ENDOGENOUS GROWTH MODEL: EVIDENCE FROM EAST EUROPEAN COUNTRIES

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ABSTRACT

Fiscal policy is one of the key issues for every government. In the endogenous growth model, fiscal policy is included as a key factor determining the growth of the economy. The focus in this study is placed on eleven East European transitional countries for the period of 1995 to 2014. The model includes both sides of government finance, taxation and expenditures, with expenditures being grouped into homogeneous categories in order to increase the structural efficiency. We find a positive impact on growth for certain government expenditures such as expenditures aimed at improving human resources, property protection and social investment and a negative one for distortionary taxation. The results provide empirical evidence for the theoretical predictions of endogenous growth.

Keywords: East European countries, Fiscal Policy, Public Expenditures, Taxation, Economic growth

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1. INTRODUCTION

The endogenous growth models have made the fiscal policy a crucial field of study of economic growth. According to Kongsamut, Rebelo, & Xie (2001) the theory of endogenous growth is widely applied in macroeconomics as it is consistent with the fact expressed by Kaldor (1960), that the per capita output rate, real interest rate, capital-output ratio, and the labour capital ratio in national income are constant over time.

The theoretical framework of endogenous growth models incorporates the tax and expenditure levels as determinants of long-run growth. Barro (1990), Barro & Sala-i-Martin (1992), Mendoza, Milesi-Ferretti, and Asea (1997) developed models that incorporated fiscal policy as a determinant of the level of output and long term growth. A significant number of studies have been performed aimed at testing the theoretical models of endogenous growth, but the studies fail to produce conclusive evidence due to significant difference in results between various studies. The endogenous growth models classify governmental fiscal policy instruments into several categories. Taxation is grouped into distortionary and non-distortionary taxation; the first group reduces the incentives to invest and thereby reduces growth and the second group has no effect on the investment incentive and therefore has no effect on growth. The other side of government finance, the expenditures, are classified into productive expenditures, expenditures that positively impact the marginal product of privately owned capital and thereby increase economic growth, and unproductive expenditures, expenditures that have no impact on marginal product of privately owned capital and therefore do not affect growth.

The basic endogenous growth model has been extended upon in numerous studies. Studies such as Barro (1990) and Cashin (1995) allowed for publicly-provided goods to be productive. Devarajan, Swaroop, and Zou (1996), Sala-I-Martin (1997), Kaganovich and Zilcha (1999), and Zagler & Dürnecker (2003) allowed for different forms of expenditures to be productive, while Ortigueira (1998) allowed for various forms of taxation.

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Kneller et al. (1999) show that in empirical studies the impact of fiscal policy on growth is usually estimated by the fallowing equation:

$$G_{it} = a + \sum_{i=1}^{k} b_i E_{it} + \sum_{j=1}^{l-1} (c_j - c_l) F_{jt} + u_{it} \quad (1)$$

In equation (1) the represents the economic growth achieved by the country i at time t. represents the non-fiscal variable and is the fiscal variable. Furthermore is the constant term and is the coefficient of the non-fiscal variable i, furthermore the number of i variables is equal to k. Additionally, represents the coefficient of the effect on growth for the variable. The number of such variables is equal to *l*-1. The represents the effect on growth for the *l*th fiscal variable. The *l*th is used to finance changes in one of the *l*-1 fiscal policy instruments.

It is possible to observe, based on equation (1), that the empirical studies are usually conducted with the aim of testing the hypothesis that the variable has a coefficient equal to zero or alternatively to test whether . This is because the aim is to examine the effect of a change in fiscal category of interest, which is offset by a change in the *l*th fiscal variable. The *l*th variable represents the omitted variable that is used to implicitly finance variation in the fiscal category of interest.

One of the common issues that is present in many studies that examine the impact of fiscal policy on economic growth is the lack of accounting for the effect on policy of transition onto steady-state. According to Benos (2005), this is important as the endogenous growth models differ from neoclassical models only in the prediction of the long term effects of fiscal policy. This is further supported by Bleaney, Gemmell, and Kneller (2001) as they show that taking data in five-year averages does not fully account for long term impact of fiscal policy.

