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Short-term fiscal imbalance comparison in V4 countries using a dynamic conditional correlation approach

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Keywords: *primary balance; dynamic conditional correlation approach; V4 countries; consolidation policy; role of government*

Abstract

Research background: The crisis periods have highlighted the interdependence between individual European economies in the area of economic and fiscal development. The common development tendencies raise the question whether the fiscal indebtedness and preferred fiscal policy of V4 countries can be considered as interdependent. Considering this assumption, a possibility for implementing a similar type of consolidation in selected clusters of countries could be proposed.

Purpose of the article: The research is, from the empirical point of view, focused on the analysis and comparison of primary balance indicator, analysis and assessment of fiscal measures (in identified fiscal episodes) and analysis of fiscal development intercorrelations using the dynamic conditional correlation approach.

Methods: The empirical assessment of the research objective is, from the methodological point of view, divided into five phases: (1) the calculation of primary deficit indicator, (2)

the analysis, comparison and assessment of the fiscal development in the V4 countries based on the annual primary deficit during the selected period 1999–2016, (3) the seasonal adjustment of performing time series and non-stationarity testing, (4) the dynamic conditional correlation approach (DCC) application. Within the analysis, the traditional and specific methods were used (time series analysis, content analysis, descriptive statistics, correlation methods, DCC approach).

Findings & Value added: The results of the research suggest that between V4 countries do exist significant differences based on which cannot be clearly confirmed the assumption about the fiscal development interdependence in V4 countries. From the long-term perspective, it can be stated that the fiscal development in V4 countries is a very slightly positively related aspect, but in the context of the implementation of a common consolidation strategy it is not sufficient.

Introduction

Development of fiscal imbalance in the EU has been pointing to an increasing deficit slope since the 70's of the 20th century (European Commission, 2000). Issues aimed at defining the type of fiscal consolidation, the determination of the specific components of one-side-oriented consolidation, and the determinants of individual components, came into the spotlight of a large part of the literature and empirical studies (Afonso & Jalles, 2016; Bröthaler & Getzner, 2015; Mirdala, 2013; Alesina & Ardagna, 2013; Nickel, Rother, & Zimmermann, 2010; Barrios, Langedijk, & Pench, 2010; Guichard, Kennedy, Wurzel, & André, 2007; OECD, 2007; etc.). According to the empirical research, the composition of consolidation seems to be one of the most important determinants of its success (Alesina & Ardagna, 2010). However, in practice, the focus of fiscal consolidation is to a certain extent a "stumbling block" among the indebted countries (Dráb & Mihóková, 2011).

The crisis periods highlighted an interdependence between individual economies and a conditionality of economic and fiscal development between the European countries. Globalisation and openness have become one of the main channels for crisis impact transmission and stimulation for common consolidation efforts in countries. Therefore, in the development of the fiscal management are visible common development tendencies that raise the question whether the fiscal development, fiscal indebtedness and preferred fiscal policy of EU countries from the empirical point of view can be considered as interdependent. Based on that, the possibility of implementing a "similar" or "uniform" type of consolidation in countries (or cluster of countries) has to be considered.

The objective, research methodology and data

The main objective of the research is, through the fiscal management analysis of the V4 countries and their intercorrelations, to assess the possibilities for common fiscal consolidation model adoption. The analysis objective is to verify if an interdependency in the primary deficit of the V4 countries exists by using the estimates of dynamic conditional correlation, and thus to verify the possibility for similar fiscal consolidation strategies implementation.

As part of the research, two approaches were used. The first one, described as "standard", is an analysis of the traditional fiscal indicator in the form of a cyclically adjusted primary balance. The primary balance was used in order to eliminate the impact of past interest on public debt (Alesina & Ardagna, 2010) and to eliminate the effects of business cycles on the fiscal stance (Mirdala, 2013). To investigate the conditionality of implemented fiscal consolidation types an analysis of the period 1999–2016 was conducted, focused on the periods in which the consolidation took place, and the measures that the countries applied.

The second approach, for the purpose of research described as "specific", represents a method of dynamic conditional correlations (hereinafter "DCC approach"). DCC's method verified whether the fiscal developments and fiscal consolidation strategies in the V4 countries are interdependent. The application of DCC approach in 1999–2016 allowed to analyse the development of year-by-year changes in primary balances in V4 countries, their convergence and oscillation, while the method has erased the time series of short-term memory.

As a part of these approaches, Table 1 presents specific indicators, general methods and statistical methods (tests), and data processing.

