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Regional Migration in the Czech Republic: Economic Factors Are the Key*

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Abstract

This article aims to determine and evaluate factors influencing migration behaviour and decision to migrate in 14 regions of the Czech Republic in the periods 1995–2018 and 2004–2018 (after the accession to the EU). The panel data analysis conducted mostly confirms our hypotheses on the impact of the analysed factors, confirming the impact of GDP growth, number of job listings at Labour Offices, number of job applicants, employment in industry and number of finished dwellings. The exceptions are the variables for the crime rate and number of college students in the region, where we found a positive but barely statistically significant coefficient. One group of factors (GDP growth, jobs at Labour Office, finished dwellings) prove to be pull factors, *i.e.*, they are statistically significant and have a positive impact on migration flows. There are also two push factors, both of which represent the labour market situation and, to some extent, the structure of the economy in the region (number of job applicants and employment in industry). Their relationship with migration flows is negative and statistically significant, while several robustness tests are employed.

Keywords: Regional migration, pull factors, push factors, migration balance, labour market, panel data

JEL Classification: J11, J21, J6, O18

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1. Introduction

Migration is a phenomenon known since the dawn of civilization. It includes regional migration driven by a variety of factors. These factors influence potential migrants by either "pulling" (pull factors) or "pushing" (push factors) them to migrate; that is, either pushing them out of their home region or pulling them into the receiving region. More important than the absolute level of the push or pull factor is its relative difference between the home and receiving regions (Bansak *et al*., 2021). There are a number of factors that may convince a potential migrant to migrate (push or pull them). A number of economic theories have emerged to explain migration with a particular socioeconomic factor or a group of such factors. Most of them have been created to explain international migration, but some are also suitable for explaining regional migration.

For example, the macroeconomic neoclassical theory of migration claims that migration is caused by differences in wage levels between countries (or other regions). Microeconomic neoclassical theory states that migration occurs when a potential migrant expects a net return to migration. Migration costs are included in these considerations (*e.g*. psychological costs, travel costs, *etc*.) (Massey *et al*., 1993). Furthermore, labour market imperfections, namely a non-zero unemployment rate, are included in the research (Harris and Todaro, 1970). According to the "new economics of migration", migration is a family decision taken to diversify risks by diversifying sources of income. Another theoretical approach applicable to regional migration is "network theory". It focuses on the existence of social capital, which significantly reduces migration costs (Massey *et al*., 1993). The distance-based gravity model is also used to explain migration flows (Bansak *et al*., 2021).

Based on these migration theories, a literature review (see below) and data availability, we decided to use as our explanatory variables a group of factors including GDP growth, number of jobs available, crime rate, number of college students, employment in industry, number of job applicants and number of finished dwellings in a given region. Differences in these indicators may be a reason to migrate or may influence the decision making of potential migrants. Due to data availability, we examine intraregional migration determinants in the administrative regions of the Czech Republic in the period from 1995 to 2018, by using panel data regression with net flow (immigration-emigration) as the dependent variable. Moreover, we also focus on a period after the Czech Republic's accession to the European Union and compare the results for the overall examined period (1995–2018) with this shorter period (2004–2018).

The aim of this paper is to determine and evaluate the push and pull factors that influenced migration decision making in the Czech Republic and its regional migration flows between 1995 and 2018 and between 2004 and 2018 (after the country's accession to the European Union). The paper contributes to the existing research on the determinants of regional migration in the Czech Republic, which is important for the formation of national regional policy concerning the labour market and beyond. The selection of assumed migration determinants also corre-

sponds to this aim. Our choice of the time period and its division into two subsamples is mainly due to data limitations. The current administrative division of the Czech Republic into regions has only existed since 2000, and for most variables, retrospectively computed data are available from 1995 onward. This allows us to extend our research as far back as the late 1990s, but given that these early data were computed retrospectively for administrative units that did not exist at the time, the pre-2000 results should be treated with caution.

The remainder of this paper is organized as follows: Section 2 provides a review of the literature on determinants of regional migration. Section 3 describes the data and models employed, Section 4 presents the results, Section 5 provides discussion, and Section 6 concludes.

2. Literature Review

Migration is an international phenomenon that has been growing in scale, complexity and impact. It is both a cause and an outcome of broader development processes and a natural feature of the current globalized world. Regional migration is a key component of the spatial distribution of population, influencing communities, households and individuals. It affects the social, cultural and demographic environment of countries and has numerous economic consequences. Regional migration can also be a tool to achieve specific economic and social goals, for example, a better distribution of the workforce.

Aronsson *et al*. (2010) explored the factors behind income growth and net migration in Sweden at a regional level. They found a negative relationship between the initial level of average regional income and subsequent income growth. The level of human capital, measured as the share of people with higher education, had a positive effect on net migration. Other determinants of regional migration can be treated as fixed factors related to climate, geography and regional labour market characteristics, all of which play a role in migration decisions. Pekkala (2003) analysed migration in Finland using a large sample from a longitudinal census data file for the period 1985–1996. The analysis implies that individuals with higher human capital (*i.e*., younger and more educated) migrate to growth centres more frequently, presumably attracted by the broader employment options and higher wages available there.

There are also studies from other parts of Europe that focus on traditional socioeconomic factors as explanatory variables of regional migration. For instance, Germani *et al*. (2021) dealt with the relationship between air pollution, socioeconomic factors and the net migration rate at the province level in Italy. They found a positive relationship between migration and GDP per capita (taxable income in euros), entrepreneurial density and levels of education and infrastructure. On the other hand, migration is negatively associated with air pollution and unemployment. Cameron *et al*. (2005) aimed to capture the effects of housing and labour markets on interregional migration in England and Wales, where housing markets seemed to have a strong effect on migra-

tion, both inflow and outflow. Furthermore, unemployment was more relevant for migration than the employment rate.

Studies on regional migration in transition economies deserve special attention. They point out possible obstacles causing migration rigidity or lower migration flows despite existing relevant migration factors. Andrienko and Guriev (2004) examined regional migration in Russia in the period 1992–1999, corresponding to the primary stages of the market transformation of the Russian economy. People in Russia migrated in the given period from northern and eastern areas and headed to western and southern regions. Using panel data on migration flows, the authors tried to determine the impact of economic, political and social factors on migration. They found a significant impact of regional migration on the economic condition of regions. Overall migration in Russia in the period was low, influenced mainly by per capita income, the unemployment rate, poverty rate, provision of public goods and macroeconomic shocks. Changes in these macroeconomic indicators were caused by the post-Soviet collapse crisis of the early 1990s. Migrants were attracted by regional policies improving quality of life, creating new job opportunities and improving the provision of public goods. According to the authors, the impact of geography on interregional allocation of workforce should not be underestimated. Migration was also restricted by insufficient amounts of liquidity among the population, where inhabitants could not leave the poorest regions, as they could not afford to finance the migration costs, particularly given the territorial size of Russia. This liquidity trap threatened up to a third of all Russian regions at the time.

