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CHANGES IN TAXATION AND THEIR IMPACT ON ECONOMIC GROWTH IN THE EUROPEAN UNION

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Abstract

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The aim of the paper is to analyze changes in taxation and their impact on economic growth in the European Union. The analysis is performed on adjusted annual panel data of 24 European Union countries in a period 1995–2008. Panel regression with fixed effects is used as a basic method of research. The panel regression is based on analysis the effect of total tax quota changes on GDP growth in model 1, of changes in its components (social contribution, direct and indirect tax quotas) in model 2 and of personal and corporate income tax quota changes in model 3. Results of empirical tests verify statistically significant negative effect of tax burden on GDP growth. Total tax quota increased by 1% decreases the GDP growth rate by 0.29% in the same year. Estimations confirm a statistically significant negative effect of direct taxes on GDP growth as well. A cut in the direct tax quota by 1% raises the GDP growth rate by 0.43%. The model also presents a high negative impact of an increase in the corporate income tax quota on GDP growth (a value of the regression coefficient is minus 1.28%). The effect of social contribution quota on GDP growth is not statistically significant in any estimation.

taxation, tax burden, economic growth, panel regression

Enlargement of the European Union and the globalization process significantly affect tax systems and fiscal policies of individual countries. The level and structure of tax burden is often discussed in the European Union. Economic theory suggests that differences in taxation may play a role in explaining differences in economic performance. Current economic development forces governments to find solutions how to support the economic growth and to consolidate public finance. There are different views of how this problem should be dealt with in general and also applied tools of individual countries have various forms – from ad hoc tax measures to substantial structural reforms. It is questionable whether the governments may affect the economic performance of countries through changes in taxation.

The aim of the paper is to analyze changes in taxation and their impact on economic growth in the European Union. The analysis is performed on adjusted annual panel data of 24 EU countries in a period 1995–2008. Panel regression with fixed effects is used as a basic method of research. The paper is structured as follows: The first section of the paper introduces basic relations between taxation and the economic growth and the aim of paper. The second part provides a basic literature review. The third part presents methods and resources for modeling changes in taxation and their impact on economic growth in the European Union. The fourth section reports results and discussions of the estimation. The panel regression is based on analysis the effect of total tax quota changes on GDP growth in model 1, of changes in its components (social contribution, direct and indirect tax quotas) in model 2 and of corporate and personal income tax quota changes in model 3. The last section presents conclusions.

Literature review

The theoretical effect of taxation on economic performance is not an obvious matter. A higher level of tax burden can be seen as a serious obstacle to sustained improvement of the economic level of the country. Scully (1991,93–96) says: *Taxes levied by government may have both positive and negative effects on economic growth. The value of economic resources and the ability to transform resources into output are greater to the degree that property is protected, roads and harbors are provided, and domestic tranquility is insured. Taxation beyond this level may have a negative effect. In modern times, many private goods are provided at public expense and direct income redistribution takes place on a large scale. At some level of taxation, resources employed in the public sector are less than in the private sector and resources escape into informal or underground economy – which diminish economic growth*. Both neoclassical and Keynesian theoretical models, for example, predict that higher taxes reduce economic activity, even though there is less agreement on the exact mechanisms that generate this result. On the other hand, taxes may be a benefit for the economy because the taxes are the basic source for financing public goods and services, and in this way can increase the living standards and wealth of the whole society. If collected taxes are used efficiently, provided public services can increase productivity of human and fixed capital in the private sector and promote long-term economic growth.

There is voluminous literature on the effects of taxes on the economy and its rate of growth (Leibfritz, Thornton and Bibbee, 1997; Barro, 1991; Slemrod, 1995). However, using statistical data for comparing levels of taxation and economic performance also does not provide unequivocal conclusions. We can find countries with high economic performance, which have a low tax burden (e.g. United States), but also countries that have high economic performance with high tax burden (e.g. Scandinavian countries).

