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Bakalářská práce

2008 **Jan Duben**

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BAKALÁŘSKÁ PRÁCE

Prophecy from crystal ball
-
Forecast of foreign labour immigration in Czech Republic with panel data

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1. Prohlašuji, že jsem bakalářskou práci vypracoval samostatně a použil pouze uvedené prameny a literaturu.

2. Souhlasím s tím, aby práce byla zpřístupněna veřenostii pro účely výzkumu a studia.

V Hlavňově dne 13.7.2008

.....

Jan Duben

Poděkování

Na tomto místě bych rád poděkoval svému konzultantovi, Mgr. Ing. Vilému Semerákovi Ph.D., za cenné připomínky a rady.

Všechny chyby a omyly jsou pak jen mé vlastní.

Věštba z křišťálové koule
-
Predikce pracovní immigrace cizinců do České republiky z panelových dat

Abstrakt

Cílem této práce je zkonstruovat predikci legální pracovní imigrace cizinců do České republiky z panelových dat. Stručný přehled migrační literatury následuje sestavení empirického modelu. Migrace je vysvětlována zejména ekonomickými proměnými jako jsou průměrná výše mezd a míra nezaměstnanosti v cílové a ve zdrojových zemích. Dalšími vysvětlujícími proměnými jsou geografická vzdálenost a průřezové dummy pro zdrojové země. Jsou použity dva rozdílné datové soubory, jeden pokrývá časové období od roku 1995 do roku 2005 a druhý 2000-2007. Oba dva datové soubory znázorňují migraci z 16 zdrojových zemí do České republiky. K odhadu byly použity následující metody: sdružené nejmenší čtverce, fixní efekty a náhodné efekty. Nejlepší model je poté využit k predikci pracovní imigrace pro roky 2006-2020. Byly vytvořeny tři rozdílné imigrační scénáře na bázi historických pozorování z Irska, Řecka a Portugalska, které jsou doplněny předpokladem o budoucí české nezaměstnanosti.

Klíčová slova: Česká republika, imigrace, panelová data, práce, predikce

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Abstract

The aim of this work is to construct a forecast of legal foreign labour immigration to Czech Republic with panel data. Brief overview of migration literature is followed by the construction of empirical model. Migration is explained here mainly through economic variables such as wage levels and unemployment rates in both, home and source countries. Moreover, additional explanatory variables such as geographical distance and cross-sectional dummies for home countries are used. Two data sets, both depicting the labour immigration from 16 source countries to Czech Republic, are available. First data set covers the years 1995-2005 whereas the second data set covers the period 2000-2007. Estimation methods includes Pooled OLS, Fixed effects and Random effects panel data models. The best model was chosen to forecast the labour migration for 2006-2020. Three different migration scenarios are created on the basis of past historical experiences of Ireland, Greece and Portugal, combined with assumptions about future Czech unemployment

Keywords: Czech Republic, forecast, immigration, labour, panel data

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1 Introduction

There have been a surge of migration literature in Europe during the last decade. It can be attributed mainly to the enlargement of European Union in 2004 and as such majority of migration empirical literature focus on the effects of opening the labour market of old EU 15 to new members and consequently on the migration flows from Central and East Europe into EU 15.

So far, Czech Republic was in this process seen as source country, a pool with possible new labour migrants for German, Austrian and other European labour markets. This study will however focus on Czech Republic from different angle. The legal labour immigration to Czech Republic from 16 source countries will be studied on the basis of past migration statistics for 1995-2007 time period, hence the Czech Republic will play the role of host country this time.

With favourable market conditions, booming economy and strengthening Czech currency, nobody can wonder why Czech Republic is becoming increasingly popular country among the labour immigrants, not only as a transient place to stay before moving further west, but also as theirs final destination.

Put it into nutshell, aim of this work will be to construct econometric model from panel data, which would be able to forecast labour immigration and thus give us certain hint, what may the situation in the Czech labour market look like in near future. Up to the knowledge of author of this paper, it is the first time, when such study is constructed for Czech Republic. Reasons are many, on the first place being lack of high-quality data, namely short time span of labour immigration statistics in Czech Republic and low comparability of such data with other sources. It is obvious, that however good the estimated model will be, we can never achieve surgical accuracy and the presented results of forecast are mere orientation numbers and by no means hard facts. In fact, this recommendation is valid not only for the forecast but also for the presented models based on poor-quality data.

On this place, let me stress the fact, that this paper will consider only legal labour immigration. Author of this paper is fully aware of the fact, that inclusion of illegal immigration would significantly complicate whole forecasting procedure (if not make it impossible at all). For similar reasons, the study is focusing mainly on economic determinants of migration, relying heavily on the

micro and macroeconomic approaches in combination with some sociological and geographical theories, thus leaving out institutional, psychological and other factors. Such considerations go far beyond the scope of this work, but they certainly represent free space for additional empirical research, especially in case of Czech Republic. It is obvious, that these factors would help to increase forecasting accuracy significantly. At the same time, they would provide us with much better picture of reality. Nonetheless, it is obvious that none of the theories which will follow, can explain the migration behaviour fully on its own. Migration decision is a complex process influenced by many factors and the reasons for migration will most probably differ among the migrants in different time, places and situations. We shall therefore always bear in mind, that full explanation of such complicated decision as migration, by whatever means is impossible, and any approach chosen is always an enormous simplification of the situation.

Before we plunge into various migration theories, you may still be bothered by simple question - why do we need any study forecasting labour immigration to Czech? One answer from many possible ones is that it may be a good contribution to current debate whether foreign labour immigrants can sufficiently support Czech ageing labour market or if other precautions such as increased support of birth policy can save the day.

Now lets talk briefly about the structure of the paper. Section 2 discusses the related theoretical and empirical migration literature. Data and their sources are briefly commented in section 3 with additional comments on the data and the situation's background in section 4. Section 5 then introduces to us the empirical model, which is later estimated in section 6. The forecasts of labour immigration to Czech republic are presented in section 7 and finally the conclusion is made in section 8. The appendix with bibliography and data sources follows.

2 Review of literature

2.1 Migration theories

As a brief insight into the topic of migration, I will on this place provide a short introduction into the various migration theories following the approach of Bijak (2006) and Šimečková (2007), who provide much broader view. Bijak distinguishes between sociological, economic, geographical and

unifying theoretical perspectives of human population flows.[1]

2.1.1 Macroeconomic theories

The economic theories of migration are either of micro or macro origin. The macro theories of migration predict that any given differences in wage levels given by scarcity of labour and capital between any two differing regions will tend to reach equilibrium in both factors as the inhabitants from the labour abundant country will move in the region with higher endowment of capital per worker, thus bridging the gap between the two, sooner or later bringing the situation to equilibrium.

Pioneering work in this area was done by Harris and Todaro (1970). They analysed the migration between urban and rural areas with assumptions of lower wage in rural region and higher unemployment and expected income in urban area. They found out that even given greater risk of unemployment in the urban area, people are willing to undergo this risk in favour of higher earnings potential. They further conclude that migration will cease when the urban-rural expected wage differential will equal to zero. Please note, that Harris and Todaro have not yet considered possible costs bounded with migration. If we would take into account such costs, expected wage differential would not be equal to zero in equilibrium.[2]

The dual labour markets theory of Piore (1979) is building on a fact that migration flows are to a large extent determined by labour demand characteristics at the destination.[3] This approach is stressing the fact that immigration labour is important for the developed countries. The wage is a approximation of status in the society and employers are happy to employ cheap immigrants instead of rising the wage for unpopular (3D – dirty, dangerous and difficult) jobs, thus attracting the home labour force. In addition to that, local labour force has higher protection such as labour unions, regulations of work by various state institutions, etc. which makes it a less flexible source of labour in contrast to the immigrants.[4]

The world systems theory of Wallerstein (1974) concludes that migration flows are connected to the development of world economies. He predicts a flow of goods from developed regions to less

1 Bijak (2006), pp. 4.
2 Harris and Todaro (1970), pp. 129.
3 By terms “destination” and “host country”, I will in this study mean the country where the migrants go. Similarly by terms “source country” or “home country”, I will mean the country from where the immigrants come from.
4 After Bijak (2000), pp. 10.

developed ones in exchange of resources and agricultural products. In addition to that, as the new, more productive technologies are being implemented in the less developed countries, it leads to decreased demand for labour in many labour intensive industries such as agriculture and these workers leave the country for the highly developed countries, where the need for low cost labour for manufacturing is rising, because these low paid jobs are no longer interesting for host countries labour. Special attention in this theory is paid to the relationship between the former colonies and their former metropolis.[5]

2.1.2 Microeconomic theories

Most of the microeconomic theories build on rational homo oeconomicus, who is maximising the net present value of his expected future income minus direct and indirect costs of migration. We need to bear in mind that not all of this costs are easily measurable (such as psychic costs, etc.). This above mentioned approach was among others chosen by Sjaastad (1962) who is one of the fathers of neoclassical microeconomic theory, which suggests that migration is an investment into human capital and is a result of a rational cost-benefit analysis. In his study, he finds that migration can not be seen in isolation on its own, but we need to consider complementary investments into the human agent which are according to this study as important or more important then the immigration process itself. In addition to this, he stress that age of the migrant is important variable which must be considered in interpreting earnings differentials over space and among occupations.[6]

First study which introduced a problem of self-selection into the migration literature is the one of Nakosteen and Zimmer (1980). They consider two individuals A and B with the same language, educational and other abilities and examine the fact that while person A migrates, the person B stays at the home country. They explain this through theory of self-selection. Thanks to the fact, that individual A sees benefits in different way then person B, A may emphasize investing in the human capital through migration and thus the authors conclude that in the world of non-existing migration he would stay at home country and receive the same benefits and wage as the other individual B, but in the case of possible migration, the possibility to stay at home country provide a lower bound to his possible earnings and possibility to migrate is utilized by individual A to realize additional gains.[7]

5 Idem (2000), pp. 10.
6 Sjaastad (1962), pp. 92-93.
7 Nakosteen and Zimmer (1980), pp. 850.

The economic theory of migration has its great contributor in the person of George J. Borjas with his many articles devoted to the topic and very thorough review of migration literature. In his 1989 paper he states three basic questions of migration. First, what determines the size and composition of immigrant flows to any particular host country? Second, how do the immigrants adapt to the host country? Third, what is the impact of immigrants on the host country?[8] His 1994 paper called "The Economics of Immigration" is absolutely essential reading for any researcher in the area. In this paper he summarize various contributions to the area such as cohorts effect, his own contribution. He points out that we can not expect that same "qualities" among the migrants skills in two different migrant waves will lead to same market performance. He further states that we can not use the current labour market experience of those who arrived twenty years ago to forecast the future earnings of newly arrived immigrants.[9] Next to this, he further examines the performance of children of immigrants in host country (second, third generations), the impact of knowledge of language on wage convergence and the impact of education. He states that skills acquired in advanced economies are more easily transferable.[10] The paper identifies three different types of immigrants. First, positively selected, i.e. those, who have above-average earnings in both the host and source countries and the host country has more dispersion in its earnings distribution. Second, negatively selected migrants are those who have below-average earnings in both source and host country and the source country has more dispersion in its earnings distribution. Third, there is a so-called "refugee sorting" group, who have below-average earnings in the source country but end up in the upper tail of the earnings distribution of the host country. Later on, he identifies the return migration as a decision mistake and we can see that if the migrants were positively selected, then those going home are "the worst of the best" and conversely in the case of negative sorting, those going home are "the best of the worst".[11] Last but not least, he examines the gender and family context of migration, which is further investigated in the so-called New Economics of Migration.