This paper focuses on examining the impact of fiscal policy on economic growth in 11 East European transitional countries that acceded to the European Union (EU) and tries to determine the effect of the fiscal policy instruments on growth.

2. EMPIRICAL LITERATURE REVIEW

A large number of studies have been performed in order to test the relationship between the fiscal policy and economic growth. Early studies adopted the neoclassical growth model developed by Solow (1956) which estimated the long run growth as being determined by population growth and the rate of technological change. The model also estimated that changes to fiscal policy that affect the incentives to save or invest also alter the capital-output ratio equilibrium and therefore impact only the output path but do not change the output slope. Further studies such as Koopmans (1963) and Cass (1965) expanded on the Solow model. The studies estimated that a country's per capita growth rate tended to be inversely related to its starting level of income per capita, with poorer countries with similar structural parameters, preferences, and technology growing faster than richer countries due to having higher marginal products of capital. Based on neoclassical growth models the studies such as Landau's (1983) which encompassed cross-sectional data for 104 countries and Barro's (1989), with a 98 country sample for the 1960-1985 period, identified an inverse relationship between the share of government consumption as part of GDP and economic growth of per capita GDP.

The studies by Romer (1986), Lucas (1988) and Rebelo (1991) departed from the neoclassical growth models by adopting the possibility of economic growth without exogenous changes in technology or population. Barro (1990) developed an endogenous growth model. The model included government services funded through taxation which had an impact on production or utility with growth being negatively correlated with utility-type expenditures. Following the development of theoretical framework of endogenous growth models, studies started differentiating between different types of public revenues and expenditures. Studies such as Easterly & Rebelo's (1993) identified expenditure on transport and communication as being consistently correlated with growth as well as a negative correlation between aggregate public investment and per capita growth. Cashin (1995) showed investment in public capital

and transfer payments as having a positive impact on growth. Furthermore, Cashin (1995) also identified distortionary taxes as having a negative impact on growth. The study was performed using panel data for 23 developed countries, with the observations taken for the period between 1971 and 1988.Using panel data for 43 countries for a period between 1970 and 1990, Devarajan et al. (1996) identified a positive impact of higher level of current public expenditures on economic growth, while also showing that government capital spending decreases per capita growth. Ortigueira (1998) extended an endogenous growth model by including physical and human capital expansion as to test the impact of tax policies. The results provide evidence that taxes on capital income have a key function along the convergence to the balanced growth path. Kneller, Bleaney, and Gemmell (1999) focused on the structure of taxation and of expenditures on panel of 22 OECD countries for a period between 1970 and 1995. They identified distortionary taxation as having a negative impact on economic growth, while also establishing that non-distortionary taxation has no effect on economic growth. Furthermore, they identified productive government expenditures as having a positive impact on growth, whilst non-productive expenditure does not. Furthermore they established that any studies must include both taxation and expenditure in order to avoid significant biases of the estimation coefficients. Zagler & Dürnecker (2003) grouped expenditures into productive and unproductive and found evidence that expenditures on education and infrastructure contribute to increased economic growth. Furthermore they found evidence that certain taxes, such as taxes on savings as well as taxes on intermediate goods and taxes on research and development spending, impact the distribution of labour among the manufacturing and research and development sectors and therefore can increase innovation and thereby enhance growth. Angelopoulos, Economides, and Kammas (2007) used data of 23 OECD countries during 1970–2000 and found evidence in support of endogenous growth theory. They showed that increased government expenditure on productive activities increases growth, as well as evidence of different impact on growth of different tax rates, with labour income taxes having a negative impact on economic growth and capital and corporate income taxes as having an enhancing effect on economic growth. Agénor (2008) established that infrastructure had an impact on manufacturing and on supply of health services and therefore increased growth but at the same time identified evidence for uncertain long-run impact on steady-state growth. Furthermore, this author identified that a revenue-neutral increase in infrastructural investment can have a contractionary effect on growth rate. Gemmell, Kneller, and Sanz (2013) identified a negative impact of distortionary taxes and a growth enhancing impact of productive expenditures on the long run economic growth in case of OECD countries.

