

Henryk Gurgul, Łukasz Lach

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Henryk Gurgul*, Łukasz Lach*

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1. Introduction

Budget deficit (government deficit) refers to the difference between government receipts and spending in a single year, that is, an increase of debt over a particular year. Budget deficit arises in most cases in the time of stagnation or a decrease of national income. In such a period government receipts become lower, usually because of falling tax revenue. However, key budgetary expenditures like outlays on national defense, police, education and health are mostly stable over time, which causes budget deficit. Business cycles may also play an important role, as in the time of recession budget deficit and an increase of public expenditures are usually inevitable.

In the past most of the countries were able to preserve a balanced budget in relatively long periods. However, since the so-called *Great Depression* in the thirties and the *New Deal* policy (increase of demand by means of public works and investment) deficit became one of the instruments of economic policy. Government deficit enables relative easy rise in GDP in the short term. The accumulated costs of this increase, i.e. public debt, are paid with some time delay. In recent decades government deficit has actually been a common feature of all market economies. One can also notice that economies with a large government sector and high social expenditures (e.g. Greece) usually exhibit higher budget deficits. Government deficit can be financed by government bonds and treasury bonds, credits and loans from abroad and money issue. The first two ways of deficit treatment increases government domestic and foreign debt. The last way causes a rise in the inflation rate.

In general, the motivation to analyze links between economic growth and budget and trade deficits in the case of CEE transition economies is twofold.

* AGH University of Science and Technology, Department of Applications of Mathematics in Economics, e-mail: henryk.gurgul@gmail.com, llach@zarz.agh.edu.pl.

First, this particular group of countries has not gained satisfactory attention from researchers so far. Second, previous papers on deficits-growth links have not reached a consensus on directions and signs of causal dependencies between examined variables.

In CEE countries in transition high budget deficits and rapidly growing public debts have become serious economic and political problems. There are many consequences of this phenomenon. First of all, the payment of interest on public debt involves a considerable part of government revenues. This is one of the main reasons for the imbalance in the budget. Moreover, a high deficit can cause rise in the interest rate in the banking system. In order to finance a rising deficit the government is forced to borrow money or to issue it. The sources of money are the same as in the case of private firms: households, foreign banks and so on. The cost of credit and loans is determined by the law of demand and supply. Therefore, excess demand due to government credit demand implies increased interest rates. In addition, in the case when government borrows indeed a lot of money, the availability of credit for private companies becomes significantly lower because of rising interest rates (the so-called *crowding-out effect*). This implies a fall in the investment rate and in the long-run GDP growth rate.

Budget deficit can also lead to higher taxes. Government may be forced to raise taxes in order to cope with the growing costs of public debt. Higher taxes hamper private consumption, enhance growth of the grey economy and discourage individuals to work and do business. Therefore, higher taxes reduce the rate of economic growth. The costs of servicing public debt are paid by a society (taxes). If a country has a foreign debt then the abroad receives the part of the domestic income. If debt is financed by citizens then natives receive the part of the national income. Usually, treasury bonds are held by wealthy people. However, also the poor pay taxes. In this way public debt (due to budget deficit and taxes) is a cause of income redistribution from poor to rich. In other words, budget deficits and public debt are the reasons for income redistribution between generations. Budget deficit used to finance future economic development is usually advantageous for future generations. However, if the budget deficit finances mostly current consumption, then one can say that the current generation lives on the cost of future generations. Most CEE countries had and still have problems with budget deficits. These troubles have been observed from the very beginning of the transition process and caused mostly by constantly lowering the taxes and growing the social expenditures.

Many economists claim that the reduction of the budget deficit does not lead to a slowdown in economic growth but it rather implies a rise in the rate of growth. The speeding up of economic growth takes place not only in the long-run but even immediately. The speed of the reaction of growth rate to reduction

of budget expenditures depends on various factors. First of all, more money remains at households. This, in turn, can increase their expenditures. Moreover, one can observe that the crowding-out effect disappears, interest rates become lower and tax increases in the near future also become less likely. These factors enhance the propensity to consume and investment expenditure. The outbreak of the financial crisis (caused by problems with debt service) becomes lower too. In addition, enterprises may cut some of their costs, which, in turn, leads to an increase of profits, therefore a rise in the propensity for investment. There are some empirical results that support these links between budget deficit and economic growth. When sources of deficit are investment expenditures, increasing the budget deficit may not be so harmful, especially when there is a reason why private investment cannot replace public investment.

Jacques J. Polak [33] from IMF developed the idea of the monetary approach to the balance of payments. This idea, often referred to as the so-called *twin deficit hypothesis*, reflects the conviction that there are links between the current account deficit and the fiscal situation of an economy. Moreover, the internal (fiscal) and the external (current account) deficits occurring at the same time may be especially harmful for the economy. According to Polak, a rise in domestic credits (which consist of credit to the government and credit to the private sector) could have a negative effect on the current account. However, an increase in exports and output has a transitory positive impact. Thus, low domestic debt is of great importance for external balance. Government should minimize the risk of crowding-out the private sector. Therefore, it is important to avoid fiscal deficits. In general, a lack of fiscal deficits guarantees external stability and stable economic growth.

The twin deficit hypothesis is frequently linked with neo-Keynesian attempts to define an economic policy, which would allow for simultaneous external and internal equilibrium. In the traditional neo-Keynesian approach the exchange rate should be applied in order to achieve external equilibrium. In turn, suitable fiscal policy should be used to ensure internal equilibrium. These general opinions were formulated by the New Cambridge School (NCS). However, NCS justified that in many situations it would be more appropriate to use fiscal policy to support the external equilibrium, and exchange rate policy to manage the internal balance. The NCS stressed the role of the private sector's marginal propensity to spend. The economists from the NCS derived their theses on the basis of a particular version of the main macroeconomic identity:

$$M - X = (A_p - Y_d) + (G - T), \quad (1)$$

where M stands for imports, X for exports, A_p is the absorption (i.e. the sum of investment and consumption of the private sector), Y_d is disposable income of

the private sector, G represents government expenses and T stands for taxes. New Cambridge School formulated conditions, under which the fiscal deficit equals the current account deficit, i.e. when:

$$M - X = G - T . \quad (2)$$

It is worth to underline, that the last equation, in contrast to the previous one, is not an identity – it is an equation that holds true only under certain assumptions. The contributors often emphasize that all versions of the neo-Keynesian theory assume a close relationship between fiscal and current account deficits [1].

Further content of this article is organized as follows. In the next section, the existing literature is reviewed. In the third section the data and its description are shown. In the fourth section the main research hypotheses are formulated. Section 5 is concerned with methodology applied. Moreover, the empirical specification of the econometric model is explained. Section 6 presents the empirical results. The last section concludes the paper.

2. Literature overview

Policy makers and advisers focus on the main goals of economic policy. Many of them, as pointed in the previous section, advise deficit reductions instead of higher economic growth at all costs (e.g. accompanied with higher inflation). However, according to some economists (comp. [10]) deficits can be reduced, even fully eliminated, nevertheless the rate of growth of an economy. On the other hand, many contributors think that the most important issue is not the reduction of budget deficit but establishing a desired level of growth and the means to keep it. The main policy goal should be shifting resources to investment in order to expand capacity of an economy and promote export, *without* reducing the level of economic activity.

It is much easier to reduce the domestic budget deficit if economic growth is relatively high. The same is true for the trade deficit, especially in the long-run. In general, however, cutting the deficit is not an easy goal. It will probably entail imposition of restrictions on important programs, a rise in taxes and an increase in pessimism. On the other hand, budget deficit supports future growth and enables economic expansion and the realisation of important public investment and social programs. Moreover, taxes may remain low, which creates a positive image of an economy in the eyes of investors, especially the foreign ones. In addition, higher growth needs not to be accompanied by high inflation. In the time of Kennedy, i.e. 1961–1963, the US economy grew at 5.3 percent a year, with inflation below 1.3 percent.

