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Analysis of Czech/Slovak Exports and German Economy¹

Radmila KRKOŠKOVÁ*

Abstract

This article compares the relationship between exports of goods and services of the Czech Republic and the development of economy of Germany, and between exports of goods and services of Slovakia and the development of economy of Germany. Germany is a major trading partner for the Czech Republic and also for Slovakia. Do Czech or Slovak exports influence the German GDP? This paper tries to find reasons for possible differences or similarities between the Czech Republic and Slovakia. The article uses the tools of time series econometrics, especially the ADF test, the Engle-Granger co-integration test, the error correction model, and the impulse-response analysis. Achieved results suggest that co-integration relationship between the Czech exports in goods and services and the German GDP exists. This relationship has not been confirmed for the Slovak exports in goods and services. The data used has the character of quarterly time series in the period from 2000Q1 to 2019Q1. EViews software version 9 has been used for the calculations.

Keywords: ADF test, Czech Republic, ECM, Engle-Granger co-integration test, Germany, impulse-response analysis, Slovakia

JEL Classification: C22, C51, E20

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Introduction

The foreign relations of the Czech Republic and Slovakia were influenced by political and economic transformation. Trade relations of both countries were also connected to the accession to the European Union. The historical ties of

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both countries also impacted the new dislocation of foreign direct investment looking for new possibilities for the utilization of production capacities in the V4 territory. The export growth is often referred to as a measure of macroeconomic performance (Baláž, 1996). The dynamics of the export growth gained new significance after the outbreak of the financial crisis and the slowdown in the economic growth of states that are important trading partners of the Czech Republic and Slovakia. For these trading partners, import development has been a major component of the growth for a long time. Therefore, in times of the economic crisis, the implementation of structural changes was not sufficiently effective and did not deliver the expected results in terms of restoring the export growth and its dynamics. Since joining the EU, the increasing inflow of foreign direct investment has been one of the important determinants of Czech and Slovak exports. When analysing the development of the economies of both countries, it is important to monitor the economic development of the main trading partners. The most important of them is the Federal Republic of Germany. The economy of Germany is usually described as the most significant for the development of exports of other EU countries. To what extent is this claim valid for the Czech Republic and Slovakia?

The Czech Republic has its largest trading partners among the countries that surround it. The neighbouring countries accounted for 37% of total Czech exports and 29% of imports in 2018. Germany has a crucial share in this. Germany remains dominant for the Czech Republic's foreign trade. 32.8% of the Czech Republic's total exports went to Germany, that is, € 55.58 billion. The orientation of Czech companies towards Germany is long-term. A total of 82% of companies have been exporting to Germany for more than five years. Thus, one third of Czech exports goes to Germany. However, domestic products do not end exclusively on the local market. The Federal Republic is also an important springboard to the world. Its industrial strength and ability to compete on foreign markets are reflected in re-export to other countries. The automotive industry is a key chapter in mutual trade. Almost 60% of Czech exports to Germany are machines and electrical engineering products or motor vehicles. The dominant feature is road vehicles, being the largest item of German imports (Businessinfo, 2018).

Slovakia is a very open economy. A significant part of total exports (85%) goes to the EU countries. Exports are dominated by the automotive, electrical engineering, metallurgical, petrochemical, and chemical industries. Foreign investors have come to like Slovakia. The main reasons for this include: a strategic location in Europe with a high export potential, political and economic stability, a common currency (euro), labour productivity, language skills, and great potential for research, development and innovation. Slovakia's exports amounted to

79.786 billion EUR in 2018. Germany is dominant for Slovakia's foreign trade. 22.2% of Slovakia's total exports go to Germany.

The Czech Republic is economy with a high ratio of export in goods to the GDP. According to the data from the Czech Statistical Office the ratio was about 79% in 2018, whereas more than 32% of Czech exports went to Germany. According to the data from the Statistical Office of the Slovak Republic the ratio was about 92% in 2018, and more than 22% of Slovak exports went to Germany. Therefore, economic development in Germany can determine the economic development in the Czech Republic and Slovakia. It is the reason to analyse the relationship between Czech exports and the German GDP, and also between Slovak exports and the German GDP. Is there a relationship between Czech and Slovak exports and the development of Germany's economy? If so, how strong is this dependence?