This paper is based on endogenous growth models developed by Barro (1990) and Mendoza et al. (1997). The applied criteria is the one proposed by their models as well as Benos (2009) in order to group fiscal data into groups and test the growth impact of each of them. Furthermore this paper includes government budget constraint in accordance with Kocherlakota and Yi (1997).

3. DATA AND ECONOMETRIC METHODOLOGY

The study was carried out on an unbalanced panel data set covering 11 East European countries. The countries in question are Estonia, Latvia, Lithuania, Poland, Slovakia, Hungary, the Czech Republic, Bulgaria, Romania, Slovenia, and Croatia. The selected countries are transitional countries that are members of the EU. The observations are annual, taken for the period of 1995 to 2014 and obtained from Eurostat.

As previously mentioned, endogenous growth models estimate a basic classification of revenues as distortionary and non-distortionary. Furthermore, expenditures are classified as productive or non-productive. However, when it comes to classifying public expenditures into productive/unproductive, there is a lack of theoretical literature as well as empirical evidence. For example, the studies such as Castles & Dowrick (1990), Cashin (1995)

and Bellettini & Ceroni (2000) imply a growth enhancing effect of social spending while Bleaney et al. (2001) classify social spending as unproductive expenditure. Easterly & Rebelo (1993), Kocherlakota & Yi (1997), Kneller et al. (1999) and Benos (2009) found a significant growth enhancing effect of government investment in infrastructure. Tatom (1993) and Holtz-Eakin (1994) identified infrastructural investment as having nether positive nor negative impact on economic growth. Kennedy (1983) and Weede (1986) found a positive relationship between military spending and economic growth while Lim (1983) and Deger (1986) identified military spending as having a contractionary impact on economic growth. Landau (1983) and Hansson & Henrekson (1994) identified education as having a strong growth enhancing effect on economic growth.

According to Benos (2009), the theoretical and empirical studies do not provide a clear classification of functional categories. He allowed for estimation results to categorize expenditures as productive or not productive in order to solve problem of classification. Consistent with Benos (2009), the various public expenditures are aggregated using the functional classification of the EU (Table 1), following the classification process of Kneller et al. (1999), Benos (2009) and Paparas, Richter & Paparas (2015).

Table 1. Theoretical/Functional classification of fiscal policy instruments

Theoretical classification	Functional classification
Distortionary taxation	Current taxes on income, wealth
	Capital taxes
	Actual social contributions
Non-distortionary taxation	Taxes on production and imports
Productive/unproductive government expenditures	Expenditure on education
	Expenditure on health
	Expenditure on housing-community amenities
	Expenditure on environment protection
	Expenditure on social protection
	Expenditure on economic affairs
	Expenditure on general public services
	Expenditure on public order-safety
	Expenditure on defence
	Expenditure on recreation-culture-religion

Source: Adopted from Benos (2009)

Definitions and descriptive statistics of variables used as estimators are provided in A1 Appendix and Table A1 respectively. The average annual growth of GDP per capita was 3.755%. Government expenditure on education (GEDU) was 5.12% of GDP and government expenditure on health (GHLT) was 4.8% of GDP. Government expenditure on housing-community amenities (GHCA) was 0.9155% of GDP, while government expenditure on environment protection (GENP) was 0.677% of GDP. The largest portion of government expenditure was on social protection (GSSP) with an average of 13.74% of GDP. Government expenditure on economic affairs (GECA) and general public services (GGPS) were 5.69% and 5.86% of GDP respectively. Government expenditure on public order and safety (GPOS) was on average 2.14% of GDP and government expenditure on defence (GDEF) was 1.39% of GDP. Government expenditure on recreation, culture and religion was (GRCR) 1.255% of GDP. Taxes represent the main source of revenues used to finance these expenditures.

