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Are the Twin or Triple Deficits Hypotheses Applicable to Post-Communist Countries?

Summary: This study examines the validity of the twin or triple deficits hypotheses using bootstrap panel Granger causality analysis and an annual panel dataset of six post-communist countries (Russia, Poland, Ukraine, Romania, the Czech Republic, and Hungary) during the period from 1994 to 2015. The results corroborate neither the validity of the twin deficits hypothesis nor its extended version, the triple deficits hypothesis, for any of the sample countries. In other words, we find no Granger causal relationship between budget deficits and external (trade or current account) deficits or among budget deficits, private savings-investment deficits, and external deficits in the countries examined. On the basis of these results, we reject the Keynesian view of the twin or triple deficits hypotheses. Rather, we confirm the Ricardian view.

Key words: Fiscal policy, Twin deficits, Triple deficits, Transition economies, Bootstrap panel Granger causality analysis.

JEL: E60, F30, F32, H62.

The twin deficits hypothesis and its extended version, the triple deficits hypothesis, are once again on the agenda of the international macroeconomic policy of many countries. Concerns over global imbalances that emerged in the aftermath of the 2008/2009 global crisis and the potential fiscal policy responses to these imbalances in many countries have resulted in a renewed interest among economists and policymakers. This interest has raised the question as to whether the twin or triple deficits hypotheses prevail.

The notion of twin deficits gained popularity in the early 1980s at a time when large chronic external deficits, typically measured and expressed by trade or current account deficits, were accompanied by the widening US budget deficits. Since then, whenever the US experiences notably widening external deficits, the twin deficits hypothesis has become a hot topic of economic and political discussions. Indeed, external deficits are a problematic macroeconomic issue not only for the US but also for many other countries. The case of the post-communist countries is not an exception. Perhaps the largest perceived threat of the co-existence of budget deficits and external deficits (trade or current

account – the two terms are used interchangeably throughout the present study unless otherwise mentioned), however, is their ability to induce macroeconomic imbalances that damage the long-run economic development trends in a country. This concern was prominent among policymakers in the post-communist countries two decades ago, as they had faced huge initial distortions, and there was a great potential to run sizable trade and budget deficits for many years. The twin deficits hypothesis proposes that the budget deficits and external deficits of an economy are intertwined. Deterioration of the budget balance eventually results in a corresponding deterioration of the external balance of an economy. As for its cousin – the triple deficits hypothesis – that emerged in recent years, it establishes a linkage between the budget balance, the savings-investment balance (i.e., the economy-wide resource gap), and the external balance. Accordingly, the budget deficit, along with the savings-investment deficit, induces trade deficits. The term “triple deficits” implies that a domestic imbalance (the simultaneous existence of budget deficits and private savings-investment deficits) is accompanied by an external imbalance, such as trade or current account deficits.

Understanding possible causal relationships among these variables is a pre-condition for setting robust macroeconomic policies and for making of policies that would promote macroeconomic stability and economic growth. It is also widely accepted that large and persistent internal and external deficits threaten macroeconomic stability and growth. Indeed, as the experiences of many countries have shown, large and persistent budget deficits pose serious problems for future generations by leaving them with a repayment burden. Furthermore, large and persistent internal and external deficits make trouble for countries especially when their currency reserves drain, resulting in excessive debt or setting the stage for an economic crisis.

This study concerns the validity of the twin and triple deficits hypotheses in a sample of six post-communist countries. To this aim, the study employs the bootstrap panel Granger causality approach proposed by László Kónya (2006) which allows for the simultaneous analysis of Granger causality between two or three variables.

The rest of the study is structured as follows. The following section briefly outlines the macroeconomic developments in the sample countries. Section 2 starts with a theoretical framework for the study and then reviews the related empirical literature. Section 3 describes the dataset and methodology of the study, while Section 4 reports and discusses the empirical results. Section 5 provides closing remarks.

1. Macroeconomic Backgrounds of Six Post-Communist Countries

In the aftermath of the collapse of the Soviet Union, a number of formerly socialist countries embarked on a long and painful transition process of becoming market-based economies similar to their Western counterparts. However, the speed of the transition process has varied considerably across transitioning countries (Pradeep K. Mitra and Marcelo Selowsky 2002). In Poland and Russia, the process was quite rapid and nearly as fast as in the countries that previously constituted Czechoslovakia. Hungary, a relatively more liberalized country, had less need for rapid change, so progress was slower. Romania and Ukraine faced domestic resistance to reforms from pressure and interest groups. Nevertheless, all of these countries eventually implemented reforms, ranging from macroeconomic stabilization to the design of new market institutions and the establishment of new legal

infrastructure. The ultimate aim of the reforms was to increase efficiency and to stimulate growth by means of several policy actions, such as providing macroeconomic stabilization, promoting price and foreign trade liberalization, restructuring and privatizing state-owned enterprises, and redefining the role of the state (see International Monetary Fund - IMF 2000).

During the first decade of transition, most countries experienced high inflation and recessions, which were, to some extent, the side effects of price liberalization and the sudden collapse of economic linkages. Actual output fell dramatically in nearly all Eastern European transition countries (Mitra and Selowsky 2002). At the same time, the removal of price controls and trade liberalization left industrial firms, in particular, with serious liquidity problems and falling demand. In addition to poor economic performance, transitioning countries neglected critical reform areas, such as establishing good governance, restructuring and privatizing state-owned enterprises, setting up open labor markets, and developing viable competition policies (International Monetary Fund 2014). Some of the political timidity in moving ahead with institution building reflected opposition from pressure and interest groups that, rightfully or not, feared change.

In any case, virtually all Eastern European countries performed poorly in their first decade of transition. Policies tended to focus on the low-hanging fruit of industrial growth revival rather than the harder-to-reach challenge of correcting macroeconomic imbalances. Thus, monetary and fiscal policies in these countries created a large demand for inadequate goods and services. With persistent excess demand, these countries encountered serious macroeconomic problems, including output gaps, unsustainable external debt, and high inflation.

Given the lack of monetary policy tools, transitioning countries initially adopted pegged exchange rate regimes. As time went on, they shifted to intermediate exchange rate regimes and eventually managed floats that recognized the potentially destabilizing effects of international capital inflows and minimized negative effects on exports. In the initial years of transition, all of our sample countries adopted conventionally fixed pegs. In subsequent years, they adopted export-oriented exchange rate regimes, such as crawling pegs, crawling bands, or managed floats without pre-announced exchange rate trajectories. Although none of these arrangements provided a stable exchange rate regime, our four sample countries that joined the EU (Hungary, Poland, Romania, and the Czech Republic) all eventually adopted independent floating regimes. Russia, in contrast, employed a managed float throughout most of the period under scrutiny. Ukraine has tried several exchange rate regimes, including fixed peg and independent float (for a survey of exchange rate regimes in transition economies, see Agnieszka Markiewicz 2006; Jeffrey Frieden, David Leblang, and Neven Valev 2010).

The 1998 Russian financial crisis negatively affected all our sample countries, most notably in the form of a collapse in Russian imports. Ukraine was hit hardest due to its close trade ties with Russia. All sample countries devalued their currencies or abandoned their existing exchange rate regime following large ruble devaluations, and all experienced subsequent declines in growth.