This paper gives answers for these questions. The main goal of this paper is to analyse the relations between Czech and Slovak exports and the German GDP. Two relationships are tested. There are constructed models to find the short and long-term relationships between Czech (Slovak) exports and the German GDP. It is also important to analyse the commodity structure of Czech and Slovak exports to Germany. The commodity structure of Czech exports and Slovak exports to Germany is divided on the basis of the SITC Classification. Finally, the article will summarize the main findings that indicate that the relationships between Czech exports and the German GDP, and Slovak exports and the German GDP are very complex and similar to each other.

1. Literature Review and Methodological Part

This chapter contains literature review and standard econometric tools to investigate the relationship between Czech (Slovak) exports and German GDP. There are many papers which study this topic.

The basic variables that determine the development of exports include: the size of foreign income, the level of domestic and foreign prices, consumer preferences, government trade restrictions and real exchange rate (Gupta, 2008). In general, export is defined as a function of foreign income and real exchange rate, see for example Obstfeld and Rogof (1996), Blanchard and Fischer (2000). The relationship between export and foreign income can be considered directly proportional. Growing consumer income in trading partner countries allows for greater purchases of goods both at home and abroad, thus increasing imports in these countries. There is an inversely proportional relationship between export and exchange rate.

The more the domestic currency is appreciated, the less competitive the domestic products are abroad. The relationship between export and foreign income or exchange rate is dealt with in studies such as: Arize (2014), Garelli (2014), Constantinescu, Mattoo and Ruta (2015). This topic is addressed by the following author in the Czech Republic: Žídek and Němec (2012), Bolotov, Čajka and Gajdušková (2013), Melecký and Staníčková (2013), Taušer, Arltová and Žamberský (2015); and in the Slovak Republic: Šoltés (2010), Šikula (2011), Jamborová and Pavelka (2013), Kittová (2015), Baláž and Hamara (2016).

The objective of article Majeed and Ahmad (2006) has been to find out the main factors that are important in the determination of exports in developing countries. The study used a fairly large sample of panel observations for 75 developing countries over the period 1970 – 2004. Results have shown that sustainable growth promotes exports. And a stable exchange rate policy has to be ensured in order to avoid the exchange-rate risks associated with the assets. Developing countries need to replace agriculture exports by the industrial exports. Moreover, the industrialisation will reduce dependence on imports. Eckaus (2008) states that the determinants of Chinese and Indian exports are on both the demand and supply sides, and concludes that the general level of foreign income in importing countries has been identified as a statistically significant explanatory variable of exports. Relative wages have been more important than exchange rates in determining the demands for Chinese and Indian exports. Tomšík (2001) presents regression analyses of import and export functions in the Czech Republic from 1993 to 1998. The author analyses models, in which besides traditional variables (GDP, exchange rate, domestic and foreign inflation, import and export prices), such variables as real money supply, foreign direct investment, unemployment data, and a number of working days. The results imply that domestic demand growth is the most important factor in explaining import dynamics. About car export of road vehicles from Slovakia to the United Kingdom is the paper Pitoňáková (2019). The aim of the article is to identify the determinants of the export. The results show that the export of road vehicles is in the long-run impacted by the exchange rate and industrial production. The implications are for governing bodies to manage the current commodity framework which is at present mainly oriented on machinery and transport equipment and to support companies from other industries. The aim is to create a much more diversified export commodity structure. Havrlant and Hušek (2011) have analysed the cost factors that influence the export of the Czech Republic and to estimate models suitable for quantitative analysis of export and its prediction. Several models are applied to set of these factors, and their impact on the export dynamics of the Czech Republic is evaluated. The study has come to the conclusion that Czech

exports depend on the GDP of the main trading partner. Mandel and Tomšík (2008) have analysed the development of the external balance in five Central and East European countries: Czech Republic, Hungary, Poland, Slovakia, and Slovenia. The paper applies and empirically verifies the dependence of export one country to GDP another country.

This paper is based on the article by Taušer, Arltová and Žamberský (2015), which used data from 2000Q1 to 2012Q2, and on the article by Baláž and Hamara (2016), who analysed time series in the period from 2000Q1 to 2015Q1. Taušer, Arltová and Žamberský (2015) state that there is a cointegration relationship between the export of goods and services of the Czech Republic and the development of the German economy, and this is confirmed by the results of this article. Baláž and Hamara (2016) state that there is no co-integration relationship between the export of goods and services of the Slovak Republic and the development of the German economy, but this fact was not confirmed in this article.