In the New Economics of Migration, the decision to migrate is not based solely on the individual itself, but also on his family and other social ties in his close vicinity. The family is minimizing the risk by sending young males abroad with head of the families staying at home. The concepts of "brain drain" and "brain gain" are discussed, the brain drain being the situation, when the educated and highly skilled person are "drained out" from the home country to the host country. In contrary to that, the brain gain is a case, when the possibility of migration leads to increased skills and higher

8 Borjas (1989), pp. 482.
9 Borjas (1994), pp. 1672.
10 Idem, pp. 1687.
11 Idem, pp. 1691.

educational attainment and thus the possibility of migration has positive effect on the home country which out weights the departure of emigrants. These two effects were broadly examined empirically due to theirs vast consequences they are assumed to cause in the developing countries such as African countries and others. In the study of Beine, Docquier and Rapoport (2001), the authors examine the brain gain effect (called Beneficial Brain Drain in the study) and conclude that brain gain effect is not only theoretical possibility but it can occur when the migration possibilities are rather low.[12]

In one of the latest contribution to the brain gain/brain drain literature by Maurice Shiff (2005) he follows the path of brain gain such as that brain drain raises the expected return on education which in addition induces higher investment in education (a brain gain) which may result in net brain gain (beneficial brain drain) and such a gain further increase the welfare and growth of the source country. He finds out that whereas the effect of brain drain is generally accepted and can be shown by many empirical studies as important, the effect of brain gain and its size as well as the impact on welfare and growth are significantly smaller than found previously and may even be negative. He comes with the term "brain waste", which depicts the situation with increased public spending on education, but majority of in this way educated people leave the country and thus the overall effect of the possibility of migration is negative.[13]

The rationality of migration is examined in the paper of Tunali (2000) on cross-sectional micro data set on male heads of households. He finds out, that both migrants and non-migrants chose the option in which they have comparative advantage, however the estimated gain from moving is slightly negative for a substantial portion of migrants, whereas the minority realize very high returns. He thus concludes that migrants are playing a lottery with a small chance of very high possible gains and high probability of losing, i.e. being in the worst situation then before the migration took place.[14]

2.1.3 Sociological theories

Between the sociological theories of migration, I find the most fitting the ideas of intervening opportunities, push-and-pull factors, migrant networks and transnational social spaces.[15]

12 Beine, Docquier and Rapoport (2001), pp. 287-288.
13 Schiff (2005), pp. 30-32.
14 Tunali (2000), pp. 893.
15 After Bijak (2006), pp. 6-8.

The concept of intervening opportunities by Stouffer (1940, 1960) states, that number of migrants is proportional to the number of attracting opportunities (for ex. jobs, etc.) available for migrants at the destination and is inversely related to the number of opportunities at home country.

The theory of push-and-pull factors proposed by Lee (1966) explains that migration is determined by the occurrence of attracting "push" factors and deterred by presence of "pull" factors. Better economic conditions of host country to that of source country measured by such means as rate of unemployment, average wage level or higher level of social security can be seen as push factors. In addition to these, favourable age composition, better environment or warmer climate can be as well seen as push factors.[16]

In the theory of migrant networks by Taylor (1986), the migrant networks in receiving country are seen as a strong push factor. Through kinship or friendship between those who migrated and those who are considering such a move or just immigrated, such network can substantially reduce the cost of information and reduce the risk of failure in the host country. In addition to that it can as well substantially reduce the psychological and other non-pecuniary costs induced by migration decision.

The generalization of the idea of migrant networks is the theory of transnational social spaces by, among others, Faist (2000). He states that: "Transnational social spaces consists of combinations of social and symbolic ties, their contents, positions in networks and organizations, and networks of organizations that can be found in multiple states. These spaces denote dynamic processes, not static notions of ties and positions".[17]

2.1.4 Geographical theories

The geographical theories stemming from human geography focus on distance in the explanation of migration flows. Such distance does not have to be only the simple distance between two capitals or economic centres in kilometres but it can be squared or logged to express various perceptions of distance and its role in migration. Some studies have chosen measuring distance through transport networks instead. They can use such variables as time needed to reach destination or simply a cost

16 After Šimečková (2007), pp. 12-13.
17 Faist (2000), pp. 199.

of such travel, taking into consideration the cheapest transport variant (car, bus, plane, boat, etc.).

For the approach chosen by this paper, the "gravity theory" of migration is important. In this theory, analogous to Newton's law of gravity, the population flows from country A to country B are proportional to the size of the population in country A times the population in country B divided by the distance between the two and later multiplied by some "gravity constant". The logarithm of this equation is usually taken (as will be done in this paper). The gravity models does not restrict themselves only to the explanatory variables as population size. In addition to that, they widely employ unemployment rates, wage level approximations and so on.[18]

2.2 Related forecasting methods of migration

There is no one-for-all forecasting method of migration, but many ways to it. Unfortunately, only in theory. In real life, the availability and quality of data is the main determining factor, which restricts us to certain approach. For the same reason, it is almost impossible to implement purely any of the theories mentioned above. Due to the macro-data availability for this paper, the following review will study closely only certain part of vast migration forecasting literature concentrating mainly on macro-data demographic-economic based forecasting econometric models which build partly on gravity models adapted to the needs of international migration and which are partly adjusted to the data available. For the much more comprehensive discussion of the topic, please see Bijak (2006).

Papers of Alho and Spencer (1985) and Isserman et al. (1985), which are building on population details and rates from demography, alternative opportunities and spatial interdependencies from geography plus labour market conditions from area of economics can serve us as basic introduction to the field. In the heart of both works is the simple gravity model for cross-sectional data, which can be sketched as

$$\text{Mij} = \frac{e^{\beta_0}(P_i)^{\beta_1}(P_j)^{\beta_2}}{(d_{ij})^{\beta_3}} \quad , \qquad (1)$$

where Mij is the estimated migration from region j to i which depends on the populations Pi and Pj of both countries and distance between them dij, e being the base of the natural logarithm. Parameters β0, β1, β2 and β3 are to be estimated. If we take natural logarithm of the equation,we get

$$\log(\text{Mij}) = \beta 0 + \beta 1(\log(\text{Pi})) + \beta 2(\log(\text{Pj})) - \beta 3(\log(\text{dij})) + \text{uij} \, , \qquad (2)$$

18 After Bijak (2006), pp. 12-13.

where errors uij are log-normally distributed continuous variables with constant variance, regardless of the size of migrant flow. The measures of attractiveness, such as labour force in state of origin and in state of destination, average wage in both places or unemployment rates are added later.

The aspects of general linear modelling of migration, specifically gravity models, are further studied in work of Peter Congdon (1992). He points out to obvious problem with log-normal distribution in case of ordinary least squares (OLS) method, if extremely large migration flows and very small (almost zero) migration flows occur at the same time, which cause heteroskedasticity problem. He advocates the use of Poisson distribution along with general linear model (GLM) instead albeit his conclusions can not be generalized due to specifications and non-universality of the data used in his study.[19]

With the enlargement of European Union by ten new countries in 2004, many papers in the pre-admission period were examining the possible effects of introducing the free labour movement from new Central and East European member countries and were trying to forecast the migration waves which were to come. We can name for example paper of Boeri and Brücker (2001) which stressed the importance of existing wage gaps between old 15 and 10 new accessing countries and was among the papers who were proposing postponement of free labour market thus favouring transitional periods especially for the countries such as Germany and Austria which are bordering new accessing countries and which would be the primary target for the immigration waves following the opening of the labour market. During transitional periods, the existing differences between old 15 and new 10 countries were thought to be lowered thus substantially decrease the migration waves which were to come.

Very relevant paper for this study is the work of Alvarez-Plata et al. (2003). Authors of this paper estimated potential migration flows from 10 candidate countries to old EU 15 on the basis of two data sources with the aim to forecast labour migration from candidate countries to Germany. They also evaluate the forecasting performance of various estimation procedures and conclude that fixed effects panel estimator is very suitable for panel data with longer time span (33 years of immigration to Germany from 19 source countries). In contrary to that, in the second data sample (migration between 215 countries over 8 years), the general method of moments (GMM) estimator

19 Congdon (1992), pp. 151.

turned out to have better forecasting performance.

The forecasting performance of more then 20 various estimation procedures were examined in the study of Brücker and Siliverstovs (2005) on panel data on migration to Germany from 18 source countries in the period 1967-2001. The study results show that fixed effects estimator along with hierarchical Bayes estimator exhibit the superior forecasting performance. Next to it, the fixed effects estimator clearly outperformed the pooled OLS and GMM estimators.

3 Data

In this paper, two data sets are used.[20] Both of them are unbalanced panel data depicting stocks of labour immigrants in Czech Republic from 16 source countries, namely Slovakia, Ukraine, Vietnam, Poland, Moldova, Russian Federation, Mongolia, Germany, Bulgaria, United States, United Kingdom, Belarus, People's Republic of China (abbreviated "China" in the following text), Romania, France and Serbia and Montenegro.[21] The selection of the countries and their sequence is given by the absolute numbers of the labour immigration stocks lined up from the largest to the smallest flow according to their hierarchy in 2005. The last chosen country Serbia and Montenegro was the last country with labour immigration stock higher than 1000 person in that year.

For the first data set, I will use term "OECD sample" in this study, because the data of labour immigration stocks stem from the OECD statistical source. This data covers time span from 1995 to 2005. The data of Vietnamese labour immigration stock were missing completely. Data set was then complemented by adding values for Vietnam from Czech Statistical Office, unfortunately, data for time period 1995-1999 are still missing in case of Vietnam.

The second data set, called "Czech sample", takes labour immigration stocks from Czech Statistical Office for the years 2000 – 2007. More observations in this sample of especially explanatory variables is missing or they are just predictions (especially those for 2006-2007 years) or just first releases of the data which may be later recalculated. This data set is also compiled from much more sources then OECD sample, thus the reliability of the results can be questioned here for this reason much easily, in addition to that, time span of the Czech data set is by three years shorter, which

20 Both data sets are available from the author upon request.
21 Serbia and Montenegro are treated as one country.

again contribute to weaker forecasting results.

Dependent variable in this study is SHARE

$$SHARE_{h,t} = \frac{STOCK_{h,t}}{LABOUR_{h,t}} 100\,\% \quad , \tag{3}$$

where $STOCK_{h,t}$ is the number of labour immigrants in Czech Republic from country h (h = 1,...,16) in time t (t = 1995,...,2005 for OECD sample; t = 2000,..., 2007 in Czech sample). The variable $LABOUR_{h,t}$ depicts the labour force, in number of persons, in country h in time t. Data for LABOUR comes from World Bank (Health, Nutrition and Population statistics).

The explanatory variables in both models are per-capita income in both, source countries (GDP_H), and Czech Republic (GDP_CZ). These variables are representing Gross Domestic Product based on Purchasing-Power-Parity (PPP) per capita GDP in Czech Republic and home countries respectively (in current international dollars). These data come from International Monetary Fund (IMF) with just one structural break, in case of Serbia and Montenegro, the data for 1995-1999 are missing.