The empirical assessment of the research objective was, from the methodological point of view, divided into five phases. The first phase is focused on the calculation of primary deficit indicator as its year-by-year changes (or quarter-by-quarter change) during the selected period. The primary deficit indicator is calculated according to accounting framework ESA 2010 for general government. The primary deficit (PB) for the country (i) in time (t) is calculated as the value of seasonally unadjusted (nsa) net lending (+)/net borrowing (-) (NL/NB) excluding interest (IR) paid by general government from previous government debt expressed in millions of euro (1). The year-by-year change (or quarter-by-quarter change) of primary balance in V4 countries is expressed as the increment growth in % ($\Delta NL/NB$) according to following formula (2).

$$PB_{i,t} = NL / NB_{nsa,i,t} + IR_{nsa,i,t} \quad (1)$$

$$\Delta PB_i = \frac{PB_{i,t} - PB_{i,t-1}}{PB_{i,t-1}} = \frac{(NL / NB_{nsa,i,t} + IR_{nsa,i,t}) - (NL / NB_{nsa,i,t-1} + IR_{nsa,i,t-1})}{(NL / NB_{nsa,i,t-1} + IR_{nsa,i,t-1})} \quad (2)$$

The second phase was focused on the analysis, comparison and assessment of the fiscal development in the V4 countries based on the annual primary deficit during the selected period 1999–2016. Time series analysis was focused on time windows where the consolidation took part (fiscal consolidation episodes) and on measures that were used by the countries during the consolidation. The fiscal consolidation episodes were identified during the period of 1995–2016 in all EU countries based on the two rules (Table 2) described in research Mihóková *et al.* (2016) and according to the methodology of selected research: European Commission (2007) and Alesina and Ardagna (2010).

In the third phase, a seasonal adjustment of time series (1999Q1–2016Q3) using the X-13 13ARIMA-SEATS was performed. The original and adjusted time series of a primary deficit in V4 countries are illustrated in the following figures (Figure 1).

After the adjustments, the time series follow the original trend. Its development was driven mainly by the income and expenditure side components changes, economic development and political factors and in 2007 also by exogenous factors like the crisis. In other periods, windows are an insignificant seasonal component.

Augmented Dickey-Fuller test (ADF test) was used for testing for non-stationary of analysed time series within the fourth phase of the research.

Stationary character of the time series of a primary deficit was confirmed.

The fifth phase of the research was the dynamic conditional correlation approach (DCC) application. With the aim to eliminate the short-term volatility of the primary balance following time series in individual countries a DCC estimate from the period 1999Q1–2016Q3 was used. The volatility elimination enables to capture stable periods with the low variable volatility that alternate the more volatile periods.

DCC method was first introduced by Engle and Sheppard (2001). Their application was used on revenues of k financial instruments analysed in n periods. In the case of primary balance, the k represents its growth rate in a country during n periods. The correlation matrix has a $k \times k$ dimension

and represents a static view on the analysed periods where the correlation is expressed:

Where the numerator represents the reciprocal primary balance covariance, denominator represents the primary balances standard deviations. If a presumption of changing primary deficits volatility is present, then a dynamic structure of primary deficit correlation should be considered. The conditioned correlation coefficient between the i -th and j -th primary deficit in time t can be expressed as:

$$\rho_{ij_t} = \frac{q_{ij_t}}{\sqrt{q_{ii_t} q_{jj_t}}} \quad (3)$$

Where q_{ijt} is a conditional variation covariation square residual matrix with the dimension of $k \times k$. Based on this method t matrixes are generated for each period. In the case when DCC record a positive value, a similar trend is observed among the matrixes. If the DCC records negative values, an opposite trend is observed. Table 3 presented below captures the results for the analysed data using the R software and the packages *rmgarch* and *PerformanceAnalytics*.

From the results it can be stated that a very weak correlation between the countries' developments of the primary deficits exists. For further analysis, a closer view of the dynamic correlation in V4 countries needs to be applied.

Research results

Assessment of fiscal development in V4 countries within "traditional" approach

The real development of primary balance in individual V4 countries (Figure 2 — Figure 5) confirmed that the primary deficit is always lower than the actual government deficit.

Slovakia has overcome high levels of primary deficits (in 1999–2002), caused mainly by the slowdown in GDP growth and increased interest rates. Another factor contributing to the reduction were the consolidation measures that Slovakia took in 2001 and 2003 together with the context of accession to the EU. Declining interest payments on the debt with the growing pace of economic growth have led to a reduction in the primary deficit to -0.4 % of GDP. The positive fiscal position began to deteriorate

due to the crisis, especially in 2009 and 2010, when the primary deficit amounted to -6.6 % of GDP (2009) and -6.3 % of GDP (2010). Consolidation efforts that Slovakia made in the years 2011 and 2013 greatly influenced the outcome of the countries' fiscal management.

The Czech Republic recorded a high negative primary balance, until the year 2003. Interest payments, at a stable low level of 1.1 % of GDP, suggesting that the high deficit levels are mainly due to structural problems and the economic performance decline. Fiscal consolidation that was implemented in 2004 contributed to the significant reduction in the primary deficit. The relatively stable rate of real GDP growth (except for Slovakia and the Baltic countries, the highest growth rate in the EU), in conjunction with a stable share of public revenue and the trend of reduction in the share of public spending on GDP since 2004, indicated a positive trend of country's fiscal management. Country's surplus (0.4 % of GDP) has since 2008 due to the crisis dramatically dropped. Since 2009–2011, CZ implemented a so-called. "gradual" fiscal consolidation, which reduced the value of the primary deficit has greatly contributed to the net lending/net borrowing decline.