1.1. Data

Quarterly data for the period from 2000/Q1 to 2019/Q1 were used for the calculations. The Eurostat database, the Czech Statistical Office and the Statistical Office of the Slovak Republic were the primary data source. The description of individual variables is shown in Table 1. All these variables (time series) were seasonally adjusted and X12ARIMA method was used. EViews software version 9 was used for the calculations. A similar procedure was used in the article Stoklasová (2018).

Table 1
Description of Variables

Variable Designation	Description of Variable
CZ_EXP	Czech exports
SR_EXP	Slovak exports
GER_GDP	German GDP

Source: Eurostat (2019).

Most time series in macroeconomics and finance are non-stationary or integrated with order $I(1)$, as stated in Engle and Granger (1987), Enders (2014). $I(1)$ denotes a time series the first differences of which are stationary. That is why data stationarity testing or unit root tests are performed. The Augmented Dickey-Fuller test (ADF) is often used in the literature. The ADF test allows you to test the presence of a unit root based on three models. The first model represents a random walk model, the second model contains a constant (μ), and the third model contains a constant (μ) and a trend component (t). The determination of

the order of integration of the individual time series is based on the zero hypothesis: $H_0 : \gamma = 0$, which states that a time series contains a unit root, i.e. that the non-systematic component of time series is type I(1). An alternative hypothesis is placed against the zero hypothesis: $H_1 : \gamma < 0$, which states that a time series is stationary.

The test results for all variables are provided in Table 2. The Dickey-Fuller test (ADF) was used to test the stationarity. The second column provides information on the model type of testing the unit root (n = no trend and level constants/c = constant/c + t = level constant and trend), the third column contains the calculated T-statistics; the following column contains the corresponding level of statistical significance. The last column includes the result of testing: N = non-stationary (H0 not rejected), S = stationary (H0 rejected).

Table 2

Testing the Unit Root of the Variables in Levels and the First Differences

Variable	n/c/c+t	T-stat	p-value	Result	Variable	n/c/c+t	T-stat	p-value	Result
CZ_EXP	c+t	2.993	0.378	N	D(CZ_EXP)	n	-5.672	0.000	S
SR_EXP	c+t	-2.288	0.119	N	D(SR_EXP)	c	-3.685	0.002	S
GER_GDP	c+t	-1.986	0.752	N	D(GER_GDP)	c	-6.584	0.000	S

Source: Own calculations.

All variables, except variable GER_IMPG, exhibit the properties of first-order non-stationarity, i.e. I(1); therefore, the long-run co-integration relationships may exist between these variables. The methods of the co-integration analysis are described in articles Hendry and Juselius (2000; 2001).

1.2. Models and Impulse-Response Analysis

After identifying the co-integration relationship we can employ Autoregressive Distributed Lag model (Hendry, Pagan and Sargan, 1984). The error correction model (ECM) can be derived from the ARDL model using a simple transformation (Engle and Granger, 1987). Using ECM, short-term development dynamics can be analyzed as:

$$\Delta Y_t = c + \beta_1 \Delta X_t + \gamma(Y_{t-1} - \beta X_{t-1}) + a_t, \quad (1)$$

$$\beta = (\beta_1 + \beta_2) / (1 - \alpha), \quad \gamma = \alpha_1 - 1$$

The correction term $\gamma(Y_{t-1} - \beta X_{t-1})$ corrects deviations from equilibrium. By definition, a negative parameter γ is assumed. This parameter indicates the time it takes for the system to equilibrate. Co-integration parameter β expresses long-term dependence between Y and X .

Impulse-response analysis allows analysis of both the short-term and long-term relations between the analysed variables based on the derived model. Arlt (1999) states that the impulse-response analysis is related to the question of what reaction in one time series will be caused by an impulse in another time series within a system that contains multiple time series. This is the study of the relation between two one-dimensional time series in a multidimensional system. A similar procedure was used in the article Krkošková (2020). Programme EViews in the Impulse table provides six options for transforming the impulses. Cholesky – d.f. adjusted was chosen for transformation in this article. Cholesky uses the inverse of the Cholesky factor of the residual covariance matrix to orthogonalize the impulses. This option imposes an ordering of the variables in the VAR and attributes all of the effect of any common component to the variable that comes first in the VAR system.