The data for unemployment rate (in %) are taken for Czech Republic (UN_CZ) and home countries as well (UN_H). These data come from ILO. There are missing observations for Moldova in 1995-1998 and Vietnam for 1995 and 2005. In the case of Czech sample, these data have been compiled together with data on unemployment from OECD and National Statistical Offices of home countries, however, the observations for the 2007 are mostly missing. Poor quality of unemployment data for countries Vietnam, Mongolia, Belarus and China inspired me to create dummy variable UNDUM, which is equal to 1 for this four countries, otherwise 0. Reason to create this dummy are unrealistically low unemployment rates in mentioned countries, in the opinion of the author rather "created" by National Statistical Offices then measured (please refer to Figure 4). In addition, it is well known fact that Chinese (and possibly also Vietnamese) labour statistics usually reports only the situation from large cities, thus underscoring overall unemployment, which would be certainly higher taken into account "hidden" countryside unemployment.[22]

Next to it, explanatory variable DIST is measuring geographical distance between Prague and

22 I am thankful to Vilém Semerák Ph.D. for pointing out to this fact.

foreign capitals (in km). Source of this data is personal web page of Kristian Skrede Gleditsch.

The additional dummy is IDUM, "intellectual" dummy for countries USA, UK, France and Germany. This dummy was inspired by work of Drbohlav (2003). According to his paper, immigrants from these countries are usually highly educated with intellectual background.[23] Because per-capita incomes in theirs countries are much higher then in Czech, there must be some other reasons, why they come. Maybe by a coincidence majority of these immigrants live in Prague.

Next to it, additional dummy variables were created to represent every home country in the sample. Thus SLODUM is dummy for Slovakia, i.e., in case of Slovakia, this dummy is 1, for other countries 0. The rationale behind this variable is language and historical closeness between Czech Republic and Slovakia. Likewise UKRDUM is dummy for Ukraine, VIEDUM is dummy for VIETNAM, and so on. I will discuss the significant dummy variables and their coefficients later, after the model will be estimated.

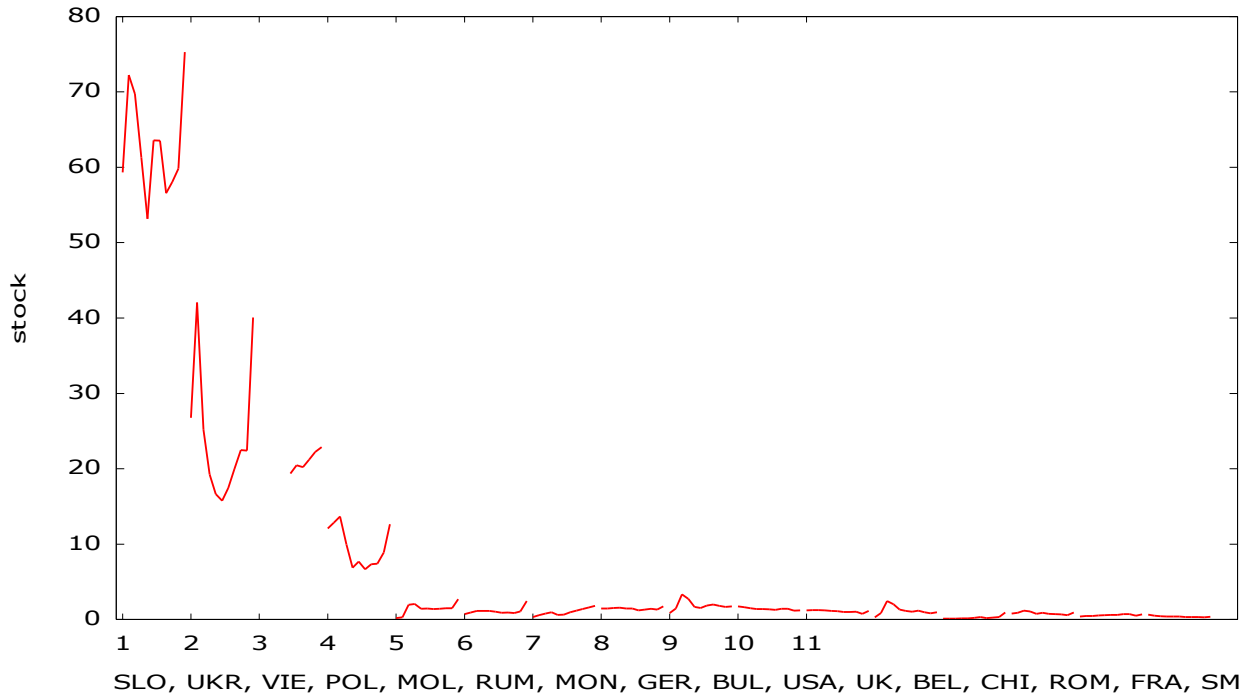
4 Current situation

As I have already mentioned in the previous part, I use two different data samples in this study. The decision to use two different samples is based on the vast difference of the data which were available. Most importantly, the variable STOCK – which is a stock of labour immigrants from source country in Czech Republic in given year, have longer time span in case of OECD sample, which is highly desirable feature from econometric point of view. Unfortunately, the the data from Czech Statistical Office and those from OECD differ significantly. On the next two graphs I will depict time series for variable STOCK from both samples to point out to the difference.

When comparing both pictures, please note, that there is sixteen source countries in following order: Slovakia, Ukraine, Vietnam, Poland, Moldova, Russian Federation, Mongolia, Germany, Bulgaria, United States, United Kingdom, Belarus, China, Romania, France and Serbia and Montenegro. When comparing both graphs, we also need to remember that the first graph is depicting the situation for 1995-2005 whereas the second graph is description of the period 2000-2007. Nonehteless, the observations from Czech Statistical Office are slightly higher than those of OECD for the same years.

23 Drbohlav (2003), pp. 40.

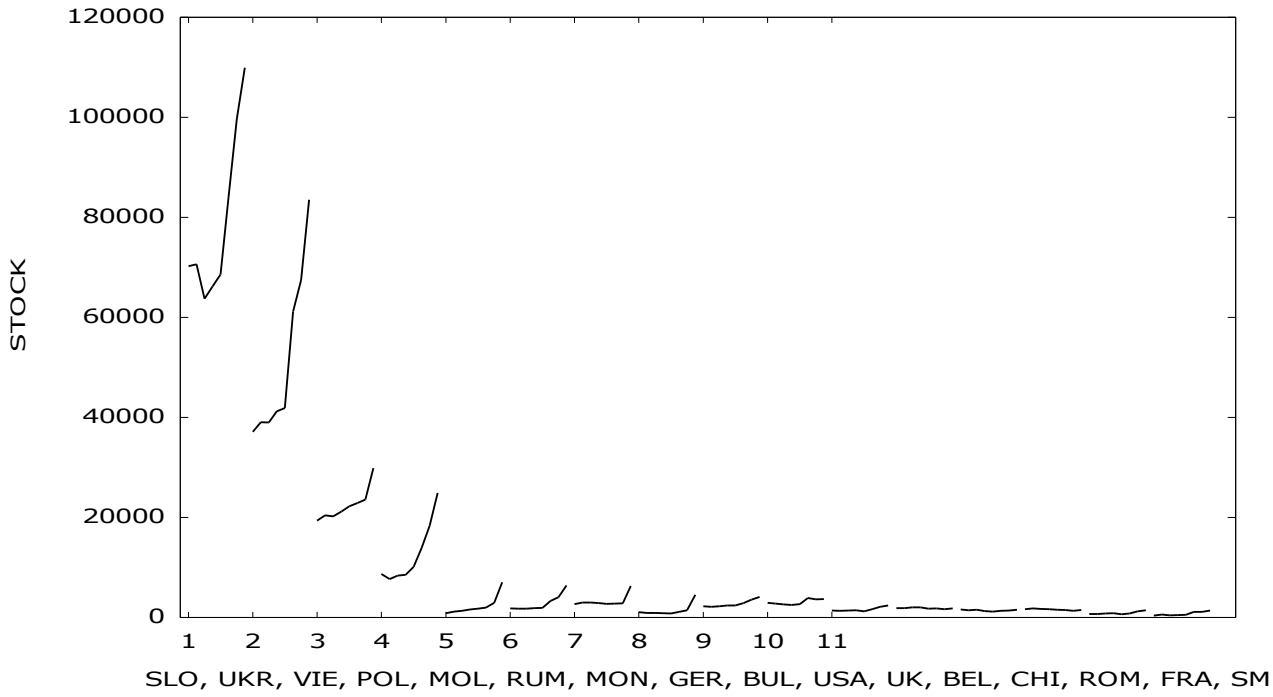
Figure 1: Variable STOCK from OECD sample (1995-2005)



Source: OECD (April 2008).

From Figures 1 and 2, we can derive the fact, that majority of labour migrants in Czech Republic comes from four source countries – Slovak Republic, Ukraine, Vietnam and Poland.

Figure 2: Variable STOCK from Czech sample (2000-2007)



Source: Czech Statistical Office (April 2008).

4.1 Population statistics

It seems to be pretty obvious that more immigrants will come from the country which is bigger and geographically closer to us. Let us then have a look on the population, labour force and distance between capitals in year 2006 to verify/refute this "common sense" idea (please refer to Table 1).

Table 1: Population, Labour Force and Distance between Prague and foreign capital (data for year 2006)

Country	Population (number of person)	Labour force (number of person)	Distance between Prague and foreign capital (km)
Czech Republic	**10270000**	**5218399**	
Germany	82374900	41018272	237
Slovak Republic	**5390400**	**2687515**	**295**
Poland	**38129400**	**17191701**	**517**
Serbia and Montenegro	8040022	3934722	800
France	61256600	27260898	911
Belarus	9732500	4766704	970
United Kingdom	60550100	30810893	1017
Romania	21590400	10138455	1104
Moldova	3832709	1860802	1105
Bulgaria	7692600	3051682	1114
Ukraine	**46787750**	**22493030**	**1140**
Russian Federation	142500000	73528949	1654
Mongolia	2584655	1258569	6352
United States	299398000	157023421	6905
China	1311797692	780548654	7513
Vietnam	**84108100**	**44806405**	**9241**

Source: World Bank, Health, Nutrition and Population statistics, (April 2008).