Taxes on income and wealth (TINW) accounted for 7.45% of GDP, while capital taxes (CAPT) accounted for 0.032% of GDP and social security contributions (ASSC) accounted for 11.71% of GDP. Finally, the average net government surplus (DEF) was -3.315% of GDP.

It should be noted that most variables show a great variation across countries and time. As such the per capita GDP growth varies from -14.56% to 13.08%. Large variation is present in government expenditure on education, ranging from 2.8% to 8% of GDP. Similarly government expenditure on health and general public services ranged from 1.8% to 8% of GDP and from 3.1% to 17.6% of GDP. Large variation is also present in taxation, with taxes on income and wealth ranging from 4.3% to 11.3% of GDP and the deficit ranging from -15% to 2.9%.

As the main aim of this study is to examine the theoretical predictions of endogenous growth model about the impact of public revenues and expenditures on economic growth, the model is specified following the research of Kneller et al. (1999), Benos (2005, 2009) and Paparas et al. (2015) but with several changes made. This study uses the latest data for fiscal variables but also expands the overall observed time frame to 20 years, starting from 1995 to 2014 while following in line with Benos (2009) and Paparas et al. (2015) and using the data for general government for fiscal variables retrieved from Eurostat. Secondly, in order to deal with a large number of variables as well as to improve the efficiency of the model, various categories of fiscal variables are grouped into homogeneous groups. Classification of variables into groups is done by following Benos (2005, 2009) and Paparas et al. (2015), while also making changes to group composition.

As such government expenditures on education (GEDU), health (GHLT) and housing-community amenities (GHCA) are classified into human resource development (GHRINV). The new composite variable accounts for 10.82% of GDP on average, with a range going from 5.8% up to 14.4% of GDP. Moreover, government expenditures on economic affairs (GECA) and general public services (GGPS) are classified into a new variable representing government expenditures on infrastructure (GINFINV) since these expenses encompass expenditures on transportation, communication, etc. The government expenditure on infrastructure represents 11.55% of GDP on average and ranges from 6.8% to 24% of GDP. Also, government spending on public order and safety (GPOS) and defence (GDEF) is classified into government expenditures on property rights protection (GPPINV). This new variable represents 3.53% of GDP on average and ranges from 1.3% to 5.4% of GDP. Finally, government expenditures on environment protection (GENP), social protection (GSSP) and recreation-culture-religion (GRCR) are classified as government expenditure on social improvement (GSIINV). The new variable represents 15.67% of GDP and ranges from 10.2% to 22.3% of GDP.

The last variable taxes on wealth and income (TINW), capital taxes (CAPT) and actual social contribution (ASSC) are grouped into a variable representing the distortionary taxation (DTY). DTY represents 19.19% of GDP, with a range between 11.5% and 25.4% of GDP. Non-distortionary taxes are taken as an implicit element used to finance the changes in expenditure side fiscal policy instrument and are omitted from the model. This is done following studies by Benos (2009) and Paparas et al.(2015).

The remaining variables included in the model are all non-fiscal in their nature. A variable Y0 is constructed using the initial GDP per capita (Yi) and the first lag of economic growth in order to isolate possible convergence effects. Furthermore, gross fixed capital formation (GFCF) by the private sectors is included as capital is a key factor of production in growth models. Moreover, gross fixed capital formation is used to control effects of business cycle on growth. Also, what is included is the portion of the population between 25 and 34 years (UNIEDU) that have completed at least tertiary education as to include the accumulation of human capital and the effect accumulated human capital may have on the economy. Finally, the country's imports and exports are also included as a percentage of GDP (OPEN) in order to take into consideration the external effects on the economy.