A similar description of the workforce mobility problem is offered by Horváth (2006), who examined the geographical migration of workers between the administrative districts of the Czech Republic in the years 1992–2001. The study used annual data from the 77 districts the country was administratively divided into at the time. For each district, the data covered the number of emigrants, number of immigrants, average wage, unemployment rate, total district population and total district area. Similarly to the other post-communist transition countries, the geographical mobility rate in the Czech Republic fell or stagnated during the 1990s, whereas regional differences increased substantially. This phenomenon represents a serious contradiction, since the reaction to an increasing regional difference should be increased emigration from worsening and stagnating regions into richer and more developed regions. According to Horváth (2006), the explanation may be limited liquidity, similar to the case of Russia, despite the vast difference in country size. Again, limited liquidity hindered workers' ability to move as a result of high migration costs. This lack of liquidity was amplified by the low development of the Czech financial market in the 1990s, limiting access to loans. Another complication for migration arises when an entire family is making the decision, not just an individual. Given the fairly high participation rate of women on the Czech labour market, migration usually meant two family members were looking for a job in the new region.

There is also the indisputable role of social benefits and housing market regulations hindering the mobility of inhabitants. Fidrmuc and Huber (2007) reacted to this by performing a sur-

vey where they examined the personal and regional factors influencing an individual's decision to migrate. The survey took place in 1998 and its outputs were linked to the Czech Statistical Office (CZSO) outputs at the NUTS4 level (corresponding to administrative districts in the Czech Republic). Respondents were asked about their financial and socioeconomic situation, work experience, economic outlook expectations in the next 2 years and attitudes towards then-ongoing reforms and political issues. Also included were variables such as gender, age, household structure, highest achieved education, personal income and wealth, time spent unemployed during the last 2 years, any entrepreneurial activity of the individual, *etc*. Some less common variables were also included, for example political preferences and a subjective assessment of own poverty. Indicators representing regional situation were separated from economic ones (labour market indicators, *etc*.). There were also variables measuring the crime rate, environment quality or public infrastructure availability. The results suggested a low mobility of the population. Personal characteristics (income, home ownership) were among the most important determinants identified. The low rate of regional migration was largely explained by the poor situation on the housing market. Unwillingness to migrate was found mostly among the less educated, homeowners, older people and inhabitants of regions with higher unemployment rates.

Another important factor possibly influencing regional migration is distance. Distance between regional urban centres was incorporated in the gravitational model of Paleta and Jandová (2010). This model was based on panel data from the 14 administrative regions of the Czech Republic for the period 1991–2008, before the global financial crisis (GFC). Regions' populations and distances between regional capitals were used as explanatory variables, where a negative relationship between distance and migration was expected. The gravitational model was adjusted to monitor intra-country migration. Variables such as common language, colonial relations, common borders, *etc*. were excluded. The GDP per capita indicator was replaced by average wages due to a hypothesis of this being more relevant in migration decision making, as well as the fact that GDP per capita and average regional wage are highly correlated in the Czech Republic. Added to the model were other explanatory variables, such as unemployment and number of job opportunities, which indicate the probability of a successful job search. The results indicate that the most important determinant of regional migration is the wage difference between regions. The distance between regional centres plays a role as well, but its importance is low, since the Czech Republic is territorially small, and its regional capitals are quite close to each other. The impact of unemployment on migration was small. The authors noted that, apart from classical economic variables, migration networks or quality of environment may also play a role.

Regional migration is also a topic of several studies from the USA. Cebula and Vedder (1973) examined the factors of regional migration in the USA. They used data on 39 standard metropolitan statistical areas (SMSAs) and found that migration is influenced by factors including per capita income, number of days below 32°F (0°C), availability of health services and unemployment rate. Feng *et al*. (2012) analysed regional migration in the USA with an emphasis

on the impact of climate change. The authors noted that migration has been part of American history from the colonial era. The American (white) population slowly migrated to the west and south of the country's present extent; thereafter, industrial development and technological changes in agriculture led to migration from the countryside to cities (urbanization). Migration policy was liberal at first, but following a strong decline in rural population, more interventions occurred, trying to prevent higher migration to cities with the aim to protect rural communities. The study points out the relationship between climate change and migration between cities and the countryside. Given that migration is connected with better opportunities, outflows of inhabitants are negatively correlated with revenues and wages in agriculture. These are, to some extent, determined by weather. According to the authors, ongoing climate change has a negative impact on agricultural production, reducing revenues and profits and causing emigration from the countryside. The study suggests climate change and changes in weather will possibly create pressure for rural populations to migrate to cities. Such pressures could be eased by government programmes insuring agricultural enterprises and farmers against unpredictable weather conditions, such as crop insurance.

Jeanty *et al*. (2010) explored the relationship between migration and housing prices, stating that identifying local interactions between population change and price of housing is complicated by their simultaneous and spatially interdependent relationship. By estimating a spatial simultaneous equations model, they found that neighbourhoods are more likely to experience a rise in housing prices if they gain inhabitants and are more likely to lose population if they experience an increase in housing prices. Plantinga *et al*. (2013) tested the role of housing prices in migration analyses, developing a new method. Using a sample of 2,000 individuals, they estimated the relationship between housing costs and the attributes of 291 metropolitan areas in the USA. Estimating models with three different alternative housing prices (median house price, average apartment rent and urban land rent), they consistently obtained results indicating counterintuitive positive effects of housing cost on immigrants' choice of residential area. Potepan (1994) aimed to explore the simultaneously determined relationship between inter-metropolitan migration and metropolitan housing prices. A two-stage least squares method was employed, with results suggesting that higher net migration raises metropolitan housing prices, while simultaneously higher housing prices discourage further net migration.

3. Methodology, Data and Descriptive Analysis

This chapter focuses on the research design. A panel data regression is presented with various effects (fixed and random); results of stationarity and multicollinearity tests are found in the Appendix. A description of variables is provided in Table 1. Figures 1 and 2 provide a brief overview of migration flows in the Czech Republic in 1995–2018. All the data are from the Czech Statistical Office. Annual data are as at year end (31 December). The GDP and wages are regional data.