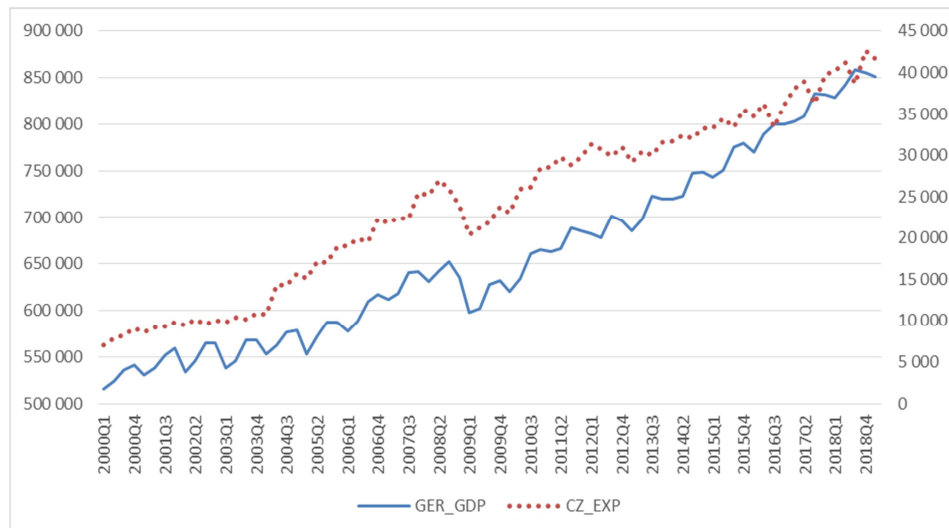
2. Error Corrections Models

There are constructed two error corrections models to find the short and long-term relation between: 1. Czech exports and German GDP and 2. Slovak exports and German GDP.

Figure 1 and Figure 2 show the time series German GDP, Czech export and Slovak export during period from 2000Q1 to 2019Q1.

Figure 1

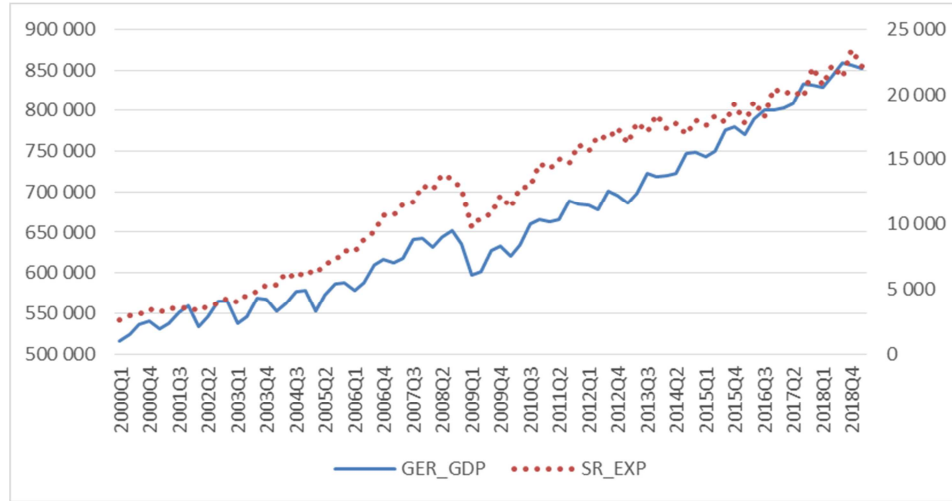
German GDP (left axis) and Czech Exports (right axis) (in million EUR)



Source: Eurostat (2019).

Figure 2

German GDP (left axis) and Slovak Exports (right axis) (in million EUR)



Source: Eurostat (2019).

All time series are non-stationary, thus we will to apply Engle-Granger test for co-integration the residuals. Null hypothesis “Series are not co-integrated” was rejected at the 5% significance level. Table 3 shows results of Engle-Granger test.

Table 3

Engle-Granger Test (CZ_EXP x GER_GDP and SR_EXP x GER_GDP)

Variable	Tau-statistic	Prob.	z-statistic	Prob.
CZ_EXP	-3.632	0.043	-21.753	0.027
GER_GDP	-3.518	0.061	-21.127	0.031
SR_EXP	-3.216	0.074	-20.506	0.039
GER_GDP	-2.958	0.079	-19.423	0.042

Source: Own calculations.