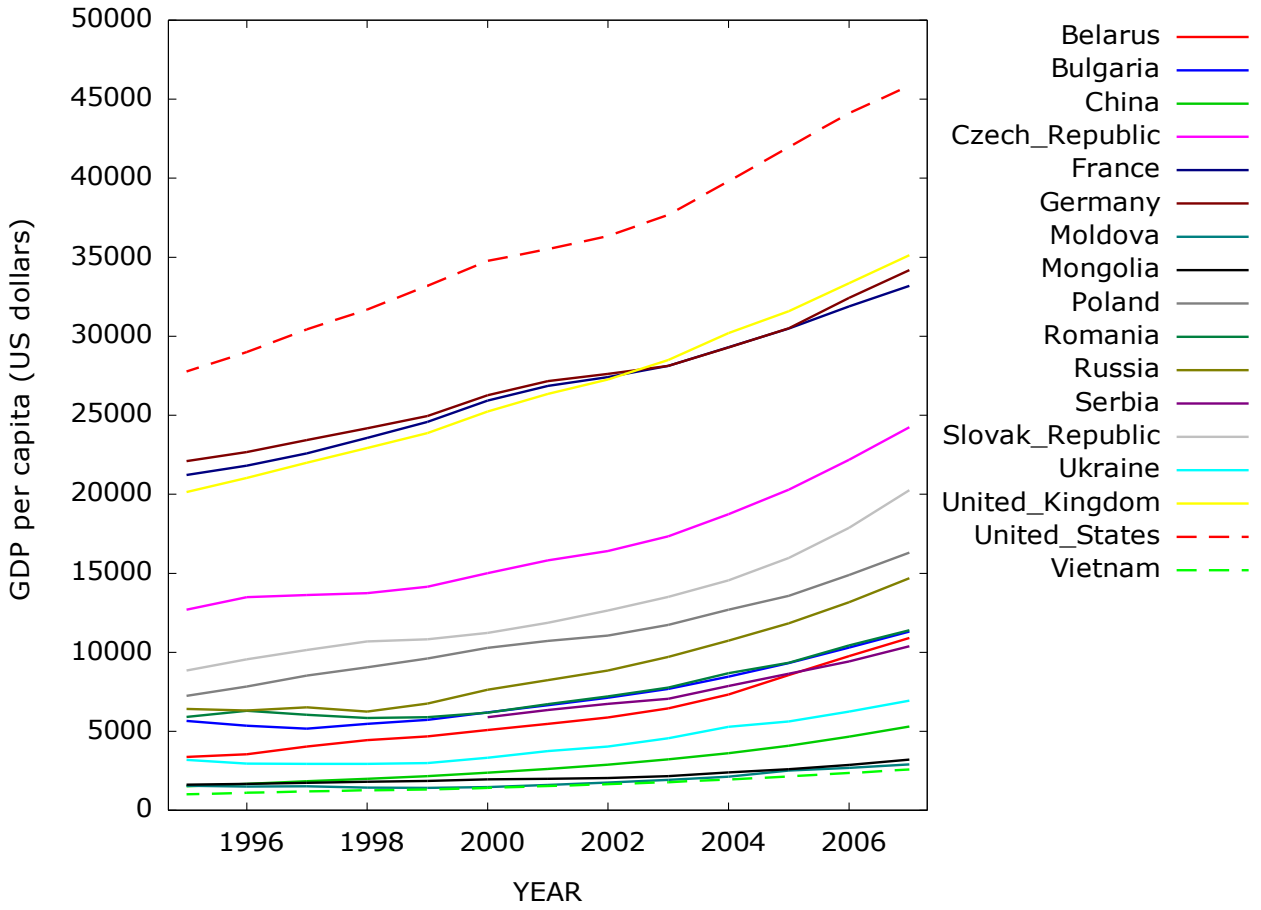
In the following section, I will examine closely differences across sample countries in GDP per capita. Further, I will attempt to briefly discuss common occupations typical for foreign labour in Czech Republic.

4.2 Wage levels and occupations

Wage level differences between source and host country are usually considered as one of the main driving forces of migration. As a proxy measure of wage levels, I am using GDP per capita based on purchasing power parities (please refer to Figure 3 below for GDP per capita based on PPP).

First important thing, which we can say after short peek at the graph below is the fact, that all four major immigrant source countries have lower GDP per capita than Czech Republic . This is common for most source countries in this study with exception of four: Germany, United States, United Kingdom and France. However, this fact can not lead to conclusion, that we can not explain migration flows from "richer" countries by the wage differential. We would have to posses micro-level data on every immigrant to be able to assess this assumption.

Figure 3: Gross Domestic Product during based on purchasing-power-parity (PPP) per capita (2007 international US dollars; 1995-2007)



Source: IMF, World Economic Outlook Database, (April 2008).

According to already mentioned study of Drbohlav (2003), migrants from the "rich 4" countries (Germany, UK, USA, France) are usually employed as top managers, advisers, employees of multinational and international companies, language teachers or small-scale businessmen. On the other hand, typical immigrants from Ukraine, Poland and to some extent immigrants from Slovak Republic are usually working in construction, various light industries, usually manual work.

Quite unique, is the case of Vietnam immigrants. Typically, Vietnamese are self-employed as small scale entrepreneurs/sellers, buying and selling clothes and electronics.[24] We should know, that Vietnamese GDP per capita is with its 2007 value of 2586 USD (measured in current international US dollars) almost ten times lower then the Czech value of 24235 USD. It is the lowest GDP per capita in the sample, almost twice smaller then the Chinese GDP per capita but only slightly lower than GDP per capita of Moldova and Mongolia.

On this place, we may ask the question: Why there is so many immigrants from Vietnam, if their home country is so far away? First factor is the size of population. The population of Vietnam in the year 2007 has grown above 85 millions people with labour force reaching almost 47 millions. For comparison, the labour force in Moldova comprise of around 2 millions of workers and Mongolian labour force market has around 1 million 300 thousand workers. But why there is so many people from Vietnam and not from India or China? The answer to this question, and the second factor, why there is so many Vietnamese in our country, is an agreement between Czech Republic (then Czechoslovakia) and Vietnam government, dating back to 1970s and 1980s, which brought considerable amount of very talented Vietnam students on long term exchange study program to study in Czech. They learned to speak Czech language, brought their wives and families and many of them decided to stay forever. Due to various family and social ties between those who already migrated and their friends or families at home, many others decided to come to Czech Republic later, as it is predicted by theories of Transnational Social Spaces and theory of Migrant Networks. In the following section, I will have a closer look on unemployment data for our sample countries.

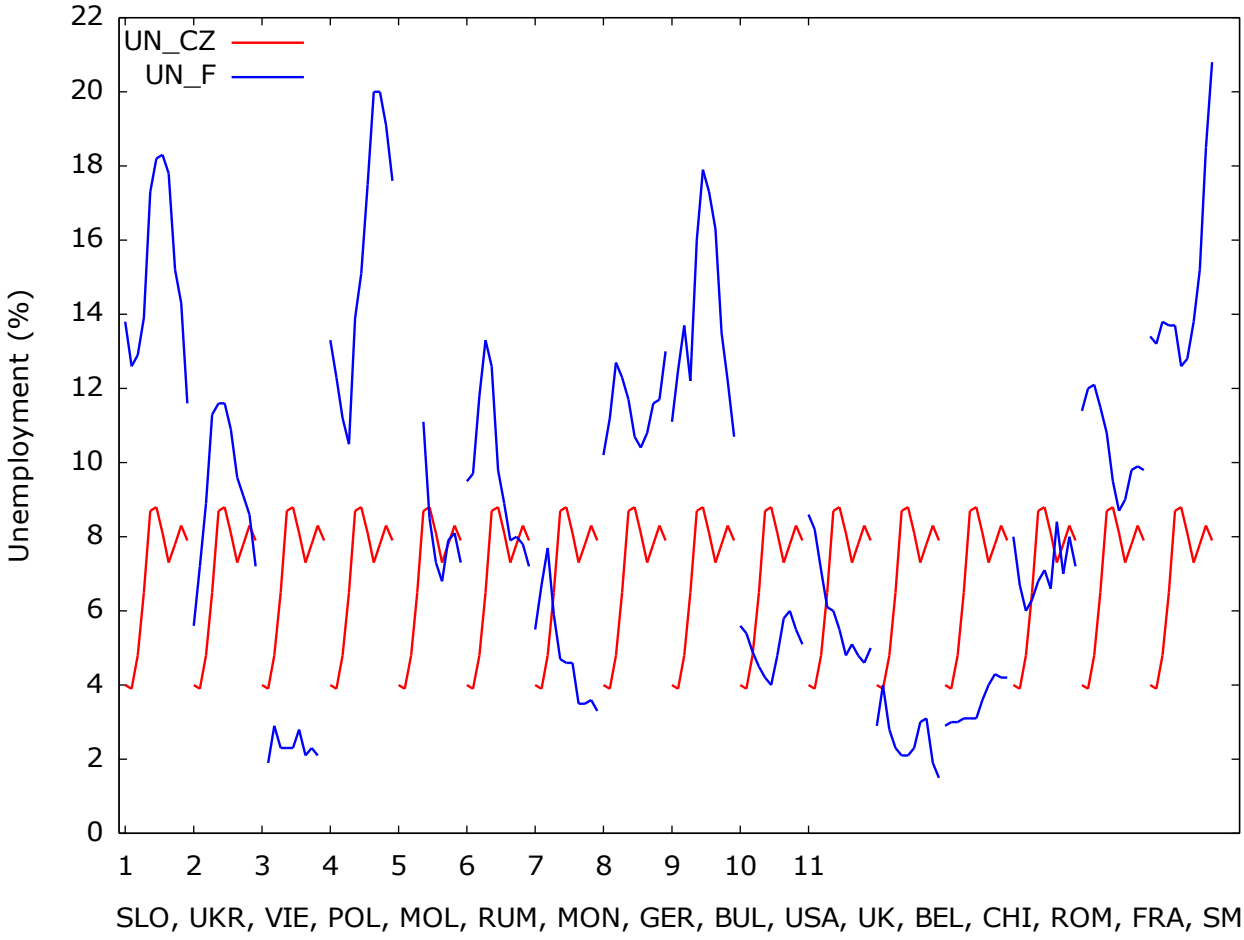
4.3 Unemployment

There is no doubt that high unemployment brings many problems for a country. Is out-migration one of those? I will try to answer this question in part 6 (Results) later. For now, you can see in the following graph (Figure 4), comparison of unemployment rate (in %) during 1995-2005 between Czech Republic and foreign countries from our sample. I intentionally put both variables into one graph to be able easily compare between them. We can see, that especially for Slovak Republic, Poland, Germany, Bulgaria plus Serbia and Montenegro, the unemployment rate was considerably higher in the chosen period. On the other hand (as I have already stated in part 3 Data) the data for Vietnam, Mongolia, Belarus and China are in my opinion unrealistically low. On this place, I will leave you to make your own conclusions. In the next chapter, I will explain in detail the model

24 Idem, pp. 39-40.

which will be later estimated.

Figure 4: Unemployment (in %; 1995-2005) – comparison between Czech Republic and source countries



Source: International Labour Organization (ILO), LABORSTA internet, (April 2008).

5 Empirical model

Theory and practise shows that immigration is determined by many factors. The model, which I will estimate, draws inspiration from human capital approach of Sjaastadt (1962), model of Harris and Todaro (1970) and from sociological theories of migrant networks and transnational social spaces.