But there are many studies which present negative relationships between taxes and economic growth, and recommend lowering tax rates. Plosser (1992) finds a significant negative correlation between the level of taxes on income and profits (as a share of GDP) and growth of real per capita GDP. King and Rebelo (1990) simulate changes in the income tax by applying an endogenous growth model and find that an increase from 20 per cent to 30 per cent reduces the rate of growth by 2 percentage points. Scully (2000) claims that countries in which government takes more than 43% of national income in the form of taxes could collect more revenue by lowering their tax rates. Further, tax rates anywhere close to 43% have devastating effects on economic growth. Hill (2008) estimated the growth–maximizing size of states for the United States in 1960–1990 was between 9% and 29% of GDP. Also Romero-Ávila and Strauch (2008) state that government consumption and direct taxation negatively affect growth rates of GDP per capita in the EU15 in the last 40 years. Johansson *et al.* (2008, 2) investigate the design of tax structures to promote economic growth. "Corporate taxes are found to be most harmful for growth, followed by personal income taxes, and then consumption taxes. Recurrent taxes on immovable property appear to have the least impact." Lee and Gordon (2005) explore how tax policies in fact affect a country's growth rate, using cross-country data during 1970–1997. The coefficient estimates suggest that a cut in the corporate tax rate by 10% will raise the annual growth rate by 1 to 2 percentage points.

Karras and Furceri (2009) examine the effects of changes in taxes on economic growth. Using annual data from 1965 to 2003 for a panel of 19 European economies, the results show that the effect of an increase in taxes on real GDP per capita is negative and persistent. An increase in the total tax rate by 1% of GDP has an effect on real GDP per capita of minus 0.5% to minus 1% in the long run. The findings also imply that increases in social security contributions or taxes on goods and services have larger negative effects on per capita output than increases in income tax.

METHODS AND RESOURCES

It should be noted that the goal of this empirical analysis is not to find the ideal model describing the behavior illustrated by the variables, but a statistically significant correlation between explanatory (the tax burden which is expressed as the tax quota) and explaining variable (economic performance which is measured by GDP growth). We use the panel data and calculations which are made in the program Eviews.

Methodology of the analysis is based on study of Plojhar and Tomšík (2004), who analyzed the influence of taxation on economic performance in OECD countries (1972–2002). We use panel data as panel data have both cross-sectional and time series dimensions and the application of regression models to fit econometric models are more complex than those for simple cross-sectional data sets. As Dougherty (2007) and Cipra (2008) wrote, there are several reasons for the increasing interest in panel data sets. An important one is that their use may offer a solution to the problem of bias caused by unobserved heterogeneity, a common problem is the adaptability of models with cross-sectional data sets. A second reason is that it may be possible to exploit panel data sets to reveal dynamics that are difficult to detect with cross-sectional data. A third attraction of panel data sets is that they often have very large numbers of observations. Panel data modelling combines elements of time series analysis and elements of regression analysis.

We performed both fixed effects and random effects regressions before analysis. A Durbin–Wu–Hausman test indicated significant differences in the coefficients so model with fixed effects is used in the paper. A panel model with fixed effects can be formally written as:

$$y_{it} = \alpha_i + \beta' X_{it} + \varepsilon_{it}, \quad i = 1, 2, \ldots, N, t = 1, 2, \ldots, T, \tag{1}$$

where y_{it} depends on a set of K explanatory variables x_{it} and the constants are specific to the i–th unit (country) at time t, at the same time but are constant. β ' is the vector dimension $1xK$ constants and α_i is a constant representing the effects of those variables, which are characteristic of the i–th observation. ε_{it} error component represents non-significant effects of variables inherent in the i-team observations and a given time interval. Furthermore, we assume it does not correlate with the vector x_{it}, for all the i and t, and it comes from independent identical distribution with zero mean and constant dispersion. This model is often referred to as a basic model representing the structure of panel data.

The panel consists of 24 EU members – Bulgaria, Romania and Malta were excluded due to lack of data. Basic panel model identifiers are country i and time t. The paper uses adjusted annual data on total tax quota and its sub-components (direct taxes, indirect taxes, social contribution, personal income taxes, corporate income taxes) from Eurostat. Annual cyclically adjusted data on GDP at market prices are taken from Eurostat and they are based on an accrual basis. Expressing GDP in PPS (purchasing power standards) eliminates differences in price levels between countries, and calculations on a per head basis allows for the comparison of economies significantly different in absolute size. Tab. I presents basic variables and their descriptive statistics. All taxes are expressed as % of GDP and they are understood as a tax quota (TTOT – total tax quota, TDIR – direct taxes, TIND – indirect taxes, TSC – social contribution, CIT – corporate income taxes, PIT – personal income taxes).

