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The Effects of Selected Macroeconomic Variables on Tourism Demand for the South Moravian Region of the Czech Republic from Germany, Poland, Austria, and Slovakia

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Abstract

International tourism is one of the most important sectors of the open economy. The aim of this paper is to investigate the effects that income as gross domestic product, tourism price as the real exchange rate, and travel cost as the price of Brent crude oil have on inbound tourism demand (tourist arrivals) from Poland, Slovakia, Germany, and Austria in the South Moravian Region of the Czech Republic over the period 2002:M1–2018:M5. The number of Polish, German, Slovak and Austrian tourists accommodated in collective accommodation establishments within the South Moravian Region as a dependent variable are considered. To achieve this aim, cointegration analysis under the VECM approach is applied. The results show that Slovak, Polish, Austrian and German tourists respond positively to their income changes. Austrian and Slovak tourists respond negatively to changes in tourism prices in the Czech Republic. Tourists from Germany and Poland do not respond to changes in the Czech price level since their elasticity coefficients are non-significant. German, Austrian and Slovak tourists respond negatively to transportation cost changes. Polish tourists do not respond to transport cost changes since their elasticity coefficient is non-significant.

Keywords: tourism demand, real exchange rate, industrial production index, crude oil price, VECM, cointegration

JEL: F14, F47, Z3

Introduction

International tourism is one of the most important sectors of the open economy. It is a sector capable of generating a considerable amount of foreign exchange, creating permanent jobs for local people, and contributing to the development of the national economy. Therefore, the World Tourism Organization (UNWTO) is constantly describing tourism as a "key to development, prosperity and well-being" (UNWTO 2018). Despite occasional shocks, tourism has shown steady growth in the last few decades. International tourist arrivals have increased from 25 million worldwide in 1950 to 278 million in 1980, 527 million in 1995 and 1.239 billion in 2016 and 1.323 billion in 2017. International travel revenue from global destinations has increased from $2 billion in 1950 to $104 billion in 1980, $415 billion in 1995, and $1,340 billion in 2017 (UNWTO 2018).

Tourism demand is one of the most researched areas of the economy of tourism. The topics studied focus on both the search for microeconomic determinants influencing the demand for tourism (see Brida and Scuderi 2012) and the search for links between, for example, numbers of tourists and the development of various macroeconomic variables (see Song and Li 2008). At the macro level, tourism demand is particularly important in order to keep track of trends in demand. Business entities in tourism make decisions about public procurement, investment, and employment just on the basis of the expected values of future demand as well as the expected consequences of changes in the demand for tourism determinants. Therefore, research studies on the analysis of tourism demand have considerable practical significance.

The concept of tourism demand is based on the classic definition of demand in the economy, namely the desire to have a product or to use the service, combined with the ability of the estate or the service to pay. However, the specificity of tourism itself represents a specific product or service – in this case, we are talking about the so-called tourism product, which represents a group of mutually complementary goods and services (see Song et al. 2010).

The question is, how can one create tourism demand. Song et al. (2010) provide four criteria for this purpose, namely (1) the number of tourists, such as the number of visits by tourists; (2) the monetary criterion, for example, the amount of travel expenditure; (3) the time criterion, for example, the number of days spent in the destination; and (4) the distance to the destination, the distance traveled in kilometers, for example. In most tourism studies, the first three criteria are used (see, e.g. Gokovali et al. 2007; Martínez-Garcia and Raya 2008; Barros and Machado 2010; Gautam 2014; Ongan et al. 2017).

The number of tourists in inbound tourism is usually recorded at the border of a given destination, either through border checks or through visitor surveys at or near the border – the latter, in particular, in cases where there are no visa restrictions or border controls have disappeared; the Schengen Area in the EU is an example. If border statistics are not implemented, the number of tourists in collective accommodation establishments can be monitored (see United Nations 2010, p. 18). Researchers can obtain citizenship information from the registration forms completed by tourists on arrival and the number of nights spent in the accommodation. Within the Czech Republic, the Czech Statistical Office provides data on the number of guests accommodated in collective accommodation establishments. In this text, the latter option is used to specify tourism demand.

An important part of the tourism demand analysis is the choice of a suitable model. In general, models can generally be divided into two subcategories: causal econometric models and models of non-causal time series. Econometric models are model types that quantify the causal relationship between tourism demand (the dependent variable) and certain influencing factors (explanatory variables), using one equation (one-dimensional model) or a system of equations (see Song et al. 2008). With variable options and different numbers of equations in the model, econometric models offer a number of sophisticated model specifications. Because of the constraints of one-equation approaches, models using equation systems are more often used (see, e.g. Wong et al. 2006; Song et al. 2008).

The development of the vector autoregressive model (VAR) is mainly focused on relaxing the assumption of exogeneity, which is implicitly applied to models with one equation. In order to take into account the endogeneity of the model, it was necessary to work with simultaneous equations in the context of structural macroeconomic modeling. To eliminate the need for structural modeling, the Sims VAR model, which considered all variables to be endogenous, was created. Additionally, the VAR model can include components representing error correction, in which case we are talking about the vector error correction model (VECM).

An important feature of the VAR model is its ability to take into account the endogenousness between dependent and explanatory variables. The interdependence between the demand for tourism and selected macroeconomic variables is one of the topics currently being addressed (see, e.g. Gautam 2014; Ongan et al. 2017). The purpose of these analyses is to find both short-term as well as long-term relationships through VECM.