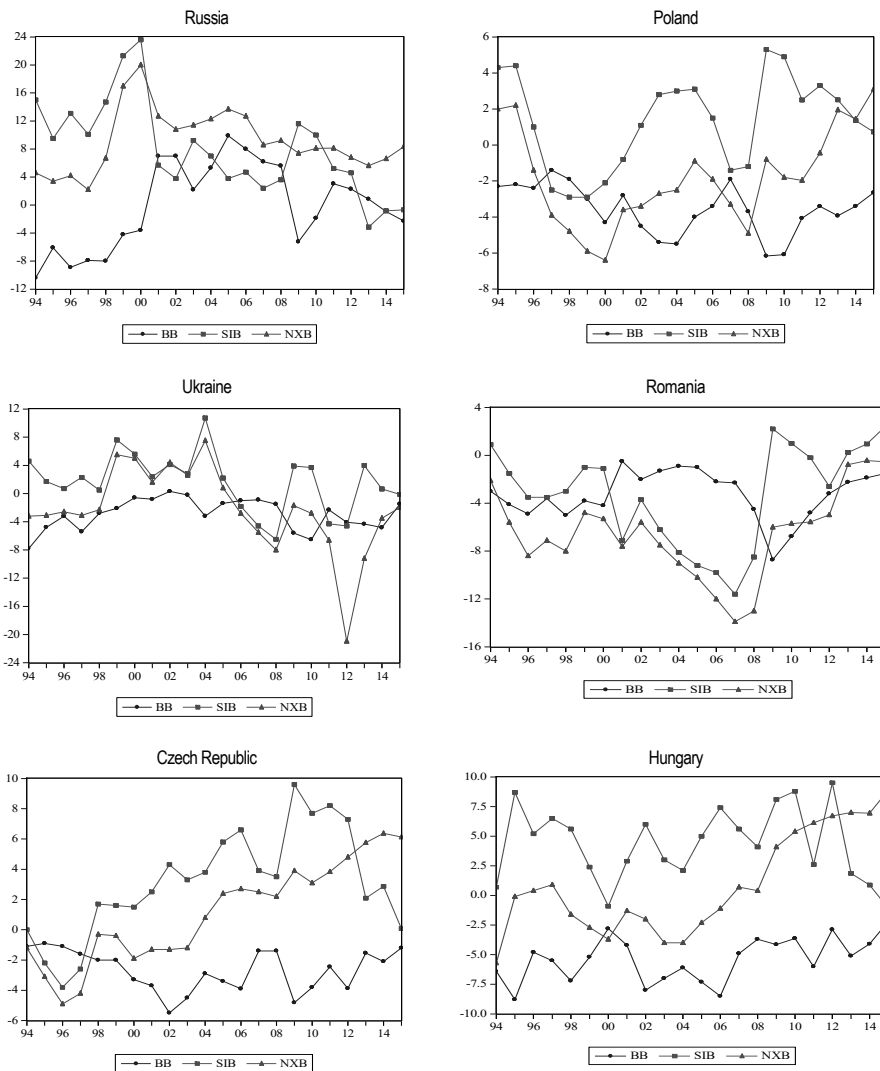
Transitioning countries, as a rule, demonstrated much better performance in their second decade of transition. Having achieved a modicum of macroeconomic stability, they started to attract foreign capital. The EU aspirants closed the convergence gap with the EU-

12 countries. In particular, Poland, Hungary, and the Czech Republic, which enjoy geographic proximity to Western European markets, benefited from investment and trade opportunities even in the earliest phases of transition. The United Nations Economic Commission for Europe (2001) reported that the share of FDI in GDP in the Czech Republic rose to 9.3% in 2000 from 1.9% in 1990-1992. The other sample countries, with the exception of Russia and Ukraine, experienced strong FDI inflows as well. In contrast, the FDI-to-GDP ratio remained relatively low for Russia and Ukraine in the first decade of transition. This ratio only increased from 0.5% to 1.2% in Russia and 0.8% to 1.8% in Ukraine. A positive trend, however, prevailed throughout the rest of the sample period. Financial sector liberalization seems to have played a significant role in easing access to capital and facilitating a credit boom. A large share of external capital came, to an extent, in the form of FDI or cross-border bank flows (IMF 2014).

The four countries that joined the EU experienced large and persistent external deficits. Figure 1 plots the evolution of the budget balance (BB), private savings-investment balance (SIB), and trade balance (NXB), all expressed as a proportion of GDP, for the sample countries during the study period. Notably, Russia's budget balance and trade balance moved counter to the trends of the other countries throughout the observation period (except in 2005 and 2007). Based on visual inspection, it may be said that there were no co-movements between the two balances during the sample period. Accordingly, the budget balance trends upward as the trade balance trends downward and *vice versa*. With the exception of Russia and Romania for a couple years, this held true for all the sample countries during the entire observation period. In Russia's case, however, the budget balance and trade balance showed parallel trends only in 2005 and 2007, whereas for Romania, the parallel trends in the two balances were rare. A glance at Figure 1 suggests that there were no parallel movements in the budget and trade balances, evidence that argues against the validity of the twin deficits hypothesis.

Considering the budget balance, the private savings-investment balance, and the trade balance as a whole, we still found no parallel movements among them. Figure 1 plots the behavior of three variables – budget, private savings-investment and trade balances – in the sample countries during the observation period. However, it provides no clear picture with regard to linkages of either the budget balance and the trade balance or budget balance, private savings-investment balance, and the trade balance to support the validity of the twin deficits hypothesis or its extended version, the triple deficits hypothesis.

During the early stages of the transition, virtually all the countries received substantial financial and technical assistance from two major international organizations, the International Monetary Fund and the World Bank. Hungary, Romania, Poland, and the Czech Republic also received substantial support from the EU as part of the accession process. Indeed, the EU's financial and technical support – often provided by the European Central Bank (ECB), the European Bank for Reconstruction and Development (EBRD), and the European Investment Bank (EIB) – played a crucial role in the reform process in these countries. The IMF estimates show that, in the first three years of the EU membership, financial inflows from the other members increased from below 1% of GDP on average to almost 2.5% of GDP on the provision of structural funds, agricultural support, and other subsidies (IMF 2014, p. 40).



Source: Authors' calculations based on data from the International Monetary Fund (2016)¹, United Nations (2016)² and the World Bank (2016)³.

Figure 1 The Evolution of Budget Balance (BB), Private Savings-Investment Balance (SIB), and Trade Balance (NXB) in the Six Post-Communist Countries, 1994-2015

¹ **International Monetary Fund.** 2016. Staff Discussion Notes. <https://www.imf.org/en/publications/search?when=After&series=IMF+Staff+Country+Reports> (accessed December 13, 2016).

² **United Nations.** 2016. National Accounts - Analysis of Main Aggregates. <https://unstats.un.org/unsd/snaama/> (accessed December 13, 2016).

³ **World Bank.** 2016. World Development Indicators. <https://databank.worldbank.org/source/world-development-indicators> (accessed December 13, 2016).

Although the aforementioned new EU members posted varied macroeconomic performances over their first two decades of transition (due to different initial conditions, each country's policies during the transition, and the impacts of the global crises), they all successfully completed their transition processes (Mitra and Selowsky 2002; IMF 2014). All faced high budget and trade deficits, high external debt, and sharp output declines along the way.