EC model has form (2):

$$D(CZ_EXP_t) = -58.431 + 0.134D(GER_GDP_t) - 0.329(CZ_EXP_{t-1} - 0.174GER_GDP_{t-1}) \quad (2)$$

Causality is captured by the statistically significant value EC (-0.329), which indicates that this variable will be modified by 32.9% within 1 quarter in case of long-term instability of the Czech exports. In other words, complete elimination of instability would last approximately 3 quarters ($1/0.329$). The long-term relationship between the variables is given by multiplier β (0.174). We can see that Czech exports directly depend on German GDP.

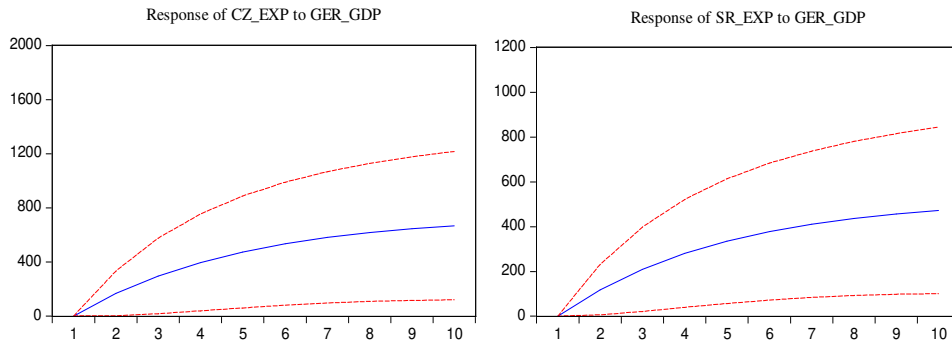
$$D(SR_EXP_t) = -61.174 + 0.127D(GER_GDP_t) - 0.218(SR_EXP_{t-1} - 0.126GER_GDP_{t-1}) \quad (3)$$

The ECM estimation results show the statistical significance of the correction component for the Slovak exports model (3). The EC value (−0.218) indicates that in the case of the long-term disequilibrium of the dependent variable, this series will be adjusted by 21.8% during the first quarter. In other words, complete elimination of instability would last approximately more than 1 year (1/0.218). The long-term relationship between the variables is given by multiplier β (0.126). We can see that Slovak exports directly depend on German GDP.

Impulse-response functions of CZ_EXP resp. SR_EXP on a unit shock of GER_GDP show that reactions of CZ_EXP resp. SR_EXP on a unit shock of GER_GDP are positive.

Figure 3

Impulse-response Function (Response to Cholesky One S.D. Innovations)



Source: Eviews, own calculations.

3. Co-integration Analysis between Commodity Structure of Czech/Slovak Exports and German Economic Growth

This section compares of the commodity structure of exports to Germany in 2000 and 2018 from the Czech Republic and from Slovakia. This section also contents co-integration analysis between individual SITC groups of Czech/Slovak and German economic growth. In the case of the Czech Republic there is confirmed only one co-integration relationship between SITC 8 (Manufactured articles) and German GDP, and in the case of Slovakia there are confirmed two co-integration relationships. The first relationship is between SITC 7 (Machinery, transport equipment) and German GDP, and the second relationship is between SITC 8 (Manufactured articles) and German GDP.

Table 4 shows the commodity structure of Czech and Slovak exports in 2018, based on the SITC Classification. The Table 7 shows the great importance of groups 6 – Manufactured goods by material, 7 – Machinery, transport equipment, 8 – Manufactured articles.

Table 4

Commodity Structure of Czech and Slovak Exports to Germany in 2018

	Total exports (billion EUR) from:	
	<i>Czech Republic</i>	<i>Slovakia</i>
0 Food and live animals	5.30	2.31
1 Beverages and tobacco	1.29	0.13
2 Crude materials, inedible	3.72	1.52
3 Mineral fuels, lubricants	3.54	2.93
4 Animal and vegetable oils	0.32	0.19
5 Chemical products	10.72	3.20
6 Manufactured goods by material	25.81	12.29
7 Machinery, transport equipment	100.54	44.29
8 Manufactured articles	21.26	7.04
9 Commodities not classified	0.44	0.32

Source: Czech Statistical Office, Statistical Office of the Slovak Republic.