According to the existing literature budget deficit (BDEF) and current account deficit (CADEF) are important indicators of economic performance and macroeconomic stability. The dynamics of time series of BDEF and CADEF may have implications for complaisance with intertemporal budget constraint and sustainability. These properties have an impact on answering the question how the two deficits are linked. The Mundell-Fleming approach (see [9]) suggests that a deficit-financed expansionary fiscal policy can cause an increase of trade deficit through either stimulated income growth (under a fixed exchange rate) or exchange rate appreciation. This gives a basis to consider the twin deficit hypothesis based on a positive co-movement of BDEF and CADEF with the possibility of using BDEF as a causal factor influencing CADEF. In contrast, under the Ricardian equivalence scenario (comp. [9]), domestic residents anticipate that the government will raise taxes in the future to close the fiscal gap and pay back the accumulated debt. As a consequence savings are increased to allow for the accumulation of wealth, which in turn leads to a reduction in consumer expenditures.

The main existing literature on twin deficits concentrates on their short-run interaction (see, for example, [8] and [25] and references therein) and suggests a strong positive, weak or even negative relationship between the deficits. The negative short-term link takes place when, for example, an unexpected change in output gives a rise to endogenous movements of the BDEF and causes a divergence of the deficits. In contrast, a much smaller group of contributions (like [27] and those cited by them) confirmed the long-run relationship between the two deficits. Leachman and Francis [27] used a variety of cointegration techniques and found that fiscal deficits contribute towards current account deficits in the case of the US economy. However, this relationship was found to be time-dependent and rather weak. The further discussion suggested (see e.g. [21]) that the investigation of the possible nonlinearities in the twin deficit relationship may indeed be necessary. The paper by Holmes [21] also considers the US economy, but in sharp contrast to the previous studies, an alternative assessment of the twin deficits relationship is based on a testing procedure advocated by Bierens ([5], [6], [7]). That procedure examines whether nonlinear trend-stationarity is present in the series and if so, whether the series are co-trended sharing the same nonlinear deterministic trend.

Using cointegration analysis along with regime shifts Daly and Siddiki [9] found a long-run relationship between budget deficits, real interest rates and current account deficits in 13 out of 23 OECD countries examined. The number of countries with apparent long-run relationships was significantly reduced when regime shifts were not permitted. The mentioned authors demonstrated that, when structural breaks are taken into account, it seems that twin deficits are less likely to be conjoined in the case of countries with a more extensive financial infrastructure.

Not only the New Cambridge School gave a theoretical interpretation of the interactions between the fiscal and current account deficits. Other well-known theories include the monetary approach to the balance of payments (Ricardian equivalence) and the structural gap approach.

The consequences of the monetary approach to the balance of payments formulated by Johnson [23] are related to the neo-Keynesian theory. However, they refer to the conviction that fiscal deficits may increase money supply. According to Harberger [19], when money holdings exceed the necessary long-term real monetary balances then the spending of foreign assets rises. This can cause worsening of the current account balance.

As already mentioned, there are two main streams of argument in the critique of the New Cambridge School ideas. First, the equation (2) can hold true when the private sector does not react to fiscal policy impulses. Second, the critique from proponents of the theory of rational expectations and Ricardian equivalence suggests that if the government intends to generate fiscal surpluses in order to reduce the current account deficit, the private sector may react by cutting savings in such a way that the effect of fiscal tightening will be cancelled out.

Barro [14] in his well-known paper demonstrated that economic agents rationally expect that a higher fiscal deficit will cause higher taxes in the future. The expected measure is increasing by the current savings. Therefore, the interest rate, the investment and the current account balance may stay constant. In other words, no connection between the fiscal and current account deficits is expected.

The second stream in the critique of the New Cambridge School concentrates on foreign investor behavior. Equation (2) assumes not only that the internal propensity to save is low and remains constant, but also that the external sector has a low and constant propensity to invest in a country.

The latter assumption is rejected by a so-called *structural gap hypothesis* [12], which argues, that foreign savings can be an active factor in financing of the current account deficit by filling the gap between the investment and saving of the domestic private sector. The main insight of the structural gap hypothesis is that the world financial system is closed. This fact has another interesting consequence: if also the twin deficit hypothesis is true in its strong form, then the sum of current account deficits of all countries in the world should equal the sum of all fiscal deficits, and the sum of current account surpluses should equal the sum of all fiscal surpluses. In this sense the twin deficit hypothesis implies that all countries cannot have simultaneously fiscal deficits. In other words, the increase in saving above the level of investment in one country leads to an increase in investment and current account deficit in another country or countries [11]. The size of these external imbalances is determined by the relative competitiveness of individual economies.

It must be emphasized that from a statistical point of view a causal relationship between the fiscal and current account deficits may be just the opposite of the current assignment of instruments to targets in the economic policy of a country. For example, if the government considers that running a fiscal surplus/deficit is a way to reduce the current account deficit (the so-called *current account targeting*), then a statistical test may establish a causal relationship from the current account to the fiscal surplus/deficit and not vice versa [35]. If the government is targeting the current account, it should generate fiscal surpluses in the case when domestic investment exceeds domestic saving, and deficits in the opposite case. Current account targeting also implies a negative link in the private and public saving/investment gaps [26].

Neo-Keynesian theory, especially the New Cambridge School, suggests the existence of a causal relationship from fiscal to current account deficits. The neoclassical theory and the school of rational expectations predict the existence of an opposite link. After increasing budget deficit, the private sector saves more. This implies a reduction in the current account deficit. In addition, the structural gap approach suggests that in small open economies current account deficit causes fiscal surpluses in the long-run. Thus, several well-known theories do not provide a common opinion on the links between the two types of deficits under study.

These contradictory points of view imply that the relationship between the fiscal and current account deficits should be established empirically. In general, this relationship should be examined in the long- and short-run. In the long-run, the link between the fiscal and current account deficits in an open economy should rather be positive. This is a consequence of the fact that foreign capital inflows help to finance fiscal deficits, while the outflows of this capital make the financing of fiscal deficits more difficult. In other words, in the long-run a rise in current account deficit encourages government to increase fiscal deficit. Moreover, the outflows force governments to cut spending or increase taxes. On the other hand, in the short-term, the rise in the current account deficit can imply a reduction of the fiscal deficit. The capital inflows speed up economic growth and fiscal revenue. In turn, short-run capital flight is linked with economic fall and worsening of the fiscal position.

In general, the twin deficit hypothesis in the case of transition and developing economies has not received considerable attention from researchers so far. The paper by Aristovnik and Zajc [3] did not supply clear conclusions on the links between budget and trade deficits. On the other hand, Vyshnyak [36] found strong evidence supporting the twin deficit hypothesis for Ukraine. Katircioglu et al. [24] investigated the direction of causality between current account balance and the overall budget balance of 24 small island state economies using panel

econometric techniques. The results of both bivariate and pairwise Granger causality tests suggest that there is a unidirectional causality, which runs from current account balance to the overall budget balance. On the other hand, the authors found no evidence on the causality running in the opposite direction in case of small island states analyzed.

Herrmann and Jochem [20] also found some support for the twin deficit hypothesis in CEE countries. This result should be considered together with the fact that the net effect of government budget deficits was in that time (the authors analyzed 1994–2004 period) rather small, since they were mostly financed by private savings.

Kohler [26] tried to explain the contradictory results in the case of CEE countries by underlining different levels of integration of these countries with the world financial markets. The author argued that countries with a high level of integration with the world markets may gain more confidence and enjoy a higher level of domestic saving. In the case of strong dependence of an economy on global financial markets the Ricardian equivalence and structural gap theories seem more convincing in the explanation of the links between current account and fiscal deficit.