Table 1: Description of variables

Variable	Meaning	Units baseline	Transformation	Units transformed
netflows	Migration balance (immigration – emigration) / number of inhabitants	‰	–	–
jobaplicants	Number of job seekers registered at Labour Offices	**Level**	**Logarithm**	**Log**
GDP_growth	Gross domestic product growth	%, Index	–	%
jobsinevidence	Jobs listed at Labour Offices	Level	Growth	%
crimes1000pop	Crime rate per 1,000 inhabitants	Level	Growth	%
unistudents	Number of college students	Level	Growth	%
emplindustry	Number of employees in industry	Level	Growth	%
finishedbuild	Number of finished dwellings	Level	Log	Log
wageavg	Average wages	Level	Growth	–
applitojobevid	Number of applicants per available registered job opportunity	Ratio	–	–

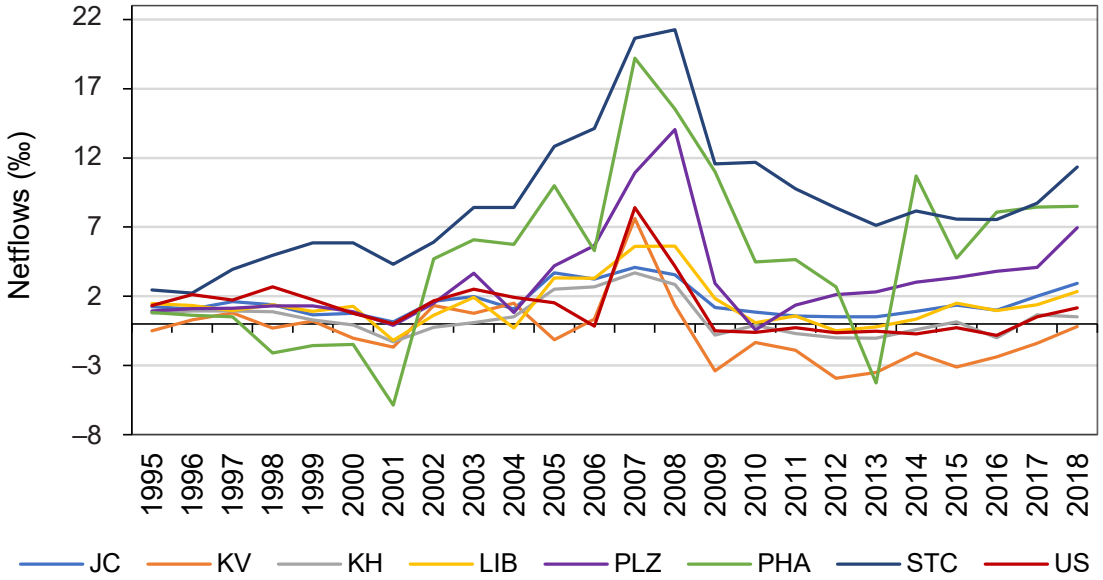
Source: Authors' own elaboration

The Czech Republic consists of 14 administrative regions (one of which, Capital City of Prague, is entirely urban), all of which are included in our analysis. The dependent variable is *netflows*, the other variables are explanatory.

3.1 Descriptive analysis

Figures 1 and 2 show the migration patterns across the 14 administrative regions of the Czech Republic during the examined time period. One can clearly see the dominance of the Capital City of Prague and its surrounding Central Bohemian Region, followed by the South Moravian, Plzeň and Pardubice Regions. This led us to adjust our models to exclude Prague and Central Bohemia as a robustness check. On the other hand, the highest population loss is seen in the Moravian-Silesian and Karlovy Vary Regions.

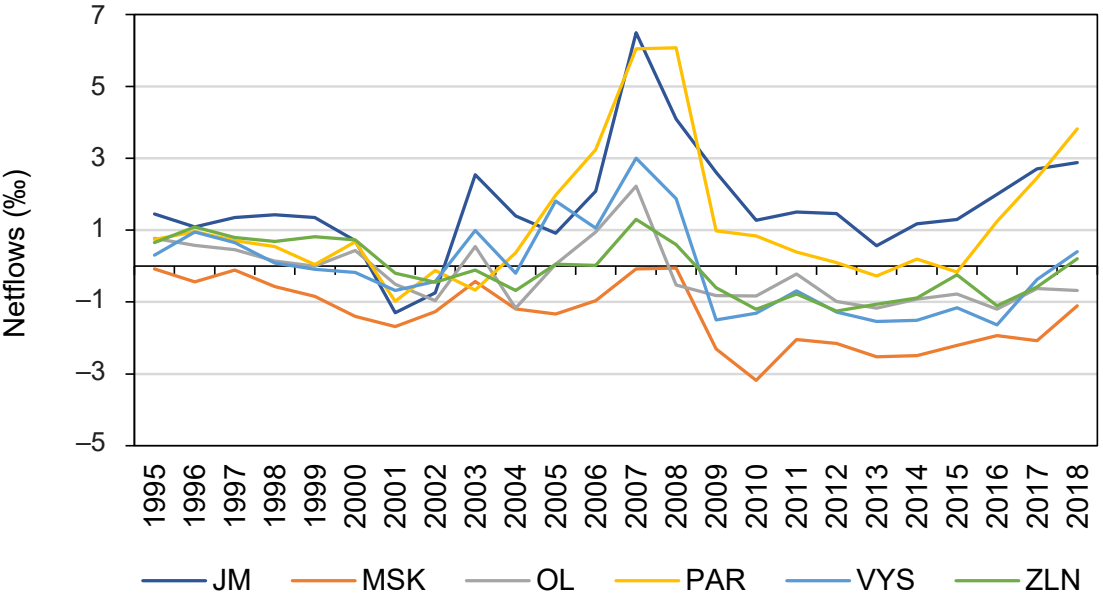
Figure 1: Migration balance in Czech regions 1995–2018



Note: Regions of the Czech Republic. JC: South Bohemian Region, KV: Karlovy Vary Region, KH: Hradec Králové Region, LIB: Liberec Region, PLZ: Plzeň Region, PHA: Capital City of Prague, STC: Central Bohemian Region, US: Ústí nad Labem Region

Source: CZSO (2021), authors' own elaboration

Figure 2: Migration balance in Czech Regions in 1995–2018



Note: Regions of the Czech Republic. JM: South Moravian Region, MSK: Moravian-Silesian Region, OL: Olomouc Region, PAR: Pardubice Region, VYS: Vysočina Region, ZLN: Zlín Region.

Source: CZSO (2021), authors' own elaboration

3.2 Panel data analysis

This section provides econometric analysis of panel data for 14 entities (13 when excluding Prague), in this case Czech administrative regions, from 1995 to 2018. Novák (2007) defines panel data analysis as studying individual subjects (regions in this case) and their mutual relationship in time, when periodical information about their characteristics is provided.

Our model consists of a dependent variable for migration balance (*netflows*) and seven explanatory variables: GDP growth (*gr_gdp*), job listings at Labour Office branches (*jobsevidence*), crime rate per 1,000 population (*crimes1000pop*), number of college students (*unistudents*), number of people employed in the industrial sector (*emplindustry*), and finished new construction of houses and apartments (*finishedbuild*). See Table 1 for additional information on the variables. All the variables were adjusted due to stationarity conditions and lagged to mitigate possible concerns about endogeneity. Lagging variables not only mitigates endogeneity concerns but also allows time for economic agents to react to new conditions and make their migration decision under the given circumstances. Some variables were transformed into their natural logarithms, while some were not stationary and growth transformations were employed to deal with this problem. After pilot estimations of the model, we incorporated an average wage variable into a new set of models.

