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Article

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Determinants of International Migration from Developing Countries to Czechia and Slovakia

*Lucie MACKOVÁ – Jaromír HARMÁČEK – Zdeněk OPRŠAL**

Abstract

Using a gravity model, this article explores the determinants driving stocks of international migrants from developing countries in Czechia and in Slovakia. It presents an overview of international migration to both countries between the years 2006 and 2015 including the major countries of origin. It also proposes a brief discussion of different migration theories that can be used to explain the number of international migrants in both destinations. The gravity model used throughout the study includes four groups of explanatory variables: standard gravity variables, economic, institutional and those that approximate mutual relationships. The results show that the number of migrants in both destinations increases with higher GDP per capita and population in the countries of origin. Furthermore, mutual links such as trade or distance between the destinations and the countries of origin are significant as well. While only developing countries were selected for this analysis, this model provides a useful exploratory tool that can help with further analyses of migration flows to different countries and regions.

Keywords: *International migration, developing countries, gravity model, Czechia, Slovakia*

JEL Classification: F22

Introduction

International migration has been in the spotlight in research and policy for the last couple of decades. With the numbers of international migrants steadily increasing, it makes sense to inquire about the determinants that drive international

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migration to different regions and countries. The “migration crisis” of 2015 has made this topic even more central in the public discourse and policy. However, it is important to analyse the past trends in migration in order to be able to better understand the current situation. In 2015, the number of international migrants was 244 million (United Nations, 2016). Out of this number, 120 million moved towards the countries of the global North (South-North and North-North migrations) and 124 million towards the global South (South-South and North-South migrations). With some originally emigration countries becoming transit and immigration countries, it is important to analyse different cases in this changing environment. Czechia and Slovakia are a case in point. Until recently, there was more emphasis on the intra-EU migration and the Eastern European countries were studied as the countries of emigration (Favell, 2008; Sardadvar and Rocha--Akis, 2016; Verwiebe, Wiesböck and Teitzer, 2014; Kahanec, Pytlikova and Zimmermann, 2016). While they used to be countries of emigration in the past, they are now becoming destination countries for international migrants.

Currently, there is no single universally accepted theory of international migration (Massey et al., 1993). Some argue that this would not even be desirable (Castles, 2010). Moreover, given the diversity of migration experiences and determinants, it would be impossible to use a one-size-fits-all model. Some authors such as King (2002; 2012) have described typologies of migration which they call migration dyads and binaries (internal vs. international, temporary vs. permanent, and regular vs. irregular). However, there are more and more complexities in the movements of people and these binaries often break down in practice. Until recently, migration research has been focusing on the perspective of the sending states and migration from the developing countries was relatively under researched (Straubhaar, 1996). We have selected several theories and perspectives that have informed our research and are suitable for explaining international migration from the developing countries. The perspective of push and pull factors has been widespread in the literature since the early works of Ravenstein (1885; 1889) and Lee (1966). There are various push factors which can cause international migration such as unemployment or poor institutions (bad governance) in the country of origin. However, since push factors largely mirror pull factors, it has been difficult to determine which one is the real cause of migration decision (de Haas, 2010).

Neoclassical economic theory was first used to explain rural-urban migration in the developing countries but has also been applied to international migration (Todaro, 1969; Harris and Todaro, 1970). On the macro level, it predicts that wage differentials make workers move to regions with higher wages, which are labour-scarce. By the same token, the ability to migrate is associated with costs so it is not the poorest individuals who usually migrate, nor the poorest countries from which the majority of the migrants originate (de Haas, 2010). This relationship between migration and development is captured by the migration-hump model. On the micro level, the total cost of movement, including the psychological costs, is important for the individuals to decide if they want to migrate (Todaro, 1969). However, it has been established that wage differentials between countries were not the strongest predictor of migration levels (Massey et al., 1998).

The NELM (New Economics of Labour Migration) theory takes into consideration the household decision when it comes to migration (Taylor et al., 1996). This challenges the earlier neoclassical economic view that migration takes place due to the wage differentials between countries and places the household decisions at the centre. Therefore, the labour market conditions (such as levels of unemployment) in the home country are an important predictor of future household decisions. This theory addresses risk diversification and minimization of risk of household income (Stark, 1991), which is especially important in developing countries where households largely lack any form of private insurance or governmental support. However, this theory has been criticized for overlooking the dynamics and power relationships within the households (Faist, 2000). This meso level has been placed between the micro-level individual motives and macro-level structural opportunities mainly related to the (lack of) development in different migrant sending and receiving countries (Faist, 1997)

The intensity of migration decreases with increasing costs of migration but established migration networks can decrease the costs of migration. Networks theory acts as an analytical tool which can explain how new linkages between the country of origin and country of destination are formed and how they are sustained (Boyd, 1989). Established networks and institutional support can further influence the propensity to migrate. The more migrants from a particular country there are in the country of destination, the more likely are additional migrants to move there. Shared history and language between the countries can be important for the establishment of migration networks. The effects of the network are usually modelled through language similarities, former colonial relationships and spatial distances (Dennett and Wilson, 2013). For example, Arango (2004, p. 28) argues that "the importance of networks for migration can hardly be overstated… [they] rank amongst the most important explanatory factors for migration."

The systems approach to international migration works with different economic, social and governmental elements that are important for migration (Mabogunje, 1970). It discusses the flows of people, institutions, and strategies and the dynamics how these elements interact with each other and the environment. Some of these elements are themselves the product of the system – such as migration policies (Bakewell, 2014). It can be flexible in scale from the village migration (Mabogunje, 1970) to the global migration system (Kritz, Lim and Zlotnik, 1992). As Faist (1997, p. 193) argues.