This paper is aimed at providing a fresh look at the dynamic links between economic growth and budget and trade deficits in ten new EU members in transition in the first decade of XXI century. It is worth to note, that besides establishing directions of causal relationships this paper also derives some suggestions on signs of the dynamic dependencies.

3. The dataset and its properties

The dataset used in this paper contains annual data on GDP per capita in Purchasing Power Standards (PPS) expressed in relation to the European Union (EU-27) average and fiscal and trade balances (expressed as percentages of GDP) in ten new EU member countries in transition in the period from 2000 to 2009.* The choice of such an indicator of output ensures that as well as analyzing the existence of causal dependencies between economic growth and budget/trade deficits one may check whether these links were important for countries under study in relation to the economic growth of the whole European Union, including the old and rich member countries. Thus, any evidence of causality may provide some

* In the period 2004–2007 twelve countries joined the EU. However, Malta and Cyprus have not been taken into consideration in this study since the evolution of the economies of these two countries is significantly different than that of the ten other new EU members (e.g. these two economies have never been in a transition phase).

additional information about the role of both types of deficits in the process of convergence of CEE countries towards old EU members.

Moreover, we used annual data on employment rate for all ten countries, since a simple two-dimensional approach based only on GDP and one deficit-related measure is likely to produce spurious results due to the omission of important variables. The technical aspect is not the only reason for including employment in the model, since this variable is also important in terms of basic theoretical growth models. The data on GDP, employment and fiscal and trade balances was obtained from the Eurostat and World Bank databases.

Table 1 contains some basic facts on the size and economic development of the countries examined in this paper, which should be especially useful for the reader, who is less familiar with the economic profile of CEE economies in transition.

Table 1
Short description of countries examined in this study

Country	GDP per capita in 2009 as a percentage of EU-27 average (EU-27 PPS)	Percentage change in GDP per capita between 2000-2009 with respect to EU-27 average (EU-27 PPS)	Total population [million] (2009 data)	Area [thousands km ²]
Bulgaria	44%	+16%	7.60	110.91
Czech Republic	84%	+13%	10.46	78.86
Estonia	64%	+19%	1.34	45.22
Hungary	64%	+10%	10.03	93.03
Latvia	52%	+16%	2.26	64.58
Lithuania	55%	+15%	3.34	65.20
Poland	61%	+13%	38.13	312.68
Romania	46%	+20%	21.49	238.39
Slovakia	73%	+23%	5.41	48.84
Slovenia	88%	+8%	2.03	20.27

Source: Eurostat database

As one can see the group of new EU members in transition is varied in terms of area, population and the level of GDP per capita. However, a common fact across all the ten countries under study is that they have experienced significant

economic growth in comparison to the EU average in the period 2000–2009. This paper is partly aimed at answering the question whether during the ongoing process of transformation of these economies the fluctuations in the levels of budget and fiscal deficits have been important factors in the convergence towards highly-developed old EU members.

In this paper abbreviations were used for all variables. Table 2 contains a summary of some basic information on the variables.*

Table 2
Abbreviations and short description of examined variables

Full name [Abbreviation]	Short description
GDP per capita in country i in year t in Purchasing Power Standards (PPS) expressed in relation to the EU-27 average [$GDP_{i,t}$]	The application of values expressed in PPS, that is a common currency which eliminates the differences in price levels between countries, allows meaningful volume comparisons of GDP between countries and may provide some basic information on the convergence process.
Employment rate in age group 15-64 in country i in year t [$EMPL_{i,t}$]	This indicator is based on the EU Labour Force Survey, which covers the entire population living in private households and excludes those in collective households such as boarding houses, halls of residence and hospitals.
General government deficit/surplus in country i in year t as a percentage of GDP [$G_BALANCE_{i,t}$]	This indicator is used to measure the general government net borrowing/lending. It is the difference between the revenue and the expenditure of the general government sector divided by GDP.
Net exports in country i in year t as a percentage of GDP [$T_BALANCE_{i,t}$]	This indicator is used to measure the sum of the balance of trade in relation to gross domestic production.

Source: Eurostat database, World Development Indicators

In the initial part of our analysis we examined some basic properties of our data. Instead of presenting a large number of descriptive statistics, we have decided to present the data in plots. Figure 1 contains the plots of analyzed variables for all sample countries.

* Throughout this paper (especially for model presentation purposes) the subscript i describes the alphabetical order of sample countries (i.e. for Bulgaria $i=1$, for the Czech Republic $i=2$, etc.).

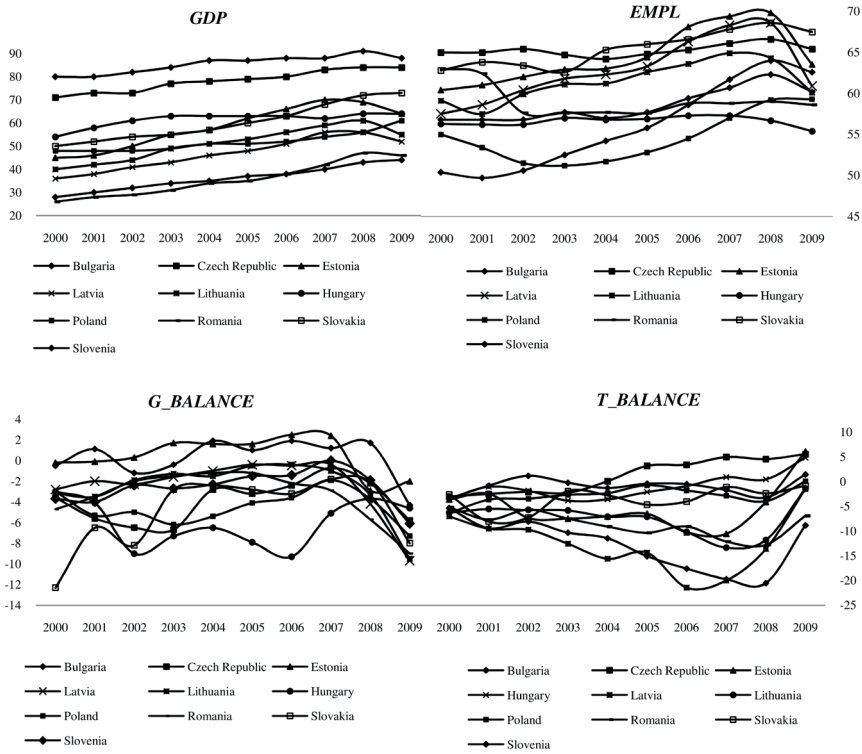


Figure 1. Plots of variables under study

Source: Eurostat and World Bank databases

The aim of Figure 1 is not to reflect the performance of each individual economy, but rather display the properties of the whole group and eventually provide some detail before the formulation of any subgroups. In general, one can easily see upward tendencies in the graphs of $GDP_{i,t}$ for $i=1, \dots, 10$ and $t=2000, \dots, 2009$. This suggests that in the period under study the group of CEE economies in transition has significantly moved towards the EU-27 average, at least in terms of per capita GDP. In general the upward tendency is also visible in most of the employment rate graphs. However, the fluctuations in these plots are larger than for per capita GDP. Finally it should be noted that Figure 1 provides some general information on the reaction of all the economies to the crisis of 2001 and especially of 2008.

The plots presented in Figure 1 also show the evolution of budget and trade deficits in the group of analyzed countries. In general, it is relatively difficult to describe clear trends in this data. However, one may claim that for most of the economies under study there was a reduction of budget deficit in the period 2000–2009, which most probably was related to EU accession requirements and suitable fiscal reforms. In other words, this could mean that the average value of $G_BALANCE$ in ten examined economies has exhibited an upward tendency. We formally verified this observation after fitting a suitable linear trend function

to the set $\left\{ \sum_{i=1}^{10} \frac{G_BALANCE_{i,t}}{10} : t = 2000, \dots, 2009 \right\}$.

