0000	0.9434	l_Direct_mil_euro
			1.0000	l_Inderect_mil_euro

Source: constructed by author with the use of Gretl

Table 5

Model 1: OLS, using observations 2002:1-2017:4 (T = 64)
Dependent variable: l_GDP

	Coefficient	Std. Error	t-ratio	p-value	
const	3.32178	0.572100	5.806	<0.0001	***
l_GFCF	0.0833057	0.0397763	2.094	0.0405	**
l_Direct_mil_euro	-0.135651	0.0674368	-2.012	0.0488	**
l_Inderect_mil_euro	0.961160	0.0894581	10.74	<0.0001	***
Mean dependent var	14.66822		S.D. dependent var	0.112050	
Sum squared resid	0.054067		S.E. of regression	0.030018	
R-squared	0.931646		Adjusted R-squared	0.928228	
F(3, 60)	272.5934		P-value(F)	6.68e-35	
Log-likelihood	135.6334		Akaike criterion	-263.2669	
Schwarz criterion	-254.6313		Hannan-Quinn	-259.8649	
rho	0.030902		Durbin-Watson	1.926727	

Source: constructed by author with the use of Gretl

Table 6

Tests results

RESET test for specification –	White's test for heteroskedasticity –	Test for normality of residual –	LM test for autocorrelation up to order 1 –
Null hypothesis: specification is adequate Test statistic: F(2, 58) = 0.737631 with p-value = P(F(2, 58) > 0.737631) = 0.482678	Null hypothesis: heteroskedasticity not present Test statistic: LM = 7.35834 with p-value = P(Chi-square(9) > 7.35834) = 0.599865	Null hypothesis: error is normally distributed Test statistic: Chi-square(2) = 4.46756 with p-value = 0.107123	Null hypothesis: no autocorrelation Test statistic: LMF = 0.159594 with p-value = P(F(1, 59) > 0.159594) = 0.690973

Source: constructed by author with the use of Gretl

Conclusions. In current research there have been tested the following hypotheses:

Hypothesis 1: Tax revenues from direct taxes had negative influence on GDP in Euro Area (19) during 2002q1-2017q4.

Hypothesis 2: Tax revenues from indirect taxes had negative influence on GDP in Euro Area (19) during 2002q1-2017q4.

Hypothesis 3: Gross fixed capital formation had positive influence on GDP in Euro Area (19) during 2002q1-2017q4.

Empirical results have revealed the problem of collinearity between the values of direct and indirect taxes which increases overall significance of the model. The problem of collinearity lies in the common

trend which both of taxes share and in the similarity of their summary statistics meanings. Taking into that model demonstrated overall adequacy, we rely on the results of the model. Furthermore, from economic point of view the model confirmed hypothesis 1 and hypothesis 3. Obtained results also confirm the empirical results of previous studies and provide an evidence of the fact that,

despite conventional theory according to which taxation contributes to distortions in the market and leads to deadweight loss exceeding budget revenues, differences in taxation structure may lead to different consequences in terms of economic growth. Our research has demonstrated that current trend of shifting tax burden from direct taxes to indirect taxes, indeed, has positive influence in Euro Area.

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Key words: *direct taxes, indirect taxes, gross fixed capital formation.*

Current paper contributes to identifying the effects of both direct and indirect taxes along with important factor of economic growth – gross fixed capital formation – on economic growth of Euro Area for available period from 2002q1 to 2017q4 in terms of one regression model.

In scientific papers that were published in the twentieth century, scientists did not sufficiently consider the effect of changes in tax rates on economic growth. It was assumed that tax policy and different types of taxes have a very significant determinant of growth and investment, but its effect on economic growth was in fact insignificant. A number of studies have examined the relationship between tax rates and economic growth using growth regression models between countries for different periods, but no definite conclusions have been made. Many economists believed that higher taxes have a negative effect on economic growth, but on the other hand, they lead to higher levels of government spending. According to studies, the dominant viewpoint favors indirect taxation and implies a shift in the fiscal burden to indirect taxes, especially on consumption.

Low tax rates lead to a decrease in government spending and an increase in the amount of resources allocated in the private sector, which has a positive effect on investment performance. On average, a market-disciplined private sector contributes to a more adequate use of resources than non-market political distribution in the public sector. But some taxes have a negative effect on economic welfare. Among them, a special place is occupied by income taxes. And sales taxes do less damage to the economy. According to the study, corporate and personal income taxes are the most harmful for growth, while taxes on consumption, the environment and property are less harmful. In addition, taxes lead to an increase in budget revenues, but increase the overall surplus. The loss in total surplus exceeds tax revenues, which leads to irreparable losses for society.

Taxes provoke people to change their behavior. Since the elasticity of supply and demand is a measure of changes in consumer and producer behavior due to price changes, it also determines the degree of market distortion. The greater the elasticity of demand or supply, or both, the greater the total loss of tax. If price elasticity of demand and supply is the same, dead weight loss is low if taxes are low and it grows if they grow. Dead weight loss increases faster than most taxes: the size of dead weight loss grows with the second power of the tax rate.

In current research there have been tested the following hypotheses:

Hypothesis 1: Tax revenues from direct taxes had negative influence on GDP in Euro Area (19) during 2002q1-2017q4.

Hypothesis 2: Tax revenues from indirect taxes had negative influence on GDP in Euro Area (19) during 2002q1-2017q4.

Hypothesis 3: Gross fixed capital formation had positive influence on GDP in Euro Area (19) during 2002q1-2017q4.

Empirical results have revealed the problem of collinearity between the values of direct and indirect taxes which increases overall significance of the model. The problem of collinearity lies in the common trend which both of taxes share and in the similarity of their summary statistics meanings. Taking into that model demonstrated overall adequacy, we rely on the results of the model. Furthermore, from economic point of view the model confirmed hypothesis 1 and hypothesis 3. Obtained results also confirm the empirical results of previous studies and provide an evidence of the fact that, despite conventional theory according to which taxation contributes to distortions in the market and leads to deadweight loss exceeding budget revenues, differences in taxation structure may lead to different consequences in terms of economic growth. Our research has demonstrated that current trend of shifting tax burden from direct taxes to indirect taxes, indeed, has positive influence in Euro Area.

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