The attraction of a system approach is that it enables the conceptualisation of migration to move beyond a linear, unidirectional, push-pull movement to an emphasis on migration as circular, multi-causal and interdependent, with the effects of change in one part of the system being traceable through the rest of the system. The systems approach summarizes some of the key variables that are discussed in this paper, and importantly, it focuses on the relationships between both origin and destination contexts. The theories described above have informed the empirical part of this paper and the selection of variables that will be further discussed in the section 2.2.

The aim of this study is to explore the determinants of the stocks of international migrants from developing countries in Czechia and Slovakia using a gravity model and different groups of explanatory variables derived from various migration theories and expressed in bilateral forms. We take a broad definition of developing countries according to the World Bank (2019) as countries with low income, lower-middle income and upper-middle income status in a particular year. While there have been studies analysing migration into OECD countries or migration on a more regional or even global scale (Pedersen, Pytlikova and Smith, 2008; Fagiolo and Mastrorillo, 2013; Anderson, 2015), our analysis focuses specifically on Czechia and Slovakia. The advantage of such a narrow focus is that the findings and conclusions hold specifically for these two countries and are not overridden or biased by much larger stocks of migrants in other destination countries. This can also be useful for policy formulations that often take place on the level of individual countries. Another benefit of our analysis is that it concentrates solely on migrants' stocks from developing countries which means that the (larger) migrants' stocks from developed countries (for example the EU member states) cannot twist the results.

The paper proceeds as follows: In the next section, we discuss the background information on Czechia and Slovakia. Next, we discuss the use of gravity models in the previous migration research and we summarize the data used throughout this study. Then we discuss the four selected groups of variables and proceed to the model itself. Finally, we discuss the results with reference to both destination countries. This study brings facts based on credible sources and rigorous statistical analysis into the often-emotional public debate about migration and its causes. The need for a solid scientific knowledge on migration is particularly important in the current period when we are witnessing (mis)use of the topic by populist movements in Czechia, Slovakia and other Central European countries.

1. Migration from Developing Countries to Czechia and Slovakia

Until the early 1990s, then Czechoslovakia was a country of emigration, rather than immigration. While certain links were sustained with other socialist countries, immigration has started to grow only since the 1990s. Many of the first arrivals before the 1990s were students and workers. After the Velvet Revolution, some of these links persevered. Growing immigration to the region attracted the attention not only of decisionmakers, but also of researchers. Some studies have looked into the factors that influence migration among the European countries (Baláž and Karasová, 2017). In Czechia, the most systematic research focused on phenomenon of migration since 1990s has been conducted by Drbohlav and his colleagues. Their research deals with various aspects of migration, focusing on important immigrant communities in Czechia – Ukrainians, Vietnamese and Moldovans (see for instance Drbohlav, 2015; Drbohlav and Čermáková, 2016) and other related issues, namely remittances (Stojanov, Strielkowski and Drbohlav, 2011) and unauthorized activities (Drbohlav, Štych and Dzúrová, 2013).

Similarly to Czechia, immigration to Slovakia has increased after its accession to the EU in 2004. Yet, Slovakia remains a country with comparatively little immigration flows (Okólski, 2007). Emigration from the country remains a more pressing issue in Slovakia than in Czechia. Some scholars have analysed the reasons making Slovaks leave the country (Grenčíková and Španková, 2016) and the motivations why they decide to return (Williams and Baláž, 2005). Other works described the general migration trends in Slovakia (Divinský, 2005) or different migration phases (Borárosová and Filipec, 2017). Another study has compared the Czech and Slovak migration policies and found that the Slovak migration policies are more inclusive in terms of political rights but lag behind in integration policies and naturalization rates (Stojarová, 2019). For a long time, both countries lacked coherent immigration and integration policies which only developed in 2009 in Czechia and in 2011 in Slovakia (Stojarová, 2019).

Some studies have classified immigration to Czechia according to certain policy-related criteria. Baršová and Barša (2005) propose classification of five different migration periods in the recent history. The first one is the period immediately after the Velvet Revolution (1990 – 1996) labeled as liberal or "laissez faire". The second period (1996 – 1999) was more restrictive, influenced by the socio-economic situation in Czechia and culminated in passing of the Law on the Residence of Aliens in the Territory of Czechia (the so-called Aliens Act) which entered into force in 2000. The third period of consolidation (2000 – 2004 or 2006) continued with this trend and led to the strengthening of the rules and convergence of the Czech and EU law. During the fourth period (2005 – 2008), there were low levels of unemployment, good economic growth, and an increasing need of workforce. However, this changed in the next period. During the fifth period (2008 – now) the state attempted to reduce the number of foreigners in Czechia after the economic downturn. While the year 2000 can serve as the milestone due to the introduction of the new legislation, the year 2010 also brought a tightening of the measures in the Czech labour market – for example, the issue of visas to the citizens of some important source countries was restricted and work permits were given more reluctantly (Drbohlav et al., 2010).

In Slovakia, the migration phases followed a similar pattern. Borárosová and Filipec (2017) classified them as a period of inheritance (1989 – 1993), a period of build-up (1993 – 2000), a pre-accession period (2000 – 2004), a post-accession period (2004 – 2015) and the latest revolting period (2015 and beyond). The authors argue that even in the late 1990s Slovakia lacked comprehensive tools of migration and asylum policy. This changed with accession and the adoption of the Act on the Residence of Aliens in 2003 which was to ensure compatibility with the EU law. Even after joining the Schengen area, migration policy was not a priority until 2015, when Slovakia and other Visegrad countries started to play a more active and sceptical role towards EU-wide solutions towards the "migration crisis". Much like Czechia, Slovakia has neglected labour migrants from third countries by focusing on skilled EU migrants. Moreover, in both countries, third country nationals face the greatest restrictions with accessing the labour market and have no access to social support during their temporary residence (Stojarová, 2019).