Model specification

A causal relationship between the variables can be simply written:

$$GDP = f(TDIR, TIND, TSC). \tag{2}$$

This means that the amount of GDP is the result of the influence of individual components of tax quota. It is necessary to test the stationary time series before starting econometric analysis due to the assumes of panel regression. For this purpose panel unit root tests are used. A stationary time series is required because any variable which stochastically permanently departs from its mean value cannot be affected by long period variable, which returns to its mean value (effect may be only in a short term). Recent literature suggests that panel-based unit root tests have higher power than unit root tests based on individual time series. Panel unit root tests are similar, but not identical, to unit root tests carried out on a single series (Verbeek, 2000). We used panel unit root tests (Levin, Lin and Chu, Breitung, Im, Pesaran and Shin, Fisher-type tests using ADF and PP tests) and they identified non- stationary of all level data. Therefore, it is not possible to analyze the effect of taxation on economic performance based on level data. Next we calculated and tested the first difference of time series with the aim to comply assumptions of panel regression. The first difference (absolute change in values) of GDP is expressed as:

$$\Delta GDP = GDP - GDP_{(-1)}. \tag{3}$$

Analogically, we used the same indication and procedure for all the remaining time series ($\Delta TTOT$, $\Delta TDIR$, $\Delta TIND$, ΔTSC, ΔCIT, ΔPIT). We also calculated and tested the first difference of logarithmic data for the GDP (rate of growth):

$$TR\_GDP = (\ln GDP - \ln GDP_{(-1)})100. \tag{4}$$

Panel unit root tests confirm that all time series are stationary at the first difference I(1). For details see Szarowská (2010). All time series are stationary even at 1% level of significance and can be used for modelling changes of GDP growth depending on changes of the tax quota and its components[1].

I: *Descriptive statistics of variables (312 observations)*

Variable	Mean	Median	Maximum	Minimum	Std. dev.
GDP	19 891	19 350	69 300	4 500	9 480
TTOT	37.734	37.206	51.822	25.766	6.002
TDIR	12.446	10.949	31.922	6.007	5.238
TIND	13.861	13.570	19.952	10.151	1.828
TSC	11.484	12.135	18.618	0.9961	3.780
CIT	2.997	2.801	8.028	0.522	1.323
PIT	8.559	7.167	26.308	2.502	4.789

Source: Author's calculations based on data from Eurostat

1 Results of tests are available on request.

RESULTS AND DISCUSSION – IMPACT OF TAX CHANGES ON GROWTH

Time series of growth rate and differences of all variables are stationary and therefore they can be used for panel regression. The panel regression is based on analysis the effect of total tax quota changes on GDP growth in model 1, of changes in its components (social contribution, direct and indirect taxes) in model 2 and of CIT and PIT changes in model 3.

Model 1

Model 1 is estimated in a very simple form:

$$TR\_GDP_{it} = \alpha_i + \beta\,\Delta TTOT_{it} + \varepsilon_{it}, \qquad (5)$$

where TR_GDP_{it} is rate of growth GDP and it depends on a first difference of total tax quota $TTOT_{it}$. α_i is a constant representing the effects of those variables, which are characteristic of the i–th observation. We suppose that GDP growth depends only on total tax quota changes ($\Delta TTOT$).

The equation shows the negative effect between variables: total tax quota increased by 1% decreases the GDP growth rate by 0.29 percentage point in the same year. The estimate is significant at the 10% level, results are not significant on standard used 5% level. The Durbin–Watson statistic (1951) is a test statistic used to detect the presence of autocorrelation in the residuals, value equal 2 indicates no autocorrelation. The value of the Durbin–Watson test is 1.961 so residues are not autocorrelated. Adjusted R–squared is 0.298[2].