The traditional method for estimation of the impact of fiscal policy on economic growth in the endogenous growth models is through the use of panel data for the periods of around 30 years. In order to deal with business cycle influences on growth, the data is usually grouped into five-year averages. According to Benos (2009), this method has several problems, as it results in the loss of information and as country business cycles are not synchronized it does not purge the cyclical effects, which is further supported by Bassanini, Scarpetta, & Hemmings (2001). Therefore, this paper follows Benos (2005, 2009) and Paparas et al. (2015) and uses annual observations. Furthermore, as Benos (2009) noted, the empirical research provides strong evidence for economic growth being influenced by a lagged effect of fiscal policy. In order to deal with the lagged effect in static estimations, the method used by Benos (2009) is applied, the sum of contemporaneous and lagged values for certain variables is used in estimations.

Therefore, to examine the impact of fiscal policy on economic growth, the following equation is estimated:

$$YG = a_0 + a_1 Y0 + a_2 \sum_{b=0}^{c} GHRINV\ (-b) + a_3 \sum_{b=0}^{c} GINFINV\ (-b) + a_4 \sum_{b=0}^{c} GPPINV\ (-b) + a_5 \sum_{b=0}^{c} GSIINV\ (-b) + a_6 \sum_{b=0}^{c} DTY\ (-b) + a_7 \sum_{b=0}^{c} DEF\ (-b) + a_8 \sum_{b=0}^{c} UNIEDU\ (-b) + a_9\ GFCF + a_{10} OPEN \quad (2)$$

The first estimation of the model is done using Ordinary Least Squares. The assumption of the OLS model is that the error is uncorrelated with explanatory variables in the same period. Then panel data models are used to resolve the problem of omitted variables. Fixed effect and random effect models are estimated and then Hausman (1978) test is applied in order to select the appropriate model. Furthermore, Wooldridge test for serial correlation and Modified Wald test for group-wise heteroskedasticity are estimated. The results call for the fixed effects regression with Driscoll and Kraay standard errors as Driscoll and Kraay standard errors are used when error structure is heteroskedastic, autocorrelated up to some lag and possibly correlated between the countries according to Hoechle (2007) and Mehmood & Mustafa (2014).

The main aim of the present study is the examination of the impact of fiscal variables on the growth of per capita GDP. However, Benos (2009) claims that the association is not indicative of one directional causality, and failing to account for it will produce biased and inconsistent estimates. As such, Arellano & Bond (1991) and Arellano and Bover (1995) - Blundell and Bond (1998) generalized methods of moments (GMM) estimators are applied. The employment of GMM estimators is supported by several studies such as Benos (2005, 2009) and Paparas et al. (2015). Finally Sargan test is applied to test the validity of the instruments used. Due to the possibility of lagged effects of fiscal policy on growth and the findings of Bleaney et al. (2001) as well as studies by Benos (2005, 2009) and Paparas et al. (2015), the emphasis is placed on results produced by GMM estimators compared with OLS/FE estimators and therefore this study emphasizes the results by GMM estimators.

4. EMPIRICAL RESULTS

Table 2: Estimation Results

Explanatory Variables	OLS Estimate	FE Estimate D-K SE[1]	A-B Estimate[2]	A-b/B-B Estimate[2]
Y0	0.2618596 (2.99)***	-0.0388132 (-0.33)	-0.14059 (-1.03)	-0.2689317 (-1.83)*
GHRINV	-0.0259798 (-0.32)	-0.1532993 (-0.66)	6.053259 (1.88)*	22.49305 (3.09)***
GINFINV	-0.068408 (-1.08)	0.2441585 (1.56)	2.443165 (1.59)	8.609324 (2.99)***
GPPINV	0.1753305 (0.70)	0.804771 (1.90)*	10.28719 (2.04)**	26.43493 (2.87)***
GSIINV	-0.0440042 (-0.72)	0.2526355 (1.96)*	5.442915 (1.78)*	5.467138 (1.76)*
DTY	-0.0395947 (-0.59)	-0.2107612 (-0.95)	-4.30653 (-1.66)*	-6.377885 (-2.29)**
DEF	-0.0611532 (-0.85)	0.1942312 (3.30)***	3.798513 (2.08)**	9.64181 (3.07)***
UNIEDU	-0.0096686 (-0.50)	-0.1956724 (-2.25)**	-0.28564 (-0.88)	-2.233024 (-3.14)***
GFCG	0.2507051 (2.69)***	0.4149979 (3.50)***	1.489142 (2.76)***	2.0578 (2.64)***
OPEN	0.0144757 (0.88)	0.1704547 (1.92)*	0.39629 (3.07)***	0.6876414 (3.05)***
C	0.356324 (0.07)	-21.61202 (-3.68)***		
Observations	156	156	167	178
R-Squared	0.2484	0.4974		
Hausman Test (p- value)		0.0000		
Sargan Test (p- value)			1.0000	1.0000
Autocorellation of Order (p- value)			0.3290	0.1482