My final model of immigration closely follows that of Alvarez-Plata et al. (2003).[25]

5.1 Model specification

Taken into account the available data and other restricting factors, to model immigration I use

25 Alvarez-Plata et al. (2003), pp. 17-22.

dependent variable SHARE, already discussed above. My dependent variable SHARE is a function of wages in Czech and at the home countries (GDP_CZ, GDP_H), unemployment rate in Czech and at the home countries (UN_CZ, UN_H), distance between capitals (DIST) plus dummy variables IDUM and UNDUM. Please note, that DIST, IDUM and UNDUM are time-invariant variables. The migration function is

$SHARE_{h,t} = f(GDP\_CZ_t; GDP\_H_{h,t}; UN\_CZ_t; UN\_H_{h,t}; DIST_h; IDUM_h; UNDUM_h)$, (4)

where the subscript t denotes the year of observation (t = 1995,...,2005 in case of OECD sample and t = 2000,...,2007 in case of Czech sample), subscript h denotes home country (h = 1,...,16). The variables and their sources were already discussed in part 3. In the following text, we will also meet with variable $RATIO_{h,t} = GDP\_CZ_t/GDP\_H_{h,t}$. (5)

Year after year possible new migrants and those who already migrated have to again and again reconsider their situation and choose the best allocation, which will bring them the highest utility, all possible costs being taken into consideration. Such behaviour will be specified by simple habit-persistence model

$$SHARE_{h,t} - SHARE_{h,t-1} = \delta(SHARE^*_{h,t} - SHARE_{h,t-1}) + u_{h,t} \quad , \tag{6}$$

where δ is intensity of habit formation and variable $SHARE^*_{h,t}$ is defined as ratio of foreign labour immigrants (in %), who wish to work in Czech Republic under specific circumstances in year t

$$SHARE^*_{h,t} = \beta^*_0 + \beta^*_1 \log(\frac{GDP\_CZ_t}{GDP\_H_{h,t}}) + \beta^*_2 \log(GDP\_H_{h,t}) + \beta^*_3 \log(UN\_CZ_t) + \beta^*_4 \log(UN\_H_{h,t})$$

$$+ \beta^*_5 \log(DIST_h) + \beta^*_6 IDUM + \beta^*_7 UNDUM \quad . \tag{7}$$

Then, if we substitute equation (3) into equation (2), we get

$$SHARE_{h,t} = \beta_0 + (1-\delta) SHARE_{h,t-1} + \beta_1 \log(\frac{GDP\_CZ_t}{GDP\_H_{h,t}}) + \beta_2 \log(GDP\_H_{h,t}) + \beta_3 \log(UN\_CZ_t)$$

$$+ \beta_4 \log(UN\_H_{h,t}) + \beta_5 \log(DIST_h) + \beta_6 IDUM + \beta_8 UNDUM + u_{h,t} \quad , \tag{8}$$

where $\beta_k = \delta \beta^*_k$ for k = 0,1,...,8. In addition, the error term is specified as one-way error-component model

$$u_{h,t} = v_h + w_{h,t} \quad , \tag{9}$$

where vh denotes country-specific effect and wh,t is considered to be white noise.

The equation (8) was used (without the dummy variables IDUM and UNDUM specific for this paper) for estimation purposes in already mentioned paper of Alvarez-Plata et al. (2003). However I will estimate the equation in the following form

$$SHARE_{h,t} = \beta_0 + (1-\delta) SHARE_{h,t-1} + \beta_1 \log(GDP\_CZ_t) + \beta_2 \log(GDP\_H_{h,t}) + \beta_3 (UN\_CZ_t)$$

$$+ \beta_4 (UN\_H_{h,t}) + \beta_5 \log(DIST_h) + \beta_6 IDUM + \beta_7 UNDUM + \beta_i DUM^*_h + u_{h,t} \quad , \qquad (10)$$

where DUM^*_i is representing corresponding dummy variables for home countries (SLODUM, UKRDUM, VIEDUM,...), consequently i = 8,...,23. If you compare equations (8) and (10), you can notice two important changes. First, I dropped logarithms in front of unemployment rates. Rationale of such move is following. The logarithms in case of GDP are in its place. We know that GDP has a tendency to grow over time and thus usage of logarithm is natural tool how to treat such growth and to stabilize the non-stationary GDP variables. Another reason for logarithms in case of GDP is the underlying utility curve, which is also perceived to have a logarithmic shape. However, the case of unemployment rate is different. The unemployment neither have any tendency to increase or to fall continually over time, nor we can conclude that utility function for unemployment is logarithmic, thus the use of logarithms has no sense and does not bring us any advantage and we can simply treat it as continuous variable. The second difference between equations (8) and (10) is stemming from simple mathematical reflection on logarithms. It is well known fact, that logarithm of share between two numbers is equal to the difference of the logarithm of dividend minus logarithm of divisor, i.e. log(A/B) = log(A) – log(B). If we apply this knowledge to our case, we find out, that trying to estimate migration by two independent variables log(RATIO) (5) and log(GDP_H), at the same time, has no sense since $\beta_1 \log(\frac{GDP\_CZ_t}{GDP\_H_{h,t}}) + \beta_2 \log(GDP\_H_{h,t})$ is equal to $\beta_1 \log(GDP\_CZ_t) + (\beta_2 - \beta_1) \log(GDP\_H_{h,t})$. Results obtained by estimating the first variant can be a little misleading. Usually, the obtained estimates of $\hat{\beta}_1$ and $\hat{\beta}_2$ by this way are both positive, which then may lead to the wrong conclusion, that increasing home wage can bring higher emigration out of the country, however the overall effect of home wage has to be recalculated with consideration to the estimated $\hat{\beta}_1$. In fact, the overall effect of home wage is equal to $(\hat{\beta}_2 - \hat{\beta}_1)$ in the model estimated in such way. Some argued, that positive effect of raising home wages on out-migration can enable possible migrants to overcome the initial migration costs and thus is possible to obtain, however such hypothesis can not be confirmed by the results of the equation above, if

logarithms of the dependent variables were already taken. Further, if migration is estimated with logarithms of RATIO and GDP_H, then it has a far reaching consequences for significance of coefficient of variable GDP_H, which will appear to be significant when the coefficient of the RATIO is significant as well. In opposition to this, I found that when estimating from the same data with logarithms of GDP_CZ and GDP_H , the coefficient of variable GDP_H does not have to appear significant even though we get the same result.

5.2 Discussion of estimating methods

In the first part of this section, I will talk briefly about estimating methods used in this paper.[26] In the second part, I will discuss the robust estimation methods, namely the application of heteroskedasticity and autocorrelation consistent (HAC) standard errors. Please remember that the data obtained for this study have panel structure, i.e. they have both time and cross-sectional dimension. The most extensively used model in this study will be simple pooled ordinary least squares (Pooled OLS).

5.2.1 Panel data estimators

Pooled OLS specification can be depicted as

$$y_{it} = X_{it}\beta + u_{it} \quad , \tag{11}$$

where y_{it} is the observation on the dependent variable for cross-sectional unit i in time t, next X_{it} is a 1 x k vector of independent variables observed in time t for unit i and last uit is a disturbance term specific for unit i in time t.

More sophisticated, but still very basic, alternatives to Pooled OLS are Fixed effects (FE) and Random effects (RE) models. Both these models address, in slightly different manner, the issue of the disturbance term u_{it} in Pooled OLS model (11). In case of Fixed effects, it is decomposed as

$$u_{it} = \alpha_i + \varepsilon_{it} \quad , \tag{12}$$

where ε_{it} is once again a disturbance term specific for unit i in time t and α_i is representing a unit i specific time-invariant constant. Fixed effects model then takes form

$$y_{it} = X_{it}\beta + \alpha_i + \varepsilon_{it} \quad . \tag{13}$$

26 Please note, that estimation methods used in this paper are the very basic tools from panel data area. However, use of more advanced methods like GMM , Arelano-Bond and other estimators goes far beyond the scope of this work.

Basically, there are two ways how to construct and estimate Fixed effects model, the first being addition of cross-sectional dummy variables and suppressing the global constant, the second way goes through the demeaning of the variables. Addition of cross-sectional dummy variables is also called Least Squares Dummy Variables (LSDV). The important issue in case of Fixed effects models is a correct model specification. Because the α_is are treated as time-invariant constants different for every cross-sectional unit, we need to pay close attention to our explanatory variables. In case there would be any time-invariant variable presented among explanatory variable, it would be in conflict with cross-sectional unit dummy during estimation which would lead into exact multicollinearity problem. We should therefore consider the cross-sectional constants as representatives of all relevant time-invariant variables (which are not, because they can not be, considered by our model). Thus, we are able to explain part of the behaviour of our dependent variable through correctly chosen time-variant variables and the rest is explained through unit constants. The advantage is that we do not have even know the variables which are explained through the unit constants. A slightly different approach is taken in case of Random effects models.

Random effects models decompose the disturbance term uit as

$$u_{it} = v_i + \varepsilon_{it} \quad . \tag{14}$$

This time, all else being equal, v_is are treated as unit i's specific disturbance terms, i.e. not as a fixed parameters like in previous case of FE, but rather as random drawings from a given probability distribution. Due to differences between variances of disturbance terms, the Gauss-Markov conditions, which ensure efficiency in case of OLS, are not satisfied, so RE models use features of Generalized Least Squares (GLS) to ensue efficiency. I will not discuss the estimators on this place in bigger detail. For nice introductory description of the panel models please refer to chapter 16 in Gujarati (2004).[27] Another source with good description of the topic can be find at Gretl manual by Cottrell and Lucchetti (2008).[28]

5.2.2 Robust HAC standard errors[29]

Because we are dealing with the panel data in this paper, two possible problems can arise. First problem, which is connected to the cross-sectional dimension of the data, is heteroskedasticity. In the case of heteroskedasticity, the classical assumption about the regression disturbances u_{it}s, that

27 Gujarati D. N. (2004), pp. 636 – 655.
28 Cottrell, A., and Lucchetti, R. (2008), pp. 101-105.
29 I thank professor Jan Ámos Víšek for helpful comments and discussion about robust estimation methods.

the error terms are independently and identically distributed (iid) is broken. The second possible problem, which we are facing with the introduction of time series dimension of our data, is serial correlation (autocorrelation). Autocorrelation violates the OLS assumption that the error terms are uncorrelated. While it does not bias the OLS coefficient estimates, the standard errors tend to be underestimated (and the t-scores overestimated) when the autocorrelations of the errors at low lags are positive. In the case of autocorrelation, we can help much by the right specification of the model, namely by introduction of lagged values of our variables. This approach is chosen in this paper, but because time span of our data is not very long, the number of lags of dependent variable was restricted to be at the outside two. Hence, to correct for both problems at the same time, I have chosen to use heteroskedasticity and autocorrelation consistent (HAC) standard errors. We should realize that sole use of HAC standard errors can not ensure robust estimation if the model was wrongly specified. The HAC approach can provide for asymptotically valid statistical inference only in models that are basically correctly specified, but in which the disturbances are not iid. For thorough description of the HAC issue, please refer to chapter 14 in Cottrell and Lucchetti (2008).[30]

6 Results[31]

In the following two sections, I will present results from both, Czech and OECD samples. Prior to that, I will just encourage the reader to take the results presented in this and especially the next chapter, dealing with the migration forecast, not as a hard facts, but rather like an orientation numbers, which can provide basic orientation in the topic and can give us certain hint about the direction of migration flows and about the signs of coefficients. Thus, motto of the following two sections can be a statement of econometrician (whose name I have unfortunately forgotten), who claims that econometric study can be only as good as the data available for it.

When searching for the model which would suit best to our needs, significance of variables and high coefficient of determination (R^2) were the most important indicators of quality of the chosen model with high R^2 being essential for the quality of forecast later. In addition to it, I paid close attention to the difference between R^2 and $\overline{R^2}$ (R^2 adjusted). I wanted to get a parsimonious model, hence in addition to $\overline{R^2}$ I was also comparing Akaike and Schwarz Bayesian criterion. Last, I gave my attention to issues of heteroskedasticity and autocorrelation with inclusion of first and second

30 Idem, pp. 94-100.

31 Majority of the estimations in this and following section were performed using econometrics package Gretl. Gretl is an open-source software application for compiling and interpreting data mainly for econometrics. For more information about Gretl, please refer to Gretl's home page: http://gretl.sourceforge.net/.

lag of dependent variable among the explanatory variables. Moreover, I used HAC standard errors throughout estimation instead of Prais-Winsten or Cochran-Orcutt transformation.