In the case of trade deficit the suitable plots are also varied, as some countries have in general improved their trade balance while others have not. Anyhow, after fitting a suitable linear trend function to the set of average values of $T_BALANCE$ a slight negative tendency was reported, which clearly corresponds to the significant overall rise in imports in the group of countries under study in the years 2000–2009. Different signs of general trends estimated for average $T_BALANCE$ and $G_BALANCE$ may provide some initial evidence against the possibility that both these deficits move together (act like “twins”), however, some detailed testing is required to formally verify this preliminary supposition.

4. Main research hypotheses

A mere glance at the examined data suggests that per capita GDP of new EU member countries in transition has indeed moved closer to the EU average. In this context two natural questions arise for research and economists. First, one may want to check what the nature of the dynamic links between growth of this group of countries and their current account and government budget balances were. Second, it seems interesting to deeply examine the linkage of the discussed process with the widely discussed twin deficit hypothesis.

Figure 1 provides no clear suggestion on the direction of causality between both types of deficits analyzed. One may claim that changes in the current account, at least in the short-run, precede the reactions of fiscal policy. Therefore, it is likely that the current account deficit may be related to the fiscal surplus by Granger-type causality. Moreover, one may state that causality from the current account deficit to the fiscal surplus is likely to increase as the time lag between an impulse in CADEF and a reaction in BDEF also increases. If, however, the government anticipates a worsening of the current account at time $t+1$ and starts running fiscal surpluses at time t , a causal relationship should be expected in the opposite direction.

Despite using carefully selected econometric methods (described in detail in Section 5) and considering a small group of relatively similar economies, the structure of dynamic interrelations between economic growth and the two types of deficits may still depend, at least to some extent, on the individual characteristics of sample countries. The differences between examined economies are especially visible in the case of government balances (see Figure 1). It is relatively easy to form a subgroup of economies with most positive (Bulgaria and Estonia) and negative (Hungary, Poland, Slovakia) average* budget balances in the period 2000–2009. In other words, even within the group of new EU member countries in transition one may select a high-budget-deficit, and low-budget-deficit clusters. Therefore, taking into account the technical properties of econometric procedures used to test for Granger causality,** we used three possibilities of choosing members of groups of examined economies. Table 3 contains the details.

Table 3.
Groups of countries examined in this study

Group of countries	Countries included
I_0	All sample countries.
I_1	All but low-budget-deficit (i.e. Czech Republic, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, Slovenia).
I_2	All but high-budget-deficit (i.e. Bulgaria, Czech Republic, Estonia, Latvia, Lithuania, Romania, Slovenia).

To investigate all the discussed issues one should test some carefully formulated research hypotheses. These conjectures should reflect both the results of visual inspection of the data as well as the major findings and suggestions of the papers mentioned in Section 2.

Since the data presented in Figure 1 provides a basis to claim that, in general, the relatively fast economic growth of CEE transition economies was accompa-

* This time the 10-element set of averages is calculated in time dimension, i.e. we consider the set

$$\left\{ \sum_{t=2000}^{2009} \frac{G_BALANCE_{i,t}}{10} : i = 1, \dots, 10 \right\}.$$

** It should be underlined that the outcomes of analysis of causal dependencies for groups containing data only on two specific countries would be seriously biased due to a very small number of degrees of freedom; see Section 5 for more details. Therefore, in order to check the structure of causal dependencies in specific subgroups of the economies we decided to drop mentioned countries from the full sample and next analyze the reduced groups.

nied by a considerable reduction of budget deficits, one could formulate the first research hypothesis in the following way:

Hypothesis 1: The reduction of budget deficits played an important role in the economic growth of new EU members in transition in the period 2000–2009. Moreover, it was one of the factors stimulating the process of convergence of these countries towards highly developed EU members.

For the sake of comprehensiveness we should also ask an analogous question from an opposite research perspective. It seems reasonable to expect that increasing GDP could encourage CEE economies to increase the level of public spending (e.g. in order to speed up modernization of post-communist infrastructure etc.). The later may in turn suggest the formulation of:

Hypothesis 2: Economic growth caused a rise in the budget deficit of new EU members in transition in the period 2000–2009.

An important research avenue is to examine the nature of dynamic dependencies between budget and trade deficits of CEE economies in transition. As already mentioned, the visual inspection of $G_BALANCE$ and $T_BALANCE$ variables provided some basis to claim that both these deficits were moving in opposite directions. Therefore, is rather hard to expect that the twin deficit hypothesis held true for CEE economies in period 2000–2009. Moreover, if we take into account the expectations reflected in the first hypothesis and the interpretation of the standard net export function* we could formulate the:

Hypothesis 3: The twin deficit hypothesis did not hold in case of new EU members in transition in the period 2000–2009. Instead, there was a negative Granger causality running from trade deficit to budget deficit.

Finally, it is interesting to check whether the results of testing the three above-mentioned hypotheses turn to be robust against different choices of subgroups of countries according to the criteria presented in Table 3. It seems quite reasonable to claim that the higher was the budget deficit the more pronounced were the budget-deficit-related causal dependencies. Thus, we could formulate:

Hypothesis 4: The evidence supporting the causalities between GDP and budget deficit as well as the negative impact of budget deficit on trade deficit were strongest in the case of the subgroup of countries with higher budget deficit (group I_1).

* The net export function takes the form $X=a-bY-cR$, where X denotes net exports, Y is the production (income), R denotes interest rate and parameters a , b and c are all non-negative. This well-known dependence suggests that increasing the income leads to a drop in the trade balance, as a propensity to import also increases.

All the hypotheses listed above will be verified by carefully selected econometric methods. The details on methodological issues are presented in the next section.

5. Methodology

In this paper we applied the method of evaluating panel datasets developed by Granger and Huang [14]. This approach focuses on the forecasting properties of examined models rather than on significance tests (as in the case of the traditional approach). It has often been used in recent empirical papers dealing with panel-based causality analyses (e.g. [37], [31], [16]), since it is quite simple to perform, does not require complex pretesting procedures and may be applied even for a short time series or a small number of observations in each cross-section.

In order to present this idea we will analyze the case of testing for causality in the direction from government surplus/deficit to economic growth.* Let I denote the group of examined countries (e.g. all examined countries, high-budget-deficit countries or low- budget-deficit countries) and T denote the number of time points. Next, consider the following two models:

$$GDP_{i,t} = \mu_i + \sum_{j=1}^p \alpha_j GDP_{i,t-j} + \sum_{j=1}^p \beta_j EMPL_{i,t-j} + \sum_{j=1}^p \gamma_j G_BALANCE_{i,t-j} + \zeta_{i,t} \quad (3)$$

$$GDP_{i,t} = \mu'_i + \sum_{j=1}^p \alpha'_j GDP_{i,t-j} + \sum_{j=1}^p \beta'_j EMPL_{i,t-j} + \zeta'_{i,t}, \quad (4)$$

where $i \in I$, p denotes the lag length and $t=p+1, \dots, T$. A constant source of conflict in the panel-related literature is the use of fixed and random effects. It is surprising that previous studies used different, and often even incompatible, definitions of these two effects.** In consequence the same factor could be “fixed” according to one definition and “random” in the sense of another. The reason of this common misunderstanding was not only the subtle intricacies in mathematical aspects of suitable models, but often the lack of a clear concept of conducting the research. Following the suggestions of Gelman ([13]) we do not use the overloaded terms “fixed” and “random”, but instead we consider two types of effects (coefficients) in a multilevel model: “constant”, if they are identical for

* Testing for causality in the opposite direction and/or based on the application of different variables requires an analogous procedure.