Note: t-statistics, z-statistics are reported in parentheses for OLS, FE and AB,AB-BB; *, **, *** denote 10%, 5% & 1% significance levels respectively. [1] Fixed effects regression with Driscoll and Kraay standard errors [2]A-B: Arellano and Bond (1991) estimator; A-B/B-B:Arellano and Bover (1995) - Blundell and Bond (1998) estimator; Dependent variable and explanatory variables lagged up to 8 periods were used as instruments.

As previously mentioned, one of the issues with examining the effect of fiscal policy on economic growth is the presence of lagged effect. In order to account for lagged effect in static estimations, the sum of contemporaneous and the first and second lag of explanatory fiscal policy variable is used in static models. Based on Table 2, in case of government expenditure on human resource development, these are government expenditures on education, health and housing and community amenities. The empirical results of estimations indicate a significant positive relationship between expenditures on human resources and economic growth. This is not surprising and is in line with many of the previous studies on the topic such as Landau (1983), Hansson & Henrekson (1994), Kneller et al. (1999), and Zagler & Dürnecker (2003). Therefore, we can conclude that grater investment in human resource development is beneficial for economic growth.

Furthermore, the empirical results of government expenditure on infrastructure are statistically significant in only one of estimations. Based on the results, there is a lack of robust evidence for a significant positive relationship. There are several explanations for this apparently surprising result. In this study, a composite variable made up from government expenditure on economic affairs and general public services was used to represent government expenditure on infrastructure, as for the mentioned categories these include government spending on transportation, communication, etc. Although being surprising, the results are not unprecedented. Several studies such as Landau (1986), Barro (1991), Tatom (1993), Hansson & Henrekson (1994) and Holtz-Eakin (1994) similarly found inconclusive or nonexistent relationship between economic growth and infrastructure spending. Benos (2005) provides one possible explanation, as he shows evidence that a positive impact of infrastructural investment is dependent on economies of scale, therefore large scale expenditure is required in order to increase infrastructural productivity and increase economic growth. At lower levels of investment "we might well have a growth depressing impact of expenditures on transportation-communication, due to the high initial cost of this type of infrastructure" Benos (2005, pp.32).

Government expenditures on public order and safety and defence are combined in order to represent government expenditures on property rights protection. The empirical results of estimations identify a growth enhancing impact of higher level of expenditure on property rights protection. According to the theory by Barro & Sala-i-Martin (1992), increased expenditure on property rights protection increases the incentive to accumulate capital and this enhances growth. The results are in line with several previous studies such as Bleaney et al. (2001) and Benos (2009).

In regard to government expenditure on social improvement, these being government expenditures on environment protection, social protection and recreation-culture-religion, the estimations produce evidence for a significant positive relationship. This is consistent with studies such as Castles & Dowrick (1990), Cashin (1995) and Bellettini & Ceroni (2000), which identified a growth enhancing effect of social spending. It is worth noting that in a survey of literature, Atkinson (1999) found mixed evidence on the impact the size of welfare state has on economic growth.