Table 5 shows that three groups (6, 7, 8) of total exports to Germany was about 87% from the Czech Republic and about 91% from Slovakia in 2000. And the total exports to Germany of these three groups was about 89% from the Czech Republic and about 92% from Slovakia in 2018. Czech and Slovak exports to Germany in 2000 and also in 2018 are concentrated within groups 6, 7, 8. This is a typical attribute of Czech and Slovak exports.

Table 5

Comparison of the Commodity Structure of Exports to Germany (%) in 2000 and 2018

	2000		2018	
	<i>Czech Republic</i>	<i>Slovakia</i>	<i>Czech Republic</i>	<i>Slovakia</i>
0 Food and live animals	1.16	0.9	2.09	0.93
1 Beverages and tobacco	0.43	0.1	0.22	0.002
2 Crude materials, inedible	3.4	1.5	2.00	0.99
3 Mineral fuels, lubricants	3.01	1.8	1.89	1.55
4 Animal and vegetable oils	0.05	0.01	0.09	0.02
5 Chemical products	4.5	3.9	4.40	3.83
6 Manufactured goods by material	24.9	19.4	14.58	15.96
7 Machinery, transport equipment	47.16	55	59.88	65.23
8 Manufactured articles	15.26	17	14.71	10.76
9 Commodities not classified	0.14	0.39	0.13	0.72

Source: Czech Statistical Office, Statistical Office of the Slovak Republic.

Table 5 also shows increase in these groups: 0 – Food and live animals, 4 – Animal and vegetable oils, 7 – Machinery, transport equipment. In the group 7 was increase from 47% in 2000 to almost 60% in 2018 for the Czech Republic and for Slovakia it was increase from 55% in 2000 to 65% in 2018.

3.1. Co-integration between Individual SITC Groups of Czech and German GDP

Table 6 shows that all variables, except variable SITC_0, exhibit the properties of first-order non-stationarity, i.e. $I(1)$; therefore, the long-run co-integration relationships may exist between these variables and GDP of Germany.

Table 6

Testing the Unit Root of the Variables in Levels and the First Differences
(SITC Groups of Czech)

Variable	n/c/c+t	T-stat	p-value	Result	Variable	n/c/c+t	T-stat	p-value	Result
<i>SITC_0</i>	n	0.651	0.846	N	<i>D(SITC_0)</i>	n	-1.942	0.052	N
<i>SITC_1</i>	n	0.093	0.699	N	<i>D(SITC_1)</i>	n	-4.45	0.000	S
<i>SITC_2</i>	n	1.682	0.972	N	<i>D(SITC_2)</i>	n	-3.681	0.001	S
<i>SITC_3</i>	n	0.341	0.773	N	<i>D(SITC_3)</i>	n	-4.483	0.000	S
<i>SITC_4</i>	n	0.001	0.671	N	<i>D(SITC_4)</i>	n	-3.228	0.003	S
<i>SITC_5</i>	n	2.434	0.994	N	<i>D(SITC_5)</i>	n	-3.174	0.003	S
<i>SITC_6</i>	n	1.715	0.974	N	<i>D(SITC_6)</i>	n	-3.325	0.002	S
<i>SITC_7</i>	n	4.021	0.999	N	<i>D(SITC_7)</i>	n	-2.225	0.029	S
<i>SITC_8</i>	n	3.611	0.999	N	<i>D(SITC_8)</i>	n	-2.121	0.035	S

Source: Own calculations.

Table 7 confirms only one co-integration relationship between SITC 8 (Manufactured articles) and German GDP.

Table 7

Co-integration Analysis for Czech Export (SITC_8 and GER_GDP)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	Critical Value	Sign.
None *	0.483	12.96	12.32	0.038
At most 1	0.097	1.74	4.12	0.219

Note: * denotes rejection of the hypothesis at the 0.05 level.

Source: Own calculations.

The VECM is a tool for examining short-term deviations needed to achieve a long-term equilibrium between two variables. The VECM estimation for the co-integration relationship is in the equation (4).

$$D(GER_GDP_t) = -28.731 - 0.293 \cdot D(GER_GDP_{t-1}) + 31.211 \cdot D(SITC_8_{t-1}) - 0.031 \cdot (GER_GDP_{t-1} - 3002.5 \cdot SITC_8_{t-1}) \quad (4)$$

Causality is captured by the statistically significant value EC (-0.031), which indicates that this variable will be modified by 3.1% within 1 quarter in case of long-term instability of Germany GDP. In other words, complete elimination of instability would last approximately 32 quarters ($1/0.031$), it means 8 years. A statistically significant positive relationship between Germany GDP and the Czech export of machinery and transport equipment is delayed by one quarter.