Table 1 shows the trends in the stock of migrants from top 5 developing countries in Czechia and Slovakia originating from these countries as for 2015. The structure of migrants from developing countries in Czechia has been since beginning dominated by two countries – Ukraine and Vietnam.[1] While in 1994 migrants from Ukraine accounted for almost 36% and from Vietnam for 24% of all migrants from developing countries, the share has increased to 46% for Ukraine in 2015. The share of Vietnamese migrants was almost identical at the end of the period and equalled 25%, however the total number has increased almost six-fold from 9 633 in 1994 to 56 900 in 2015.[2] In Slovakia, the migrants from Vietnam and Ukraine clearly outnumber the others as well. The growth of migration from these countries was disrupted by two events – first, by

[1] The share of Ukrainian and Vietnamese migrants is also high in the total population of migrants, not only migrants from developing countries. The highest overall share belongs to citizens of Ukraine (22%) and Slovakia (21%), followed by Vietnam with 12% in 2015.

[2] Figures regarding migrants from developing countries include third-country nationals staying in Czechia temporarily (generally up to 90 days), third-country nationals with a long-term residence permit and permanent residence permit (CSO, 2016).

the introduction of more restrictive migration policies which correspond to the classification of migration periods according to Baršová and Barša (2005) and Borárosová and Filipec (2017). Second, the economic downturn in 2009 led to the reduction in numbers of international migrants in the following years, which is especially visible in the case of Slovakia.

T a b l e 1

Number of Immigrants (stock of migrants) **from top 5 Developing Countries in Czechia and Slovakia** (in thousands)

	Czechia						Slovakia				
	Ukraine	*Vietnam*	*Mongolia*	*China*	*Kazakhstan*		*Ukraine*	*Vietnam*	*China*	*Serbia*	*Korea*
2006	102,6	40,8	3,3	4,2	2,4		39,3	10,6	8,9	7,4	8,4
2007	126,7	51,1	6,0	5,0	3,0		37,5	14,3	12,0	14,2	11,4
2008	131,9	60,3	8,6	5,2	3,4		47,2	25,2	14,8	28,5	14,9
2009	131,9	61,1	5,7	5,4	3,9		59,1	23,4	17,2	33,4	16,9
2010	124,3	60,3	5,6	5,5	4,2		63,0	22,6	18,8	38,5	17,8
2011	118,9	58,2	5,4	5,6	4,5		25,6	11,9	6,8	5,5	4,8
2012	112,5	57,3	5,3	5,6	4,8		26,6	12,7	7,8	5,9	5,0
2013	105,1	57,3	5,3	5,5	4,8		27,4	13,8	8,4	6,2	5,2
2014	104,2	56,6	5,5	5,6	5,0		28,5	14,4	8,8	6,5	5,3
2015	105,6	56,9	6,0	5,7	5,1		30,7	14,9	9,3	7,1	5,5

Source: Authors, based on CSO (2016) and OECD (2019).

2. Determinants of International Migration from Developing Countries to Czechia

2.1. Gravity Models in Migration Research

While gravity models have been (discontinuously) used since the 1960s to estimate international trade flows, their application in the field of migration has become possible only recently with the improved availability of bilateral migration data. The basic version of gravity models relates bilateral migration flows between origin and destination countries to their relative size (in terms of area, population, total GDP or GDP per capita) and the distance between them. There are of course other pull and push factors that affect migration between origin and destination countries such as economic opportunities (as measured by unemployment rate or by GDP per capita), political and/or economic stability (inflation), freedom and democracy etc. which are usually included in the analysis. Dyadic factors such as linguistic or cultural proximity or even policy impacts (for example visa restrictions) may be accounted for as well.[3]

Gravity models can be easily derived from theory such as random utility maximization (RUM) models which provide an appropriate theoretical justification of the intuition behind gravity models (see for example Beine, Bertoli and Fernández-Huertas Moraga, 2016; Ramos, 2016). Gravity models then create a convenient framework to analyse the determinants of migration flows (or stocks) between countries. However, the estimation of gravity models is data-demanding: it requires country-pairs migration data that are not always available, although the situation has substantially improved in this regard. There are also some other issues that may complicate the use of gravity models in migration empirical research, such as the definition of migrants according to their origin (birthplace, last place of residence or citizenship) or the kind of migration data that researchers work with.[4] Usually, different studies work with different definitions and different data, depending on data availability which also determines some of the independent variables used in the analyses.

For example, Ramos and Surinach (2013) employed gravity models to explain migration (using migration stocks as the dependent variable) between the EU countries and EU neighbouring countries (ENC). Their results showed a clear increase in migratory pressures from ENC to the EU. Another research on intra-EU migration highlighted the importance of shared experience of nation-state formation, geography, and accession status in the EU for migration systems theory (DeWaard, Kim and Raymer, 2012). Karemera, Oguledo and Davis (2000) investigated the international migration to North America (USA and Canada) using a gravity model. They applied bilateral migration flows as their dependent variable and estimated the results (separately for USA and Canada) based on a panel of data by using the fixed effects (FE) model. They found that the population of origin countries and the income of destination countries were two major determinants of migration to North America. Domestic restrictions on political and civil freedom in origin countries were proven to significantly impair migration into destination countries. Lewer and Van den Berg (2008) used a gravity model to investigate a panel of data for immigration into 16 OECD countries over 1991 – 2000. Their model exhibited high explanatory power and almost all independent variables were significant in the expected directions.