The aim of this paper is to investigate the effects that real exchange rates, incomes, and travel costs have on inbound tourism demand (tourist arrivals) from Poland, Slovakia, Germany and Austria to the South Moravian Region of the Czech Republic over the period 2002:M1–2018:M5.

The remainder of the paper is organized as follows. The second section provides a short literature review. The third section presents the datasets. The fourth section provides the empirical model and methodology. The fifth presents the results and discussion. The last section offers conclusions and recommendations for application and additional research.

Literature Review

The current literature on tourism demand uses time series or panel data and their models to explore and forecast the international tourism demand. These studies are based on the application of econometric models to investigate causal relationships, with the number of arriving tourists often being chosen as the dependent variable. Dritsakis (2004) analyses the tourism demand for Greece from Germany and the United Kingdom. He uses a set of macroeconomic variables that include tourist incomes and prices. The author discovers that there is a long-term relationship between international tourists' arrivals (tourism demand) and the surveyed macroeconomic factors over a given period. Garin-Munoz (2006) examines the international tourism demand for the Canary Islands from 15 countries and for the period from 1992 to 2002. Her study concludes that income and travel are important factors explaining tourism demand. Seo et al. (2009) analyze long-term relationships in the tourism demand for selected Asian islands, and they conclude that the income of foreign tourists and real exchange rates have a positive impact on the development of the tourism demand.

Seetaram (2010) researched the international tourism demand for tourists arriving in Australia. He finds that tourism demand is elastic in the long run against changes in tourist incomes and real exchange rates. Muchapondwa and Pimhidzai (2011) use the autoregressive distributed lag (ARDL) model to explore factors influencing tourist arrivals in Zimbabwe between 1998 and 2005. The authors find that transport costs and changes in tourists' income have a significant impact on tourism demand. Massidda and Etzo (2012) examine the factors that affect the tourism demand for Italy. The authors find that prices and per capita GDP are the main factors influencing the numbers of foreign tourists in Italy. Asemota and Bala (2012) study the determinants of tourism demand for Japan from four Western countries (Canada, the United Kingdom, Germany, and Australia) from 1962 to 2009, using the Error Correction Model. The study shows that GDP per capita in the country of origin is the most important factor determining the tourism demand in the short and long term.

Hor (2015) analyses the factors that determine the tourism demand for Cambodia from 12 countries using annual time series from 1994 to 2013. Among the twelve countries examined, only five countries show a long-run relationship between tourism demand and price level, unemployment rate, and population growth. Falk (2015) finds that the demand for overnight stays in selected Austrian ski resorts is strongly dependent on the exchange rate.

Within the Czech Republic, Babecká (2013) analyses the tourism demand for the Czech Republic from selected European Union countries through a geographical gravity model. The author concludes that gross domestic product has a positive effect on the tourism demand. By contrast, real exchange rates (RER) have negative effects.

Data

This study focuses on the analysis of the international tourism demand for the South Moravian Region in the Czech Republic. For selected tourist generator countries, Figure 1 shows the number of tourists arriving from the different countries and accommodated in the South Moravian Region between 2015 and 2017. It is clear from the figure that the highest visitor numbers in this region are related to Slovak, Polish, German, and Austrian tourists. Figure 2 shows the development of visitors to the South Moravian region by the aforementioned tourists from 2002:M1 to 2018:M5. The figure shows seasonal fluctuations that are typical of tourism demand. There is a decrease in the number of tourists arriving in the crisis period. Furthermore, an increase in the number of tourists in the post-crisis period is evident from 2013, especially for the euro area countries. The reason can be seen in connection with fact that the Czech National Bank started interventions in the CZK/EUR exchange rate in 2013.

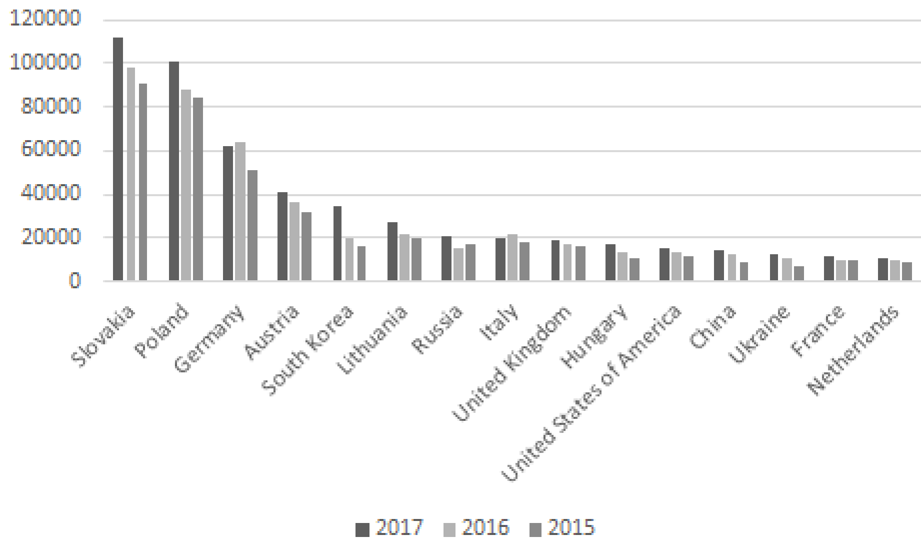

Figure 1. Number of guests in collective accommodation establishments by country in the South Moravian Region for 2015–2017
Source: own elaboration.

The data used in this paper are the monthly time series for the period 2002: M1–2018:M5. The number of Polish, German, Slovak and Austrian tourists accommodated in collective accommodation establishments within the South Moravian Region as the dependent variable are considered.