After adjustments to variables, the model is described as follows:

$$\begin{aligned} netflows_{it} = {} & \beta_0 + \beta_1 \times gr\_gdp_{it-1} + \beta_2 \times gr\_jobsevidence_{it-1} + \beta_3 \times \\ & \times gr\_crimes1000pop_{it-1} + \beta_4 \times gr\_unistudents_{it-1} + \beta_5 \times gr\_emplindustry_{it-1} + \\ & + \beta_6 \times lnfinishbuild_{it-1} + \beta_7 \times lnjobaplicants_{it-1} + \beta_8 \times gr\_wageavg_{it-1} + \varepsilon_t \end{aligned} \quad (1)$$

Based on the literature and economic theory, we expected the following relationships: *Migration balance (netflows)* should increase in a given region with *GDP growth*, suggesting a positive relationship. More available jobs offer more opportunities, as well as possibly higher salaries due to higher demand for workers; therefore, a positive relationship between *jobsevidence* and the dependent variable is expected. The variable *jobaplicants* is, similarly to *jobsevidence,* a proxy for the labour market and unemployment. Unlike *jobsevidence*, a negative relationship is expected for *jobaplicants*, since a larger number of job applicants signals higher unemployment and more competition among job seekers on the regional labour market. This is good for employers, less so for employees or potential employees making their migration decisions.

Given the transformation of the Czech economy in the 1990s and the associated decline in heavy industry, the variable *number of people employed in industry (emplindustry)* is expected to have a negative impact on migration flows, due to the general decline of industry and of opportunities for workers with related skillsets in the observed period. Regions that had been more in-

dustrialized at the time of the Velvet Revolution (1989) would be expected to lose competitiveness in the following years and decades and start to lose population. On the other hand, some of these regions saw new development in the automotive industry, which might prove to be a pull factor as well.

For the variable *crimes1000pop*, we expect a negative relationship, since individuals in general are risk-averse, and a high crime rate is a risk of sorts when considering a new place to live. For *number of college students*, we expect a positive relationship, as universities are a source of knowledge, human capital and innovation, and students who commuted to college might later relocate permanently to their place of education due to connections, familiarity, *etc*. The *finishedbuild* variable might run into a causality problem, where housing construction could be a "pull factor" due to increased supply of housing for potential migrants, or it could be a by-product of immigrants causing increased housing construction in their new regions.

Multicollinearity between explanatory variables is addressed in Table 4 in the Appendix.

4. Results

Table 2 shows three variants of the model, including models with standardized variables. All the models use fixed effects; random-effect models are presented in Table 7 in the Appendix, partially as an additional robustness check. The Capital City of Prague is much wealthier than any other locale in the Czech Republic, and has a number of other specifics, which is why it is often excluded from nationwide economic analyses; therefore, models 3 and 6 exclude the Prague Capital Region.

The regression coefficients reported in Table 2 show that the regression results mostly match our prior hypotheses and are statistically significant, with two exceptions, one being the crime rate and the other being college student numbers. For crime rate, we find a positive (opposite than expected) statistically significant coefficient, while for college students, we find the expected positive coefficient, but it is statistically insignificant. In the case of crime rates, the reason may be that the employed geographic division (regions) is too coarse, and better results might be achieved with a more granular approach at the level of the former administrative districts (counties). In the case of college students, the coefficients are only barely statistically significant, with a *p*-value of 0.123. This may be the result of the uneven distribution of universities and hence students around the country, or a longer time perspective may be necessary when trying to determine the impact of numbers of college students on migration flows.

Our findings are similar for the overall period and for the period after the Czech Republic's accession to the European Union.

Several variables have the expected positive and statistically significant effect, in both examined periods: GDP growth, job listings and finished dwellings. Greater economic growth, higher

numbers of vacancies and broader supply on the real estate market (compared to the potential migrant's current region) can motivate people to migrate, as they can more easily find a job or a place to live. Thus, these factors seem to be significant pull factors of migration.

Excluding the Capital City of Prague from the model has almost no significant effect on the results when considering models with fixed (FE) or random effects (RE). In addition, models with FE and RE offer very similar results. Incorporating average wages does not change the results much, while the statistical significance of coefficients slightly declines in some cases (from the 1% to the 5% level). However, the coefficient on average wages is statistically significant only for the full period, not for the shorter period from 2004. Thus, average wages do not seem to have been a pull factor of migration after the Czech Republic's accession to the European Union. Also interesting is the effect of taking out Prague Capital Region. In this case, average wages are statistically significant in both examined periods for the fixed-effect model, varying in the random-effect model. For job applicants, the coefficient values and statistical significance decrease. For the period after the EU accession, there is even a loss of statistical significance. The coefficient value also decreases for the number of employees in industry and finished dwellings.

Excluding the Central Bohemian Region (see Table 8 in Appendix) yields similar results to excluding Prague. Compared to the baseline model, only a few deviations occur, consisting of minor changes in the statistical significance of certain variables, some of which are increases, some decreases. We can thus conclude that neither the exclusion of Prague nor of Central Bohemia have a significant effect on the model and the significance of explanatory variables.

The Czech Republic is one of the CEE countries that saw a period of economic transformation after the communist regimes in the region collapsed around 1990. We try to capture changes in migration behaviour by creating separate models for the period 2004–2018. This means we effectively consider the Czech Republic's transformation period to have ended in 2004, which in a broader perspective may be a debatable call. However, the reason we chose 2004 as the dividing line is largely practical, as this was the year the Czech Republic joined the EU. This event may have changed migration patterns not only internally, but also opened the market further to foreign migrants.

There can occur an endogeneity problem among some variables. For example, finished dwellings may "pull" new inhabitants, but, from the other point of view, new inhabitants demand new dwellings. Some authors use migration as a variable to explain housing conditions. For example, Hlaváček and Komárek (2011) and Kalabiška and Hlaváček (2022) found a positive and significant effect of migration on housing prices. We deal with the potential endogeneity concerns by lagging all the variables by one year and excluding the finished dwellings variable from our estimations. The results show that excluding finished dwellings as a potential source of endogeneity does not change significantly the coefficients and their statistical significance, so the results can be considered robust and stable.

We also estimated five alternative models with the alternative variable *applitojobevid* (see Table 9 in Appendix). The results did not change when using the ratio variable instead of the variables *jobaplicants* and *jobsinevidence*; therefore, we believe that our labour market variables are robust. The coefficient of the variable *applitojobevid* is positive and, thus, an increase in this ratio means that the region is more attractive for potential migrants since there are either more job opportunities, fewer job seekers, or both.