Hungary in 1999–2001, recorded a primary surplus, which was, despite the high value of the interests, the result of the consolidation effort implemented in 1999. Fiscal management significantly deteriorated until 2003, and thus the country, in accordance with the requirements of the EU accession, implemented consolidation measures. In 2007 another one-off consolidation was implemented. Other measures in the consolidation efforts framework were conducted in the following years in 2008 with an IMF bailout and the country reduced the net lending to the level of 3.64 % in 2008. The crisis effect led to the growth of net lending in 2011. In 2011 and 2012 Hungary started a major one-off measure that resulted in a surplus of 2.1 % of GDP. The adopted measures have contributed to a positive trend in the primary surplus and fiscal management with low levels of net lending, until 2016.

In Poland after the accession into the EU, the fiscal management has changed significantly, which has contributed to the fact that in 2007 Poland recorded a primary surplus of 0.4 % of GDP. Interest paid on debt had a downward trend that contributed positively to the development of the primary deficit. Despite the increase in the share of the total deficit to GDP, Poland is the only V4 country that did not record a real GDP decline, only slowed down the pace of economic growth (3%). The fiscal measures adopted by the government in 2011 and 2012 contributed to the improvement of the country's fiscal management and improvement of the primary deficit in 2011 (-2.3 % of GDP) and 2012 (-1.1 % of GDP). The share of

the declining interest on the debt had an impact on the improvement of the real net lending. In 2013, Poland had its interest payments on debt at the same level as in the previous year, and on this basis it can be concluded that own management in the form of a primary deficit of -1.7 % of GDP contributed to the overall increase in the growth of short-term fiscal imbalances (0.8 % of GDP).

A similar trend can be identified in the primary balance development of V4 countries, which can suggest an existing interdependence of the fiscal development. The conducted analysis allowed to identify groups of countries in which a specific dominant trend in the primary balance was present. Four individual clusters within four time periods were identified (Table 4).

In the context of the interdependence development, a negative or a positively correlated relation between each pair of countries' primary balance development identified. The analysis results show the six groups of countries and four time periods (Table 5).

Fiscal episodes and consolidation strategy in V4 countries

Identification of consolidation episodes pointed out that in the V4 countries consolidation has been observed from 1998 to the present, and as a typical consolidation effort the so-called "cold shower" approach was used. The time distribution of fiscal episodes determined the selection of the analysis period also for the dynamic conditional correlation approach and constituted a basis for examining the similarities and conditionalities of accepted consolidation measures. The results of fiscal episodes' identification for V4 countries illustrates the Table 6.

Analysis of the primary balance pointed out that consolidation efforts, present in the years 1999–2007 were strengthened not only during the crisis period (2008–2010), but also after the crisis (2011–2016). Consolidations, which were realized in V4 countries before 2004, were mainly associated with the effort to fulfil the criteria for joining the EU. Despite the necessity of retaining the fiscal condition the deficient tendency of public finances in 2005–2007 remained still present. Although the countries had achieved a positive fiscal position before the crisis, the crisis itself has fostered the existing persistent structural problems of countries' fiscal systems. Given the importance of the crisis period in the countries' consolidation strategies, the analysis has been focused on the measures implemented in those years (Table 7).

V4 countries' measures were implemented on both the revenue and the expenditure side, and therefore in some cases it was not clear what type of consolidation the country had applied.

The revenue based consolidation of the V4 countries was focused mainly on the taxation area. The countries focused on the transfer of the tax burden into the indirect taxation field, the social contributions and into the VAT efficiency increase and issues of tax governance. Three out of the four countries, apart from those areas, took the road of reforming the pension system.

Expenditure consolidation in three of the four V4 countries was focused primarily on austerity measures in the form of spending cuts in essential areas such as staff salaries, expenditure on intermediate goods, capital expenditures and social transfers. The exception was PL, which was focused on the implementation of the measures on the labour market and to promote employment, pension area system and social system.

Assessment in V4 countries within the "special" approach

Classical correlation approach, based on the literature review has identified three pairs of countries that form the basis for the implementation of DCC model GARCH (1, 1). The method compares mutual matrixes for each time period between a pair of countries using the equation (4). Graphical interpretation of conditional dynamical correlations between countries is illustrated in Figure 6, where DCC average is highlighted in red dashed line, and usually converges to a Pearson correlation coefficients indicated in Table 4. The blue dashed lines show increased and decreased average values of the standard deviation. In the case when DCC values record positive numbers, a similar development trend is present. In the case of the negative values, an opposite trend is present between the pair of countries.

From the Pearson's coefficients values, a more significant relation could be derived for these pairs of countries: SK-HU, PL-HU, PL-CZ, and SK-CZ. In the remaining cases there were values very close to zero, indicating a neutral independent relation. According to this fact, the analysis is therefore focused mainly on the three mentioned pairs.