As explanatory variables, income, price and travel costs in relation to each country are considered. The *income variable* is usually based on GDP, but the measurement frequency of GDP is one quarter. On a monthly basis, GDP can be replaced by the Industrial Production Index (IPI) (see Rünstler and Sédillot 2003). In this paper, the IPI is used in the form of the basic index (Base 2015 = 100). The *price level* of tourism is measured by the real exchange rate (RER). RER is defined as the ratio of the price level abroad (Czech Republic) and the domestic price level, where the foreign price level is converted into domestic currency units via the current nominal exchange rate. Thus, the RER measures the relative competitiveness of foreign and domestic goods. *Transportation cost* refers to total expenses for transportation from the country of origin to the destination. The price of Brent crude oil is considered to represent transportation expenses.

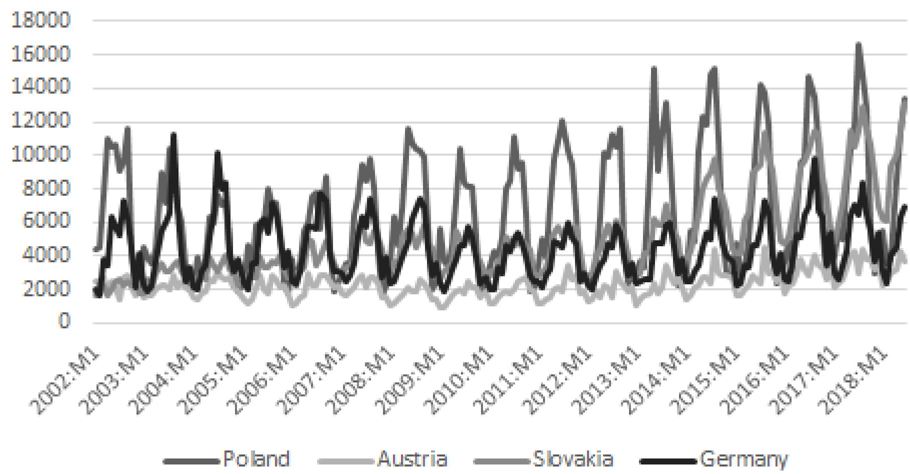

Figure 2. Number of guests from Slovakia, Poland, Germany and Austria for 2002:M1–2018:M5 (monthly time series)
Source: own elaboration.

Methods

To analyze the tourism demand for the South Moravian Region of the Czech Republic from Slovakia, Poland, Germany, and Austria, an empirical model can be illustrated by the function below

$$TD_{it} = F(RER_{it}, IPI_{it}, Brent_t), \tag{1}$$

where TD_i is the number of Polish, German, Slovak and Austrian tourists accommodated in collective accommodation establishments within the South Moravian Region. The RER_i is calculated as follows

$$RER_i = \frac{NER_i CPICZ}{CPI_i}, \tag{2}$$

where NER_i is the nominal exchange rate between the Czech Republic and every tourist generator country, CPI_i is the Consumer Price Index for restaurants and hotels of Slovakia, Poland, Germany and Austria. *CPICZ* is the Consumer Price Index for the restaurants and hotels of the Czech Republic. *IPI* is the Industrial Production Index and *Brent* is the Brent crude oil price. All data have been seasonally adjusted and within the logarithmic form, i.e.,

$$\log TD_{it} = F(\log RER_{it}, \log\ IPI_{it}, \log Brent_t), \tag{3}$$

The Eview and Gretl statistical software packages were used for the analyses. Within the influence of individual explanatory variables on the number of tourists arriving in the Czech Republic, the following hypotheses are considered:

Tourist income is an important factor in tourism demand, as it was also included in the existing literature mentioned briefly in the literature review. We expect that income (as the IPI) has a positive impact on the number of tourists (as tourism demand).

If the RER is greater than one, it means that foreign (Czech) goods are actually more expensive, i.e., the foreign (Czech) price level is higher than the price level in the tourists' home countries. Thus, one can expect a negative relationship between price level and tourism demand, which follows the law of demand.

Transportation cost refers to total expenses for transportation from the country of origin to the destination. We expect a negative relationship with tourism demand.

A VAR(p) model with lag length p can be presented as

$$Y_t = C_0 + \sum_{l=1}^{p} A_l Y_{t-l} + U_t,\ U_t \sim iid(0, \Sigma) \tag{4}$$

where Y_t is a $k \times 1$ vector of endogenous variables, A_l is a $k \times k$ matrix of coefficients to be estimated, C_0 is a $k \times 1$ vector of constants and $U_t \sim iid(0, \Sigma)$ is a $k \times 1$ vector of independent and identically distributed innovations. The idea of the VAR model is that each variable in Y_t is stationary, i.e., the order of integration is zero, or the series follows an I(0) process. If the series is differenced once to become stationary, then it follows an I(1) process, and it is said the series contains a unit root. The Augmented Dickey-Fuller test as suggested by Dickey and Fuller (1979) has been used to test the stationarity of the variables.