** The Hausman test is often applied to choose which type of effects should be considered. However, this procedure has relatively poor small sample properties and its results should not always be treated as more important than the well-justified theoretical structure of the model.

all members of a group, and “varying”, if they are allowed to differ from country to country. Therefore, in the models (3) and (4) we assume varying effects in the intercept terms.* When turning to estimation details (including the choice of method in evaluating the variance of the error term), we decided to rely on the standard least-squares-related methods. The reason for this is that in the case of our dataset it is rather hard to justify the need for using an approach based on linear unbiased prediction [34].**

One should also bear in mind that in the case of samples as small as the one used in this paper, several problems occur during the estimation of panel models for variables in their levels.*** One of the simplest solutions is to use first differences, which may easily eliminate individual characteristics (varying effects expressed in intercepts μ_i and μ'_i) and significantly improve the performance of least square estimators. Thus, instead of analyzing equations (3) and (4) we evaluate the following equations:

$$\Delta GDP_{i,t} = \sum_{j=1}^p \alpha_j \Delta GDP_{i,t-j} + \sum_{j=1}^p \beta_j \Delta EMPL_{i,t-j} + \sum_{j=1}^p \gamma_j \Delta G_BALANCE_{i,t-j} + \varepsilon_{i,t} \quad (5)$$

$$\Delta GDP_{i,t} = \sum_{j=1}^p \alpha'_j \Delta GDP_{i,t-j} + \sum_{j=1}^p \beta'_j \Delta EMPL_{i,t-j} + \varepsilon'_{i,t} \quad (6)$$

One can easily see that formulas (5) and (6) describe two competitive models of changes in per capita GDP in the countries included in group I . If model (5) forecasts a change in GDP more accurately than model (6), one may claim that information on the past values of government surplus/deficit is indeed important [14]. In other words, $G_BALANCE$ Granger causes economic growth in the countries listed in group I .

Following papers of Granger and Huang [14], Weinhold and Reis [37], Pérez-Moreno [31] and Gurgul and Lach [16], we used two forecast-based testing procedures to test for Granger causality in the discussed framework:

* Preliminary results (not presented in detail to save the space, but available from the authors upon request) based on significance tests provided no clear evidence in favor of adding any time trends (constant or varying in Gelman's [13] sense) in models (3) and (4).

** The application of one (simple) model constructed for a very large group of (often dissimilar) countries may sometimes lead to the formulation of spurious conclusions. In this paper we aimed at describing the structure of deficit-growth causal links only for a particular and small group of (relatively similar) CEE countries. In other words, in our research the sample used *exhausts the underlying population*, which actually makes the decomposition of the variance of error term needless [13].

*** The estimation of varying intercepts in models (5) and (6) (using e.g. a least squares dummy variable model) would significantly reduce the number of degrees of freedom.

PROCEDURE I
(count method)

1. Set $i_0 \in I$.
2. Estimate models (5) and (6) using $i \in I \setminus \{i_0\}$ and $t=p+1, \dots, T$.
3. Obtain two sequences of forecasts for i_0 -th country for $t=p+1, \dots, T$ using models (5) and (6).
4. Obtain two sequences of forecast errors, i.e. $\{\eta_t^{i_0}\}_{t=p+1, \dots, T}$ (forecast errors for model (5)) and $\{\xi_t^{i_0}\}_{t=p+1, \dots, T}$ (errors for model (6)).
5. After performing points 1–4 for all possible choices of $i_0 \in I$, define $p_1 = n\left(\left\{(i, t) \in I \times \{p+1, \dots, T\} : (\eta_t^i)^2 > (\xi_t^i)^2\right\}\right)$ and $p_2 = n\left(\left\{(i, t) \in I \times \{p+1, \dots, T\} : (\eta_t^i)^2 < (\xi_t^i)^2\right\}\right)$, where $n(A)$ denotes the number of elements of set A .
6. Let $z_{1-\frac{\omega}{2}}$ denote the $\left(1 - \frac{\omega}{2}\right)$ -quantile of standard normal distribution. If:
 - a) $\frac{p_1}{p_1 + p_2}$ lies outside the interval $\left(\frac{1}{2} - \frac{z_{1-\frac{\omega}{2}}}{2\sqrt{p_1 + p_2}}, \frac{1}{2} + \frac{z_{1-\frac{\omega}{2}}}{2\sqrt{p_1 + p_2}}\right)$;
 - b) the variance of $\{\eta_t^i\}_{t=p+1, \dots, T}$ is smaller than the variance of $\{\xi_t^i\}_{t=p+1, \dots, T}$, then the $\Delta G_BALANCE_{i,t}$ Granger causes $\Delta GDP_{i,t}$ for countries included in group I at % significance level.

PROCEDURE II
(out-of-sample sum-difference test)

1. Conduct points 1–4 from PROCEDURE I.
2. Define $\{SUM_t^i\}_{t=p+1, \dots, T} : = \{\eta_t^i + \xi_t^i\}_{t=p+1, \dots, T}$ and $\{DIFF_t^i\}_{t=p+1, \dots, T} : = \{\eta_t^i - \xi_t^i\}_{t=p+1, \dots, T}$
3. Estimate via OLS the regression: $SUM_t^i = a + b \cdot DIFF_t^i + \varepsilon_t^i$
4. If:
 - a) the result of a Student's t -test rejects the null that $b=0$ (at chosen significance level);
 - b) the variance of $\{\eta_t^i\}_{t=p+1, \dots, T}$ is smaller than the variance of $\{\xi_t^i\}_{t=p+1, \dots, T}$, than the Granger causes for countries included in group I (at a chosen significance level).

In general, PROCEDURE I and PROCEDURE II are based on finding out-of-sample forecasts for models (5) and (6) and then testing whether the augmented model is indeed more accurate than the restricted one. PROCEDURE I is not always as powerful as PROCEDURE II, however, it is robust to any covariance between and heteroscedasticity of the errors [14]. For the sake of the comprehensiveness of our research we additionally applied a traditional in-sample Granger causality procedure:

PROCEDURE III
(*in-sample test*)

1. Estimate model (5) using all available information (i.e. $i \in I$, $t = p + 1, \dots, T$).
2. Test the null hypothesis that $\bigvee_{j=1, \dots, p} \gamma_j = 0$.
3. If the null hypothesis is rejected at the chosen significance level then the $\Delta HERITAGE_{i,t}$ Granger causes $\Delta GDP_{i,t}$ in the case of countries included in group I .

Note that when the Granger-Huang [14] approach (PROCEDURE I and II) is applied to the panel of two countries the forecasts for each country are based only on the data on the other one, which may lead to significant errors, especially in the case of weak similarity between the two economies. Moreover, the statistical performance of all approaches (including traditional PROCEDURE III) is also likely to suffer from the small (extremely small in the case of two economies) sample considered. These two remarks clearly justify the strategy of choosing the subgroups of countries listed in Table 3.

At this place we should also underline two specific problems, which arise while performing significance tests (e.g. t -test, F -test) of regression coefficients on the basis of asymptotic distribution theory (as in step 4a of PROCEDURE II or step 2 of PROCEDURE III) or establishing asymptotic-based confidence intervals (step 6a of PROCEDURE I). First, if some of required modelling assumptions do not hold, the application of asymptotic theory may lead to spurious results [29]. Second, the distribution of the test statistic may still be significantly different from an asymptotic pattern when dealing with small samples, even when all modelling assumptions are generally fulfilled. One of ways to overcome these difficulties is to use the bootstrap procedure. This approach is used to estimate the distribution of a test statistic (or to construct a confidence interval) by resampling the data. Since the bootstrap distribution depends only on the available dataset, one may expect that this procedure does not require assumptions as strong as parametric methods.