In the case of the long-term relationship between SK-HU, there was the Pearson's coefficient above 0.05, which indicated a positive correlation. Based on the DCC approach, the prevailing positively correlated trends were identified in the period 1999–2008 (DCC average above 0.198). A similar trend was determined by the use of similar consolidation efforts in the EU pre-entry period. Since 2008 the economic performance has declined in both of the countries due to the crisis, which led to an increase in the primary deficit. Both countries used similar revenue (No. 1., 2., 4.; Table 8) and expenditure (No. 1., 3., 4.; Table 8) based measures to correct the situation. These measures were applied in different years. This fact

determined the negative correlation trends in 2009–2016. In 2013 HU authorities introduced two additional fiscal consolidation packages, one targeting the expenditure side and the other mainly raising and redesigning sector-specific taxes. Since 2013 SK has undergone a revenue based consolidation.

In the case of PL-HU relation, Pearson's coefficient was at the level from -0.0419, thus indicating a long-term negatively correlated relation of the fiscal development. This negative trend was highlighted in the period 2002–2012 (DCC average under -0.0267). Indications from Table 8 show that countries used similar consolidation strategies either revenue based in 2012 (No. 1., 2., 4.; Table 8) or expenditure based in 2013 (No. 1., 2., 8.; Table 8). The results suggest that the country's fiscal position in case of similar fiscal measures application is determined by the economic performance of the country. Positive correlation between countries was present only in short-time periods in 1999–2001 and 2012–2014.

Negative correlation in the primary balance was present in PL-CZ over a long period. The Pearson's coefficient confirmed this assumption with the value of -0.0395. From the correlation matrix analysis for each of the analysed period, a positive and neutral relationship between countries was identified in 1999–2007 period. The resulting relation could be determined by the lasting structural problems in the fiscal management, by the decline in the economic performance and size of the debt service costs in CZ. A slightly positive trend is present in 2011, when both countries applied similar revenue based (No. 1., 2., 3., 4.; Table 8) and expenditure based (No. 1., 6.; Table 8) measures.

The resulting correlations were determined by the situation in PL. The interesting fact was that, contrary to the other V4 countries, the deterioration of the fiscal situation in PL in 2009 was accompanied by positive economic growth. The biggest constraint to cut deficit was the considerable inflexibility of public expenses. The other important factor affecting consolidation design was the inflow of EU budget allocations to PL. The consolidation effort could be made on the revenue side as well as the expenses side. Until 2013, mostly revenue based strategies for the fiscal position adjustment were used in PL. Only after the year 2013, did PL change its strategy to expenditure based one.

The long-term relation between SK-CZ was, according to the Pearson's correlation coefficient (-0.0076), negatively correlated. Reciprocal negative correlation trend (under DCC average 0.025) was present in periods 2001–2007 and 2014–2016. The development was determined mainly by the differences in the consolidation strategies, economic performance and debt servicing costs. From the correlation matrix analysis for each of the

analysed period, a reciprocal positive correlation trend in 1999–2001 and 2008–2014 was identified. In the period of 2008–2014, a positive correlation trend (above the DCC average 0.025) was identified, which is in line with the measures of either revenue or expenditure based undertaken in the individual countries. In the crisis period (2008–2010) analysed countries have used revenue (No. 1., 2., 4.; Table 8) but also expenditure (No.1., 2., 4.; Table 8) based consolidation. In both countries a cold shower was recorded in 2013, followed by an expenditure-based consolidation.

In other cases the coefficient values were close to zero, which in the correlation context represents a neutral or independent relation. In the case of the HU-CZ, long-term relationship is the Pearson's coefficient equal to 0.00114. This value was neutral during the whole analysed period. Significant correlation was not recorded in the individual time periods analysis. In the case of the long-term relationship between SK-PL, according to the Pearson's coefficient (0.000345) a low (very small) negative correlation trends (below the DCC average 0.054) was recorded. From the results, it can be suggested that neither the development of the consolidation strategies nor the economic development had an impact on the fiscal development interdependence.

Discussion

Based on these results, it can be stated that the analysed period was characterised by a variable trend with three break points (2003, 2008 and 2011) (Tab. 5). In the development interdependence context, it can be stated that between countries both a negative and positive relation was identified (Tab. 6). Positive correlations were mostly accumulated in the crisis period (2008–2011 or 2012), while in the previous period (1999–2007) only in two cases (SK-HU and SK-PL). These findings are in line with several empirical studies (such as Koopman & Székely, 2009; Reinhart & Rogoff, 2009; Dvořák, 2008; etc.), confirming that negative effects of the systemic crisis have spread into all EU countries and revealed a strong interconnection of individual economies and their economic and fiscal interdependence.

In general, it can be stated that the development of the primary balance trends was similar, but only with a weak dynamic correlation between individual countries. The reasons for this fact could lie in various determinants (like growth of GDP, inflation, employment, government effectiveness and political stability, debt servicing cost or interest rate etc.), which are ac-

ording to research (such as Maltritz & Wüste, 2015 or Saraç & Basar, 2014; etc.).