6.1 OECD sample

The best model for OECD sample turned out to be Pooled OLS with robust HAC standard errors. 136 observations were available with 16 cross-sectional units and time-series length with minimum of 4 and maximum of 9 observations. Results of the estimated model, with dependent variable SHARE, are presented in the following table, which is a slightly modified printout from econometrics software Gretl.[32]

Variable	Coefficient[33]	Std. Error	t-statistic	p-value	sign[34]
const	-0.53313	0.23830	-2.2372	0.02703	**
l_GDP_CZ	0.07393	0.02773	2.6665	0.00867	***
l_GDP_H	-0.01427	0.00595	-2.4001	0.01786	**
UN_CZ	-0.00477	0.00269	-1.7709	0.07900	*
SLODUM	2.13806	0.20485	10.4371	<0.00001	***
UKRDUM	0.05770	0.01145	5.0403	<0.00001	***
POLDUM	0.03337	0.00582	5.7343	<0.00001	***
MONDUM	0.04451	0.01393	3.1956	0.00176	***
SHARE_1	0.56777	0.04645	12.2232	<0.00001	***
SHARE_2	-0.46921	0.04036	-11.6263	<0.00001	***

Sum of squared residuals = 0.41430
Standard error of residuals = 0.05734
Unadjusted R^2 = 0.99118
Adjusted R^2 = 0.99055
F-statistic (9, 126) = 1572.93 (p-value < 0,00001)
Akaike information criterion = -382.006
Schwarz Bayesian criterion = -352.879
Hannan-Quinn criterion = -370.17

Estimated model above was further tested against its alternatives – Fixed effects and Random effects. Both models will be estimated and compared against Pooled OLS with F test in case of Fixed effects and Breusch-Pagan test in case of Random effects. In addition to it, models will be compared against each other with Hausman test. The panel diagnostics follows:

32 Variable SHARE was introduced in chapter 3 as equation (3).
33 All numbers were rounded to five decimal places where needed.
34 Significance: *** - significant on 1%, ** - significant on 5%, * - significant on 10%.

Fixed effects estimator allows for differing intercepts by cross-sectional unit slope (standard errors in parentheses, p-values in brackets).

const:	-0.30918	-0.46792	[0.51009]
l_GDP_CZ:	0.05849	-0.11181	[0.60192]
l_GDP_H:	-0.00398	-0.08501	[0.96271]
UN_CZ:	-0.00496	-0.00484	[0.30769]
SHARE_1:	0.52474	-0.08217	[0.00000]
SHARE_2:	-0.50493	-0.08235	[0.00000]

16 group means were subtracted from the data.

Residual variance: 0.37683/(136 - 21) = 0.00328
Joint significance of differing group means:
F(15, 115) = 0.76238 with p-value 0.71595
(A low p-value counts against the null hypothesis that the pooled OLS model is adequate, in favour of the fixed effects alternative.)

Breusch-Pagan test statistic:
LM = 0.57976 with p-value = 0.44641
(A low p-value counts against the null hypothesis that the pooled OLS model is adequate, in favour of the random effects alternative.)

Variance estimators:
between = 4.38748e-007
within = 0.00328
Panel is unbalanced: theta varies across units.

Random effects estimator allows for a unit-specific component to the error term (standard errors in parentheses, p-values in brackets).

const:	-0.53313	(-0.38949)	[0.17351]
l_GDP_CZ:	0.07393	(-0.04164)	[0.07822]
l_GDP_H:	-0.01427	(-0.00581)	[0.01533]
UN_CZ:	-0.00476	(-0.00483)	[0.32607]
SLODUM:	2.13810	(-0.20219)	[0.00000]
UKRDUM:	0.05770	(-0.02118)	[0.00736]
POLDUM:	0.03337	(-0.02024)	[0.10165]
MONDUM:	0.04451	(-0.02187)	[0.04396]
SHARE_1:	0.56777	(-0.08125)	[0.00000]
SHARE_2:	-0.46921	(-0.08163)	[0.00000]

Hausman test statistic:
H = 11.8209 with p-value = 0.03733
(A low p-value counts against the null hypothesis that the random effects model is consistent, in favour of the fixed effects model.)

6.2 Czech sample

Creation of a model with a good fit for Czech sample turned out to be much more difficult. The first reason for that being the shorter time span of the sample, hence less observations available. The second reason is the fact, that Czech sample was glued together from more sources than OECD sample thus I assume that the quality of the Czech data set is lower. For this reason, in the next part, I will use only the results from OECD sample to do a forecast of migration. Nonetheless, results from Czech sample can help us to verify/refute the signs of coefficients of the independent variables and compare the results with the OECD sample. This time, the best model to represent data from Czech sample turned out to be Random-effects (GLS). Czech sample was considerably smaller then OECD sample, hence we had available 105 observations over 16 cross-sectional units with time-series length minimum 5 and maximum 7 observations. Once again, dependent variable was SHARE. The results of the estimation are presented in the table bellow. Bellow the table, two tests are enclosed. First, we test validity of our Random effects model against Pooled OLS with Breush-Pagan test. Second, we test our Random effects model against its Fixed effects alternative by Hausman test:

Variable	Coefficient	Std. Error	t-statistic	p-value	sign.
const	-1.66425	0.68977	-2.4128	0.01771	**
l_GDP_CZ	0.16039	0.06508	2.4643	0.01549	**
l_GDP_H	0.00333	0.00841	0.3960	0.69299	
UN_CZ	0.01576	0.01083	1.4545	0.14904	
UN_H	-0.00267	0.00162	-1.6502	0.10213	
l_DIST	-0.00627	0.00894	-0.7013	0.48482	
SLODUM	-0.49192	0.16498	-2.9816	0.00363	***
SHARE_1	1.24881	0.05895	21.1848	<0.00001	***

Sum of squared residuals = 0.46173
Standard error of residuals = 0.06864
'Within' variance = 0.00495
'Between' variance = 1.47377e-005
Akaike information criterion = -255.83
Schwarz Bayesian criterion = -234.598
Hannan-Quinn criterion = -247.226

Breusch-Pagan test -
Null hypothesis: Variance of the unit-specific error = 0
Asymptotic test statistic: Chi-square(1) = 6.20351
with p-value = 0.01275

Hausman test -
Null hypothesis: GLS estimates are consistent
Asymptotic test statistic: Chi-square(5) = 8.92785
with p-value = 0.11198

6.3 Evaluation of results

In the following table, I have presented the signs of coefficients from both sample's estimations.

Variable	OECD sample	Czech sample
l_GDP_CZ	+	+
l_GDP_H	-	+
UN_CZ	-	+
UN_H	Not significant	-
l_DIST	Not significant	-
SLODUM	+	-
UKRDUM	+	NA
POLDUM	+	NA
MONDUM	+	NA

Let me comment the results from OECD sample first. All the signs of coefficients are in harmony with expectations. When Czech GDP per capita rise, more labour immigrants is coming. Inversely, if foreign GDP per capita rise, less immigrants is coming. Higher Czech unemployment has the same influence, it lowers the labour immigration as well. All significant dummies have positive signs and they are all representing countries with particularly high labour immigration stocks. Hence, people from those countries have slightly higher probability to immigrate to Czech Republic then others. It seems to be obvious what is such an advantage in case of Slovak Republic, Ukraine and Poland. The languages are close to Czech one, the geographical distance between Czech Republic and these countries seems to be rather small in comparison with other countries from the sample. In addition, there is certain cultural and historical proximity between these countries and Czech Republic. Why the Mongolian dummy is also significant? I think that significance of Mongolian dummy is a drawback of use of SHARE as explanatory variable. Labour force in Mongolia is really small, hence even if just a few people from Mongolia will come to work in Czech, the SHARE for Mongolia may appear very high in comparison with other sample countries with lots of inhabitants. This causes the significance of Mongolian dummy.

Now few words about Czech sample. Czech sample has much shorter time span. Lots of variables did not appear significant in Czech sample. I enclosed it to this work in order to verify/refute some

key results from OECD sample. Similarly like in OECD sample, the foreign unemployment rate (UN_H) was not significant. This can lead to the conclusion, that foreign unemployment rate is not an important variable according to which would many people made their immigration decision. The signs of coefficients of Czech GDP per capita PPP (l_GDP_CZ), home GDP per capita PPP (l_GDP_H) and Czech unemployment rate (UN_CZ) are all positive which is very confusing in case of the later two. However both of them are not significant. Although not significant, the coefficient of log of distance between Prague and foreign capital (l_DIST) is negative which has a sense. The farer home country is, less labour immigrants come from that country. In this place, we can conclude this section. We found out, that the results from OECD sample seems to be more appropriate for the forecasting purposes. Therefore, in the forecast of immigration, we will utilize the estimated model from OECD sample.

7 Forecast of labour immigration

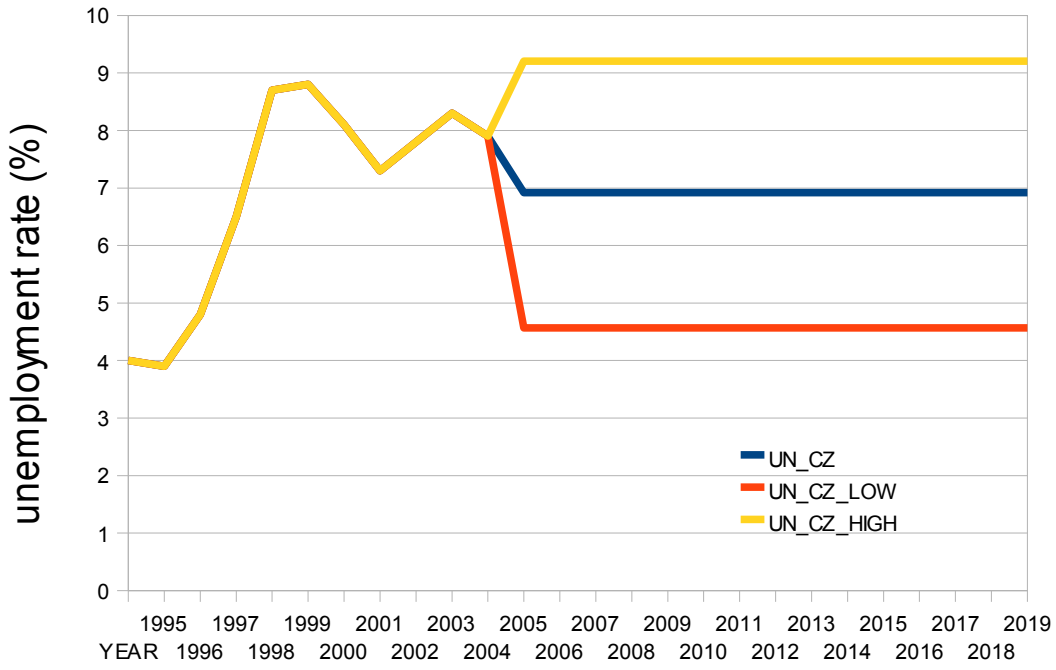
In this part I will attempt to forecast labour immigration to Czech Republic. This forecast is based on the OECD estimated model. Due to various imperfections of our data, estimation procedures and estimated model, such forecast can not be taken too much seriously. Hence I am asking every reader to take the results from this part merely as an orientation raw data rather then exact facts. Nobody can foresee the future, neither me. I have chosen the OECD sample which covers years 1995 to 2005. I will try to predict the immigration stocks for next 15 years, hence, I will forecast the years 2006 – 2020. It is more than obvious, that we can trust the results less and less with every added year, thus we may (maybe) to a certain extant believe in forecasts for 2006 – 2012. On the other hand, the forecast for 2020 can be considered as a mere mathematical exercise, as forecasts over such a long period of time must loose credibility. Standard errors grow excessively, furthermore we can never be sure, that such a distant future will produce similar immigration (and every other) behaviour like our past and immediate present.