In hindsight, in a broad sense, it appears that most of the countries in the sample exhibited weak growth performance – even large declines in their output – during the transition. The transition period was characterized in particular by two things: widespread corruption and poor property rights discouraging investors from investing in these countries. These issues still pose a problem especially for those sample countries that are non-EU members: namely Russia and Ukraine.

Despite the fact that observers noticed a recovery following the 2008/2009 global crisis, it has been short-lived. Especially due to the sovereign debt crisis in the Eurozone, growth in the countries examined tended to slow down starting from the second half of 2011 onwards. Also, two additional developments witnessed in the following years have worsened the economic outlook for the countries. First, the political clashes that have been ongoing in Ukraine since 2013 have created an uncertain economic environment not only for this country but also for the region as a whole. Second, negative expectations related to the international reflections of the quantitative easing program of the US together with the tightening monetary policy program of the ECB have prompted capital outflux (see EBRD 2013, 2014, 2015). All these have triggered a significant reduction in net capital inflows. Thanks to EU membership, however, improvements in the budget and current account balance, especially in new member countries – four out of the six sample countries – helped, to some extent, in mitigating the negative impact of external monetary policies on capital inflows.

The case of Russia does not differ very much from that of Ukraine. In the aftermath of early 2014, the Russian currency, the ruble, has started to lose value against major currencies, such as the euro and the US dollar, partly due to economic sanctions imposed by the US and the EU and partly owing to postponed or canceled plans to borrow in international markets. Concerns over sanctions, which are likely to be widened as well as tightened in the near future, together with weakening currencies have triggered a decrease in investor confidence. All these developments have discouraged private capital influx on the one side and sparked capital outflux on the other. Starting in early 2015, output in Russia has deteriorated further following the decline in oil prices and the economic sanctions imposed by the EU, the US, and some other countries (EBRD 2015). Weakening GDP growth in Russia negatively affected the country's remittances and export demand. The combined effects of these external developments together with country-specific bottlenecks have weakened growth in the other sample countries as well. In the nature of things, the internal and external balances of the sample countries have been affected by these developments in some ways, but to different degrees.

2. Theoretical Framework and Review of the Empirical Literature

2.1 Theoretical Framework

The literature offers two major views that contradict each other in terms of how they explain the twin deficits hypothesis. The first one is the Keynesian view and the second one is the Ricardian view. The former, sometimes called the “conventional” approach to twin deficits, states that a worsening in the budget balance results in a worsening trade or current account balance. The latter, in contrast, sees no systematic association between the budget balance and trade or current account balance. The guiding spirit of the Ricardian view is the Ricardian equivalence proposition which was articulated first by David Ricardo, a 19th century British economist, and further developed by Robert J. Barro. This view, sometimes referred to as the “neo-classical view”, became prominent with the seminal work of Robert J. Barro (1974).

Meanwhile, it is important to note here that, in addition to the two aforementioned fundamental views, the existing literature presents two additional views explaining the relationship between budget deficits and trade or current account deficits: (i) current account targeting and (ii) feedback linkage (see, for example, Marianna Siničáková, Veronika Šulíková, and Beata Gavurova (2017)). The current account targeting view put forward by Lawrence H. Summers (1988) suggests the existence of an opposite relationship of what the twin deficits hypothesis tells us, arguing that there is a one-way relationship between budget deficits and trade or current account deficits that runs from trade deficits to budget deficits. As for the feedback linkage view, it claims that there is a bidirectional causality between budget deficits and trade deficits, running from budget deficits to trade deficits or *vice versa*.

The twin deficits hypothesis implies the presence of a close relationship between budget deficits and trade deficits in an economy. Even as discussion continues as to whether the twin deficits hypothesis is even valid, the past decade has witnessed the rollout of a “triple deficits” hypothesis which makes the case for a connection between the government budget balance, the private savings-investment balance, and the trade balance. Under the Keynesian approach, an increase in the government budget deficit increases interest rates because domestic funds are insufficient to cover profitable investment opportunities and government borrowing. With the attraction of foreign capital inflows, the domestic currency appreciates, putting domestic goods at a competitive disadvantage against foreign goods and driving the current account balance into deficit.

This view has spawned two corollaries: the “Keynesian income-spending” and “Feldstein chain” approaches. The Keynesian income-spending approach takes the simple Keynesian model of the national income and establishes a direct link between budget deficits and trade deficits. The Feldstein chain approach proposes an indirect association between budget deficits and external deficits, whereby, under the assumption of an open economy with a flexible exchange rate regime and free movements of capital, budget deficits put an upward pressure on domestic interest rates through the deficit financing mechanism. An increase in interest rates attracts foreign capital to the host country, resulting in a net inflow of foreign capital. Appreciation of the domestic currency, in turn, undermines the international competitiveness of the country by making its goods and services more costly than those imported. Thus, increased budget deficits eventually

result in increased trade deficits. In stylized form, the Feldstein chain could be illustrated as budget deficit $\uparrow \rightarrow$ government's deficit-financing requirement $\uparrow \rightarrow$ domestic interest rates $\uparrow \rightarrow$ foreign capital inflows $\uparrow \rightarrow$ real value of domestic currency against foreign currencies (appreciation in exchange rate) $\uparrow \rightarrow X \downarrow M \uparrow \rightarrow NX \downarrow$, where \uparrow , \downarrow and \rightarrow respectively stand for increase, decrease, and causal direction. Additionally, "X", "M", and "NX" represent exports, imports, and net exports.

The Ricardian approach, in contrast, asserts that increased budget deficits (regardless of whether they stem from tax cuts, higher spending or both) cause forward-looking economic agents to increase their savings in anticipation that the government will increase taxes in the future to meet rising deficits and pay off accumulated debt. These economic agents respond to budget deficits by accumulating wealth further rather than by increasing their spending. Thus, a reduction in public savings (i.e., an increase in budget deficits) is balanced by a corresponding increase in private savings. As a result, trade deficits do not respond to changes in budget deficits (see Barro 1974 for details).

The simple Keynesian model of national income identity for an open economy is a good starting point for our theoretical analysis of the twin and triple deficits hypotheses. Following similar derivations by, *inter alia*, B. Douglas Bernheim (1988), George A. Vamvoukas (1997, 1999), Jarko Fidrmuc (2003), Ahmad Zubaidi Baharumshah, Evan Lau, and Ahmed M. Khalid (2006), Tuck Cheong Tang (2014) and Zixiong Xie and Shyh-Wei Chen (2014) we can express GDP for an open economy for the period t as follows under the assumption that net factor income from abroad is zero:

$$GDP = C + I + G + X - M, \quad (1)$$

where GDP – gross domestic product, C – consumption, I – investment, G – government spending, X – M – net exports (NX).