Model 2

Model 1 is very simplistic as total tax quota does not reflect changes of its individual components. Model 2 reflects changes of tax quota components: direct taxes *TDIR*[3], indirect taxes *TIND*[4] and social contribution *TSC* on GDP growth.

$$TR\_GDP_{it} = \alpha_i + \beta_1\,\Delta TDIR_{it} + \\ + \beta_2\,\Delta TIND_{it} + \beta_3\,\Delta TSC_{it} + \varepsilon_{it}. \qquad (6)$$

The results in Tab. III express the negative effect of direct taxes and social contribution on GDP growth and the positive impact of indirect tax changes on GDP growth. The effect of direct taxes is statistically significant, while other variables are not statistically significant at standard level. The coefficient suggests that a cut in the direct taxes by one percentage point raises the growth rate by a 0.43 percentage point. Due to the values of the adjusted coefficient of determination residues are not autocorrelated. Fig. 1 shows how the actual data correspond to the estimated values.

II: *Specification of model 1*

Variable	Coefficient	Std. Error	t–Statistic	Prob.
Constant	5.686536	0.156343	36.37216	0.0000
TR_TTOT	–0.128693	0.060859	–1.796245	0.0736
Effects Specification				
R–squared	0.357248			
Adjusted R–squared	0.298594			
Durbin–Watson stat	1.958847			

Source: Author's calculations

III: *Specification of model 2*

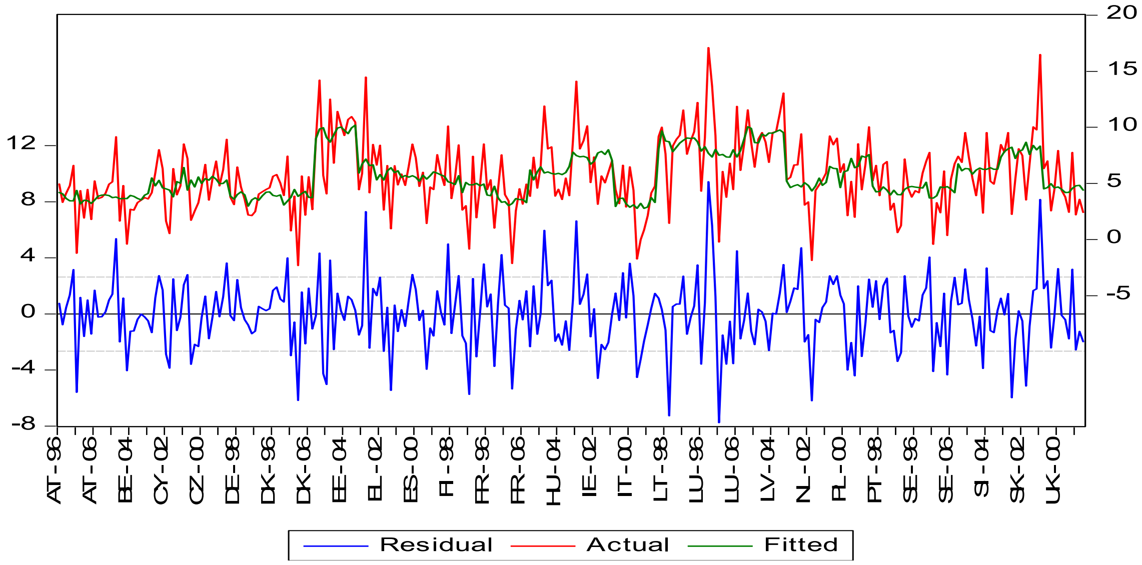
Variable	Coefficient	Std. Error	t–Statistic	Prob.
Constant	5.662490	0.157107	36.04221	0.0000
ΔTDIR	–0.431771	0.222504	–1.940508	0.0434
ΔTIND	0.285605	0.286615	0.996477	0.3199
ΔTSC	–0.233530	0.352001	–0.663435	0.5076
Effects Specification				
Adjusted R–squared	0.299303			
Durbin–Watson stat	1.981283			

Source: Author's calculations

2 The estimations with lags does not confirm statistically significant effect of tax changes on GDP growth at standard levels. Detailed results of estimation are available on reguest.

3 Direct taxes are imposed on a concrete subject, which cannot transfer this tax on somebody else, e. g. personal and corporate income taxes.

4 Indirect taxes are value added tax, consumer tax, customs and other indirect taxes. Indirect taxes are imposed on a concrete subject as well, but it can transfer them on some other subject.