I have created three forecasting scenarios. The scenario with high immigration will be called Ireland scenario, the scenario with low immigration I will call Greece scenario and of course, we have a middle (Portugal) scenario variant as well. All three scenarios share the same data for foreign GDP per capita PPP (GDP_H). This data are based on the past values from 1995-2005. Further, I got additional observations (predictions) for 2006-2013 from IMF. The observations for 2014-2020 were extrapolated out of the 1995-2013 sample with Hodrick-Prescott filter. We screened out the cyclical part of the GDP and left only the growth component. The penalty parameter (smoothness

parameter λ) have been set to 100 (we work with annual data). The scenarios differ in the assumptions about the Czech unemployment rate (UN_CZ) and Czech GDP per capita PPP (GDP_CZ). It would be possible to let the scenarios differ also in the variable GDP_H, however due to substantial differences between the countries in the sample, it would bring lots of restrictions (which do not have to be met in the future) and it would considerably complicated whole forecasting procedure.

Our estimated variable is SHARE so in order to get the stocks of labour immigrants in Czech Republic, we need to know labour force of home countries for 2006-2020. Predictions of labour force of home countries come from International Labour Organization (Laborsta).

Figure 5: Unemployment rate (%) - low (Ireland), high (Greece) and middle scenario (Portugal)



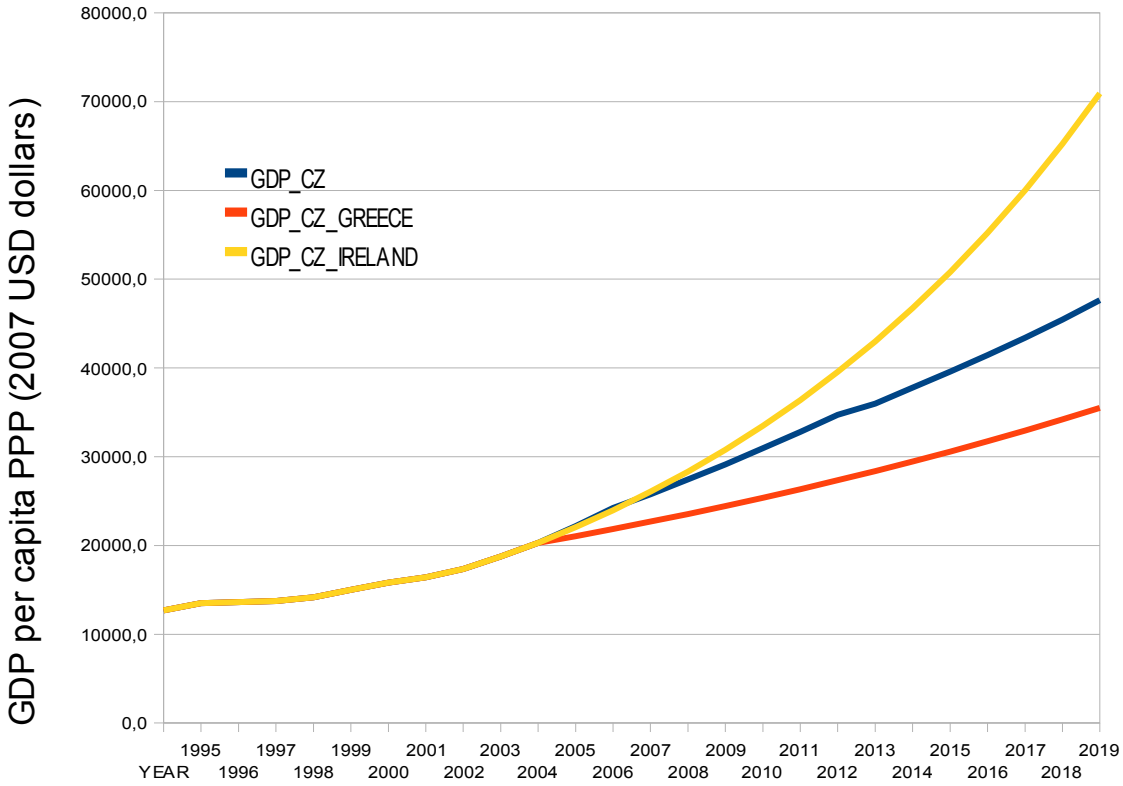
Source: Author's computation.

- **Middle scenario (Portugal).** Value for Czech unemployment rate (UN_CZ) for 2006-2020 is simply average value of Czech unemployment rate during 1995-2005. The exact number is 6.92% (see Figure 5). Values for Czech GDP per capita PPP (GDP_CZ) were, similarly like in the case of foreign GDP per capita, extrapolated using Hodrick-Prescott filter for 2014-2020. Values for 2006-2013 are, once again, estimates from IMF. On this place, we can mention, that average growth

rate of Czech GDP per capita PPP in 1995-2005 was approximately 4.8% per year. We should also note, that Czech Republic is a member of European Union (EU) from 2004, hence period 2006-2020 will cover first 15 years of our being in the EU. The extrapolated data for Czech GDP per capita PPP using HP filter plus the data from IMF (overall coverage 2006-2020) grow by 5.8% on average per year. We may think, that such a fast tempo of growth can seem to be utopian. Fortunately we have some historical experience, therefore we can compare with other countries who have joined EU before us and judge the validity of such number. Let me introduce to you the case of Portugal who joined EU in 1981. During the next 15 years (1982-1997), the growth of GDP per capita PPP in Portugal was exactly 5.8%. Take note, that population of Portugal is almost that of Czech Republic. For the results of middle scenario, please refer to Figure 7.

Figure 6: GDP per capita PPP (2007 USD dollars)

- low (Ireland), high (Greece) and middle scenario (Hodrick-Prescot filter)



Source: Author's computation. See text for the assumptions of the scenario.

- **Ireland scenario (high immigration).** In the Ireland scenario, I am trying to create (obtainable) favourable conditions for immigration, which would take place if our country would be so successful in its first 15 years in EU, like Ireland (in terms of GDP per capita PPP growth). Ireland entered EU in 1973. During the next fifteen years, in period 1974-1989, the Ireland's GDP per capita PPP grew by 8.7% per year. I am trying to follow this example, so for Ireland scenario,

the Czech GDP per capita PPP (GDP_CZ) will grow by 8.7% per year during 2006-2020. I complemented this by low rate of Czech unemployment (UN_CZ), which I computed as 2/3 of the average Czech unemployment rate during 1995-2005. The number is 4.57%. For the results, refer to Figure 8.

- **Greece scenario (low immigration).** Greece entered EU in 1981. During 1982-1997 its GDP per capita PPP grew on average by 3.8%. The same growth was implemented in this scenario for Czech GDP per capita PPP (GDP_CZ) during 2006-2020. You can see comparison with other two scenarios in Figure 6. In contradiction to the Ireland scenario, the Czech unemployment rate (UN_CZ) for the years 2006-2020 in this scenario is set to be 4/3 of the average Czech unemployment rate during 1995-2005. The value is 9.2%. For the results, refer to Figure 9.

Figure 7: Forecast of labour immigration STOCKS – middle scenario

YEAR	Slovakia	Ukraine	Vietnam	Poland	Moldova	Russian Fed.
2006	73095,34	35557,79	31080,24	15251,46	2171,99	29009,9
2007	64853,21	25800,19	38594,69	15875,6	1408,01	47120,08
2008	61421,77	22925,43	41251,02	15600,17	1310,7	47298,33
2009	63527,16	26461,5	41571,1	15785,58	1701,16	41383,53
2010	66451,77	30352,08	42785,59	16568,5	2045,14	40229,11
2011	67138,92	31426,13	45706,22	17482,22	2133,5	44553,17
2012	66156,01	30652,22	49095,95	18135,37	2092,62	49529,09
2013	65208,64	30052,77	51761,48	18552,24	2096,73	52167,67
2014	64962,08	30232,47	53618,94	18785,72	2164,41	52489,16
2015	65081,24	30823,23	55495,62	19102,57	2256,35	52881,34
2016	65022,11	31234,18	57760,44	19529,11	2328,43	54260,26
2017	64695,39	31303,65	60202,39	19955,97	2373,11	56046,44
2018	64202,91	31232,85	62589,41	20315,98	2411,76	57574,34
2019	63781,87	31215,93	64850,01	20625,21	2458,89	58725,68
2020	63443,62	31291,67	67154,45	20939,56	2511,75	59821,28

YEAR	Mongolia	Germany	Bulgaria	USA	UK	Belarus
2006	1598,34	10885,61	1500,69	33454,42	7939,52	2196,77
2007	1474,29	18325,51	1474,44	61810,78	13457,38	3056,24
2008	1576,55	19959,07	1649,49	69965,21	14655,91	3112,09
2009	1779,2	19193,76	1850,25	68790,15	14067,21	2895,23
2010	1918,19	19643,09	1963,17	71083,84	14394,86	2884,82
2011	1967,75	21915,85	2011,14	79741,38	16108,44	3120,71
2012	2012,5	24547,18	2057,14	90211,8	18146,64	3383,77
2013	2096,4	26470,01	2126,31	98656,21	19684,59	3541,36
2014	2190	27259,34	2192,25	103083,05	20313,73	3559,97
2015	2275,98	28034,57	2252,68	107457,86	20956,39	3578,62
2016	2355,73	29267,36	2309,44	113542,24	21997,66	3651,33
2017	2430,99	30687,25	2364,47	120551,63	23248,85	3746,18
2018	2510,06	31971,55	2419,01	127262,16	24426,55	3823,63
2019	2591,59	33058,03	2473,22	133482	25460,71	3879,61
2020	2673,22	34065,56	2527,73	139670,54	26461,48	3932,15

YEAR	China	Romania	France	S. and M.
2006	420562,86	4503,97	7076,05	2313,62
2007	701579,78	6860,91	12250,83	3682,3
2008	690030,42	6852,66	13280,68	3751,92
2009	578936,71	6095,34	12589,09	3351,74
2010	548153,08	5972,28	12730,01	3292,11
2011	611451,56	6560,82	14159,59	3649,77
2012	688228,56	7232,31	15857,22	4068,6
2013	727063,99	7604,37	17089,25	4319,79
2014	733707,09	7702,61	17587,67	4385,49
2015	741683,5	7819,72	18090,34	4462,36
2016	764769,17	8073,66	18893,41	4621,77
2017	794807,25	8387,01	19856,8	4823
2018	821114,71	8665,92	20754,61	5006,61
2019	842032,38	8899,03	21550,86	5161,39
2020	861591,23	9117,52	22333,29	5312,4

Source: Author's computation.