Table 2: Model estimations 1995–2018

	1	2	3	4	5	6
Variables	**Model 1 without wages**	**Model 2 with wages**	**Model 3 without Prague**	**Model 1 std.**	**Model 2 with wages std.**	**Model 3 without Prague std.**
Standardized variables				✓	✓	✓
gr_gdp	0.158**	0.147**	0.127**	0.145**	0.135**	0.116**
	(0.058)	(0.054)	(0.058)	(0.053)	(0.049)	(0.053)
gr_jobsevidence	1.581***	1.666***	1.499**	0.185***	0.195***	0.175**
	(0.421)	(0.452)	(0.493)	(0.049)	(0.053)	(0.058)
gr_crimes1000pop	7.277***	7.058***	8.213***	0.141***	0.137***	0.159***
	(2.058)	(2.327)	(2.105)	(0.040)	(0.045)	(0.041)
gr_emplindustry	−7.559***	−8.919**	−5.254**	−0.083***	−0.098**	−0.058**
	(2.314)	(3.319)	(2.134)	(0.026)	(0.037)	(0.024)
lnfinishedbuild	2.817***	3.076***	2.280**	0.506***	0.553***	0.410**
	(0.801)	(0.982)	(0.831)	(0.144)	(0.177)	(0.149)
gr_unistudents	1.693	1.681	1.593	0.082	0.082	0.077
	(1.053)	(1.039)	(0.928)	(0.051)	(0.050)	(0.045)
lnjobaplicants	−2.907***	−2.540**	−1.678*	−0.521***	−0.455**	−0.301*
	(0.806)	(1.157)	(0.939)	(0.144)	(0.207)	(0.168)
gr_wageavg		0.401*	0.462**		0.070*	0.081**
		(0.186)	(0.181)		(0.032)	(0.031)
Constant	−5.189	−12.418	−13.829	0.168***	0.155***	0.096**
	(8.739)	(10.601)	(11.245)	(0.027)	(0.031)	(0.038)
Observations	223	218	204	223	218	204
***R*-squared**	0.403	0.434	0.440	0.403	0.434	0.440
Number of id	14	14	13	14	14	13

Note: Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Source: Authors' own calculations

Table 3: Model estimations 2004–2018

	1	2	3	4	5	6
Variables	**Model 1 without wages**	**Model 2 with wages**	**Model 3 without Prague**	**Model 1 std.**	**Model 2 with wages std.**	**Model 3 without Prague std.**
Standardized variables				✓	✓	✓
gr_gdp	0.136**	0.122**	0.101*	0.124**	0.112**	0.093*
	(0.054)	(0.048)	(0.051)	(0.050)	(0.044)	(0.047)
gr_jobsevidence	1.565***	1.750***	1.562**	0.183***	0.205***	0.183**
	(0.435)	(0.477)	(0.542)	(0.051)	(0.056)	(0.063)
gr_crimes1000pop	7.557***	6.873**	8.211***	0.146***	0.133**	0.159***
	(2.363)	(2.546)	(2.347)	(0.046)	(0.049)	(0.045)
gr_emplindustry	−10.116***	−11.641***	−7.876***	−0.112***	−0.128***	−0.087***
	(2.390)	(3.227)	(2.356)	(0.026)	(0.036)	(0.026)
lnfinishedbuild	2.074***	2.606**	1.700**	0.373***	0.469**	0.306**
	(0.672)	(0.996)	(0.742)	(0.121)	(0.179)	(0.133)
gr_unistudents	3.082	2.838	2.901	0.150	0.138	0.141
	(2.216)	(2.190)	(2.081)	(0.108)	(0.106)	(0.101)
lnjobaplicants	−3.270***	−2.765**	−1.904	−0.586***	−0.495**	−0.341
	(0.870)	(1.280)	(1.134)	(0.156)	(0.229)	(0.203)
gr_wageavg		0.435	0.475*		0.076	0.083*
		(0.246)	(0.254)		(0.043)	(0.044)
Constant	6.425	−4.293	−4.654	0.221***	0.189***	0.122**
	(9.406)	(13.047)	(13.955)	(0.042)	(0.046)	(0.046)
Observations	196	192	179	196	192	179
***R*-squared**	0.434	0.465	0.481	0.434	0.465	0.481
Number of id	14	14	13	14	14	13

Note: Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Source: Authors' own calculations

5. Discussion

In line with economic theory, we find positive and statistically significant relationships for GDP growth, job listings and finished dwellings. These may be considered to be pull factors in an individual's decision to migrate. These results correspond to the assumptions formulated in Section 2.2. People are attracted to the regions by available job opportunities and wide housing options. We find a negative, statistically significant relationship for employment in industry and job applicant numbers, which may be considered push factors for the Czech Republic. These results also

correspond to the assumptions formulated in Section 2.2. The general decline of industry and of opportunities for workers with related skillsets due to the transformation of the Czech economy and unemployment are causing people to leave their regions.

The results for the crime rate and number of college students are mixed. We find a relationship contrary to expectation for the crime rate variable, possibly due to migration into more densely populated areas where the crime rate is higher. The result might also indicate that economic factors are significant enough to outweigh the effect of crime rates when deciding about migration. The impact of college student numbers on migration flows proved to be (just) statistically insignificant, with the expected positive sign. As mentioned, this may be the result of the fairly uneven territorial distribution of universities in the Czech Republic, and hence of students around the country. Alternately, a longer time perspective might be necessary when trying to determine the impact of college student numbers on migration flows.

Unlike in Paleta and Jandová (2010), GDP rather than average wages was used in the pilot model and proved to be statistically significant and in line with theory. On the other hand, incorporating an average wage variable into the model improves the fit and leaves the results for other variables unchanged, indicating that the model is robust to this change. We may conclude that average wages as well as GDP growth in the region are both statistically significant pull factors.

The differences between the overall examined period and the period after the Czech Republic's accession to the European Union are not large, with the exception of employment in industry, where the coefficient is larger for the post-accession period.

Removing the Prague Capital Region from the sample changes the coefficient and statistical significance of some variables. We believe that the main reason for this is the economic power of the capital region (about one eighth of the population and one quarter of the national GDP), which is an outlier that may be magnifying the impacts of some explanatory variables. The exclusion of Central Bohemia, the region surrounding the Capital City of Prague, has a similar effect, probably for similar reasons, as at least the inner part of Central Bohemia (towards Prague, an enclave in the region's centre) is effectively Prague's metropolitan area. This shows that excluding the capital city and the major target region for its emigrants from one set of estimations is the right path. Nevertheless, even these exclusions leave most of the coefficients statistically significant and largely unchanged compared to the baseline set of models.

Overall, it would be beneficial for studying migration flows in the Czech Republic to work with smaller geographical entities, probably the former administrative districts (counties). This is hindered by poor data availability for certain variables, such as average wages, GDP and more. Many of these data series end after the abolition of district-level administration in 2002, and attempting to extend them by some estimation for any substantial length of time would introduce large error margins.

Because of the potential problem of multicollinearity between GDP and wages, we provide an additional model (Table 9) with only wages included as well. This model yields similar results since there is no collinearity among the variables. We think that the impact of wages can be seen primarily in the difference between wage variables coefficients when excluding Prague and Central Bohemia since wages in these regions differ significantly from the rest of the country.

It is advisable to keep in mind that the explained variable is calculated as the difference between total immigration and emigration in individual regions. This means that where people migrate from and to is not tracked. There may be differences in the determinants of migration just among Czech regions and migration from abroad. This fact may be the subject of further research. On the other hand, we assume that factors influencing domestic migration are very similar to those that affect migration abroad.