[3] For different pull and push factors of migration, see for example Vogler and Rotte (2000), Mayda (2010) or Ortega and Peri (2013). The dyadic factors are investigated for example in Bertoli and Fernández-Huertas Moraga (2012), Belot and Ederveen (2012) or Adsera and Plytikova (2012).

[4] Ideally, gravity models of migration should be based on dyadic (pair) data between origin and destination countries on bilateral gross migration flows, i.e. the absolute value of people moving from an origin country to a destination. However, such data are often not available which leads to the use of alternatives such as migration stocks, variation in stocks or net flows etc. These alternatives tend to be more prone to measurement errors: for example, variation in stocks is influenced by return migration, migration to other countries, deaths of migrants etc.

2.2. Variables and Data

As already pointed out, the aim of our research is to assess what factors are significant determinants of migration stocks in Czechia and Slovakia. Specifically, we focus on migrants from developing countries over the period 2006 – 2015. We define developing countries according to the World Bank (2019) as countries that did not belong to the high-income category (using the World Bank's classification) in any year over the defined period. This provides us with a maximum of 1226 observations per one destination. However, because of missing data for most of the variables, in practice we work with about 950 observations for Czechia and 600 observations for Slovakia.

Since we use the gravity models' framework, our dependent migration variable must be of a bilateral nature. In this context, migrants are defined according to their citizenship and migration is thought of as voluntary so asylum seekers and refugees have been excluded from our analysis. We have decided to use migration stocks as our dependent variable because the data for Czechia are available at the website of the Czech Statistical Office (CSO, 2016). The stocks include third-country nationals staying in Czechia on a longer-term basis (more than 90 days, including permanent residence permit) as measured at the end of each year.[5] We have found precisely the same data for Slovakia in the OECD International Migration Database (OECD, 2019). However, the data were available only since 2006 and that has effectively limited our period under review for both countries to 2006 – 2015. Moreover, the data in the OECD database are measured at the beginning of each year and therefore, we had to move them back by one year to make them consistent with the data for Czechia.

We express all independent variables in a bilateral form which means that they apply to both countries of origin and destinations at the same time. Some of our variables are bilateral by nature (for example trade flows or distance), while the others are expressed as ratios (a destination's value to a country of origin value for all such variables). The reason for such a transformation is simple: if we include some unilateral variables that reflect characteristics in only the origin or destination country, the estimates are biased unless fixed effects are added into the model (Lewer and Van den Berg, 2008). This issue is addressed in a more detailed way in the following sub-section.

We work with four groups of explanatory variables. The first group consists of standard gravity variables, i.e. variables that are commonly used in gravity models. These are the ratio of total populations (destinations' to origin countries'

[5] As was already discussed earlier, our data may therefore suffer from measurement error as migrant stocks do not account for return migration, re-emigration or for example deaths of the migrants in the stocks.

values), the ratio of gross domestic product (GDP) per capita (destinations' to origin countries' values) and the distance between Czechia/Slovakia and a particular country of origin (measured as the distance between Prague/Bratislava and a given capital city). While data for populations and GDP per capita variables were taken from the World Bank (2016a), data for the distance variable were accessed at the website of *Centre d'Etudes Prospectives et d'Informations Internationales*, CEPII (Mayer and Zignago, 2011).

The second group contains economic variables: we work with the ratio of unemployment rates and with the ratio of inflation rates (destinations' to origin countries' values). Since inflation rates in percentages take negative values which can distort the ratios, we express them as growth coefficients. Data for both variables were obtained from the World Bank (2016a). The third category of variables measures the difference in institutional quality between Czechia/ Slovakia and countries of origin. In this context, we use the ratio of averages over Worldwide Governance Indicators (destinations' to origin countries' values). Also this variable takes negative values with a damaging effect on the ratios. Therefore, we add the minimal value in the dataset to both origin and destination countries' values so that all observations are positive. The data were obtained from the World Bank's website of the Worldwide Governance Indicators (World Bank, 2016b).

The fourth group consists of variables measuring relationships between countries of origin on one side and Czechia/Slovakia on the other. We use the volume of bilateral trade as a measure of economic relationships. For example, Anderson (2015) found that not only migration affects trade, but also bilateral trade affects labour migration. We have obtained the data at current prices (in USD) from the Comtrade Database (United Nations, 2019) and adjusted them by the US GDP deflator to express the variable at constant prices of 2010. We also want to control for a common historical background and closeness of mutual historical relationships in the second half of the twentieth century. To account for that, we construct a dummy variable which takes value of 1 if a given country of origin was a member, an associated member, an observer or closely cooperated with The Council for Mutual Economic Assistance (COMECON) before 1989 (Zwass, 1989). It is apparent that this dummy variable is time-invariant throughout our sample. We also include a variable measuring language similarity to approximate language and cultural proximity between Czechia/Slovakia and countries of origin. Data for this variable were acquired from the CEPII website (Melitz and Toubal, 2012).

Moreover, migration research usually works with dummy variables measuring colonial relationships, expressing common official or spoken languages, border contiguity etc. As Czechia or Slovakia never had any colonies, do not share languages or borders with any developing countries,[6] we have not been able to capture these features. However, we have tried to accommodate the selection of our variables so that they at least partially reflect similar effects. Most of the variables (except for the language index that is often equal to zero and the binary variables) are expressed in natural logarithms so that the estimated coefficients represent elasticities between a particular independent variable and the dependent variable. The variables we work with, including their names used in our analysis and expected signs, are summarized in Table 2.