Equation (1) represents the national income from the perspective of total expenditures. It is also possible to express national income in terms of total income as in Equation (2). By definition, nations dispose of their income (GDP) for the period t as consumption (C), savings (S), or taxes (T). Accordingly:

$$GDP = C + S + T. \quad (2)$$

As total expenditure in the economy equals total income, we obtained Equation (3):

$$C + I + G + X - M = C + S + T. \quad (3)$$

After canceling out "C" and making necessary arrangements in Equation (3), we obtained Equation (4):

$$(T - G) + (S - I) = (X - M). \quad (4)$$

Breaking down total savings in an economy (S) into private (Sp) and government (Sg) savings yields Equation (5):

$$(T - G) + (Sp + Sg - I) = NX. \quad (5)$$

Since private savings are the part of disposable income saved rather than consumed, we obtained Equation (6):

$$Sp = GDP - T - C. \quad (6)$$

On the other hand, government savings are equal to the difference between government revenues and government expenditures such that:

$$S_g = T - G. \quad (7)$$

Using the decomposed forms of S_p and S_g (Equations (5) and (6)) and then substituting them into Equation (5), allowed us to re-write Equation (5) in the following form:

$$(T - G) + (GDP - T - C) + (T - G) - I = NX. \quad (8)$$

After making the necessary arrangements in Equation (8), we obtained Equations (9) and (10):

$$(T - G) + (GDP - C - G) - I = NX; \quad (9)$$

$$(T - G) + (S_p - I) = NX. \quad (10)$$

Equation (10) indicates that the trade balance (NX) equals the sum of the government budget balance (T – G) and the excess of private savings over domestic investment (Sp – I). Equation (10) implies that, if private savings are roughly equal to domestic investment (Sp ≅ I), domestic investment is financed entirely by private savings, and the budget balance of an economy is equal to its trade balance. Obviously, Equation (10) could also be written in terms of the current account balance. By definition, the national income identity can be expressed in terms of the gross national product as follows: $GNP = C + I + G + X - M + NFI$, where NFI stands for net factor incomes from abroad. Substituting GNP for GDP and following the same process from Equations (1) through (10), the sum of last two items, (X – M) plus NFI, gives the current account balance. Here, the equation takes the form $(T - G) + (Sp - I) = CAB$. This means (at least arithmetically) that the budget balance moves together with the trade balance in the same direction by about the same amount, therefore, we can infer that the two balances are twinned or directly interrelated. In this case, a deterioration of the budget balance leads to a deterioration of the trade balance. If private savings do not equal the investment balance, that is, the shortfall of domestic saving as compared with domestic investments ($Sp < I$) and budget balance is negative ($T < G$) – we are faced with triple deficits, where the sum of the two domestic deficits is equal to the trade deficit. From a policy perspective, this implies that, if budget deficits exist along with a private savings-investment gap, triple deficits are unavoidable.

Equation (10) by itself says nothing about the causes and interconnections of the deficits. The commonly accepted view is that budget deficits are the fundamental cause of twin or triple deficits and that the cure is to reduce budget deficits (see, for example, Martin Feldstein 1992; Syed M. Ahmed and Mohammed I. Ansari 1994; Ahmed M. Khalid and Teo Wee Guan 1999; International Monetary Fund 2011; Tang 2014). Here, twin or triple deficits are seen as a consequence of government overspending, and all three deficits should cease to exist when the government cuts spending.

2.2 Review of the Empirical Literature

The origins of the empirical studies on fiscal deficits and trade deficits go back to the late 1970s. The study by Elizabeth S. Milne (1977), to the best of our knowledge, is the first

empirical study conducted on the relationship between fiscal deficits and trade deficits. Examining a sample of 38 countries, she concluded that fiscal deficits are an important factor in determining trade deficits. The following decade witnessed an increased number of studies examining the nexus between budget deficits and trade or current account deficits. The studies by Bernheim (1988), Stephen M. Miller and Frank S. Russek (1989), John D. Abell (1990), and Nazma Latif-Zaman and Maria N. DaCosta (1990) deserve to be mentioned here. Unlike Milne (1977), all these studies paid special attention to the case of the US and took the issue into consideration in the context of the US perhaps due to the co-movements of the US budget and trade deficits throughout the 1980s. The findings of these studies yielded results in favor of the twin deficits hypothesis.

In the following two decades, interest in the twin deficits hypothesis has increased further, resulting in an expanding empirical literature. A number of researchers have tested whether the twin deficits hypothesis is valid for other countries or country groups as well. Among this new strand of studies, we can list the studies conducted by Ahmed and Ansari (1994) for Canada, Elif Akbostancı and Gül İpek Tunç (2002) and Burcu Kıran (2011) for Turkey, Chul-Hwan Kim and Donggeun Kim (2006) for South Korea, Baharumshah and Lau (2007) for Thailand, Cosimo Magazzino (2012) for Italy, César R. Sobrino (2013) for Peru, Carlos Fonseca Marinheiro (2008) and Osama El-Baz (2014) for Egypt, BigBen Chukwuma Ogbonna (2014) for South Africa, Dominick Salvatore (2006) for the G-7 countries, Baharumshah, Lau, and Khalid (2006) for the ASEAN-4 countries, António Afonso, Christophe Rault, and Christophe Estay (2013) and Emmanouil Trachanas and Constantinos Katrakilidis (2013) for five EU countries, Šuliková, Siničáková, and Denis Horváth (2014) for three Baltic economies (Estonia, Latvia and Lithuania), and Xie and Chen (2014) for OECD countries.

The empirical findings of the studies above are mixed in terms of support for the twin deficits hypothesis. Studies confirming the validity of the hypothesis include Akbostancı and Tunç (2002) for Turkey, Baharumshah and Lau (2007) for Thailand, Vamvoukas (1999) for Greece, Ahmed and Ansari (1994) for Canada, and Jeffrey A. Rosensweig and Ellis W. Tallman (1993) and Mark J. Holmes (2010) for the US. Studies finding no supporting evidence include William G. Dewald and Michael Ulan (1990) and Matiu Rahman and Banamber Mishra (1992) for the US, S. M. Ali Abbas et al. (2010) for 124 countries, Kıran (2011) for Turkey, Sobrino (2013) for Peru, and Ogbonna (2014) for South Africa. Overall, about all that can be said is that these studies point to a very weak link or none at all between budget deficits and trade or current account deficits, supporting the Ricardian equivalence hypothesis. On the other hand, a few researchers, including Kim and Kim (2006), Magazzino (2012), and El-Baz (2014) for Egypt have found a reverse relationship between government budget deficits and trade or current account deficits, wherein causality runs from the latter to the former. This suggests a unidirectional causality running from trade or current account deficits to budget deficits. Most studies reveal short-run, rather than long-run, relationship between the two variables.

Some other findings support the existence of bidirectional causality between budget deficits and trade deficits. For example, the studies of Emmanuel Anoruo and Sanjay Ramchander (1998) for five Asian countries, M. Faizul Islam (1998) for Brazil, Baharumshah, Lau, and Khalid (2006) for Malaysia and the Philippines, Lau, Shazali

Abu Mansor, and Chin-Hong Pua (2010) for the Philippines, Sofia Kalou and Suzanna-Maria Paleologou (2012) for Greece, Asrafuzzaman Asrafuzzaman, Amit Roy, and Sanat Das Gupta (2013) for Bangladesh, and Xie and Chen (2014) for 11 OECD countries discovered evidence of bidirectional Granger causality between budget deficits and trade or current account deficits, especially over the short-run.

The existing literature on the twin deficits hypothesis yields highly disparate results that change according to the statistical techniques used, the length and timing of the observation period, as well as country-specific features. For instance, Miller and Russek (1989) found different results for the same sample countries, whereas Khalid and Guan (1999) revealed that the twin deficits hypothesis is only valid for developing countries. Along similar lines, Artatrana Ratha (2012) provided evidence that, while the Keynesian proposition holds in the short-run, the Ricardian equivalence proposition is present in the long-run.