Regarding current migration issues, we can see in Figure 3 that the inflow of foreign workers did not affect unemployment rate significantly in any of the regions. In addition, we calculated the correlation coefficient between the change in the number of foreign workers (between 2021 and 2022) and unemployment rate at the end of 2021, since we believe that this is the relevant unemployment for our idea rather than 2023. The distribution of incoming foreign workforce seemingly did not reflect differences in unemployment rates in Czech regions. We believe that economic policy should primarily aim at distributing newly available workforce into regions with lowest unemployment rates. Nonetheless, this really matter little since the unemployment rates did not change in the regions and incoming workers were assimilated by the labour market.

6. Conclusion

The aim of this article was to determine and evaluate the push and pull factors influencing migration decision making in the Czech Republic and the country's regional migration flows between 1995 and 2018. Migration balance was examined in the study as the dependent variable, while GDP, Labour Office job listings, crime rate, number of college students, employment in industry and finished dwellings were the explanatory variables. An average wage variable was added to some model specifications. We began with a literature review, then presented the descriptive statistics of the data and the results of our econometric analysis.

Data transformation was necessary due to panel unit roots (non-stationary data; see Table 5 for stationarity tests of the transformed variables) and to mitigate endogeneity concerns.

The panel analysis confirmed most of our expectations about the regression coefficients, except the coefficients on crime rate and college student numbers. Several push and pull factors in migration decision making emerge from the results. The pull factors are the regional GDP growth, number of Labour Office job listings, number of finished dwellings and average wages.

The push factors are employment in industry and number of job applicants, the latter of which reflects the level of competition on the local labour market. The analysis shows that economic factors are key to migration decisions. GDP growth has proven to be a predictor of migration flows equally reliable to the average wages used by Paleta and Jandová (2010). Furthermore, when average wages are included in the model, their impact is positive and statistically significant and does not influence other coefficients significantly. Thus, we conclude that average wages are a statistically significant pull factor as well, their addition proving the pilot model to be robust at the same time.

Furthermore, when dividing our data set in the year 2004 (the Czech Republic's accession to the EU), the results did not change significantly, with only the number of job applicants losing its statistical significance. We can thus conclude that factors influencing migration behaviour within the Czech Republic did not change significantly with the country's EU accession, and that economic determinants of migration are the key factor in the Czech Republic.

Standardization of variables allows us to underline the strongest factors influencing migration, notably the number of unemployed persons, indicating that moving for a job may be one of the main reasons to migrate. This is further supported by the results for the other side of the labour market, where available jobs are shown to be a pull factor in our model.

Based on the descriptive analysis, we ran various sets of estimations, excluding two major regions, the Capital City of Prague and the Central Bohemian Region (inside which the Prague Capital Region is an enclave), looking for deviations from the baseline model. Apart from minor changes in statistical significance, lowering or increasing it by a small margin, there are no notable differences, and estimates on this restricted sample are comparable to the baseline model and its results.

Future research should try to work with more granular geographic divisions, *i.e.*, the former administrative districts (77 entities), and possibly include the impact of foreign direct investment, which was significant in the Czech Republic during the transformation period of the 1990s and continues to the present day. These investment flows can be a strong pull factor stimulating the development of certain industries and regions. One might also look into the effect of the GFC and the subsequent recession on migration within the Czech Republic. The crisis and recession period in the country was quite long, spanning about 5 years and bringing uncertainty that may have influenced migration decisions.

Appendix

Table 4: Collinearity diagnostics results

Variable	VIF	Tolerance	*R*-Squared
gr_gdp	1.68	0.5941	0.4059
gr_jobsevidence	1.66	0.6014	0.3986
gr_crimes1000pop	1.15	0.8664	0.1336
gr_emplindustry	1.12	0.8914	0.1086
lnfinishedbuild	1.37	0.7305	0.2695
gr_unistudents	1.21	0.8272	0.1728
lnjobaplicants	1.49	0.6718	0.3282
gr_wageavg	1.49	0.6712	0.3288
Mean VIF	1.4		

Source: Authors' own calculations

Table 5: Unit root tests results

Variable	Test	*p*-value
netflows	HT	0
gr_gdp	HT	0
gr_jobsevidence	HT	0
gr_crimes1000pop	HT	0
gr_emplindustry	HT	0
lnfinishedbuild	HT	0
gr_unistudents	FT	0
lnjobaplicants	HT	0
gr_wageavg	FT	0.0024

Note: HT is the Harris-Tzavalis unit root test, FT is Fisher type tests due to partially unbalanced panel data for two variables. These tests have the null hypothesis that all the panels contain a unit root; hence, p-value < 0.05 indicates stationary data.

Source: Authors' own elaboration

Table 6: Basic descriptive statistics

Variable	Observations	Mean	Standard deviation	Minimum	Maximum
Migration balance	336	1.58	3.62	–5.86	21.26
GDP growth index	322	102.27	3.38	91.85	113.7
Employment in industry	336	136.27	48.94	51.61	291
Labour Office job listings	336	5724.7	6,856.14	664	67,323
Job applicants	336	30,674.33	20,647	1,845	106,304
Finished dwellings	336	1,984.79	1,584.64	326	9,422
College students	251	20,816.53	27,655.9	33	126,049
Crime rate per 1,000 pop.	336	29.13	14.73	10.44	100.98
Average wages	336	18,191.67	6,178.68	7,270	38,255

Source: CZSO (2021), authors' own elaboration

Table 7: Model estimate – random effects

	1	2	3	4	5	6
Variables	**Model 1 excl. wages**	**Model 2 incl. wages**	**Model 3 excl. Prague**	**Model 4 excl. wages**	**Model 5 incl. wages**	**Model 6 excl. Prague**
	1995–2018			**2004–2018**		
gr_gdp	0.156*** (0.061)	0.146*** (0.054)	0.126** (0.058)	0.133** (0.062)	0.117** (0.050)	0.097* (0.054)
gr_jobsevidence	1.758*** (0.422)	1.763*** (0.437)	1.634*** (0.480)	1.945*** (0.431)	2.004*** (0.430)	1.947*** (0.503)
gr_crimes1000pop	6.609*** (1.720)	6.671*** (2.097)	7.518*** (1.709)	5.951*** (1.714)	5.863*** (2.029)	6.086*** (1.627)
gr_emplindustry	–6.897*** (2.289)	–8.592*** (3.293)	–4.973** (2.124)	–8.171*** (2.405)	–10.653*** (3.351)	–6.624** (2.641)
lnfinishedbuild	3.724*** (0.981)	3.574*** (1.022)	3.022** (1.209)	4.104*** (0.986)	3.899*** (1.001)	3.858** (1.499)
gr_unistudents	1.589 (1.142)	1.626 (1.109)	1.554 (1.021)	2.112 (2.073)	2.219 (2.051)	1.972 (1.978)
lnjobaplicants	–2.600*** (0.720)	–2.365** (1.050)	–1.630* (0.887)	–2.729*** (0.782)	–2.399** (1.090)	–1.965* (1.177)
gr_wageavg	–	0.418** (0.211)	0.445** (0.216)	–	0.498* (0.290)	0.444 (0.328)
Constant	–14.923 (10.228)	–17.937 (10.955)	–19.631 (12.620)	–14.091 (11.333)	–17.712 (12.284)	–19.439 (14.996)
Observations	223	218	204	196	192	179
Number of id	14	14	13	14	14	13