If all the variables are I(d) (non-stationary) with $d > 1$, then the variables can be cointegrated. The Johansen Cointegration Test (Johansen and Juselius 1990) uses two tests to determine the number of cointegration vectors (relationships): the Maximum Eigenvalue test and the Trace test. If the variables are cointegrated, then the error correction term has to be included in the VAR. The model becomes a Vector error correction model (VECM) which has a very similar structure to (4)

$$\Delta Y_t = C_0 + \Pi Y_{t-1} + \sum_{l=1}^{p-1} A_l Y_{t-l} + U_t, \tag{5}$$

where ΠY_{t-1} is the error correction vector. If the variables are cointegrated with r cointegration vectors, then Π can be expressed as $\Pi = \alpha\beta'$, where the columns of β contain the m cointegrating vectors, and the columns of α contain the m adjustment vectors. The α coefficients are adjustment coefficients measuring how strongly the deviations from equilibrium feedback onto the system (see Garratt et al. 2012).

Results and Discussion

It is clear from Table 1 that the null hypothesis of no unit roots for all the time series are rejected at their first differences since the ADF and PP test statistic values are less than the critical values at 1% levels of significance. Thus, the variables are stationary and integrated of the same order, i.e., I(1). In view of this, cointegration (long-term) relationships between these variables can be further investigated. In order to determine the number of these relationships, cointegration tests can be applied. In this case, with all the variables I(1), it is possible to work with the Johansen cointegration test with a zero hypothesis, assuming that there is no cointegration relationship between the variables tested.

The Johansen test works with two test statistics based on both the trace of the cointegration matrix (λ-trace) and the maximum eigenvalue of the same matrix (λ-max). Enders (2010) classifies these statistics according to the length of the time series for which they are used. Specifically, the λ-max test for longer time series and the λ-trace test, which is recommended for shorter time series. On this basis, the λ-trace test is preferred herein – our time series contain 194 observations. For the application of the cointegration test, knowledge of the lag order of all variables is necessary. For this purpose, an apparatus is used to find the optimal lag order of the VAR model, with the successive use of all four groups of variables. We therefore work with the same lag order for all variables belonging to one of four groups (Germany, Poland, Austria, and Slovakia). In particular, we use three information criteria, namely the Akaike, Bayes and Hannan-Quinn information criteria (AIC, BIC, HQIC). Given the set of monthly time series, the maximum lag order of 12 was considered.

Table 1. Unit Root Test

Series	ADF test level		ADF test first difference	
	Intercept	Intercept and Trend	Intercept	Intercept and Trend
l_TD_{DE}	0.069	–0.403	–18.548***	–18.643***
l_TD_{PL}	–0.282	–2.712	–15.421***	–15.493***
l_TD_{AT}	0.094	–0.917	–15.461***	–15.612***
l_TD_{SK}	1.626	–0.239	–3.768***	–3.852**

Series	ADF test level		ADF test first difference	
	Intercept	Intercept and Trend	Intercept	Intercept and Trend
l_RER_{DE}	–1.411	–1.422	–6.059***	–7.399***
l_RER_{PL}	–2.698*	–3.081	–7.164***	–7.198***
l_RER_{AT}	–1.197*	–2.173	–6.855***	–7.973***
l_RER_{SK}	–1.731*	–1.923	–7.278***	–7.991***
l_IPI_{DE}	–1.116	–1.988	–5.022***	–5.009***
l_IPI_{PL}	–1.549	–2.062	–3.642***	–3.747**
l_IPI_{AT}	–0.875	–2.091	–3.481***	–3.485**
l_IPI_{SK}	–1.532	–2.086	–4.908***	–4.978***
l_Brent	–2.332	–1.728	–5.07***	–5.133***

Note: ***, **, * indicate significance levels at 1%, 5% and 10%.
Source: own elaboration.

Table 2. Selection criteria of the VAR lag order

AIC	BIC	HQIC
Group Germany		
3	3	3
Group Poland		
5	4	4
Group Austria		
4	4	4
Group Slovakia		
2	2	2

Source: own elaboration.

The resulting values are shown in Table 2. For the lag order of cointegration, the test is that of the first difference of variables, so it is equal to the optimal lag order of the VAR model minus one, then the lag order of cointegration test is 2 for the group of variables related to German tourists. In the case of the group of Polish variables, the choice is based on the BIC and HQIC, i.e., 3. For the Austrian and Slovak variables, we select the lag orders 3 and 1, respectively.

The lag orders were used in the Johansen Cointegration Test. Table 3 shows the results of the test. For all groups of variables, the λ-trace and λ-max values indicate the presence of one cointegration vector at a 5% significance level. This means that there are long-term relationships between the variables.

Based on Granger representation theorem, if a group of variables is cointegrated, then their relationship can be expressed in a form of VECM. From the previous analysis, there is cointegration among variables for all four groups, so we built the VECM to study the long-term and short-term relationships among variables of the system. Table 3 shows the VECM of used variables.

Table 3. Johansen cointegration test of the related variables

No. of CVs	Eigen Value	Trace test Statistic	Max. Eigenvalue Test Statistic
Group Germany			
None	0.196	21.759***	42.42***
At most 1	0.04	12.338	7.979
Group Poland			
None	0.184	63.948***	39.115***
At most 1	0.077	24.834	15.319
Group Austria			
None	0.231	64.616***	50.959***
At most 1	0.046	13.657	9.045
Group Slovakia			
None	0.166	52.297**	35.591***
At most 1	0.088	16.706	10.787

Source: own elaboration.