The partial results indicated that the "traditional" approach using a primary balance indicator only is not sufficient. Despite that, several common trends among countries emerged the results show significant differences that reject the paper presumptions. Also, the graphical analysis and the Pearson's coefficient comparison supported those findings.

The results show that countries have been focused on both consolidation types. In several cases, the type of the consolidation was not possible to determine. Many pieces of research (such as Molnar, 2012; Nickett *et al.*, 2010; etc.) consider expenditure-based consolidation as successful because of its association with reforms that increase the efficiency of budgetary procedures. On the other hand, many bodies of research (such as European Commission, 2011; OECD, 2007; etc.) consider the revenue-based consolidation effective, especially in countries where there is space for increasing tax revenues that are less harmful to economic growth. Identified empirical findings confirm the contradiction in theories.

The focus of the analysis was on the crisis period, where more frequent consolidation interventions were expected. As the results show (Table 8), altogether three common consolidation periods were identified: (1) year 2011 for CZ, PL, SK, (2) year 2012 for PL and HU and (3) year 2013 for SK and CZ. In the years 2011 and 2012 CZ and SK preferred the expenditure-based consolidations that turned into revenue-based one in 2013. Hungary and Poland preferred a revenue-based consolidation that turned to expenditure-based in 2013. The consolidation type preference was determined by the recommendations of the European Commission, but also by the initial fiscal condition of the country, including the macroeconomic environment and political settings, that can be in accordance to EC (2007) be considered as the most important factors determining the beginning of consolidation. This situation was present in all of the V4 countries.

Based on the second partial analysis results, it can be stated that a positively correlated development occurred only in few cases. The source of this limited evidence could be found in the short-time preference of a specific measure or the time inconsistency of applied measures. The undertaken consolidation strategy played a minor role in the long-term context. The assumption about interdependence can be neither rejected nor confirmed. However, it needs to be noted that the results are determined by the used methodology of the fiscal episodes' identification.

The results pointed out that from the long-term perspective the fiscal development cannot be considered as conditionally interdependent. Given the fact that the results could be biased by the analysed data nature, were

the previous analysis supported by a "special" approach in the form of DCC. This method has eliminated the short-time data variability and so enabled to record stable time periods with low volatility in the form of dynamic charts of V4 countries' pairs. A very weak correlation between countries was identified during 1999Q1–2016Q3. However, in shorter periods (1999Q1–2002Q4, 2007Q1–2010Q4 a 2011Q1–2013Q4) significant correlations were identified. A positive correlation was identified during shorter periods for CZ-HU, CZ-PL and partially HU-SK, CZ-SK or SK-PL. According to results (Figure 6), it can be stated that in the analysed period mostly negative correlation was present, indicating that no long-term interdependence between countries exists. The DCC results confirm those from the previous two analyses. A positive interdependence between countries exists only in the short-time periods, which is not sufficient for the purpose of common consolidation implementation.

Conclusions

The main objective of the paper was to verify through selected methodology whether an interdependence in the primary balance development between V4 countries exists and so a common consolidation effort could be proposed. The analysis showed that despite the fact that primary balance development trends were similar among the countries, a mutual correlation was rather scarce. Positively correlated development was limited to short-time intervals (mainly due to EU pre-entry measures) and crisis period (2008–2011) only, thus in the common consolidation strategy implementation context not sufficient in the long-term perspective. The development was mainly determined by the numerous exogenous factors, which have contributed to significant differences in the countries' fiscal development. In line with the presented results, a common consolidation strategy can be proposed to the countries as a guide presenting the fields where a country can focus its reforms and consolidation measures. Based on the specific initial fiscal conditions, different economic performance, consolidation measures preference and other determinants a uniform consolidation in V4 countries cannot currently be applied.

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Annex

Table 1. Data and Methods

| Approach | | |
|--------------------|--|--|
| | “traditional” | “specific” |
| Variable(s) | Net lending/net borrowing and interest payable (sector: general government) (accounting framework: ESA 2010) | Net lending/net borrowing and interest payable (sector: general government) (accounting framework: ESA 2010) |
| Computed indicator | year-on-year change of primary deficit (computed based on (2)) | quartal-on-quartal change of primary deficit (computed based on (2)) |
| Methods | Quantitative research: time series analysis Qualitative research: observation, text and documents | Quantitative research: content analysis Qualitative research: text and documents |
| | General methods: analysis, comparison, induction, synthesis, Statistical methods: descriptive statistics, correlation methods (Pearson CC), seasonal adjustment (X-13ARIMA-SEATS method), stationary test (ADF test), DCC | |
| Processing | graphical and numerical description of data | |
| Data and Source | annual data: 1999 - 2016 Eurostat | quarterly data: 1999 - 2016 Eurostat |
| Unit of measure | Million euro (excessive deficit procedure) | Million euro (excessive deficit procedure) |

Table 2. Conditions of fiscal episode's identification

| Type of consolidation | Condition |
|------------------------------|--|
| "cold shower" (CD) | an improvement of the cyclically adjusted primary balance (CAPB) of at least 1.5 % of GDP in one single year |
| "gradual consolidation" (GC) | an improvement of the cyclically adjusted primary balance (CAPB) of at least 1.5 % of GDP over a period of three years where in each single year the improvement of the CAPB is less than 1.5 % of GDP and the CAPB does not deteriorate by more than 0.5 % of GDP compared to the year before |

Source: Mihóková *et al.*, (2016).