Examining the revenue side of the budget, the results indicate a significant negative relationship. The results are consistent with the Barro (1990) theoretical model as well as many studies such as Kocherlakota & Yi (1997), Kneller et al. (1999) and Bleaney et al. (2001). With regard to the related variable, that of net government surplus (DEF), the results show a strong positive relationship between lower deficit and economic growth. The results are in line with the predictions of the Ricardian Equivalence theory. According to Kneller et al. (1999), Ricardian Equivalence predicts that current surplus will be used in the future to finance deficits that come about from reduction of distortionary taxation or increases in productive spending and thereby cause an increase in growth and investment. The results are consistent with those of Kneller et al. (1999).

With regard to non-fiscal variables, the gross fixed capital formation by the private sector as a percentage of GDP is included as capital represents an important factor of production in growth models. Furthermore, in this study gross fixed capital formation is used to control business cycle effects on growth. A significant positive relationship between gross fixed capital formation and economic growth is identified. This is consistent with Levine & Renelt (1992), Bond, Leblebicioğlu, & Schiantarelli (2004) and Benos (2009). Furthermore, the portion of the population between 25 and 34 years old that have completed at least tertiary education is included to account for the growth effect of accumulated human capital on the economic growth. The estimations produce a significant negative relationship. According to Krueger & Lindahl (2000) and Benos (2009), the measurement of human capital presents significant problems as it attempts to quantify complex characteristics. Pritchett (2001) identified insignificant relationships between human capital and rate of growth. He offers several explanations such as low quality education which fails to produce human capital or excess of supply reducing marginal return of education. Similar reasoning could explain the negative relationship identified in this paper. Furthermore, trade as portion of GDP is used to represent the openness of an economy and its susceptibility to external effects. The results of estimations show a significant positive relationship between trade as portion of GDP and economic growth. Funk (2001) and Olivier, Marcelo, & Maurice (2005) present evidence that trade increases R&D spill over between trading partners thereby increasing economic growth.

5. CONCLUSION

Under the endogenous growth theory, the governments' choice of tax rates and expenditure levels impacts the long term economic growth. By taking into account both sides of government finance, taxation and expenditures, it becomes possible to properly examine the impact of fiscal policy on growth. Eurostat data for eleven East European countries is used to test prediction of Barro's (1990) model of endogenous growth. Several different estimation methods are used in order to provide robust estimates. Government revenues which come from taxes on wealth and income, capital taxes and actual social contribution have a distortionary and depressive impact on economic growth. Furthermore, the results provide support for the Ricardian Equivalence theory, which is that a budget surplus finance by non-distortionary taxes increases growth as current surplus can be used to cover future deficits resulting from productive expenditures or reduction of distortionary taxes. Moreover, evidence is found for certain types of government expenditures, such as investment in human resources, that is education, health and housing and community amenities as well as property protection, that is public order and safety and defence, and social improvement, that is social security, environmental protection, recreation, culture and religion, increase economic growth. Inconclusive results are obtained in case of government expenditure on infrastructure, which is expenditure on economic affairs and general government services.

While the sample provided reasonably comprehensive data for the analysis of East European countries which are members of the European Union, further studies including the East European non-EU member countries might provide more robust conclusions regarding the impact of fiscal policy on economic growth and the validity of predictions of endogenous growth model as well as examine the impact of EU membership. Furthermore, the aggregation of expenditures into homogeneous groups leaves the possibility for further research expanding the model and focusing on individual expenditures which make up aggregated homogeneous expenditure groups, while controlling for overall expenditure allowing for a more detailed examination of the impact of individual expenditures. In conclusion, the results provide support for some of the predictions of the endogenous growth model developed by Barro (1990).