The bootstrap procedure applied in this paper was based on resampling leveraged residuals, which minimizes the undesirable influence of heteroscedas-

ticity [18].* This approach has often been applied in recent empirical causality investigations conducted on the basis of relatively small datasets (see e.g. [15], [17]). In the case of PROCEDURE I we applied percentile bootstrap confidence intervals.

In recent years the academic discussion on the establishment of the number of bootstrap replications has attracted considerable attention (see e.g. [22]). In this paper the procedure of establishing the number of bootstrap replications developed by Andrews and Buchinsky [2] was applied. In every case we aimed to choose a value of the number of replications which would ensure that the relative error of establishing the bootstrap critical values (at a 10% significance level) would not exceed 5% with a probability equal to 0.95. The Gretl script including the implementation of PROCEDURES I–III is available from the authors upon request.

In addition to standard linear Granger causality tests, the impulse response (IR) analysis was also performed. The traditional Granger causality analysis provides an opportunity to establish the directions of causal links between variables under study, however, it does not tell anything about the signs of these relationships. Therefore, in order to examine the reaction of the effect variable to the shock in the cause variable we generated impulse responses for the horizon of 20 periods.

For the sake of the comprehensiveness two values of the lag parameter were applied for each of the pairs of models (augmented and restricted) analyzed. Despite using first differences, we also examined the stationarity properties of the (differenced) data, since the LS-based approach is likely to produce spurious results for the short (in both the time and cross-sectional dimensions) nonstationary panels and time series (see e.g. [32]). Moreover, at present there are only some (rather preliminary) theoretical results on the availability of bootstrap to provide asymptotic refinements when dealing with integrated or cointegrated data [22]. Thus, before performing the panel-LS-based tests of significance (PROCEDURE III) we applied a number of unit root tests allowing for common (Levin, Lin and Chu test, Breitung test) or individual (Im, Pesaran and Shin test) unit root processes. Similarly, we used ADF, KPSS and PP tests before performing each sum-difference time-series-based test (PROCEDURE II). We applied the Schwarz criterion for choosing the optimal lag length before unit-root testing and the Newey and West [30] method for bandwidth selection. In all cases (different types of deficits, different groups of countries, time series tests (PROCEDURE II) and panel-least-squares-based tests (PROCEDURE III)) we found no evidence of nonstationarity at a 5% level.

* In order to deal with heteroscedasticity one may use the well-known concept of so-called *wild bootstrap* [28]. For the sake of the comprehensiveness we additionally considered this standard approach. Since the results obtained after the application of both bootstrap approaches were not significantly different, in further parts of this paper we will report only the results obtained by the leverage-based scheme.

6. Empirical results

In this section the results of examining causal dependencies between economic growth and budget and trade deficits in new EU members in transition are presented. The data analyzed in this paper covers the period from 2000 to 2009, which naturally means that the data in first differences covers the period from 2001 to 2009.

6.1. The impact of budget deficit on economic growth

Table 4 contains the results of testing for Granger causality in the direction from government surplus/deficit to the economic growth. All the testing procedures were performed at a 10% significance level.* Results obtained after the application of bootstrap-based methods are presented in square brackets.**

As we can see the results presented in Table 4 provided evidence to claim that budget surplus/deficit was a causal factor for economic growth in ten CEE economies examined. Moreover, we found some support to claim, that this causal link was especially strong for all but low-budget-deficit countries.

Table 4

Results of testing for causality from government surplus/deficit to economic growth

Group of countries	Testing procedure						
	Lag	PROCEDURE I		PROCEDURE II		PROCEDURE III	
		Result ^a	Details	Result ^a	Details	Result ^a	Details
I_0	1	✓	-	✗	p -value=0.23 [p -value=0.44]	✓	p -value=0.09 [p -value=0.02]
	2	✓	-	✓	p -value=0.04 [p -value=0.01]	✓	p -value=0.00 [p -value=0.01]
I_1	1	✓	-	✓	p -value=0.18 [p -value=0.08]	✓	p -value=0.03 [p -value=0.06]
	2	✓	-	✓	p -value=0.09 [p -value=0.04]	✓	p -value=0.12 [p -value=0.08]

* In Tables 4–6 we used shading to mark the finding of significant causality (in case of conducting several tests for one specific direction the shading was used whenever the asymptotic-based or bootstrap-based p -value was smaller than or equal to 0.10).

** The number of replications chosen according to Andrews and Buchinsky ([2]) algorithm varied between 1999 and 3319 for each bootstrap application. In general, results obtained after construction of asymptotic- and bootstrap-based confidence intervals were not significantly different in the case of each conducted test, thus we present results of the asymptotic variant only.

Table 4 cont.

I_2	1	✓	-	*	p -value=0.63 [p -value=0.56]	*	p -value=0.17 [p -value=0.28]
	2	✓	-	*	p -value=0.73 [p -value=0.94]	*	p -value=0.15 [p -value=0.22]

The symbol ✓ () denotes finding (not finding) causality at a 10% significance level

After finding statistically significant Granger causality from $G_BALANCE$ to GDP one should examine the signs of this link. IR functions obtained for all three groups of countries are presented in Figure 2.

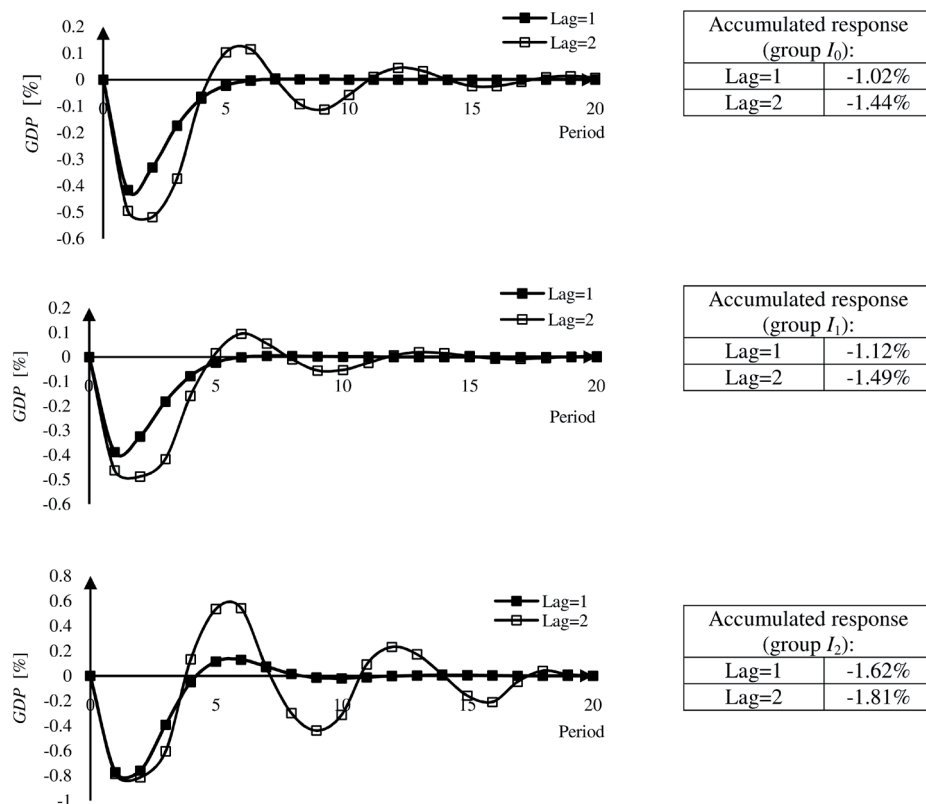


Figure 2. Responses of GDP to a one-unit drop in $G_BALANCE$

Source: own calculations

In general, a one-unit drop in $G_BALANCE$ (which corresponds to a rise in budget deficit by 1% of GDP) causes negative responses in the first four years in all groups of countries examined. This phenomenon together with the results presented in Table 4 provides a basis to claim that Hypothesis 1 is indeed true. In other words, in case of CEE economies in transition large budget deficits were slowing down the economic growth and the process of convergence toward rich EU members in the period 2000–2009. It is also worth to mention that all accumulated impulse responses were negative and oscillated in the range between -1% to -1.8% . This implies that a rise in deficit by a 1% of GDP caused over a 1% drop in the subsequent output in the long-run.