The estimation leads to a cointegration equation for all groups. The cointegration equation also defines the equilibrium long-term relationship between tourism demand and explanatory variables. For example, the cointegration equation for tourism demand of German tourists has the following form

$$l\_LD_{DE} = 3.71 - 0.38 l\_RER_{DE} + 0.82 l\_IPI_{DE} - 0.15 l\_Brent \tag{6}$$

It follows from the above equation that a 1% increase in the Czech price level compared to the German one will reduce the number of German tourists by 0.38%, but this result is not statistically significant – see Table 4. For an increase in tourist income by 1%, tourism demand falls by 0.82%. In terms of transport costs, a 1% increase in oil prices will reduce the number of German tourists in the South Moravian Region by 0.15%. By analogy, cointegration equations can be expressed for the remaining groups of variables. In the case of Polish tourists

$$l\_TD_{PL} = 6.71 - 0.33 l\_RER_{PL} + 0.66 l\_IPI_{PL} + 0.007 l\_Brent \tag{7}$$

a 1% increase in the Czech price level will reduce tourism demand by 0.33%, and a 1% increase in income will increase demand by 0.66%. The long-term impact of Brent prices to tourism demand has proven to be statistically insignificant. The long-term equilibrium for tourism demand of Austrian tourists can be expressed as

$$l\_TD_{AT} = -4.22 - 1.21 l\_RER_{AT} + 0.89 l\_IPI_{AT} - 0.25 l\_Brent \tag{8}$$

where a 1% increase in the Czech price level will cause a decline in tourism demand by 1.21%. Similarly, a 1% increase in the Brent price will reduce tourism demand by 0.25%. Additionally, a 1% income growth will increase tourism demand by 0.89%.

Finally, according to the cointegration equation (9), with a 1% growth in the Czech price level compared to the Slovak price, the number of Slovak tourists will drop by 0.84%; a 1% increase in tourist incomes will increase tourist demand by 1.45%. Consequently, a 1% increase in travel costs will cause a 1% decrease in the number of Slovak tourists in the South Moravian Region.

$$l\_TD_{SK} = -1.21 - 0.84 l\_RER_{SK} + 1.45 l\_IPI\_SK - 0.08 l\_Brent \quad (9)$$

Because of the error correction vector mechanism, deviations from the equilibrium state are corrected by a series of partial short-term adaptations. This is also supported by the VECM specification, which gives room for short-term dynamics. The VECM is a tool for examining short-term deviations needed to achieve long-term equilibrium between variables. The specific expression of the VEC model for the case of the German variables is as follows

$$\begin{gathered} \Delta l\_TD_{DE} = 0.944 - 0.54[l\_TD_{DE}(-1) + 0.38 l\_RER_{DE}(-1) \\ -0.82 l\_IPI_{DE}(-1) + 0.15 l\_Brent(-1) - 3.71] - 0.3\Delta l\_LD_{DE}(-1) \\ -0.05\Delta l\_LD_{DE}(-2) + 0.57\Delta l\_RER_{DE}(-1) + 1.39\Delta l\_RER_{DE}(-2)\ . \\ -0.41\Delta l\_IPI_{DE}(-1) + 0.41\Delta l\_IPI_{DE}(-2) \\ +0.01\Delta l\_Brent(-1) + 0.04\Delta l\_Brent(-2) + U \end{gathered} \quad (10)$$

In the above-mentioned VEC model equation, short-term fluctuation l_TD_{DE} is caused by two parts, namely the direct impact of the first differences l_TD_{DE}, l_RER_{DE}, l_IPI_{DE} and l_Brent for a short time horizon, and by adjusting the long-term equilibrium, expressed by the Error Correction (EC) term. For the group of German variables, the EC term is significant with negative signs, which imply short-term adjustments of this series by 54% in a month. Then, it took approximately 2 months (1/0.54) to eliminate the disequilibrium.

Table 4. Vector Error Correction Model of the related variables

	Germany	Poland	Austria	Slovakia
l_TD(–1)	1***	1***	1***	1***
l_RER(–1)	0.375	0.331	1.211**	0.841**
l_IPI(–1)	–0.817**	–0.664**	–0.891**	–1.45**
l_Brent(–1)	0.146**	–0.007	0.254**	0.086**
C	–3.705***	–6.707***	4.221***	1.214***
EC	–0.537	–0.547	–0.311	–0.132
Δl_TD(–1)	–0.299***	–0.202**	–0.373***	–0.411***
Δl_TD(–2)	–0.049	–0.127	–0.187**	–
Δl_TD(–3)	–	–0.075	–0.02	–

	Germany	Poland	Austria	Slovakia
Δl_RER(–1)	0.572	1.278**	–0.23	0.181
Δl_RER(–2)	1.392	0.324	0.598	–
Δl_RER(–3)	–	1.088	–0.188	–
Δl_IPI(–1)	–0.409	0.394	–0.077	0.315*
Δl_IPI(–2)	0.136	–2.106**	–0.046	–
Δl_IPI(–3)	–	–0.095	–0.08	–
Δl_Brent(–1)	0.011	–0.031	0.071	–0.04
Δl_Brent(–2)	0.044***	0.081	0.186*	–
Δl_Brent(–3)	–	0.065	–0.001	–
C	0.944***	2.778***	–2.32***	–0.61***

Source: own elaboration.

By analogy, according to Table 4, VEC models can be defined for other monitored tourism demands. In these cases, the EC term is negative and statistically significant at the 5% level. That is, the system will draw a non-equilibrium state back to equilibrium with the adjustment of 55% (Poland), 31% (Austria), or 13% (Slovakia) in a month.

In order to verify the validity of the model, it is necessary to perform econometric tests focusing mainly on the correlation and the normality of the residual components of the estimated VECM. Non-correlatability of the residual components was tested using the LM test. Under the null hypothesis, residuals are assumed to be independent and identically distributed (i.i.d.) over periods. Under the alternative, residuals may be correlated. LM is asymptotically distributed as Chi-squared with the degrees of freedom corresponding to the second power of the number of endogenous variables. In this case, 16 degrees of freedom were considered. Table 5 presents the test statistic values. This test confirms the non-correlatability of the residual components at the 5% significance level.