Note: Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Source: Authors' own calculations

Table 8: Model estimate – FE excluding Central Bohemian Region

	7	8	9	10
Variables	**Model 7 without Central Bohemia**	**Model 8 without Central Bohemia**	**Model 9 without Central Bohemia 2004**	**Model 10 without Central Bohemia 2004**
Standardized variables		✓		✓
gr_gdp	0.118* (0.055)	0.108* (0.050)	0.103* (0.050)	0.095* (0.046)
gr_jobsevidence	1.765*** (0.480)	0.206*** (0.056)	1.901*** (0.488)	0.222*** (0.057)
gr_crimes1000pop	5.136** (1.695)	0.099** (0.033)	5.024** (1.795)	0.097** (0.035)
gr_emplindustry	−9.798*** (3.190)	−0.108*** (0.035)	−12.163*** (2.982)	−0.134*** (0.033)
Infinishedbuild	2.575** (1.018)	0.463** (0.183)	2.608** (1.043)	0.469** (0.188)
gr_unistudents	2.137 (1.534)	0.104 (0.075)	2.184 (1.572)	0.106 (0.076)
lnjobaplicants	−2.195* (1.194)	−0.393* (0.214)	−2.134 (1.265)	−0.382 (0.227)
gr_wageavg	0.405* (0.203)	0.071* (0.035)	0.542** (0.243)	0.094** (0.042)
Constant	−9.932 (10.959)	0.010 (0.037)	−10.188 (12.046)	0.012 (0.032)
Observations	202	202	178	178
R-squared	0.412	0.412	0.444	0.444
Number of id	13	13	13	13

Note: Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Source: Authors' own calculations

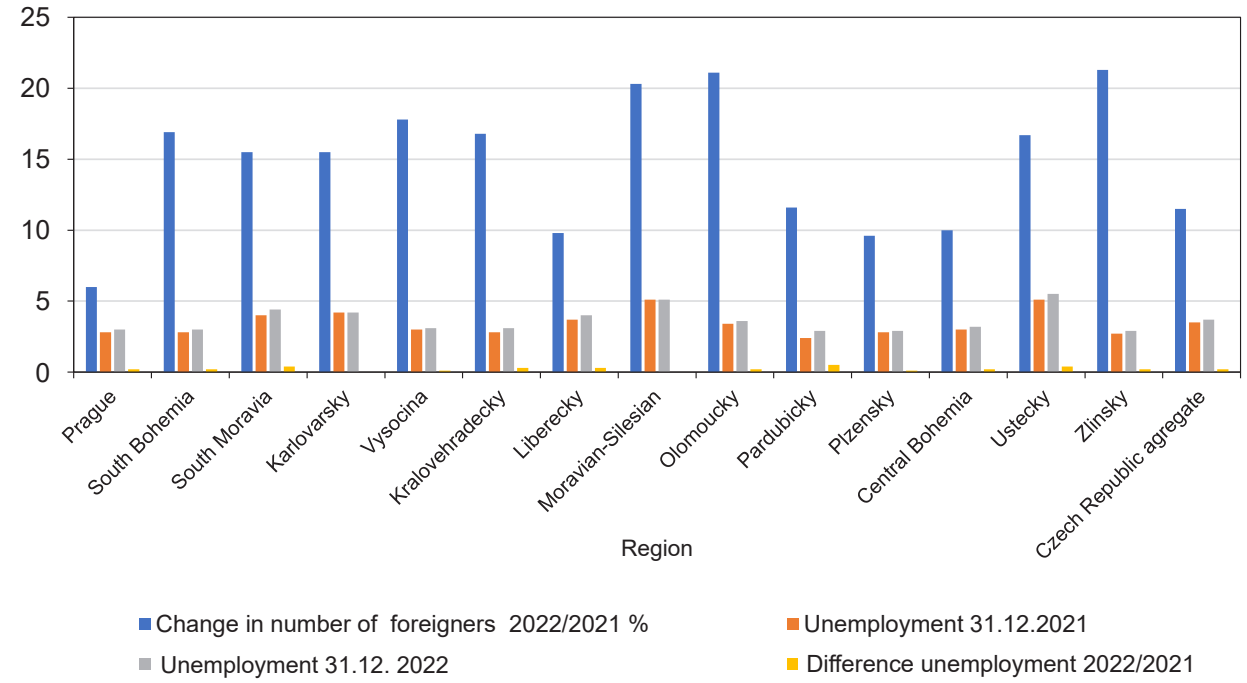
Table 9: Alternative estimates with ratio variable *apllitojobevid* and excluding finished dwellings

	(1)	(2)	(3)	(4)	(5)
Variables	**M1_ alternatives**	**M2_ alternatives**	**M3_ alternatives**	**M4_ alternatives**	**M5_ alternatives**
zgr_gdp	0.231*** (0.035)	0.154** (0.052)	0.215*** (0.034)		
zgr_crimes1000pop	0.131*** (0.043)	0.179*** (0.058)	0.165** (0.057)	0.141** (0.048)	0.168** (0.060)
zgr_emplindustry	−0.053 (0.042)	−0.109** (0.046)	−0.070 (0.047)	−0.096** (0.043)	−0.034 (0.063)
zlnfinishedbuild	0.388** (0.129)			0.588** (0.196)	
zgr_unistudents	0.068 (0.041)	0.100 (0.060)	0.093* (0.050)	0.116* (0.056)	0.134** (0.055)
zgr_wageavg	0.069** (0.027)	0.094** (0.038)	0.090** (0.038)	0.091** (0.040)	0.138** (0.047)
zapplitojobevid	0.540*** (0.100)		0.521*** (0.126)		0.595*** (0.122)
zgr_jobsevidence		0.123** (0.045)		0.268*** (0.046)	
zlnjobaplicants		−0.452* (0.219)		−0.479** (0.220)	
Constant	0.154*** (0.020)	0.246*** (0.056)	0.217*** (0.024)	0.168*** (0.033)	0.257*** (0.030)
Observations	218	218	218	218	218
***R*-squared**	0.426	0.383	0.397	0.411	0.314
Number of id	14	14	14	14	14