6.2. The impact of economic growth on budget deficit

Table 5 contains the results of testing for Granger causality in the direction from economic growth to budget balance. The empirical outcomes are presented in similar fashion like in the case of the previous table.

Table 5

Results of testing for causality from economic growth to government surplus/deficit

Group of countries	Testing procedure						
	Lag	PROCEDURE I		PROCEDURE II		PROCEDURE III	
		Result ^a	Details	Result ^a	Details	Result ^a	Details
I_0	1	×	6b) unfulfilled	×	4b) unfulfilled	✓	p -value=0.04 [p -value=0.00]
	2	×	6b) unfulfilled	×	p -value=0.92 [p -value=0.87]	×	p -value=0.43 [p -value=0.22]
I_1	1	×	6b) unfulfilled	×	4b) unfulfilled	✓	p -value=0.07 [p -value=0.01]
	2	×	6b) unfulfilled	×	4b) unfulfilled	×	p -value=0.23 [p -value=0.29]
I_2	1	×	6b) unfulfilled	×	4b) unfulfilled	×	p -value=0.19 [p -value=0.38]
	2	×	6b) unfulfilled	×	p -value=0.84 [p -value=0.79]	×	p -value=0.16 [p -value=0.27]

^aThe symbol ✓ (×) denotes finding (not finding) causality at a 10% significance level

As we can see the results presented in Table 5 provided only weak evidence of causality running from economic growth to budget surplus/deficit in ten CEE

economies examined. Moreover, this weak evidence was supported by results obtained mostly for all but low-budget-deficit countries. In other words, we found only weak evidence in favour of Hypothesis 2.

Similarly, to the previous case, we present the results of the IR analysis conducted only for those research variants, in which significant causality was confirmed by at least one testing procedure.

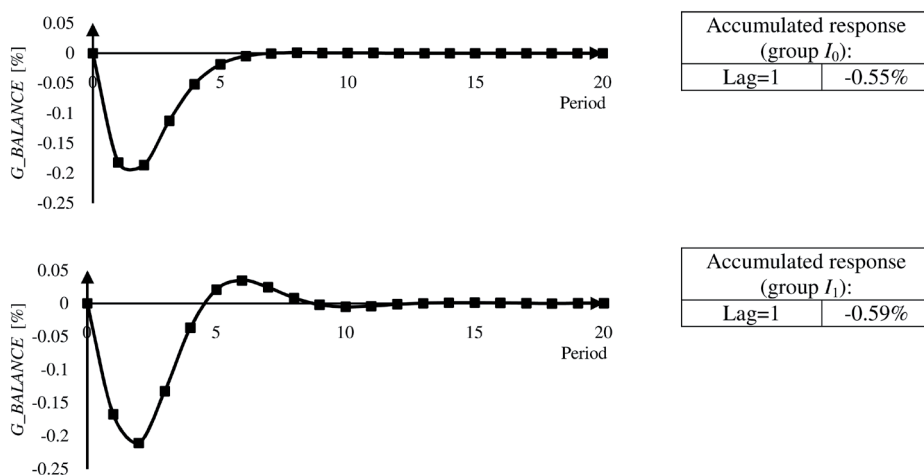


Figure 3. Responses of $G_BALANCE$ to a one-unit rise in GDP

Source: own calculations

In general, a one percent rise in GDP also causes negative responses of $G_BALANCE$ in the first four years in both groups of countries examined (Figure 3). The later means that in the period under study a rise in GDP caused a rise in budget deficit in subsequent periods. It is also worth to mention that both accumulated impulse responses were negative and oscillated around -0.5%. This implies that a one percent rise in GDP caused around 0.5% rise in the budget deficit in the long-run.

6.3. The dynamic relations between budget and trade deficits

In this section the results of testing for causality between budget deficit and trade deficit in the case of CEE transition economies in the years 2000–2009 are presented. As already mentioned, this part of the analysis is expected to provide

a formal examination of dynamic dependencies between both types of deficits, including the verification of the twin deficit hypothesis. Table 6 contains suitable results of Granger causality tests.

Table 6
Results of testing for causality between $G_BALANCE$ and $T_BALANCE$

Testing for causality from $G_BALANCE$ to $T_BALANCE$							
Group of countries	Lag	PROCEDURE I		PROCEDURE II		PROCEDURE III	
		Result ^a	Details	Result ^a	Details	Result ^a	Details
I_0	1	✓	-	✗	p -value=0.16 [p -value=0.33]	✓	p -value=0.05 [p -value=0.01]
	2	✓	-	✓	p -value=0.02 [p -value=0.14]	✓	p -value=0.01 [p -value=0.00]
I_1	1	✓	-	✗	p -value=0.35 [p -value=0.38]	✓	p -value=0.04 [p -value=0.02]
	2	✓	-	✗	p -value=0.12 [p -value=0.24]	✓	p -value=0.09 [p -value=0.03]
I_2	1	✓	-	✗	p -value=0.19 [p -value=0.23]	✓	p -value=0.00 [p -value=0.00]
	2	✓	-	✓	p -value=0.01 [p -value=0.01]	✓	p -value=0.04 [p -value=0.07]
Testing for causality from $T_BALANCE$ to $G_BALANCE$							
Group of countries	Lag	PROCEDURE I		PROCEDURE II		PROCEDURE III	
		Result ^a	Details	Result ^a	Details	Result ^a	Details
I_0	1	✗	6b) unfulfilled	✗	4b) unfulfilled	✗	p -value=0.75 [p -value=0.81]
	2	✗	6b) unfulfilled	✗	p -value=0.83 [p -value=0.65]	✗	p -value=0.38 [p -value=0.42]
I_1	1	✗	6b) unfulfilled	✗	p -value=0.74 [p -value=0.81]	✗	p -value=0.98 [p -value=0.75]
	2	✗	6b) unfulfilled	✗	4b) unfulfilled	✗	p -value=0.73 [p -value=0.48]
I_2	1	✗	6b) unfulfilled	✗	4b) unfulfilled	✗	p -value=0.81 [p -value=0.68]
	2	✗	6b) unfulfilled	✗	4b) unfulfilled	✗	p -value=0.25 [p -value=0.27]

^aThe symbol ✓ (✗) denotes finding (not finding) causality at a 10% significance level

As one can see, the test outcomes provided solid basis for claiming that in the period under study budget surplus/deficit caused trade balance. On the other hand there was no statistically significant causality in the opposite direction. In order to measure the signs of the significant causal dependencies we also calculated impulse responses for the horizon of 20 periods. Suitable results are presented in Figure 4.