Figure 8: Forecast of labour immigration SOCKS – Ireland (high migration)scenario

YEAR	Slovakia	Ukraine	Vietnam	Poland	Moldova	Russian Fed.
2006	73386	37914	35998	17137	2407	36914
2007	65300	29391	46304	18764	1770	59245
2008	61865	26460	49055	18457	1672	59313
2009	63936	29699	48913	18415	2036	52442
2010	66890	33800	50812	19380	2406	52054
2011	67655	35457	55334	20783	2560	58415
2012	66752	35274	60426	21940	2586	65462
2013	65866	35110	64478	22739	2642	69632
2014	65709	35931	68320	23532	2785	72201
2015	65916	37141	72218	24401	2951	74776
2016	65933	38067	76324	25302	3087	77991
2017	65676	38593	80535	26167	3191	81423
2018	65255	38977	84773	26973	3289	84612
2019	64907	39413	88958	27736	3398	87437
2020	64640	39914	93190	28487	3509	90137

YEAR	Mongolia	Germany	Bulgaria	USA	UK	Belarus
2006	1736	15328	1831	50473	11226	2710
2007	1690	25164	1975	88162	18518	3842
2008	1795	26760	2139	96323	19690	3889
2009	1985	25484	2297	93303	18724	3609
2010	2144	26406	2438	97603	19406	3646
2011	2239	29896	2565	111234	22030	4012
2012	2333	33785	2692	126922	25020	4405
2013	2458	36678	2821	139522	27301	4659
2014	2609	38872	2976	149950	29012	4818
2015	2754	41038	3124	160405	30744	4973
2016	2889	43480	3254	171943	32752	5158
2017	3018	46008	3377	184148	34921	5354
2018	3153	48420	3500	196255	37050	5532
2019	3293	50651	3623	208120	39065	5691
2020	3434	52748	3744	219914	41026	5842

YEAR	China	Romania	France	S. and M.
2006	505668	5603	9980	2872
2007	833204	8533	16706	4548
2008	821471	8498	17692	4618
2009	700970	7604	16650	4156
2010	679885	7581	17077	4159
2011	767557	8448	19274	4676
2012	869706	9408	21763	5259
2013	928431	9999	23606	5639
2014	963805	10421	24996	5890
2015	1000356	10858	26388	6153
2016	1048513	11392	27966	6475
2017	1101907	11966	29657	6829
2018	1152051	12510	31302	7170
2019	1197448	13016	32871	7486
2020	1240816	13495	34412	7795

Source: Author's computation.

Figure 9: Forecast of labour immigration STOCKS – Greece (low migration) scenario

YEAR	Slovakia	Ukraine	Vietnam	Poland	Moldova	Russian Fed.
2006	72699	32338	24362	12675	1851	18212
2007	64128	19963	26062	11180	819	27411
2008	60647	16749	27615	10608	679	26304
2009	62828	20925	29014	11289	1128	22471
2010	65773	25017	30365	12218	1487	21931
2011	66390	25582	31745	12695	1516	24452
2012	65318	24159	33177	12790	1399	27143
2013	64317	23194	34514	12874	1357	28481
2014	64087	23553	36386	13222	1437	29383
2015	64222	24319	38280	13648	1541	30341
2016	64149	24685	39967	13995	1601	31514
2017	63795	24611	41533	14253	1622	32746
2018	63281	24452	43165	14487	1643	33901
2019	62850	24427	44883	14736	1681	34946
2020	62502	24505	46664	14999	1727	35962

YEAR	Mongolia	Germany	Bulgaria	USA	UK	Belarus
2006	1411	4817	1049	10205	3450	1496
2007	1124	7209	661	18975	5231	1778
2008	1195	8076	793	23910	5859	1754
2009	1427	8435	1086	26866	6102	1674
2010	1569	9178	1229	30046	6640	1707
2011	1574	10345	1209	34076	7521	1829
2012	1562	11567	1166	38634	8490	1949
2013	1606	12626	1185	43231	9354	2026
2014	1699	13647	1274	48145	10118	2085
2015	1783	14648	1356	52948	10880	2143
2016	1844	15645	1404	57564	11689	2207
2017	1892	16620	1435	62159	12532	2270
2018	1947	17570	1473	66852	13374	2327
2019	2010	18487	1521	71665	14193	2380
2020	2074	19362	1571	76517	14999	2429

YEAR	China	Romania	France	S. and M.
2006	304298	3002	3109	1550
2007	487617	4143	5009	2274
2008	460361	3977	5573	2239
2009	370221	3516	5644	1977
2010	344305	3482	6003	1950
2011	385092	3824	6743	2162
2012	433253	4176	7559	2396
2013	453955	4357	8250	2530
2014	463984	4516	8904	2622
2015	475377	4691	9548	2722
2016	492799	4893	10198	2846
2017	512839	5101	10859	2981
2018	531349	5300	11519	3113
2019	547669	5490	12175	3236
2020	563131	5673	12827	3359

Source: Author's computation.

8 Conclusion

In this paper, the legal labour immigration to Czech Republic was modelled. Two different panel data sets were used for this purpose. The results from both data sets largely confirmed the previous empirical findings, that migration decision is positively influenced by increasing wage levels in the host country and negatively influenced by higher home wage levels as well as higher unemployment rate in the host country. Unemployment rate in the home country seems to have no significant effect on the migration. Similarly, the distance between the Prague and foreign capital, did not proof to have any significant impact on the immigration decision in our models. On this place, we can only note, that both coefficients were negative. From the other explanatory variables, the dummy variables for Slovak Republic, Ukraine, Poland and Mongolia were significant and all had positive signs. This can be explained by the geographical proximity between these countries and Czech Republic, historical, language and cultural closeness in case of the first three countries. The dummy variable for Mongolia might have appeared significant because the population in Mongolia is comparably much smaller then the population in other countries in the sample. Given the fact, that migration was modelled with variable SHARE which depicts the share of foreign migrants in Czech Republic to its home labour force, even the small inflow of workers from Mongolia may appear as a large portion of the Mongolian labour force and thus appear as significant.

The aim of this work was to present the first labour forecast for Czech Republic. The low quality of the data and short time span considerably complicated the process. For the purpose of the forecast, the econometric model based on OECD sample was used to forecast labour immigration to Czech Republic for the consecutive 16 years, i.e. for the time period 2006-2020 for three different migration scenarios. Those scenarios were modelled on the basis of previous historical experience. As I have already stresses, nobody can foresee the future, neither econometrician. Nonetheless, the methods used can assure us, that at least the forecasts of labour immigration until 2010 or maybe even 2014 carry certain informational meaning. Bear in mind, that not a precise facts, but rather orientation raw data are presented. Such information may be for example used in the ongoing debate whether better birth policy or more opened immigration policy can help to revive the ageing Czech labour market.

The presented model utilizes mainly economic incentives for migration. Additional empirical

research and possible broadening of the presented model would be more then welcomed especially in the areas of sociology and psychology. It is clear that any contribution will benefit to the forecasting accuracy and to our overall knowledge on the issue in Czech Republic.

I would like to end this paper with one cheerful but valid question. If in the year 2020 approximately every tenth person in the Czech Republic is from China, should not we have already started to learn Chinese?

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10 Data sources

IMF
International Monetary Fund
data - Gross domestic product based on purchasing-power-parity (PPP) per capita GDP (Current International Dollar)
http://www.imf.org

(http://www.imf.org/external/pubs/ft/weo/2008/01/weodata/weorept.aspx?sy=1995&ey=2013&scsm=1&ssd=1&sort=country&ds=%2C&br=1&pr1.x=76&pr1.y=14&c=913%2C921%2C948%2C943%2C918%2C924%2C964%2C968%2C922%2C935%2C942%2C936%2C132%2C134%2C926%2C112%2C111%2C582&s=PPPPC&grp=0&a=)

ILO
International Labour Organization – LABORSTA internet
data - Unemployment (% rate)
http://laborsta.ilo.org

OECD
data - Foreign labour immigrants stocks in Czech republic
http://stats.oecd.org

WORLDBANK
HNPStats - the World Bank's comprehensive database of Health, Nutrition and Population (HNP) statistics
http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/EXTHEALTHNUTRITIONANDPOPULATION/EXTDATASTATISTICSHNP/EXTHNPSTATS/0,,menuPK:3237172~pagePK:64168427~piPK:64168435~theSitePK:3237118,00.html

Kristian Skrede Gleditsch
data - Distance between Capitals - contains the great circle distance between capital cities in the kilometers
http://privatewww.essex.ac.uk/~ksg/data-5.html

Czech
Czech Statistical Office
http://czso.cz

Pilot project Selection of Qualified Foreign Workers
http://www.imigracecz.org/?lang=en&article=home

Moldova
National Bureau of Statistics of the Republic of Moldova
http://www.statistica.md

Ukraine
State Statistics Committee of Ukraine
http://www.ukrstat.gov.ua/

Vietnam
General Statistics Office Of Vietnam
http://www.gso.gov.vn/

Mongolia
Mongolian National Statistical Office
http://www.nso.mn

Bulgaria
2000-2002
http://www.worldwide-tax.com/bulgaria/bul_Unemployment.asp
2003-2007
National Statistical Institute
http://www.nsi.bg/

Romania
INSSE-statistical database
https://statistici.insse.ro

Russia
Federal State Statistics Service
http://www.gks.ru

Belarus
Ministry of Statistics and Analysis of the Republic of Belarus
http://belstat.gov.by

Serbia
Statistical Office of the Republic of Serbia
http://webrzs.statserb.sr.gov.yu

China
National Bureau of Statistics of China
http://www.stats.gov.cn

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Akademický rok 2007/2008

TEZE BAKALÁŘSKÉ PRÁCE

Student:	Jan Duben
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Garant studijního programu Vám dle zákona č. 111/1998 Sb. o vysokých školách a Studijního a zkušebního řádu UK v Praze určuje následující bakalářskou práci:

Předpokládaný název BP:

The overall effect of imigration and emigration in case of Czech republic

Charakteristika tématu, současný stav poznání, případné zvláštní metody zpracování tématu:

The aim of the work is to analyze the overall effect of immigration and emigration on Czech republic. It will be discussed mainly from economic point of view.
I plan to divide my work into four main parts.
In the first part I plan to study current Czech legislation and discuss Czech law in contrast with recent economic theories of migration, studying possible impact of overall migration effect.
In the second part I would like to construct model of imaginary migrant and discuss the different characteristics between the immigrants and emigrants in relation to Czech republic.
Next in the third part I will focus on empirical data for last ten - twenty years, studying evolution of migration phenomenon in Czech republic and I will try to construct econometric model which would enable me to forecast future trend in migration.
In the last fourth part of my work I will try to discuss all my previous achievements and draw some conclusions for possible policy making changes.
In the conclusion I will summarize my results and stress important facts according to this work and my point of view.

Struktura BP:

1.Introduction
2.Czech legislation in contrast with recent economic theories
3.Model of imaginary migrant
    3.1Discussion of different characteristics between possible immigrants and emigrants
4.Empirical data
5.Econometric model
    5.1 Construction
    5.2 Forecast
6.Discussion of possible policy making suggestions
7.Conclusion

Seznam základních pramenů a odborné literatury:

Beine M., Docquier F. and Rapoport H. (2001): **Brain drain and economic growth: theory and evidence**, Journal of Development Economics Vol. 64, pp.275–289

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