Considering the characteristics of the domestic tax systems of four ex-communist and new EU member countries (Bulgaria, Croatia, Poland, and Romania), Alka Obadić, Tomislav Globan, and Ozana Nadoveza (2014) drew attention to an important point related to the twin deficits hypothesis. The authors argued that the co-movements of budget and trade deficits cannot be explained by the twin deficit hypothesis, especially in countries with a tax system dominated by indirect taxes owing to the fact that reductions in trade deficits would cause increases in the budget deficits. They also contended go further in that only the structural economic transformation and export orientation of the economy may reverse the causality direction between budget and trade balances.

A more recent study by Hany Eldemerdash, Hugh Metcalf, and Sara Maioli (2014) produced different results for oil-producing versus non-oil producing Arab countries. Their findings suggest a positive relationship between fiscal and external balances for oil producing countries but no similar relationship between two non-oil producing countries. Among the most interesting of all the studies reviewed is that of Soyoung Kim and Nouriel Roubini (2008). They asserted that, in the case of the US, cuts in budget deficits increase current account deficits, resulting in twin divergences. Put differently, budget deficit shocks in the US tend to improve the current account and depreciate the real exchange rate in the short-run.

Perhaps due to a lack of data, economists have bypassed the issue of the twin deficits hypothesis for post-communist countries. Indeed, there are only a handful of studies that examine the twin deficits hypothesis for these countries. To the best of our knowledge, with the exception of a few single-country studies, the big-picture works are limited to the studies of Fidrmuc (2003), Henryk Gurgul and Łukasz Lach (2012), Aleksander Aristovnik and Sandra Djurić (2013), M. Umur Tosun, Pelin Varol İyidoğan, and Erdinç Telatar (2014), and Hubert Gabrisch (2015). With exception of Fidrmuc (2003), all these studies yielded results supporting the Ricardian view.

As for the triple deficits hypothesis, the existing literature in this matter is indeed scarce. During our review of the literature, the only relevant studies were those by György Szokolczai (2006), Merter Akıncı and Ömer Yılmaz (2012), Ali Şen et al. (2014) and Tang (2014). Without exception, these papers provide evidence in favor of the validity of the triple deficits hypothesis. However, we should note that all are single-country studies.

On the other hand, it is important to acknowledge here that the paper by Szokolczai (2006) is not an empirical study but a descriptive one. However, Szokolczai's (2006) paper should be credited with introducing the term "triple deficits" into wide use in the literature.

Briefly stated, the existing literature is rich in terms of studies that attempt to capture the nexus between fiscal deficits and trade or current account deficits. Although numerous studies have been conducted up to now, the literature is far from arriving at clear-cut empirical results. Put differently, the current literature provides mixed results regarding the validity of the twin and triple deficits. While some researchers (e.g., Latif-Zaman and DaCosta 1990; Baharumshah and Lau 2007; Xie and Chen 2014) have asserted that budget deficits and current account deficits are "twins", "identical twins", or even "reverse twins" (Anoruo and Ramchander 1998; Kim and Kim 2006; El-Baz 2014), others such as Walter Enders and Bong-Soo Lee (1990), and Kim and Roubini (2008) have argued that they are less like twins than distant cousins. Gregory Mankiw (2006), widely considered one of America's most proponents of the new Keynesian economics, affirmed the exact opposite, expressing that budget deficits and trade deficits are not twins, but they are cousins. Some even claim they were "separated at birth" (IMF 2011).

Overall, despite a large number of empirical studies attempting to capture the link between fiscal deficits and trade or current account deficits regardless of the types of economies – developed, developing, or transitioning – the results provide inconclusive evidence. Hence, further empirical studies focusing on different economies with modern econometric techniques, as in the case of this study, may help gain a better understanding of nature and the underlying mechanisms of the twin and triple deficits issue.

3. Data and Methodology

3.1 Data

In this study, we used annual data on budget balance, private savings-investment balance, and trade balance for six post-communist countries. The dataset is restricted by the availability of comparable data, especially at the onset of transition. According to the data availability, we limited the time span of our data to the period 1994–2015. The data on budget balance (cash surplus/deficit basis and at the general government level and as a fraction of GDP) come from the World Bank's World Development Indicators Database (2016). However, it is worthy to note here that the aforementioned data for Poland and Russia for the period 1994–2000, for Ukraine for the period 1994–1998, for Romania for the period 1994–2001, and for Hungary for 1994 were extracted from the respective International Monetary Fund (2016) country reports. As seen in column 1 of Table 1, most of our sample countries ran sizable budget deficits during the sample period.

The data on the trade balance, which refers to the difference between exports and imports of goods and services, were also obtained from the World Bank's World Development Indicators Database (2016). To obtain the trade balance as a share of GDP, we deducted the value of imports of goods and services-to-GDP from the value of exports of goods and services-to-GDP. Again, as seen in column 3 of Table 1, the countries under consideration predominantly ran trade deficits during the observation period.

Table 1 Summary Statistics

Country	Budget balance to GDP		Private savings-investment balance to GDP		Trade balance to GDP	
	Mean	Std. dev.	Mean	Std. dev.	Mean	Std. dev.
Russia	-0.09	6.15	7.92	6.77	9.11	4.39
Poland	-3.76	1.36	1.27	2.60	-1.81	2.70
Ukraine	-2.93	2.22	1.61	4.15	-2.27	6.03
Romania	-3.29	2.01	-3.31	4.21	-6.54	3.71
Czech Rep.	-2.65	1.37	3.07	3.54	1.12	3.32
Hungary	-5.38	1.87	4.31	3.12	0.86	4.31

Source: The International Monetary Fund (2016) and the World Bank (2016) data for budget balances, data from the United Nations (2016) and own calculations for private savings-investment balances, and the World Bank (2016) for trade balances.

To construct a data series for the private savings-investment balance, we drew on the United Nations National Accounts Main Aggregates Database (2016) to obtain data on both domestic savings and gross capital formation (a proxy for gross domestic investment). We used government general budget balance on a cash surplus/deficit basis as a proxy for government savings and deducted government savings from the figures for total domestic savings obtained from UN sources mentioned above to arrive at our private savings figures. The balance of private savings over gross domestic investment describes the private savings-investment balance.

3.2 Methodology

In the literature, there are commonly used three approaches for testing the direction of Granger causality in a panel data analysis. The first approach is based on estimating a panel vector error correction model by means of a generalized method of moments (GMM) estimator that estimates a panel model by eliminating the fixed effect. This approach does not account for heterogeneity or cross-sectional dependence. The second approach, proposed by Elena-Ivona Dumitrescu and Christophe Hurlin (2008), consists of a panel data causality test that allows for slope heterogeneity. This approach does not take into account cross-sectional dependence, which, if it exists, creates substantial biases and size distortions. The last approach, proposed by Kónya (2006), allows both heterogeneity and cross-sectional dependence to be taken into account.