T a b l e 2

Description of Variables

Name used in regressions	**Description**	**Unit of measurement; Source of data**	**Expected sign according to migration theories**
stock (ln; L1)	stock of migrants (according to their citizenship) from a given country of origin in the destination countries	number of migrants in the stock; CSO (2016); OECD (2019)	*dependent variable*
pop_rat (ln; L1)	ratio of a destination country's total population to total population of a given origin country	total number of inhabitants; World Bank (2016a)	negative sign
gdp_pc_rat (ln; L1)	ratio of a destination country's GDP per capita to GDP per capita of a given country of origin	international dollars in purchasing power parity, constant prices 2011; World Bank (2016a)	both signs possible
dist (ln)	distance between Prague/Bratislava and the capital of a given origin country	kilometres; Mayer and Zignago (2011)	negative sign
unem_rat (ln; L1)	ratio of a destination country's unemployment rate to unemployment rate of a given country of origin	rate of unemployment (% of total labour force, as estimated by the International Labour Organization) World Bank (2016a)	negative sign
infl_rat_gc (ln; L1)	ratio of a destination country's inflation rate to inflation rate of a given country of origin	annual rate of inflation based on consumer prices (expressed in growth coefficients); World Bank (2016a)	negative sign
avgwgi_adj_rat (ln; L1)	ratio of an average of Worldwide Governance Indicators (WGI) for a destination country to an average of WGI for a given country of origin	average of six Worldwide Governance Indicators adjusted by adding the minimal value to all observations; World Bank (2016b)	both signs possible
comtrade_cp (ln; L1)	bilateral trade of Czechia/Slovakia with a given country of origin	USD, constant prices of 2010; UN (2019)	positive sign
comecon	dummy variable approximating historical relationships between Czechia/Slovakia and a country of origin	equal to 1 if an origin country was a member, associate member, observer or cooperated with COMECON; Zwass (1989)	positive sign
lang_prox	language proximity between the Czech/Slovak language and a language of a given country of origin	index with values from 0 (no similarity between languages) to 7.46 (very high similarity); Melitz and Toubal (2012)	positive sign

Notes: 'ln_' means that variables entered regressions in logarithmic form. 'L1' means that variables entered regressions lagged by one period (year).

Source: Authors.

[6] Except the borders between Slovakia and Ukraine which is included among developing countries in our sample.

2.3. Choice of an Appropriate Estimation Method

There is a variety of econometric methods that have been used to deal with gravity models in migration research. These methods commonly include pooled Ordinary Least Squares (OLS) estimation technique, static panel data models (random- or fixed-effects) or dynamic panel data models (using the Generalised Methods of Moments estimators, GMM). If unobserved heterogeneity is assumed to exist, the panel data models (random- or fixed-effects) may provide simple and suitable framework. However, the fixed-effects models cannot estimate the influence of time-invariant variables. This issue has been overcome by inclusion of fixed effects for both origin and destination countries while the pooled OLS technique, usually with clustered standard errors, has been used. The incorporation of country fixed effects has also been proposed to deal with the multilateral resistance to migration (Bertoli and Fernández-Huertas Moraga, 2013).[7] Only recently, dynamics has been introduced to gravity models estimations to handle possible autocorrelation and endogeneity problems (Martínez-Zarzoso, Nowak-Lehmann and Horsewood, 2009; Fourie and Santana-Gallego, 2011).

Another typical issue for the gravity models is the presence of zero observations on the dependent variable. Sometimes, the zeros can be substituted by a very small positive number (such as 1) or they may even be deleted and then estimated by pooled OLS or panel data methods. However, if the quantity of zero migration flows (or stocks) is significant, the zero observations should be taken into account (otherwise the results yielded by pooled OLS or panel data estimations are incorrect). There are at least three options that may be adopted to solve this issue: count data models (such as Poisson, negative binomial or zero-inflated models), two-part models (for count or continuous pooled or panel data, or even the Heckman's selection procedure) or possibly a panel data tobit model (Beine, Bertoli and Fernández-Huertas Moraga, 2016; Ramos, 2016). In our data, we have in total 17% zero observations on the dependent variable (11.6% in the case of Czechia and 22.1% in the case of Slovakia). However, usually around 10% of the total enters our regressions due to missing data on some of our independent variables used in those regressions. Although this percentage is a bit higher for Slovakia (18%), we have decided to ignore this issue of zero observations in our analyses.[8]

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[7] The multilateral resistance to migration is related to the influence of other countries on migration between two countries (Ramos, 2016).

[8] When performing our regressions using the data for the Slovakia, we have also carried out a set of tobit regressions as a robustness check for the static models. The results have not changed much, only the GDP and the inflation rate ratios have become significant and the significance of the *comecon* variable has also increased.

The second challenge of selecting an appropriate approach is related to the fact that most gravity models in empirical research have been applied to estimate various flows (or stocks) between two *groups* of countries: a group of origin countries on one side, and a group of destination countries on the other side. In such applications, the inclusion of countries' fixed effects (both origin and destination) in regressions, estimated by pooled OLS, is the preferred approach to the gravity analysis. However, in our research we work mostly with only one destination country at a time which, of course, does not allow us to incorporate the fixed effects for the destination(s). Having only one destination also makes our sample size smaller. Due to these two facts, the incorporation of fixed effects dummy variables has led to a severe distortion of our results.