The Jarque-Bera (J-B) test statistic has been used to test the normality of the residual components. The null hypothesis assumes that residuals come from a normal distribution. Under the null hypothesis, the J-B test statistic follows the chi-square distribution with two degrees of freedom. Within the cumulative normality test for all components, J-B statistics with eight degrees of freedom were used. The results show that the null hypotheses were not rejected at the 5% significance level for all residual components.

Table 5. Residuals serial correlation LM tests

Lags	Germany	Poland	Austria	Slovakia
	LM-Stat	LM-Stat	LM-Stat	LM-Stat
1	15.326	8.737	15.44	17.522
2	13.254	6.364	14.26	16.984

Source: own elaboration.

Granger causality solves the problem of whether variable *x* affects variable *y*. In particular, if *x* is helpful for the prediction of *y*, we can say that *x* Granger-causes *y*. The essence of the Granger causality test is to test whether the lagged terms of one variable can be introduced into the equation of other variables. The Granger test requires the time series of variables to be stationary. So in our case, we work with the first differences of all variables. The aim of Granger causality testing is then to determine whether the changes in *l_RER*, *l_IPI* and *l_Brent* Granger-cause changes to *l_TD*. The lag order of the Granger causality test can be obtained from Table 2. We consider the 5% significance level. The results of the Granger causality test are shown in table 7.

Table 6. Residuals normality test

Component	Germany	Poland	Austria	Slovakia
	JB-Stat	JB-Stat	JB-Stat	JB-Stat
1	3.12	3.678	3.598	2.687
2	4.21	4.117	4.114	4.831
3	4.25	3.664	4.014	3.981
4	3.68	3.284	3.687	2.354
all	15.26*	14.743*	15.413*	13.853*

Source: own elaboration.

Thus, changes in the price level in the Czech Republic cause changes in tourism demand from Germany with a 2-month delay. Changes in other variables with a 2-month delay do not causally affect the tourism demand of German tourists. In addition, changes in the tourism demand of Polish and Austrian tourists Granger-cause changes of *l_IPI*, i.e., the income of tourists, with a 3-month delay. Finally, changes in the tourism demand of Slovak tourists Granger-causes changes of *l_RER*.

Table 7. Pairwise Granger causality tests

Group	Δ*l_RER* does not Granger Cause Δ*l_TD*		Δ*l_IPI* does not Granger Cause Δ*l_TD*		Δ*l_Brent* does not Granger Cause Δ*l_TD*	
	F-stat	p-value	F-stat	p-value	F-stat	p-value
Germany	3.504	0.032	2.359	0.097	0.340	0.712
Poland	1.911	0.129	2.808	0.041	0.276	0.843
Austria	2.801	0.043	1.178	0.319	0.792	0.500
Slovakia	1.658	0.199	6.770	0.010	1.671	0.198

Source: own elaboration.

For a more detailed description of the short-term and long-term relationships, the Impulse response function (IR function) can be used. An impulse response function is defined as the change in the current and expected values of a variable, conditional on the realization of a shock at a point in time. The basic idea of the impulse response function is to analyze the impact of the impulse of a random disturbance unit standard deviation on the current and future values of each endogenous variable. The selected countries' tourism demand responses to unit shocks in the observed explanatory variables with 95% bootstrap confidence intervals are shown in Figure 3. The horizontal axis shows the individual months with the forecast horizon of 24 months, i.e., 2 years, and the vertical axis indicates the impulse response. Given that we work with monthly time series, it is clear that short-term responses to changes in the monitored variables will not be statistically significant, as is already clear from Granger causality.