For this study, we adopted and then employed the Kónya's (2006) approach which has three fundamental superiorities over the first two approaches. First, Kónya's (2006) approach is based on the SUR procedure, allowing us to take into account cross-sectional dependence across countries. Second, it does not require the joint hypothesis for all members of the panel because it is based on a Wald test with country-specific bootstrap critical values. Finally, it requires no pre-testing for panel unit roots or cointegration relationships. A general drawback of the unit root test is its low testing power, which can lead to incorrect judgments with regard to cointegration relationships.

Here, we consider the possible existence of a direct relationship between budget deficits, and trade deficits, and/or among budget deficits, private savings-investment deficits, and trade deficits. To do so, we employed the bootstrap Granger causality approach, based on bivariate – budget balance (BB) and private savings-investment balance (SIB) – and tri-variate – (BB), (SIB), and trade balance (NXB) – finite-order vector

autoregressive models. As stressed above, the bootstrap panel causality approach is superior to the other two techniques in terms of accounting for cross-sectional dependency and country-specific heterogeneity. In detecting Granger causal relationships, the bootstrap panel causality approach is based on a SUR estimation of the set of equations and Wald statistics with country-specific bootstrap critical values. Notably, it is important that Kónya's (2006) approach does not require any pre-testing for the panel unit root and cointegration. Since country-specific bootstrap critical values are used, the model variables need not be stationary. The variables can be used in level form regardless of their unit root and cointegration properties.

The panel causality approach of Kónya (2006) can be formulated for the twin and triple deficits hypotheses as follows:

$$NXB_{1t} = \alpha_{11} + \sum_{l=1}^{p_1} \beta_{11l}NXB_{1t-l} + \sum_{l=1}^{p_1} \delta_{11l}BB_{1t-l} + \sum_{l=1}^{p_1} \varphi_{11l}SIB_{1t-l} + \varepsilon_{11t}$$

$$\vdots$$

$$NXB_{Nt} = \alpha_{1N} + \sum_{l=1}^{p_1} \beta_{1Nl}NXB_{Nt-l} + \sum_{l=1}^{p_1} \delta_{1Nl}BB_{Nt-l} + \sum_{l=1}^{p_1} \varphi_{1Nl}SIB_{Nt-l} + \varepsilon_{1Nt}$$
(11)

$$BB_{1t} = \alpha_{21} + \sum_{l=1}^{p_2} \beta_{21l}NXB_{1t-l} + \sum_{l=1}^{p_2} \delta_{21l}BB_{1t-l} + \sum_{l=1}^{p_2} \varphi_{21l}SIB_{1t-l} + \varepsilon_{21t}$$

$$\vdots$$

$$BB_{Nt} = \alpha_{2N} + \sum_{l=1}^{p_2} \beta_{2Nl}NXB_{Nt-l} + \sum_{l=1}^{p_2} \delta_{2Nl}BB_{Nt-l} + \sum_{l=1}^{p_2} \varphi_{2Nl}SIB_{Nt-l} + \varepsilon_{2Nt}$$
(12)

$$SIB_{1t} = \alpha_{31} + \sum_{l=1}^{p_3} \beta_{31l}NXB_{1t-l} + \sum_{l=1}^{p_3} \delta_{31l}BB_{1t-l} + \sum_{l=1}^{p_3} \varphi_{31l}SIB_{1t-l} + \varepsilon_{31t}$$

$$\vdots$$

$$SIB_{Nt} = \alpha_{3N} + \sum_{l=1}^{p_3} \beta_{3Nl}NXB_{Nt-l} + \sum_{l=1}^{p_3} \delta_{3Nl}BB_{Nt-l} + \sum_{l=1}^{p_3} \varphi_{3Nl}SIB_{Nt-l} + \varepsilon_{3Nt}$$
(13)

where NXB, BB, and SIB denote trade balance, budget balance, and private savings-investment balance, respectively. Also, N represents the number of countries of the panel ($i = 1, 2, 3, \dots, N$), t is the time period ($t = 1, 2, 3, \dots, T$), and l is the lag length. The error terms ε_{1Nt} , ε_{2Nt} , and ε_{3Nt} are supposed to be white-noises (i.e., they have zero means, constant variances, and are individually serially uncorrelated) and may be correlated with each other for a given country.

We assumed that NXB, BB, and SIB are stationary or cointegrated; therefore, depending on the time-series properties of the data, they may denote the level, the first difference, or some higher difference. To test for the panel Granger causality in this

system, alternative causal relations for a country are likely to be found. For example, there is a one-way Granger causality running from BB to NXB if not all $\delta_{1,I}$ are zero, but all $\beta_{2,I}$ are zero; there is one-way Granger causality from NXB to BB if all $\delta_{1,I}$ are zero, but not all $\beta_{2,I}$ are zero; there is two-way Granger causality between BB and NXB if neither $\delta_{1,I}$ nor $\beta_{2,I}$ is zero; there is no Granger causality between BB and NXB if all $\delta_{1,I}$ and $\beta_{2,I}$ are zero. This definition can easily be extended to causal relations among the budget balance, the private savings-investment balance, and the trade balance. To determine the direction of causality, the Wald statistics for Granger causality were compared with country-specific critical values obtained from the bootstrap sampling procedure.

As the results from our Granger causality test may be sensitive to lag structure, determining the optimal lag length(s) was crucial to ensure the robustness of the findings. To determine the optimal lag structure, we followed Kónya's (2006) approach, whereby maximal lags are allowed to vary across variables but remain the same across equations. We estimated the system for each possible trinity of $p_1p_1p_1$, $p_2p_2p_2$, and $p_3p_3p_3$ by assuming the existence of one to four lags and then chose the combinations that minimize the Akaike information criterion (AIC) and Schwartz information criterion (SIC).

4. Empirical Results

Taking into account cross-sectional dependence and country-specific heterogeneity in the empirical analyses was essential since our sample countries are highly integrated and highly globalized in their economic relations. If a cross-sectional dependency does exist, the use of the SUR approach could be more efficient than an ordinary least-squares (OLS) approach in estimating panel data causality. Moreover, the causality results obtained from the SUR estimator developed by Arnold Zellner (1962) should be more reliable than those obtained from country-specific OLS estimations. The Monte Carlo experiment of M. Hashem Pesaran (2006) emphasizes the importance of testing for the cross-sectional dependence in a panel data study. It also illustrates the substantial bias and size distortions that arise when cross-sectional dependence is ignored. A further issue to decide was whether to treat slope coefficients as homogenous to impose the causality restriction on the estimated parameters. The causality from one variable to another by imposing the joint restriction for the panel is the strong null hypothesis and the homogeneity assumption for the parameters is unable to capture heterogeneity due to country-specific characteristics. Thus, we started our empirical analysis by testing for cross-sectional dependency followed by slope homogeneity across countries. We then opted for the appropriate panel causality method in order to identify the direction of causality between the budget balance, the private savings-investment balance, and the trade balance in the sample countries.

To investigate the existence of cross-sectional dependence, in turn, we implemented four tests: the LM, CD_{lm} , CD, and LM_{adj} tests, as in the work of Hüseyin Şen, Ayşe Kaya, and Barış Alpaslan (2018). The results of these tests were summarized in Table 2. As shown from the table, the null hypothesis of no cross-sectional dependence across the countries was strongly rejected at the 1% level of significance, implying that the SUR method is more appropriate than a country-by-country OLS estimation. The

results presented in Table 2 indicate that a shock in one sample country was transmitted to the other countries under consideration. The same table also reports the results of two slope homogeneity tests ($\tilde{\Delta}$, $\tilde{\Delta}_{adj}$). The results of both tests resulted in a rejection of the null hypothesis of slope homogeneity for each group of countries, thus supporting country-specific heterogeneity. The rejection of slope homogeneity hints at the idea that the panel causality analysis imposing homogeneity restrictions on the variable of interest resulted in misleading inferences.