3.2. Co-integration between Individual SITC Groups of Slovak and German GDP

Table 8 shows the same results as Table 6. It means that all variables, except variable SITC_0, exhibit the properties of first-order non-stationarity, therefore, the long-run co-integration relationships may exist between these variables and GDP of Germany.

Table 8

Testing the Unit Root of the Variables in Levels and the First Differences
(SITC Groups of Slovak)

Variable	n/c/c+t	T-stat	p-value	Result	Variable	n/c/c+t	T-stat	p-value	Result
<i>SITC_0</i>	n	1.345	0.947	N	<i>D(SITC_0)</i>	n	-1.417	0.139	N
<i>SITC_1</i>	n	0.297	0.761	N	<i>D(SITC_1)</i>	n	-4.755	0.000	S
<i>SITC_2</i>	n	0.671	0.851	N	<i>D(SITC_2)</i>	n	-4.228	0.000	S
<i>SITC_3</i>	n	0.256	0.749	N	<i>D(SITC_3)</i>	n	-3.731	0.000	S
<i>SITC_4</i>	n	-0.841	0.337	N	<i>D(SITC_4)</i>	n	-3.505	0.001	S
<i>SITC_5</i>	n	1.491	0.961	N	<i>D(SITC_5)</i>	n	-3.838	0.000	S
<i>SITC_6</i>	n	1.604	0.968	N	<i>D(SITC_6)</i>	n	-3.492	0.002	S
<i>SITC_7</i>	n	3.443	0.999	N	<i>D(SITC_7)</i>	n	-2.271	0.026	S
<i>SITC_8</i>	n	4.541	0.999	N	<i>D(SITC_8)</i>	n	-2.021	0.045	S

Source: Own calculations.

Table 9 shows that in the case of Slovakia there are confirmed two co-integration relationships. The first relationship is between Slovak export of machinery, transport equipment (SITC 7) and German GDP, and the second relationship is between Slovak export of manufactured articles (SITC 8) and German GDP.

Table 9

Co-integration Analysis for Slovak Export

	Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	Critical Value	Sign.
SITC_7 and GER_GDP	None *	0.631	25.99	25.87	0.048
	At most 1	0.387	8.344	12.52	0.224
SITC_8 and GER_GDP	None *	0.711	28.961	25.87	0.0200
	At most 1	0.368	7.811	12.52	0.2675

Note: * denotes rejection of the hypothesis at the 0.05 level.

Source: Own calculations.

The VECM estimation for the co-integration relationship between Slovak export of machinery, transport equipment (SITC 7) and German GDP is in the equation (5).

$$\begin{aligned}
 D(GER_GDP_t) = & \\
 = & 394.28 + 0.119 \cdot D(GER_GDP_{t-1}) + 10.72 \cdot D(SITC_7_{t-1}) + \\
 & + 0.082 \cdot (GER_GDP_{t-1} - 343.93 \cdot SITC_7_{t-1})
 \end{aligned} \quad (5)$$

Causality is captured by the statistically significant value EC (0.082), which indicates that this variable will be modified by 8.2% within 1 quarter in case of long-term instability of Germany GDP. In other words, complete elimination of instability would last approximately 12 quarters (1/0.082), it means 3 years. A statistically significant positive relationship between Germany GDP and the Slovak export of machinery and transport equipment is delayed by one quarter.

The VECM estimation for the co-integration relationship between Slovak export of manufactured articles (SITC 8) and German GDP is in the equation (6).

$$\begin{aligned} D(GER_GDP_t) = & \\ = 333.35 + 0.194 \cdot D(GER_GDP_{t-1}) + 78.97 \cdot D(SITC_8_{t-1}) - & \quad (6) \\ - 0.162 \cdot (GER_GDP_{t-1} - 1155.86 \cdot SITC_8_{t-1}) & \end{aligned}$$

Value of variable EC (−0.162) is statistically significant and complete elimination of instability would last approximately 6 quarters (1/0.162), it means 1.5 year. A statistically significant positive relationship between Germany GDP and the Slovak export of manufactured articles is delayed by one quarter.