To overcome this difficulty, we opt for a slightly different procedure. We express all independent variables as bilateral in the sense that they apply to both countries of origin and destination. Besides the variables that already are bilateral by nature (trade flows, historical relations, language proximity or distance), we express all other variables in a form of ratios (i.e. a destination's value to a particular country of origin value for all such variables). By doing this, we reduce the need to include the origin countries' fixed effects dummy variables in our regressions (Lewer and Van den Berg, 2008).[9] This allows us, in the first part of our analysis, to employ the pooled OLS estimation technique with standard errors clustered on country pairs and year dummy variables. The destinations' fixed effects are included in those specifications that work with both destinations at the same time.

Finally, to solve the autocorrelation problem resulting from the highly persistent data on migration stocks, we have decided to work with the dynamic panel data in the second part of our analysis. Since the inclusion of the lagged dependent variable among regressors creates endogeneity, GMM estimators must be used. We opt for the Blundell-Bond model (Blundell and Bond, 1998) that works with the system-generalised methods of moments estimator (SYS-GMM). The SYS--GMM method, which is especially appropriate for highly persistent dependent variables, is based on the estimation of a system of two equations, one in levels and the other in first-differences. The only endogenous regressor in our specification is the lagged dependent variable, the other explanatory variables are considered exogenous. We use the second through the last (ninth) lag of the endogenous variable as instruments in the first-differenced equation and the second lag of the first-difference of this regressor as an instrument in the level equation. We also use all exogenous variables as standard instruments in both equations.

[9] According to Rose and van Wincoop (2001) and Redding and Venables (2004), gravity model estimates will probably be biased when some variables in the model are unilateral (i.e. if they apply to only one of the two countries in an observation pair). Adding country fixed effects to such models should eliminate this bias (Feenstra, 2004).

Moreover, we lag all time-variant exogenous explanatory variables by one year to account for the delay between the time when migration decision is made and the time the migrant is recorded in statistics. So, our final specification for the dynamic model estimated by SYS-GMM can be written in the following way (where *j* stands for a destination, *i* stands for a particular country of origin, *t* stands for time and *ε* is the error term; subscript *t* is missing for time-invariant variables):

$$\begin{aligned} ln\_stock_{(j,\,i,\,t)} &= \alpha + \beta_1\, ln\_stock_{(j,\,i,\,t-1)} + \beta_2 \ln(pop_{(j,\,t-1)}/pop_{(i,\,t-1)}) + \\ &+ \beta_3 \ln(gdp\_pc_{(j,\,t-1)}/gdp\_pc_{(i,\,t-1)}) + \beta_4 \ln(dist_{(j,\,i)}) + \beta_5 \ln(unem_{(j,\,t-1)}/unem_{(i,\,t-1)}) + \\ &+ \beta_6 \ln(infl\_gc_{(j,\,t-1)}/infl\_gc_{(i,\,t-1)}) + \beta_7 \ln(avgwgi\_adj_{(j,\,t-1)}/avgwgi\_adj_{(i,\,t-1)}) + \\ &+ \beta_8 \ln(comtrade\_cp_{(j,\,i,\,t-1)}) + \beta_9\, comecon_{(j,\,i)} + \beta_{10}\, lang\_prox_{(j,\,i)} + \\ &+ \text{year fixed effects} + \varepsilon_{(j,\,i,\,t)} \end{aligned} \qquad (1)$$

2.4. Results

Our analysis can be divided into two parts. In the first part, we employ the pooled OLS technique with standard errors clustered on country pairs and perform three regression models [(a) – (c)]. In the second part, we work with the dynamic panel data approach and using the SYS-GMM, we run three regression models [(d) – (f)] as well. The complete results of our regression analyses are presented in Table 3. Models (a) and (d) use only the data for Czechia, models (b) and (e) work with Slovakia data and models (c) and (f) combine both destinations. The last set of models [(c), (f)] additionally includes destinations' fixed effects. Other than that, the specification for all models is the same (apart from the obvious fact that the dynamic models include the lagged values of the dependent variable among the regressors).

In model (a), we estimate the determinants of migration into Czechia using static panel data approach. We find that all variables have the expected signs but the levels of their statistical significance vary. All three traditional gravity variables are negative and highly significant implying the number of migrants in Czechia increases with a higher population and GDP per capita of countries of origin (compared to the Czech values) and with a lower distance between the countries in pairs. Among the economic variables only inflation rate ratio is significant and positive, meaning that with a lower inflation rate in countries of origin (compared to the Czech value) higher stocks of migrants in Czechia are associated. The negative coefficient of the institutional variables ratio suggests that there are more migrants in Czechia from countries with better institutions. However, this relationship is clearly insignificant. The variables indicating mutual relationships mostly play a role as well. Both the trade and the 'comecon' variables are positive and significant suggesting that more immigrants come from countries that trade more with Czechia and from countries that used to be closely connected to the COMECON. Conversely, language ties do not seem to be a significant factor of the stock of migrants from developing countries in Czechia.