1: *Effect of tax quota components on GDP growth*
Source: Author's calculations

We also calculated estimations with time lag. We used information criteria (Akaike info criterion, Schwarz criterion and Hannan–Quinn criterion) and it seems that the model with 1 year lag is the most appropriate. Equation with 1 year lag has following form:

$$TR\_GDP_{it} = \alpha_i + \beta_1\, \Delta TDIR_{it-1} + \\ + \beta_2\, \Delta TIND_{it-1} + \beta_3\, \Delta TSC_{it-1} + \varepsilon_{it}. \quad (7)$$

An estimation with 1 year lag reflects statistically significant negative effects of direct taxes on GDP growth at 10% level and positive effect of indirect taxes on GDP growth at 5% level. Regression coefficients are higher than in the previous equation: 0.65% and –0.44%. Cross-sectional nature and persistence of taxes can be one of the reasons explaining this development. Indirect taxes have impact on demand and positively effect on economic growth. Direct taxes can have an impact on GDP by affecting labour utilization and labour productivity or both. However, it is generally difficult to assess the overall effect of the tax changes on GDP. For example, changes in any single tax may simultaneously affect several determinants of GDP. The effects of changes in taxation often depend also on the design of other policies and institutions. Thus, the negative effect of labour taxes on employment is often dependent on wage setting institutions which determine e.g. minimum wages, which negatively affect labour cost and then GDP growth.

Model 3

Model 2 confirmed statistically significant negative effect of direct taxes on GDP growth. Model 3 is focused on analyzing the effect of changes in corporate (CIT) and personal income taxes (PIT) on GDP growth. The equation takes the following form:

$$TR\_GDP_{it} = \alpha_i + \beta_1\, \Delta PIT_{it} + \beta_2\, \Delta CIT_{it} + \\ + \beta_3\, \Delta TIND_{it} + \beta_4\, \Delta TSC_{it} + \varepsilon_{it.} \quad (8)$$

Results in Tab. V show the negative correlation between corporate income taxes and GDP growth even at 1% level. The regression coefficient (–1.28) confirms high negative impact of an increase in the corporate income taxes on GDP growth. Other variables are not statistically significant in this estima-

IV: *Specification of model 2 with 1 year lag*

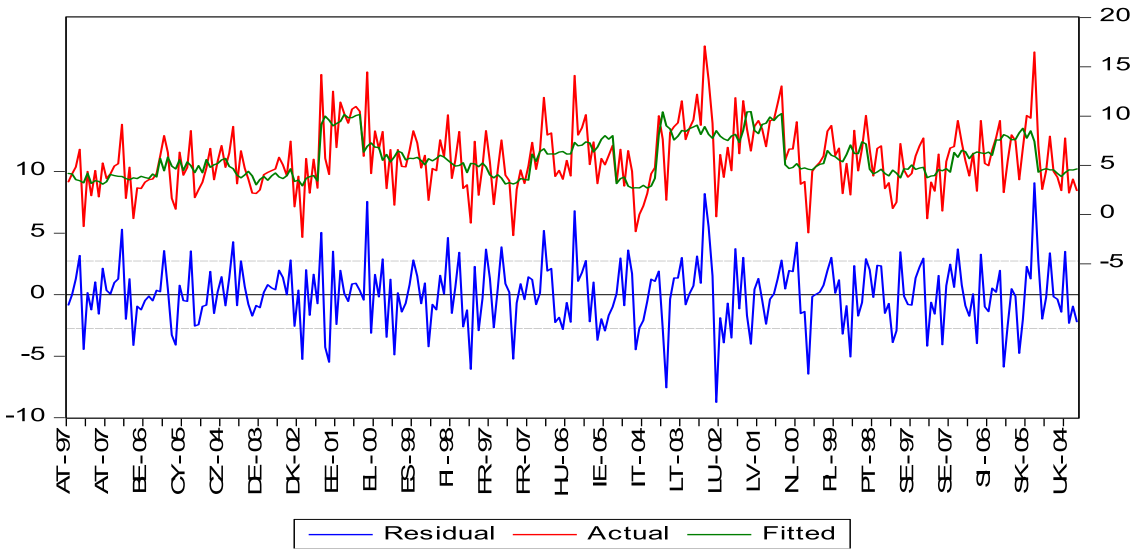
Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant	5.638532	0.168810	33.40173	0.0000
ΔTDIR(–1)	–0.442761	0.246102	–1.799096	0.0733
ΔTIND(–1)	0.646778	0.306936	2.107206	0.0362
ΔTSC(–1)	–0.220433	0.375224	–0.587469	0.5574
Effects Specificatio				
Adjusted R-squared	0.299392			
Durbin–Watson stat	2.000670			