Table 3. Cor(dat, method = c("pearson"))

| | SK | CZ | HU | PL |
|----|---------------|---------------|---------------|--------------|
| SK | 1.0000000000 | | | |
| CZ | -0.0076170020 | 1.0000000000 | | |
| HU | 0.0523745945 | 0.0011427190 | 1.0000000000 | |
| PL | 0.0003450437 | -0.0395826240 | -0.0419280020 | 1.0000000000 |

Table 4. Trend of primary balance development in V4 countries

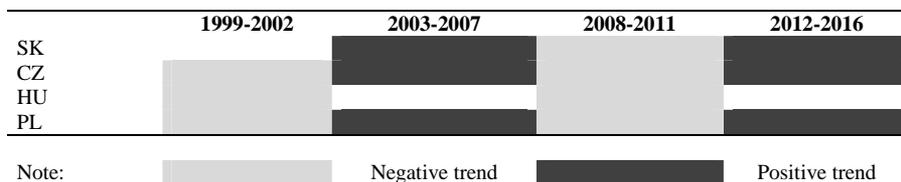


Table 5. Relations between primary balances in V4 countries

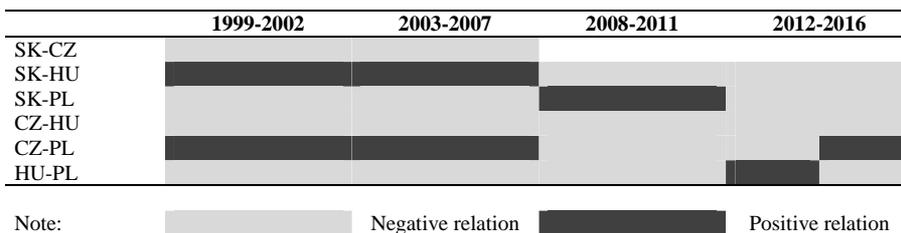


Table 6. Conditions of fiscal episode's identification

| Country | Year of consolidation |
|---------|--|
| | <i>CD ("cold shower") fiscal consolidation</i> |
| SK | 1998, 2001, 2003, 2011, 2013 |
| CZ | 2004, 2013 |
| HU | 1999, 2003, 2007, 2008, 2009, 2012 |
| PL | 2011, 2012 |
| | <i>GC ("gradual consolidation") fiscal consolidation</i> |
| SK | - |
| CZ | 2009, 2010, 2011 |
| HU | - |
| PL | - |

Source: Mihóková *et al.* (2016).

Table 7. Overview of the selected fiscal consolidation measures in V4 countries

| <i>Revenue measures</i> | | | | | |
|---|----------------|------|---------------|-----------|-----------|
| Measure/year | 2007 - 2009 | 2010 | 2011 | 2012 | 2013 |
| (1) Introduction new direct taxes and changes in tax rate or tax base in direct taxes | HU, CZ | CZ | CZ, SK, PL | PL, HU | SK |
| (2) Introduction new indirect taxes and changes in tax rate or tax base in indirect taxes | HU, CZ | CZ | CZ, SK, PL | PL, HU | SK, CZ |

Table 7. Continued

| <i>Revenue measures</i> | | | | | |
|--|----------------|------|------------|--------|--------|
| Measure/year | 2007 - 2009 | 2010 | 2011 | 2012 | 2013 |
| (3) Abolishing or introducing exceptions, tightening the rules or restricting deductions in taxes | CZ | CZ | CZ, PL | PL, HU | SK |
| (4) Changes in social security contributions (healthcare, pension or another type of insurance) | HU, CZ | CZ | CZ, SK, PL | PL, HU | SK, CZ |
| (5) Abolishing exceptions, tightening the rules or restricting deductions social security contributions | HU | | SK, PL | PL | CZ |
| (6) Changes in tax collection, effectiveness or tax administration | | | | | SK |
| (7) Reform of the pension system (private or state pension funds) | | | PL | PL, HU | SK |
| <i>Expenditures measures</i> | | | | | |
| Measure/year | 2007 - 2009 | 2010 | 2011 | 2012 | 2013 |
| (1) Decrease in wage and salaries of the public sector, staff remuneration | HU, CZ | CZ | CZ, SK, PL | PL, HU | SK |
| (2) Increase/Decrease in capital investments, public investment expenditures | HU, CZ | CZ | CZ, SK | | SK |
| (3) Decrease in operational costs of public sector (expenditures on goods and services or consumption expenditures) | HU | | SK | HU | SK |
| (4) Increase/Decrease of the social security contributions and social transfers or social insurance | HU, CZ | CZ | CZ, SK | HU | SK |
| (5) Changes in subsidies capital subsidies or capital injections to municipalities or other subjects (farmers, Agencies, etc.) | HU | | SK, PL | PL | SK |
| (6) Changes in pension programme | CZ | CZ | CZ, PL | PL | |
| (7) Implementation of the measures focus on labour market | | | PL | PL, HU | |
| (8) Introduction new rules for various social benefits, exceptions or conditions of transferring expenditures | HU | | PL | PL, HU | |