T a b l e 3

Regression Models and Results

Variables // Models	**Dependent variable:** ln_stock					
	(a) CZ pooled OLS	(b) CZ pooled OLS	(c) CZ&SK pooled OLS	(d) CZ SYS-GMM	(e) CZ SYS-GMM	(f) CZ&SK SYS-GMM
L1.ln_stock				0.579*** (0.127)	0.813*** (0.070)	0.563*** (0.062)
L1.ln_pop_rat	–0.528*** (0.085)	–0.401*** (0.071)	–0.509*** (0.061)	–0.258*** (0.081)	–0.092*** (0.030)	–0.295*** (0.064)
L1.ln_gdp_pc_rat	–0.538*** (0.174)	–0.222 (0.151)	–0.423*** (0.124)	–0.233** (0.111)	–0.064** (0.032)	–0.215*** (0.072)
ln_dist	–1.128*** (0.212)	–0.618*** (0.154)	–0.903*** (0.141)	–0.449*** (0.169)	–0.121** (0.049)	–0.402*** (0.108)
L1.ln_unem_rat	0.193 (0.143)	–0.149 (0.100)	0.041 (0.105)	0.074 (0.066)	–0.033 (0.028)	0.007 (0.053)
L1.ln_infl_rat_gc	0.227** (0.113)	1.108 (1.058)	0.285*** (0.096)	0.076 (0.061)	0.189 (0.152)	0.103* (0.059)
L1.ln_avgwgi_adj_rat	–0.247 (0.395)	0.113 (0.304)	–0.083 (0.272)	–0.131 (0.168)	–0.081 (0.072)	–0.184 (0.156)
L1.ln_comtrade_cp	0.236*** (0.064)	0.277*** (0.077)	0.254*** (0.048)	0.078** (0.033)	0.032 (0.021)	0.066** (0.026)
comecon	1.420*** (0.413)	0.578* (0.322)	1.100*** (0.282)	0.584** (0.277)	0.129 (0.091)	0.503*** (0.170)
lang_prox	0.040 (0.153)	0.169 (0.130)	0.089 (0.103)	0.045 (0.062)	0.034 (0.031)	0.051 (0.058)
Constant	10.382*** (2.544)	3.373 (2.459)	7.960*** (1.827)	4.627*** (1.783)	1.101** (0.499)	3.492*** (1.156)
Year fixed effects	yes	yes	yes	yes	yes	yes
Destination fixed effects			yes			yes
R^2	0.797	0.755	0.778			
F test	36.94***	27.36***	51.48***			
Wald chi^2				2 812.20***	13 881.58***	2 991.14***
AR(1)				–1.93**	–3.69***	–2.70***
AR(2)				1.05	–1.07	0.65
No. of observations	967	632	1 599	960	582	1 542
No. of groups	104	91	195	104	87	191
No. of instruments				109	81	109

Notes: Standard errors of the estimates are in parentheses. *** Significant at 1% level. ** Significant at 5% level. * Significant at 10% level. 'ln_' means that variables enter regressions in logarithmic form. 'L1' means that variables enter regressions lagged by one period (year). The pooled OLS models (a) – (c) are estimated with standard errors clustered on country pairs. The SYS-GMM models (d) – (f) are estimated with WC-robust standard errors. This means that it is not possible to calculate the Sargan test.[10] The consistency of the SYS-GMM model requires first-order autocorrelation and the lack of second-order autocorrelation. The Arellano-Bond (AR) test examines the null hypothesis that there is no autocorrelation of a specific order. The results of the AR(1) and AR(2) tests confirm that there is autocorrelation of the first order and no autocorrelation of the second order.

Source: Authors.

[10] The standard errors for the two-step SYS-GMM estimation tend to be biased in the presence of heteroscedasticity and autocorrelation. The bias can be mitigated using the Windmeijer correction (i.e. the WC-robust standard errors). However, when the disturbances are heteroscedastic, the distribution of the Sargan test is not known and it cannot be calculated.

In the second model (b) we perform the same analysis using the data for Slovakia. The results are similar but generally less significant which can also be a consequence of lower data availability (see Table 3). The stock of immigrants in Slovakia increases with a lower distance and a higher population and GDP per capita of origin countries (compared to the Slovak values). However, the GDP per capita ratio is not significant even at the 10% level. Interestingly, the unemployment and institutional ratios have opposite signs when compared to the Czech case but they are both insignificant. On the contrary, the 'relational' variables are positive and significant (except for the language proximity index) indicating that higher numbers of immigrants in Slovakia are associated with more intensive trade ties and with a common historical background.

In model (c) we estimate a more typical gravity model with both destinations at the same time. The results (not surprisingly) confirm our findings above. While all gravity variables are significant and negative, the unemployment and institutional ratios are clearly insignificant (retaining the signs from the Czech regression). The inflation rate ratio is positive and significant again as well as the trade and 'comecon' variables while language proximity stays insignificant.

Since high collinearity may exist between trade flows and some other variables (distance, GDP per capita or even population ratio) which may impact the regression analysis,[11] we have re-performed all models without the trade variable (the results are not presented in Table 3). In all models (a), (b), (c) the significance of the GDP ratio and the distance variable has increased substantially (they are now significant at the 1% level even in the Slovak regression). Moreover, the inflation rate ratio and the language proximity index have become significant in the Slovak regression (although only marginally). Other than that, the results have not been changed by the exclusion of the trade variable.

In the second part of our analysis, we employ the SYS-GMM technique on dynamic panel data (i.e. when the lagged dependent variable is included among regressors). The results do not change much. The lagged dependent variable is always positive and highly significant which confirms the high persistence in migration stocks data. The gravity variables are all negative and significant (at least at the 5% level). Among the economic variables only inflation rate ratio positively influences migration stocks, yet it is only (marginally) significant in

[11] The collinearity (and multicollinearity) issue is more pervasive with a lower number of observations which makes the 'Slovak regression' more vulnerable. We have calculated the correlation coefficients among our independent variables in all regressions and found high correlations especially between trade and population (Pearson's correlation coefficient approximately –0.55) and between trade and GDP per capita (–0.40). The variance inflated factor in our regressions has indicated the highest multicollinearity impact for the trade variable with values from 3.5 to 4.5, however the mean VIF was substantially lower at around 1.9 – 2.2 in all original regressions. It has decreased to around 1.5 after removing the trade variable from all the models.

the joint regression. The institutional variable is never significant in the dynamic analysis. On the contrary, the 'relational' variables do have some positive effects on the stock of migrants: trade and the 'comecon' variable are mostly significant (it is not the case only in the Slovak regression).