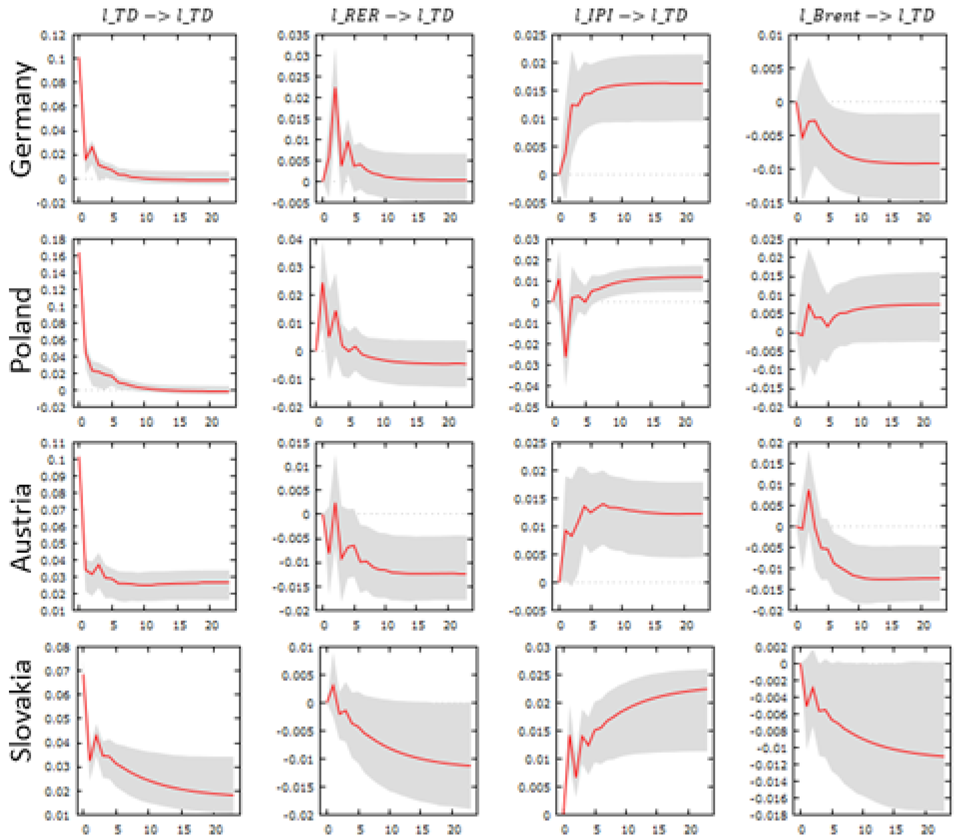

Figure 3. Response to Generalized One Standard Deviation Innovations
Source: own elaboration.

If we first look at the *l_TD* response to the unit shock of *l_RER*, then long-term equilibrium occurs after 12 months for Germany, Poland and Austria. The tourism demand from Slovakia has long-term negative stability after 2 years. The response of *l_TD* to the shock of *l_IPI* is positive in the longer term. The tourism demand returns to equilibrium after more than 12 months in the case German tourists, and as about 15 months for Polish and Austrian tourists. The longest return to long-term stability due to the shock of tourist income variability is shown by the tourism demand of Slovak tourists, namely after two years. Finally, the positive impact of *l_Brent* will have a negative influence on tourism demand in the long term. It will cause a decrease in tourism demand, and in the long term (over 12 months for Austrian tourists, 15 months for German and Polish tourists and 24 months for Slovak tourists), the trend will be steady.

Variance decomposition decomposes fluctuation of endogenous variables into parts in order to understand the relative importance of random disturbance terms to endogenous variables in the model. The results of the variance decomposition of tourism demand are presented in Figure 4.

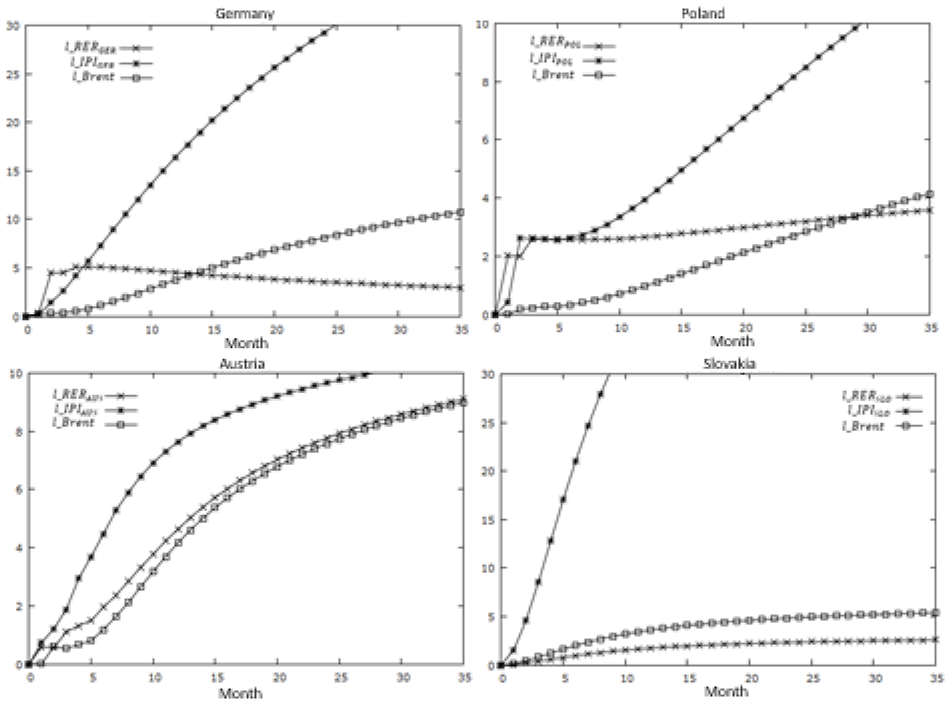

Figure 4. Variance Decomposition of Tourism Demand from Selected Countries
Source: own elaboration.

The graphical representation of the variance decomposition results indicates that the variable *l_TD* itself has the highest explanatory power in the first months. Over the next few months, the percentage of explanatory variables increases. The most significant explanatory force is the variable *l_IPI*, within all countries surveyed. Specifically, after 24 months, the impact of *l_IPI* on tourism demand from Germany is almost 30%, with the sum of the remaining two variables being less than 15%. For Poland, the influence of explanatory variables is growing more slowly. After 24 months, the influence of *l_IPI* is 9% and the sum of the influence of *l_RER* and *l_Brent* is 4%. For the demand of Austrian tourists, the influence of the most prominent variable is almost 10% and the sum of the influence of *l_RER* and *l_Brent* is 16%. Moreover, within the demand of Slovak tourists, the I_IPI variable most affects tourism demand; the effect of other variables can be considered insignificant. Based on the results of the impulse response and variance decomposition, it can be assumed that the variables *l_IPI*, *l_RER* and *l_Brent* can be considered endogenous variables in relation to tourism demand from Germany, Poland, Austria and Slovakia.