Table 2 Cross-Sectional Dependence and Homogeneous Tests

Test	Statistic	p-value
LM	31.7000*	0.000
CD _{LM}	14.146*	0.000
CD	7.215*	0.000
LM _{adj}	4.588*	0.000
$\tilde{\Delta}$	4.217*	0.000
$\tilde{\Delta}_{adj}$	2.055*	0.000

Notes: * indicates rejection of the null hypothesis at the 1% level of significance. The data covers the whole sample period from 1994 to 2015.

Source: Authors' calculations.

The existence of cross-sectional dependence and heterogeneity across countries supports the suitability of the bootstrap panel causality approach. The results provided from bootstrap panel Granger causality analysis are presented in Tables 3 and 4 (see Tables A1 and A2 of the Appendix for the other Granger causality analyses).

The results reported in Table 3 suggest that there exists a significant but negative, Granger causality from budget deficits to trade deficits at the 10% level of significance only for Poland and Romania. However, we do not find any significant relationship between budget deficits and trade deficits for Russia, Ukraine, the Czech Republic or Hungary. Additionally, Table 3 indicates the existence of a significant and positive Granger causality that runs from trade deficits to budget deficits at the 10% level of significance for three post-communist countries (Russia, Romania, and Hungary). The possible explanation for these findings might be that widening trade deficits may have decreased aggregate demand in these countries, resulting in a reduction in output due to increasing unemployment. To overcome this problem, their governments may have attempted to boost their economies through expansionary fiscal and monetary policies such as allowing budget deficits, increasing reliance on foreign borrowing, or injecting money into the economy to eliminate the loss of exports. Thus, trade deficits are likely to cause budget deficits, especially if they are financed through external borrowing.

Overall, the empirical findings led us to reject the validity of the twin deficits hypothesis for all countries under examination. However, we found reverse causality – a Granger causality – running from trade deficits to budget deficits for Russia, Romania, and Hungary. This could be attributed to the fact that these countries are in need of foreign capital inflows to finance their economic development.

Table 3 Granger Causality between Budget Balance (BB) and Trade Balance (NXB)

Country	Estimated coefficient	Wald test stat.	Bootstrap critical values			Granger causality Yes/No
			10%	5%	1%	
H ₀ : Budget deficits do not cause trade deficits						
Russia	-0.01417	0.43256	7.47156	10.47450	18.11723	No
Poland	-0.40196	8.43258***	6.15855	10.14831	19.55460	Yes
Ukraine	0.23299	0.97330	6.65377	9.95445	16.42181	No
Romania	-0.92127	20.21801***	7.25378	11.68902	22.02418	Yes
Czech Rep.	-0.13700	0.42418	6.50229	9.31635	18.09784	No
Hungary	0.15851	1.90335	5.93813	9.32911	17.52058	No
H ₀ : Trade deficits do not cause budget deficits						
Russia	0.76506	11.36402***	6.98460	10.02202	17.03746	Yes
Poland	0.17616	3.26943	7.34278	10.49092	20.58118	No
Ukraine	0.21562	6.33453	6.90454	9.83368	21.95512	No
Romania	0.16368	6.87793***	6.84512	10.73502	16.51710	Yes
Czech Rep.	-0.01992	0.3514723	7.601263	11.43412	20.26351	No
Hungary	0.63412	9.06174***	7.46132	10.96323	18.97069	Yes

Notes: The data cover the whole sample period from 1994 to 2015. *** indicates statistical significance at the 10% level of significance. Critical values are based on 1000 bootstrap replications.

Source: Authors' calculations.

The results of our tri-variate model, where NXB is the independent variable and BB and SIB are the dependent variables, are reported in Table 4. As seen in the table, the bootstrap critical values considerably higher than the chi-square critical values usually applied to the Wald test, and they varied considerably from country to country. The Granger causality test results for the null hypothesis revealed that BB and SIB do not Granger cause NXB as indicated in the Wald test column of Table 4. In other words, the null hypothesis of non-causality was accepted for all the countries studied. We did not find any empirical support for the validity of the triple deficits hypothesis for these countries.

Table 4 Granger Causality from Budget Balance (BB) and Private Savings-Investment Balance (SIB) to Trade Balance (NXB)

Country	Estimated coefficient	Wald test stat.	Bootstrap critical values			Granger causality Yes/No
			10%	5%	1%	
H ₀ : Budget deficits and savings-investment deficits do not cause trade deficits						
Russia	-17.78351	0.81432	9.40532	16.11899	54.14227	No
Poland	93.96119	3.83170	6.48753	8.13148	12.97253	No
Ukraine	14.07782	4.66674	8.36589	10.92496	18.56477	No
Romania	225.76808	3.48477	11.07674	13.81514	23.27156	No
Czech Rep.	-24.60125	0.13740	7.78581	9.13651	17.55413	No
Hungary	-160.52844	4.83125	5.24377	8.91704	20.16101	No

Notes: The data cover the whole sample period from 1994 to 2015. Critical values are based on 1000 bootstrap replications.

Source: Authors' calculations.

Overall, Table 5 summarizes the results of the direction of panel Granger causality among the three variables for all the countries examined. As seen in the table, the empirical results did not support the validity of the twin or the triple deficits hypotheses for any of the sample countries. Specifically, in no-country under examination did budget deficits Granger cause trade deficits, and the existence of dual domestic deficits (budget plus savings-investment deficits) led to external deficits.

Table 5 Direction of Granger Causality for the Sample Countries

Direction of Granger Causality	Country	Does Granger causality exist?	
BB → NXB	Poland and Romania	Yes	Significant and negative
	Russia, Ukraine, the Czech Republic, and Hungary	No	Insignificant
NXB → BB	Russia, Romania, and Hungary	Yes	Significant and positive
	Poland, Ukraine, and the Czech Republic	No	Insignificant
BB → SIB	Poland and Romania	Yes	Significant and negative
	Russia, Ukraine, the Czech Republic, and Hungary	No	Insignificant
SIB → BB	Russia, Ukraine, and Hungary	Yes	Significant and positive
	Poland, Romania, and the Czech Republic	No	Insignificant
SIB → NXB	Poland and Romania	Yes	Significant and positive
	Russia, Ukraine, the Czech Republic, and Hungary	No	Insignificant
NXB → SIB	Poland and Romania	Yes	Significant and negative
	Russia, Ukraine, the Czech Republic, and Hungary	No	Insignificant
BB, SIB → NXB	Russia, Poland, Ukraine, Romania, the Czech Republic, and Hungary	No	Insignificant

Notes: BB, SIB, NXB denote budget balance, private savings-investment balance, and trade balance, respectively. → represents Granger causal direction.

Source: Authors' calculations.