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APPENDIX

A1. Variable definitions

1. YG: Growth rate of real GDP per capita
2. Yi: Initial GDP per capita at US$ Constant 2010
3. Y0: Yi for the first year of the study followed by in following years
4. GEDU: General government expenditure on Education as percentage of GDP
5. GHLT: General government expenditure on Health as percentage of GDP
6. GHCA: General government expenditure on Housing and Community amenities as percentage of GDP
7. GENP: General government expenditure on Environment Protection as percentage of GDP
8. GSSP: General government expenditure on Social Protection as percentage of GDP
9. GECA: General government expenditure on Economic Affairs as percentage of GDP
10. GGPS: General government expenditure on General Public Services as percentage of GDP
11. GPOS: General government expenditure on Public Order and Safety as percentage of GDP
12. GDEF: General government expenditure on Defence as percentage of GDP
13. GRCR: General government expenditure on Recreation, Culture and Religion as percentage of GDP
14. TINW: Current taxes on income, wealth as percentage of GDP
15. CAPT: Capital taxes as percentage of GDP
16. ASSC: Actual social contributions as percentage of GDP
17. DEF: Net lending (+)/Net borrowing (-) by the government as percentage of GDP
18. GFCF: Gross fixed capital formation by the private sector as percentage of GDP
19. UNIEDU: Percentage of the population aged 25 to 34 who have completed at least tertiary education
20. OPEN: Trade as percentage of GDP
21. GHRINV: GEDU + GHLT + GHCA; General government expenditure on human resource development as percentage of GDP
22. GINFINV: GECA + GGPS; General government expenditure on infrastructure and government services as percentage of GDP
23. GPPINV: GDEF + GPOS; General government expenditure on property rights protection as percentage of GDP
24. GSSINV: GSSP + GENP + GRCR; General government expenditure on social improvement as percentage of GDP
25. DTY: Distortionary taxation as percentage of GDP (TINW+CAPT+ASSC)

Table A1: Descriptive statistics

Variable	Mean	Std. Deviation	Minimum	Maximum
YG	3.7555	4.368581	-14.5598	13.0814
Yi	7962.139	3551.874	3781.904	15063.71
GEDU	5.11809	1.108814	2.8	8
GHLT	4.794472	1.513448	1.6	8
GHCA	.9155779	.4261746	0	2.5
GENP	.6773869	.326353	-.3	1.8
GSSP	13.73618	2.942581	8	20.4
GECA	5.686432	1.890451	3.2	18.8
GGPS	5.862814	2.30735	3.1	17.6
GPOS	2.137688	.4215612	.5	3.8
GDEF	1.392965	.4703864	.6	3.4
GRCR	1.255779	.4294162	.6	2.3
TINW	7.453052	1.403013	4.3	11.3
CAPT	.0319249	.0783952	0	.5
ASSC	11.70798	2.315632	6.6	16.7
DEF	-3.31564	2.974397	-15	2.9
GFCF	25.20849	5.525221	.298644	41.5384
UNIEDU	24.7070	9.9066	8.3	52.6
OPEN	107.07	32.056	43.678	183.41
GHRINV	10.82814	2.150385	5.8	14.4
GINFINV	11.54925	3.177905	6.8	24
GPPINV	3.530653	.6440207	1.3	5.4
GSIINV	15.66935	3.098079	10.2	22.3
DTY	19.19296	2.902763	11.5	25.4

Table A2: Correlations of models' variables

	Y0	GHRINV	GINFINV	GPPINV	GSIINV
Y0	1				
GHRINV	-0.1534	1			
GINFINV	-0.3177	0.0682	1		
GPPINV	0.1508	-0.1863	-0.0493	1	

GSIINV	-0.3667	0.0348	0.3673	-0.2276	1
DTY	-0.1304	0.4058	0.3842	-0.2039	0.5221
DEF	0.3995	-0.1404	-0.6357	0.1022	-0.5294
UNIEDU	-0.0568	0.2909	-0.3567	-0.1402	0.0078
GFCG	0.512	-0.0784	-0.1621	0.1153	-0.3129
OPEN	-0.044	-0.0135	-0.0638	-0.3951	0.3419

	DTY	DEF	UNIEDU	GFCG	OPEN
DTY	1				
DEF	-0.2996	1			
UNIEDU	-0.2024	0.1417	1		
GFCG	0.0877	0.3616	-0.274	1	
OPEN	0.2302	0.125	0.378	0.0908	1