Note: Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

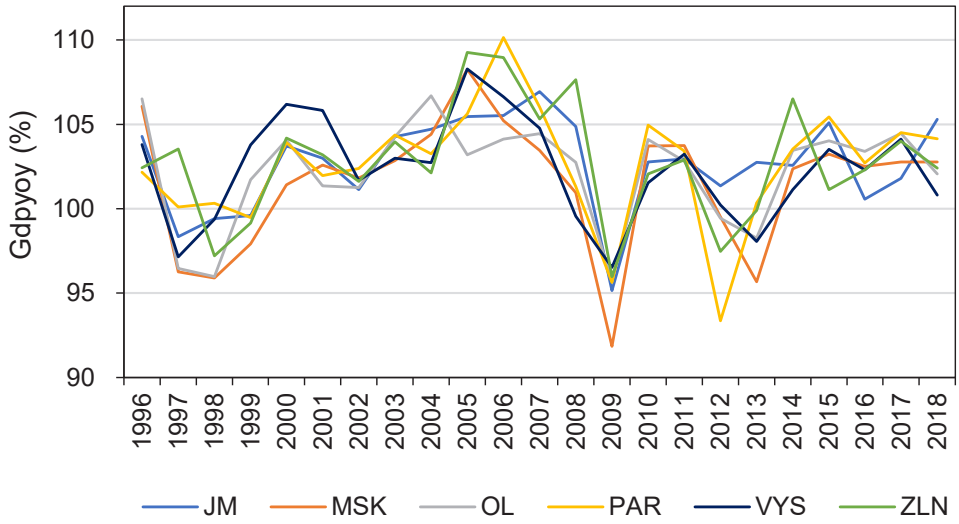
Source: Authors' own calculations

Figure 3: Flow of foreigners into Czech regions, unemployment rates and change in unemployment (2021–2022)



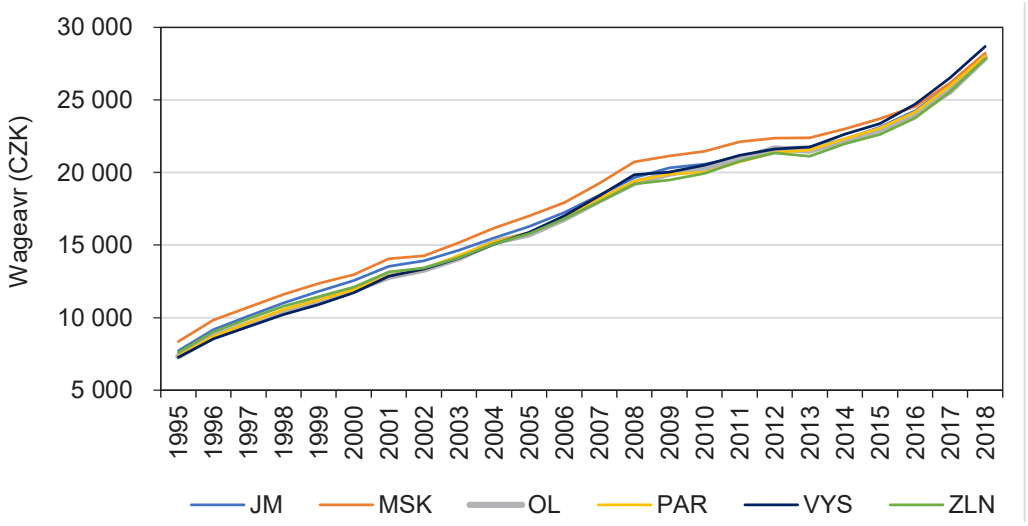
Source: MPSV (2023), authors' own elaboration

Figure 4: GDP growth in Czech regions 1996–2018



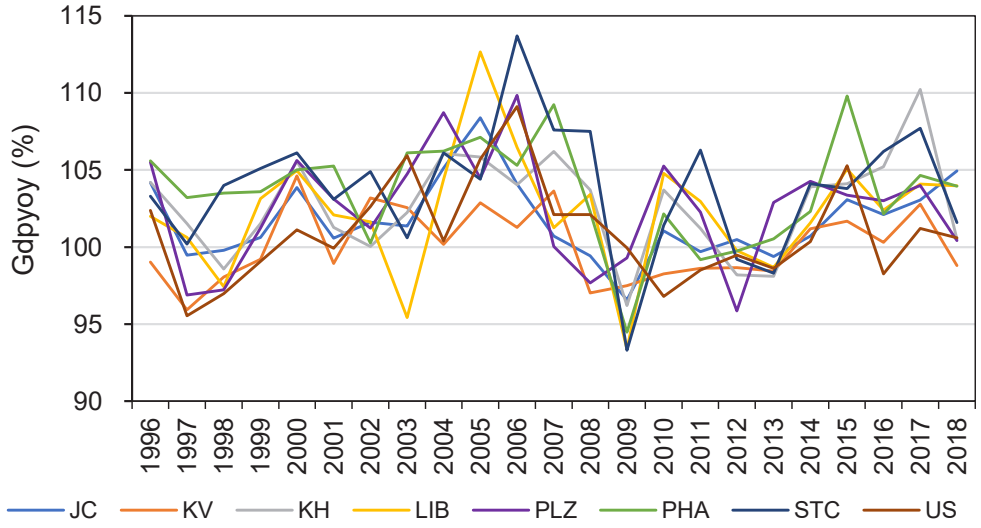
Source: CZSO (2021), authors' own elaboration

Figure 5: Average wages in Czech regions 1996–2018



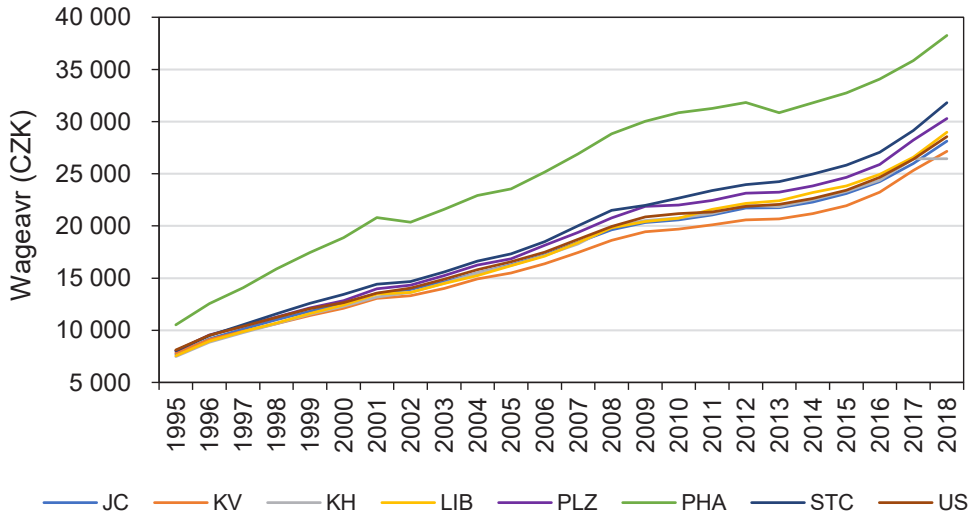
Source: CZSO (2021), authors' own elaboration

Figure 6: GDP growth in Czech regions 1996–2018



Source: CZSO (2021), authors' own elaboration

Figure 7: Average wages in Czech regions 1996–2018



Source: CZSO (2021), authors' own elaboration

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