Since collinearity and multicollinearity may be the issue also for the dynamic models, we have re-performed the analysis without the trade variable (not presented in Table 3). However, the results have changed a little only in the Slovak and the joint regressions. First, the negative coefficient of the institutional ratio has turned to be marginally significant in both instances. And second, the GDP ratio and the distance variable have become significant even at the 1% level in the Slovak case. Other results have not been modified in any practical sense

3. Discussion

What conclusions can be drawn from the analysis above regarding the migration from developing countries to Czechia and Slovakia? First, it is apparent that all standard gravity variables are significant across specifications and they have the expected signs. The population ratio is negative which means that the higher the population of origin countries is, compared to the destination's population, the more immigrants (higher stocks of migrants) there are in the destination countries. Similarly, the coefficient of per capita GDP ratio is also negative: the number of migrants in the destination countries increases with higher GDP per capita of origin countries compared to the destination's per capita GDP. This suggests that (on average and *ceteris paribus*) the wealthier a developing country is (relative to Czechia and Slovakia) the higher is the stock of migrants from that country in the destinations. This conclusion confirms the assumption according to which the intensity of migration increases with income (De Haas, 2010). In this context, income poverty cannot be thought of as a significant factor of migration from developing countries into Czechia and Slovakia. Migration stocks also depend negatively on the distance between countries of origin on one side and the destinations on the other side. As distance is generally used as an approximation of the total costs of migration, this result confirms the neoclassical economics theory according to which the intensity of migration decreases with increasing costs of migration.

Second, among the economic variables, inflation rate ratio is relevant for the size of the migrants' stocks only in Czechia (and in the joint regression). The migration stocks decrease with higher inflation in the countries of origin (compared to destinations' values). On the contrary, the unemployment ratio is statistically insignificant factor for the dependent variable in all specifications.

Third, the institutional ratio is negative but never significant in our default models. It turns to be narrowly significant in the Slovak case and joint the dynamic regressions only after the trade variable has been excluded.[12] The negative sign of the coefficient indicates that there are more migrants in the destinations from developing countries with better institutions.

Fourth, variables measuring the intensity of mutual relationships are mostly significant and they have the expected signs. The trade variable is significant and positive in all specifications (except for the Slovak case) suggesting that trade links correlate with migration from developing countries to the destinations. Likewise, similar historical background and therefore closer historical relationships (as measured by the 'comecon' variable) are positively associated with higher stocks of immigrants in both countries. On the other hand, while the language proximity variable has positive sign in all models, it is always insignificant.

When comparing the determinants in both countries, lot of similarities and only several differences are found. The gravity variables influence the stocks in the same direction in both countries. They seem to be stronger in the case of Czechia but this can also be a consequence of a different numbers of observations entering the analyses. Similar conclusion holds also for the variables expressing mutual relationships between the countries of origin and the destinations (trade, historical background and language proximity). Some differences can be found with respect to economic and institutional variables. While the inflation rate ratio is mostly significant for Czechia, the institutional ratio appears to have some (rather weak) effects in the case of Slovakia.

Conclusion

In this study, we applied the gravity model to assess what factors can be considered significant determinants of migration stocks in Czechia and Slovakia. Specifically, we have focused on migrants from developing countries over the period 2006 – 2015 for which we have comparable data for both countries. We have expressed all independent variables as bilateral in the sense that they apply to both countries of origin and the destination. There are four types of variables used throughout the study: standard gravity variables, economic, institutional and relational variables.

[12] Because institutional quality is difficult to approximate by a single indicator, we also tried to employ some alternatives to measure it, such as the Freedom House's Index of Freedom or the Polity IV's indicator of political regime. We constructed ratios for these variables (i.e. destinations' values to values of countries of origin) and then we included these ratios in our regressions (replacing the original variable). Both variables were proved to be insignificant while other results were not modified at all.

This study showed that all standard gravity variables were highly significant in all specifications and had the expected signs. The number of immigrants in Czechia and Slovakia increases with a lower distance, higher population of a country of origin and with a higher GDP per capita of a country of origin (relative to the destinations' values). The last finding may be surprising. However, it is in line with the research showing that higher levels of economic and human development are associated with higher levels of migration (De Haas, 2010). The economic conditions have also some effect on the number of immigrants in both countries (namely the inflation ratio in the case of Czechia) indicating that more immigrants come from developing countries with a higher level of economic stability (as measured by the lower inflation rate).

Variables measuring the intensity of mutual relations are mostly significant with the expected signs. This is important in terms of the networks theory which suggests that the networks created between the country of origin and destination decrease the costs of migration and lead to higher levels of migration. For example, the trade links are an important correlate of migration from developing countries to Czechia and Slovakia. Likewise, close historical relations are positively associated with higher stocks of immigrants in both countries.

All of this has relevant policy implications. Restrictive migration policies (such as the one introduced in Czechia in 2000) can lead to reducing the flows and stocks of international migrants. Nevertheless, such measures cannot separately regulate flows coming from different countries. Moreover, development assistance (aiming to increase the economic well-being in the countries of origin) can often have unintended consequences. We have shown above that the wealthier and more stable in economic terms a developing country is, the higher is the stock of migrants from that country in Czechia as well as in Slovakia. Therefore, the relationship between policies, migration and development is not straightforward.

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