Figure 1. Original and Adjusted Data in V4 Countries

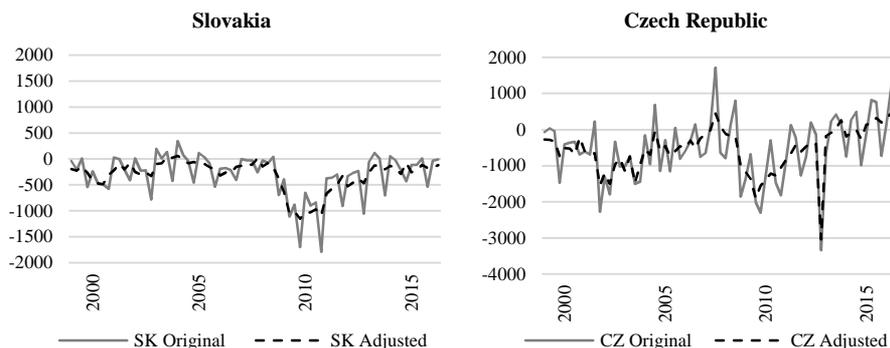
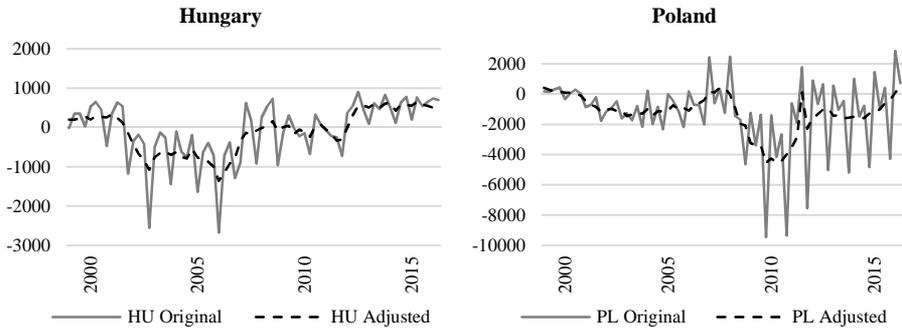
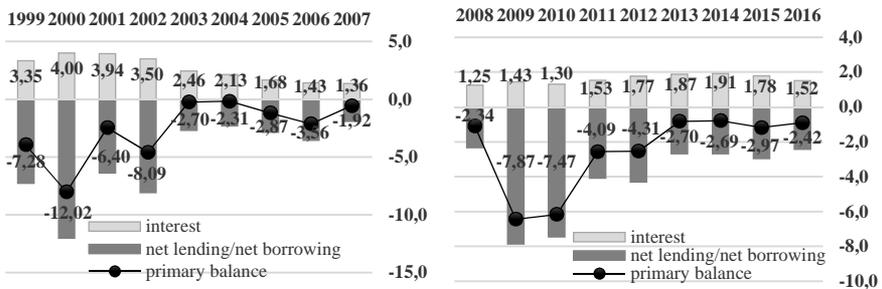


Figure 1. Continued



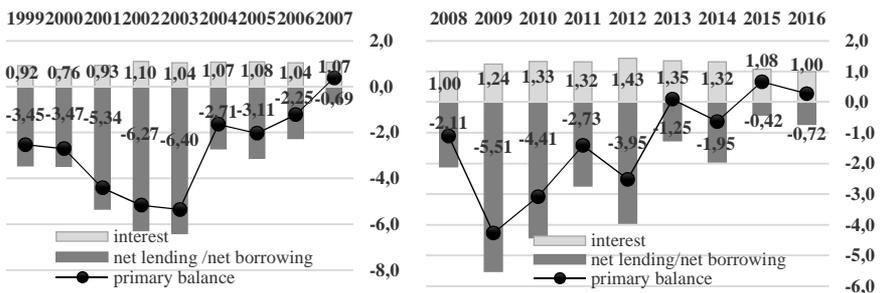
Source: Authors, own processing based on data form Eurostat.