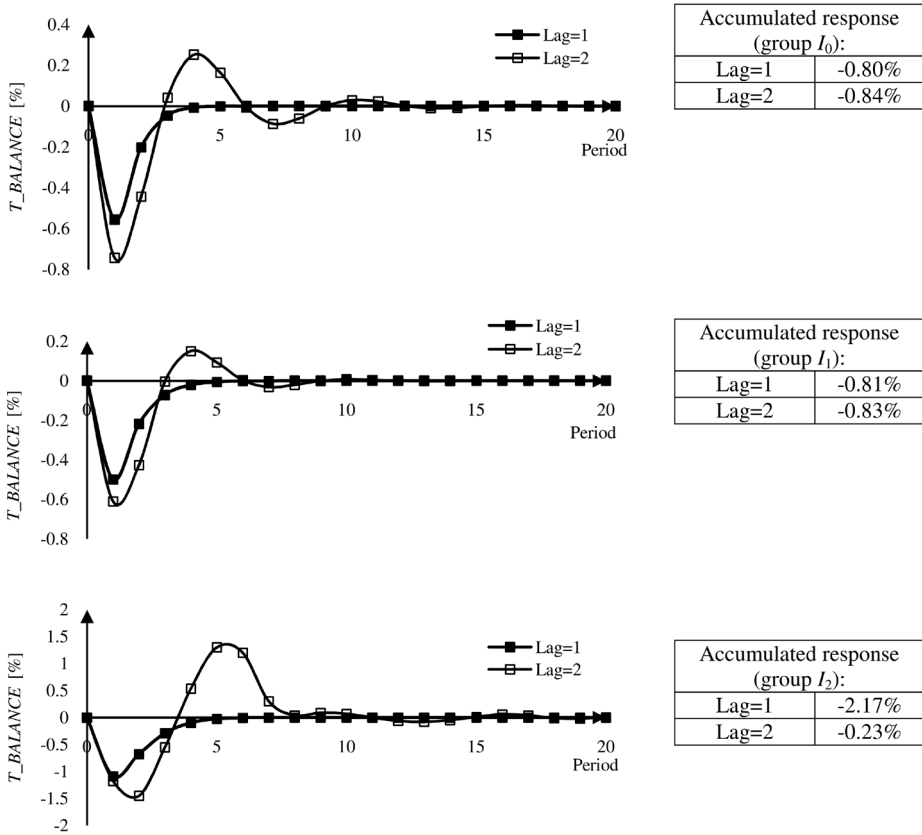


Figure 4. Responses of $T_BALANCE$ to a one-unit rise in $G_BALANCE$

Source: own calculations

In general, the plots presented in Figure 4 suggest that a one percent rise in $G_BALANCE$ causes negative responses of $T_BALANCE$ in first few years in all groups of examined countries. In other words, in the period under study a rise in

budget deficit Granger caused an improvement in the international trade balance. It is also worth to mention that all accumulated impulse responses were negative and in most cases oscillated around -0.8%. This implies that a one percent rise in budget deficit led to around 0.8% drop in trade deficit in the long-run. All these arguments provide a solid basis to accept Hypothesis 3. To summarize, these empirical results provided a basis to claim that budget deficits caused a slowdown in GDP and a rise in international trade balance. Both these causal links are simply connected through a basic macroeconomic theory (comp. the net export function).

Therefore, one may present the structure of the dependencies between variables under study in the following figure:

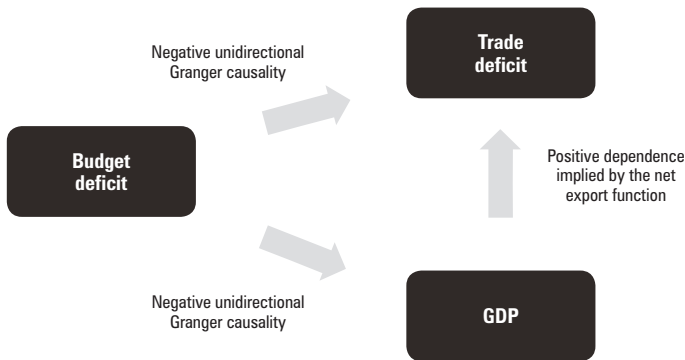


Figure 5. The structure of dependencies between the *GDP*, budget deficit and trade deficit in CEE transition economies in period 2000–2009

Source: own elaboration

Figure 5 summarises the empirical evidence on direct (see Table 6) and indirect (comp. Table 4 and the macroeconomic net exports function) negative impact of budget deficit on trade deficit. We should also underline that this figure presents the structure of dependencies between the variables under study, which was evidently supported by our empirical results and the macroeconomic theory. Some other causalities (in opposite directions to those presented in Figure 5) were also reported, however, empirical evidence supporting these results was too weak to consider them as indeed significant.

We should also underline that the results presented in Tables 4–6 and Figures 2–4 provided relatively weak evidence in favour of Hypothesis 4. Causalities between budget deficit and GDP were stronger for I_1 subgroup (all but low-budget-deficit)

than for I_2 subgroup (all but high-budget-deficit), however, this regularity was not confirmed in the case for causalities between $T_BALANCE$ and $G_BALANCE$.

In order to analyze the impact of the financial crisis of 2008 on the structure of established causal links we additionally re-ran all causality tests on the basis of the pre-crisis subsample (2000–2008). In general, we found only slight differences between results obtained for both samples, thus we found no reason to present pre-crisis results in separate tables. However, it is without question that this issue deserves more attention in the future, when data on at least several post-crisis years will be available.*

7. Concluding remarks

The aim of this paper was to examine the nature of causal dependencies between economic growth and budget and trade deficits of 10 new EU-members in transition from CEE region in the period 2000–2009. The specific choice of variables enabled an examination of the impact of fiscal policy on the process of convergence of these economies towards highly developed old EU members. In order to examine the stability of the results we additionally performed empirical investigations on two specific subgroups chosen on the basis of differences in the levels of budget balances of sample countries. Moreover, three methods of testing for Granger causality were applied (two out-of-sample procedures and a traditional in-sample significance test) in asymptotic- and bootstrap-based variants, which was especially important for the validation of the empirical findings.

The results of the first part of the study provided solid basis to claim that budget deficits were indeed significantly slowing down the GDP growth rates in the case of new EU-members in transition from CEE region. Moreover, these deficits had a negative impact on the convergence process of examined countries towards rich European economies. On the other hand, the evidence supporting the existence of causality in the opposite direction was markedly weaker.

We also found relatively solid evidence to claim that in the period under study there was a unidirectional negative Granger causality running from budget deficits to trade deficits. This implies that in the case of CEE economies in transition the twin deficit hypothesis did not hold in the period 2000–2009. In other words, the posi-

* In the case of every group listed in Table 3 the difference between the size of the full and reduced sample is equal to the number of considered countries, therefore it is hard to expect that suitable results (PROCEDURE III) could differ significantly, even in the face of possible structural change in the third quarter of 2008. Moreover, in the case of out-of-sample tests (PROCEDURE I and II) one should also bear in mind that forecasts based on equations (3) and (4) suffer *equally* from all model specification imperfections ([14]). Finally, measuring GDP in relation to EU-27 average additionally made the impact of crisis less apparent.

tive impact of budget deficit on trade deficit (i.e. twin deficit hypothesis), which in theory is usually explained through a rise in interest rates and next the fluctuations in exchange rate, turned out to be much weaker than the often underlined impact of a large rise in imports in CEE economies during the transition period.

After the collapse of the communist system the group of examined countries has started a long and difficult process of transforming towards market economies. The process of modernizing and reforming the economies along with EU-accession requirements were two factors having probably the most important impact on the size of budget deficits in this particular group of economies. This paper proved that budget deficits had in turn a significant and negative impact on the economic growth and convergence of CEE transition economies towards rich EU member states.

The empirical analysis of this paper also proved that for CEE economies in transition budget deficits were negatively causing trade deficits in the period under study. This finding is in line with the latter one if we take into account some basic macroeconomic concepts. The simple connection between both these empirical findings is based on the net export function. This formula, which is one of the fundamentals of macroeconomic theory, suggests that a rise (drop) in GDP should cause a drop (rise) in the international trade balance due to a rise (drop) in propensity to imports. Our empirical analysis seems to confirm this theoretical dependence in the case of the analyzed economies. As a consequence, the concept of twin deficits was clearly rejected by the results of the empirical study. One must note, however, that the issue of deficit-growth dynamic links in CEE transition economies still deserves considerable attention from researchers as many important questions remain open.

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