Now we shall look at the results in terms of the verified hypotheses. In order to verify the hypotheses, the demand elasticities were derived. Demand elasticities are very important indicators for both policymakers and business planners. The value of the income elasticity conveys the responsiveness of the tourism demand to the change in the income level in the tourist's country of origin. Slovak, Polish, Austrian and German tourists traveling to the South Moravian Region of the Czech Republic respond positively to income changes. While tourism demand from Slovakia has the highest elasticity coefficient of 1.45, Poland, Austria and Germany have an elasticity coefficient less than one. The lowest elasticity coefficient of 0.66 belongs to Poland. Thus, tourism demand is income elastic for Slovak tourists, which means that the tourism product in the South Moravian Region of the Czech Republic can be perceived as a luxury good, but only slightly, by Slovak tourists (the elasticity of demand is greater than 1). For Polish, Austrian and German tourists, tourism demand to the South Moravian Region is not very dependent on the economic situation in the tourists' countries of origin.

As far as the RER is concerned, tourists traveling from Austria and Slovakia respond negatively to changes in tourism prices in the Czech Republic. Price elasticity is an important indicator for the suppliers of tourism products and services since it has a direct on the tourist demands. Austria and Slovakia have elasticity coefficients of 1.21 and 0.84, respectively. Tourists from Germany and Poland do not respond to changes in the Czech price level since their elasticity coefficients are non-significant. Thus, tourism demand is slightly price elastic for Austrian tourists and price inelastic for Slovak tourists. This indicates that Austrian tourists are more easily influenced by price than Slovak tourists. On the other hand, different studies suggest that tourism demand to less developed countries is not very sensitive to fluctuation in prices, for example (Surugiu et al. 2011). The price elasticity of tourism demand from Austrian tourists is probably due to the increase in the number of these tourists, especially in the period of the monetary intervention.

According to the comparative elasticities of the variables, German, Austrian and Slovak tourists respond negatively to transportation cost changes. Polish tourists do not respond to transport cost changes since their elasticity coefficient is non-significant. The highest elasticity coefficient of −0.25 belongs to Austria.

The results are consistent with the research presented in the literature review in the second part of this paper. If we focus on research conducted for tourism demand for the Czech Republic, the results obtained in this paper are in line with Babecká (2013), who used the gravity model for analysis. She concluded that income has a positive effect on the number of tourists. By contrast, RER has a negative effect.

Conclusion

The relationship between tourism demand and other macroeconomic variables has received considerable attention in empirical research. The aim of this paper was to investigate the effects that the real exchange rates, incomes, and travel costs have on inbound tourism demand (tourist arrivals) from Poland, Slovakia, Germany, and Austria to the South Moravian Region of the Czech Republic over the period 2002:M1–2018:M5. To achieve this aim, panel integration analysis using the VECM approach was applied. The following hypotheses were considered: (1) It was expected that income (as the IPI) has a positive impact on the number of tourists (as tourism demand), (2) a negative relationship between price level and tourism demand was expected, (3) a negative impact of transportation costs on tourism demand was expected. With respect to the verified hypotheses, Slovak, Polish, Austrian and German tourists traveling to the South Moravian Region of the Czech Republic respond positively to changes in their income. Tourists traveling from Austrian and Slovakia respond negatively to changes in tourism prices in the Czech Republic. Tourists from Germany and Poland do not respond to changes in Czech price level since their elasticity coefficients are non-significant. German, Austrian and Slovak tourists respond negatively to transportation cost changes. Polish tourists do not respond to transport cost changes since their elasticity coefficient is non-significant.

As a possible direction for further research, it is possible to analyze the interdependence between different groups of variables in order to find a more detailed description of tourism demand. Furthermore, non-linear dependencies using copulas could be investigated.

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Streszczenie

Wpływ wybranych zmiennych makroekonomicznych na popyt na usługi turystyczne w regionie południowych Moraw (Czechy) wśród turystów z Niemiec, Polski, Austrii i Słowacji

Turystyka międzynarodowa jest jednym z najważniejszych sektorów gospodarki otwartej. Celem tego artykułu jest zbadanie wpływu dochodu wyrażonego produktem krajowym brutto, kosztów usług turystycznych wyrażonych realnym kursem walutowym i kosztów podróży wyrażonych ceną ropy naftowej Brent, na przyjazdy turystów z Polski, Słowacji, Niemiec i Austrii do regionu południowych Moraw w Republice Czeskiej w okresie 2002:M1–2018:M5. Liczbę turystów polskich, niemieckich, słowackich i austriackich zakwaterowanych w obiektach zbiorowego zakwaterowania w regionie południowomorawskim przyjęto jako zmienną zależną. Aby osiągnąć cel badania, dokonano analizy kointegracji przy pomocy modelu VECM. Wyniki analizy wskazują, że słowaccy, polscy, austriaccy i niemieccy turyści pozytywnie reagują na zmiany poziomu ich dochodów. Austriaccy i słowaccy turyści reagują negatywnie na zmiany cen usług turystycznych w Czechach. Turyści z Niemiec i Polski nie reagują na zmiany cen w Czechach, gdyż w ich przypadku współczynniki elastyczności są nieistotne. Turyści z Niemiec, Austrii i Słowacji negatywnie reagują na zmiany kosztów transportu. Polscy turyści nie reagują na zmiany kosztów transportu gdyż w ich przypadku współczynnik elastyczności jest również nieistotny.

Słowa kluczowe: popyt na usługi turystyczne, realny kurs walutowy, indeks produkcji przemysłowej, cena ropy naftowej, VECM, kointegracja