Figure 2. Development of primary balance of SK during 1999–2016



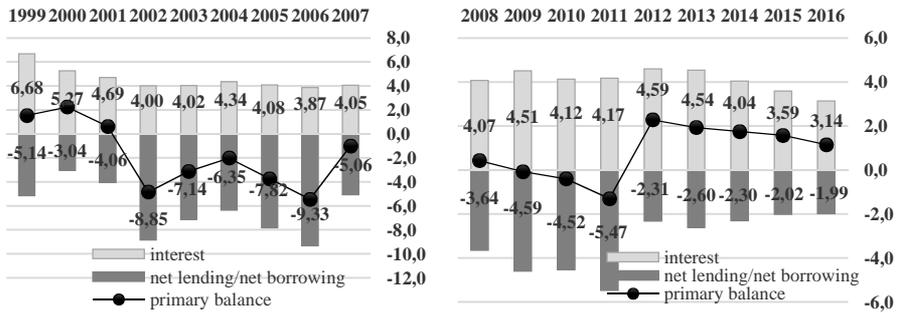
Source: Authors, own processing based on data form Eurostat.

Figure 3. Development of primary balance of CZ during 1999–2016



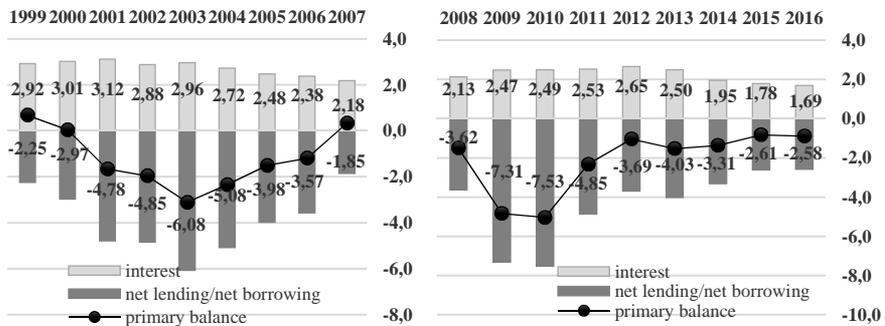
Source: Authors, own processing based on data form Eurostat.

Figure 4. Development of primary balance of HU during 1999–2016



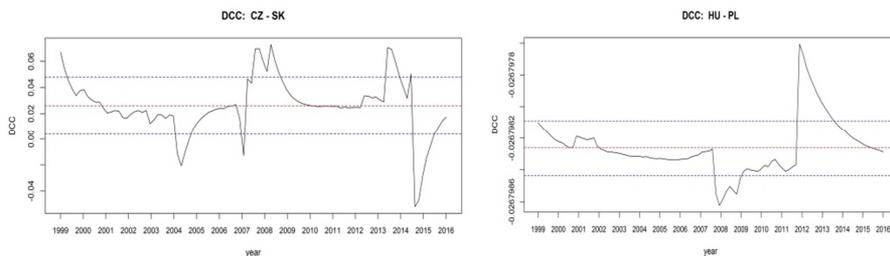
Source: Authors, own processing based on data form Eurostat.

Figure 5. Development of primary balance of PL during 1999–2016



Source: Authors, own processing based on data form Eurostat.

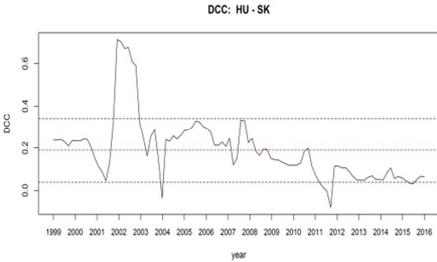
Figure 6. Development of primary balance of PL during 1999–2016



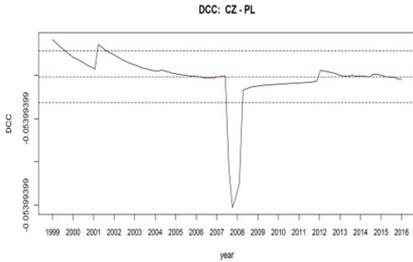
DCC: SK-CZ, Q1:1999-Q2:2016

DCC: PL-HU, Q1:1999-Q2:2016

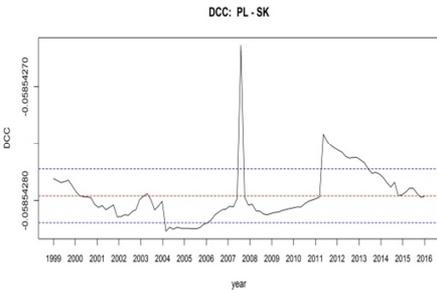
Figure 6. Continued



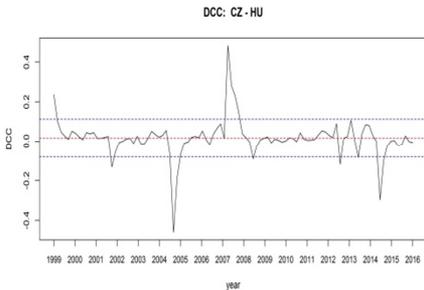
DCC: SK-HU, Q1:1999-Q2:2016



DCC: PL-CZ, Q1:1999-Q2:2016



DCC: SK-PL, Q1:1999-Q2:2016



DCC: CZ-HU, Q1:1999-Q2:2016

Source: Authors, own processing based on data form Eurostat.