5. Closing Remarks

This study tested the validity of the twin and triple deficits hypotheses by using an annual panel data from six post-communist countries, spanning from 1994 to 2015. We found no evidence in favor of the twin or triple deficits hypotheses for the sample countries. In other words, there is no Granger causality running from budget deficits to trade deficits and no Granger causality running from internal deficits (budget deficits plus private savings-investment deficits) to trade deficits when the sample countries were considered. Our findings suggest that the Ricardian view on the twin and triple deficits hypotheses holds for the countries under consideration over the observation period. These findings are broadly parallel those of similar studies conducted for non-post-communist countries. Moreover, our findings are in concordance with all but a limited number of studies regarding this subject on post-communist countries, specifically Gurgul and Lach (2012), Aristovnik and Đurić (2013), and Gabrisch (2015).

On balance, the findings above may be justified based on several arguments. The first argument involves the presence of an output gap. Indeed, with some minor exceptions, in the first decade of transition, actual output remained well below its potential level in all the sample countries. Given that, increases in aggregate demand following expansionary fiscal policies may have been masked by increases in domestically produced goods and services, rather than through imports. The second plausible explanation may be a substantial exogenous increase in private investment. These investment booms might have been generated through foreign technical assistance, technological innovation, successful market-oriented reforms, or a combination of all three. Successfully implemented free-market reforms, in particular, would have conferred the economic benefits of growth, enhanced trade competitiveness, and inflows of much-needed foreign capital. Third, there was the external assistance these countries received at the earlier stages of transition from international financial organizations such as the IMF, the World

Bank, as well as bilateral donors. Besides, the countries that had already joined the EU received substantial financial and technical support from the EU throughout their accession processes. Finally, Russia and Ukraine are two major commodity-exporting countries within the sample countries. These are the most resource-rich countries, particularly in terms of iron and steel, and they play leading roles in these products in related international markets. Furthermore, Russia is rich in oil as well as natural gas. Naturally, these goods constitute a greater part of Russian exports. This implies that external factors play an important role in the export earnings of these countries. Additionally, over the observation period, several currency devaluations effectively restrained imports to Russia and Ukraine.

The countries under consideration consist of countries that transformed from centrally planned economies to market economies in a long-lasting transition process. So, they are all relatively closed economies, or at least they were during the period of transition. Due to this fact, the nexus between internal and external deficits may have missed. Another possible justification may be the co-existence of rises in private savings together with the crowding-out effect, leading to the Ricardian effect. One more argument could be that increases in the imports of intermediate goods in the countries in the sample resulted in widening trade deficits. Therefore, one could argue that imports of intermediate goods in the domestic market boosted domestically produced final products as well as increased tax revenues, resulting in lower budget deficits.

Overall, based on our empirical findings, it may be argued that if the Ricardian view holds true, fiscal policy is limited in its ability to influence trade deficits. From a policy standpoint, such a piece of evidence implies that the causes of large and persistent external deficits should be sought somewhere else rather than the budget side of the economy. Several factors may explain this, ranging from the structure of foreign trade, the exchange rate regime adopted, the international competitiveness of the particular country in question, and the degree of capital mobility in the Feldstein-Horioka puzzle. Nevertheless, cases in which the twin or triple deficits hypotheses would apply are more likely to occur in countries with economies that are highly integrated with international markets, remain open to capital movements, and experience intense international competition.

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Appendix

Other Results Obtained from the Bootstrap Panel Granger Causality Analysis

Table A1 Granger Causality between Budget Balance (BB) and Private Savings-Investment Balance (SIB)

Country	Estimated coefficient	Wald test stat.	Bootstrap critical values			Granger causality Yes/No
			10%	5%	1%	
H ₀ : Budget deficits do not cause private savings-investment deficits						
Russia	-0.24015	4.15312	6.42051	9.26007	19.77015	No
Poland	-0.80465	17.94601***	6.15127	8.90549	17.64315	Yes
Ukraine	0.40102	2.12901	6.51255	10.25874	23.42964	No
Romania	-0.93199	11.22964***	8.89225	12.54372	20.65099	Yes
Czech Rep.	-0.07379	0.16134	6.48338	9.45151	18.44192	No
Hungary	0.20467	2.22192	6.67167	9.46679	16.74245	No
H ₀ : Private savings-investment deficits do not cause budget deficits						
Russia	0.80199	13.06200***	6.26973	9.34874	19.20931	Yes
Poland	0.204626	3.35725	7.18377	10.81664	20.25504	No
Ukraine	0.25675	6.64606***	5.57115	8.87005	16.3769	Yes
Romania	0.20138	6.41930	7.15836	10.92179	18.41324	No
Czech Rep.	-0.063012	0.19383	8.18715	12.10805	24.55494	No
Hungary	0.77152	8.88531***	5.56444	8.40617	14.69034	Yes

Notes: The data cover the whole sample period from 1994 to 2015. *** indicates statistical significance at the 10% level of significance. Critical values are based on 1000 bootstrap replications.

Source: Authors' calculations.

Notably, there is a significant and negative Granger causality running from budget deficits to the private savings-investment deficits for Poland and Romania. Moreover, only three of the sample countries (Russia, Ukraine, and Hungary) exhibit significant and positive Granger causality running from private savings-investment deficits to budget deficits. With the exception of the Czech Republic, the null hypothesis of no Granger causality from budget deficits to private savings-investment deficits or *vice versa* cannot be rejected.

Table A2 indicates significant and positive Granger causality running from private savings-investment deficits to trade deficits for Poland and Romania, but not for the other four countries. On the other hand, our findings suggest the causal direction from trade deficits to private savings-investment deficits is valid for Russia, Ukraine, the Czech Republic, and Hungary, implying that the null hypothesis stands for these countries (i.e., there is no Granger causality in this direction). For Poland and Romania, however, there is a significant, but negative, Granger causality running from trade deficits to private savings-investment deficits.

Table A2 Granger Causality between Private Savings-Investment Balance (SIB) and Trade Balance (NXB)

Country	Estimated coefficient	Wald test stat.	Bootstrap critical values			Granger causality Yes/No
			10%	5%	1%	
H ₀ : Private savings-investment deficits do not cause trade deficits						
Russia	0.02441	0.54683	6.72988	10.92135	20.78324	No
Poland	0.51152	8.66079***	6.41341	8.45589	17.95777	Yes
Ukraine	-0.24530	0.56499	6.37703	9.64124	15.51850	No
Romania	0.93565	21.11814***	7.90110	11.83135	23.58576	Yes
Czech Rep.	0.20228	0.55746	6.28131	10.14625	20.85242	No
Hungary	-0.16245	0.92193	5.86019	8.56491	19.48976	No
H ₀ : Trade deficits do not cause private savings-investment deficits						
Russia	-0.34753	3.76266	6.71692	9.26084	20.21147	No
Poland	-0.94960	22.19717***	6.75398	10.10181	17.50210	Yes
Ukraine	0.43068	1.61039	7.57116	10.82078	21.11049	No
Romania	-0.74480	11.84620***	7.34181	11.34002	21.12210	Yes
Czech Rep.	-0.13292	0.96389	6.41477	9.88861	20.66084	No
Hungary	0.22337	2.15121	6.04168	9.81286	19.73222	No

Notes: The data covers the whole sample period from 1994 to 2015. *** indicates statistical significance at the 10% level of significance. Critical values are based on 1000 bootstrap replications.

Source: Authors' calculations.

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