Conclusion

The aim of this paper was to analyse and to compare relationships between Czech exports and the German GDP, and Slovak exports and the German GDP. The second and third parts of the article form the core of the article. The second part: there are constructed two error corrections models to find the short and long-term relation between: 1. Czech exports and the German GDP, 2. Slovak exports and the German GDP. Both of the long-term relationships were confirmed. The results show that Czech and Slovak exports are dependent on the growth of the German economy. The third part of this article compares the commodity structure of exports to Germany from the Czech Republic and from Slovakia in 2000 and 2018. The group (manufactured goods by material, machinery, transport equipment, manufactured articles) of total exports to Germany was about 87% from the Czech Republic and about 91% from Slovakia in 2000. In 2018 it was 89% from the Czech Republic and 92% from Slovakia. This part also contains the co-integration analysis between individual SITC groups of Czech/Slovak and the German economic growth. In the case of the Czech Republic there was confirmed only one co-integration relationship between the group of “Manufactured articles” and the German GDP. In the case of Slovakia there were confirmed two co-integration relationships. The first relationship was between the group of “Machinery, transport equipment” and the German GDP, and the second relationship was between “Manufactured articles” and the German GDP.

Germany has been the largest export territory for a long time. It is very stable in terms of exports. The automotive industry is a key chapter in mutual trade. The Czech Republic and Slovakia are the main suppliers for German car manufacturers. However, the car market has already become saturated, and the economic growth in Germany is also constrained by the threat of tariffs on imports of selected European goods into the United States. One of the reasons for the economic downturn in Germany may certainly be the drought in 2019 and the lack of water in the Rhine, which significantly affected German industry. In 2018, the German economy was affected mainly by one-off factors, mainly the problems with car emission limits, but also the adverse weather, the flu epidemic, and strikes. The Czech and German economies are connected not only by the automotive industry. At the beginning of 2020, both economies were weakened. The Czech economy has the weakest growth in six years, and the German economy escaped the recession only by the tenths in 2019. Both economies are experiencing a decline in the industry.

The Slovak economy is also strongly linked to the German economy. Almost 85% of Slovakia's gross domestic product is exported. Slovakia reached the peak of the economic cycle in 2018, when the GDP growth was 4%. In 2019, the growth rate of the economy slowed down significantly to around 2.4%. Exports of Slovak products abroad in 2019 achieved the worst result since 2009, i.e. since the beginning of the financial crisis. According to the commodity structure of Slovak exports, in 2019 the foreign demand increased only for passenger cars. The decline in Slovak exports to Germany as the main trading partner of the Slovak Republic contributed significantly to the decrease of net exports. Slovak exports fell for three consecutive quarters and thus met the definition of a technical recession. The Slovak economy is based on industrial production and exports. The automotive and electrical engineering industries play an important role. Exports are expected to grow slightly in 2020 thanks to Jaguar Land Rover in Nitra, but the coronavirus crisis will change this prediction.

The Czech Republic is still the number one country for German companies operating in Central and Eastern Europe. Slovakia is second, followed by Slovenia and Poland. German companies positively evaluate political stability in both the Czech Republic and Slovakia. German companies would welcome the introduction of the euro in the Czech Republic. For potential investors, the euro is an important argument for making investment decisions. There are about 3,500 – 4,000 German companies operating in the Czech Republic. Most German investment in the Czech Republic has long been directed to the production of motor vehicles, trade and commercial services, finance and electrical equipment production (Businessinfo, 2019). About 2,500 German companies operate in Slovakia. German

companies in Slovakia paid taxes in the amount of approximately 400 million EUR in 2015, and it was more than 450 million EUR in 2017 (Finreport, 2018).

The Czech Republic and Slovakia have close economic ties with Germany. The favourable climate in Germany is starting to deteriorate, with the economic growth slowing in the coming years, thus affecting both the Czech Republic and Slovakia. Recent statistics show a decline in industrial orders in Germany and the country also has to deal with uncertainty regarding regulations in the car industry. Both Czech and Slovak manufacturers will be affected – directly or indirectly – the Brexit, US-China relations, the threat of US tariffs on European cars, and the coronavirus. Currently, the coronavirus has suspended the movement of people, goods and money around the world. States should be able to cope with a certain slowdown in the economic growth, especially in the short term, without significant losses.

This study has come to the conclusion that Czech/Slovak exports depend on the GDP of the main trading partner Germany. There were identified the main determinants of the export. In the case of the Czech Republic it was a group of manufactured articles and in the case of Slovakia there were groups of machinery, transport equipment, and of manufactured articles.

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