Source: Author's calculations

V: *Specification of model 3*

Variable	Coefficient	Std. Error	t–Statistic	Prob.
Constant	5.579721	0.156320	35.69423	0.0000
ΔPIT	−0.450514	0.366721	−1.228495	0.2204
ΔCIT	−1.283417	0.339171	−3.783980	0.0002
ΔTIND	0.415856	0.284175	1.463382	0.1446
ΔTSC	−0.356937	0.349241	−1.022036	0.3077
		Effects Specification		
Adjusted R–squared	0.324618			
Durbin–Watson stat	1.979723			

Source: Author's calculations



2: *GDP growth as a result of tax changes*
Source: EViews 6

tion. Fig. 2 shows how the actual data correspond to the estimated values (fitted).

We again used information criteria (Akaike info criterion, Schwarz criterion and Hannan–Quinn criterion) for identification. The most appropriate time lag and model with 2 year lags seem to be the most suitable. Estimation with 2 year lag has following form:

$$TR\_GDP = 5.011 - 1.024 \times \Delta CIT_{(-2)} - 0.4710 \times$$

$$\times\ \Delta PIT_{(-2)} + 0.594 \times \Delta TIND_{(-2)} - 0.417 \times$$

$$\times\ \Delta TSC_{(-2)} + \varepsilon_{it}. \quad (9)$$

It confirms the statistically significant negative effect of corporate tax changes on GDP growth at standard level 5% level. The adjusted determination coefficient has a value of 20%, and a Durbin–Watson test (1.880) confirms no autocorrelation of residues. Other variables are not statistically significant.

Economic theory suggests that differences in tax burden may play a role in explaining differences in economic performance. Nevertheless, it is generally difficult to assess the overall effect of the tax changes on GDP as, for example, changes in any single tax may simultaneously affect several determinants of GDP and its growth. The effects of changes in taxation often depend also on the design of other policies and institutions. The empirical findings show that an increase in taxes has a negative effect on GDP growth. Founded regression coefficients are in line with conclusions of the studies of Scully (1991, 2000), Lee and Gordon (2005), Hill (2008), Romero-Ávila and Strauch (2008), Karras and Furceri (2009).

Although founded regression coefficients are relatively high, the changes in tax burden should not be regarded as a single tool affecting the economic growth, as the GDP growth is influenced by many factors. Nevertheless, values of adjusted the determination coefficient (approximately 30%), are relatively high due to the complex nature of GDP growth.

SUMMARY

The paper analyzed the effect of tax changes on GDP growth using adjusted annual data for a panel of 24 European Union members in a period 1995–2008. We have used panel regression with fixed effects as a basic method of research. The panel regression is based on analysis the effect of total tax quota changes on GDP growth in model 1, of changes in its components (social contribution, direct and indirect taxes) in model 2 and of corporate income tax quota and personal income tax quota changes in model 3.

The empirical findings show that an increase in taxes has a negative effect on GDP growth. Founded regression coefficients are in line with conclusions of the studies of Scully (1991, 2000), Lee and Gordon (2005), Hill (2008), Romero–Ávila and Strauch (2008), Karras and Furceri (2009). The results of empirical tests verify statistically significant negative effect of tax burden on GDP growth. Total tax quota increased by 1% decreases the GDP growth rate by 0.29% in the same year. The estimations confirm a statistically significant negative effect of direct tax quota changes on GDP growth as well. A cut in the direct tax quota by 1% raises the GDP growth rate by 0.43%. The model also presents a negative impact of corporate income taxes on GDP growth. The regression coefficient (–1.28%) expresses the high negative impact of an increase in the corporate income tax quota on GDP growth. On the other hand, the effect of social contribution quota changes on GDP growth is not statistically significant in any estimation.

Although founded regression coefficients are relatively high, the changes in tax rates should not be regarded as a single tool affecting the economic growth, as the GDP growth is influenced by many factors. Nevertheless, values of adjusted the determination coefficient (approximately 30%) are relatively high due to the complex nature of GDP growth.

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