WIFO
ÖSTERREICHISCHES INSTITUT
FÜR WIRTSCHAFTSFORSCHUNG

WORKING PAPERS

Spatial Effects of Open Borders on the Czech Labour Market

Michael Moritz (IAB)

345/2009

Spatial Effects of Open Borders on the Czech Labour Market

Michael Moritz (IAB)

WIFO Working Papers, No. 345
October 2009

E-mail address: michael.moritz@iab.de
2009/229/W/0

Spatial effects of open borders on the Czech labour market

Michael MORITZ, Institute for Employment Research*

Nuremberg
August 2009

Preliminary version, please consult the author before quoting.

Acknowledgements:

I would like to thank the participants of the 49th European Congress of the Regional Science Association International in Liverpool, the Annual Conference of the European Association of Labour Economists (EALE) in Amsterdam, the Annual Congress of the Verein für Socialpolitik in Graz and the 5th Biennial Conference of the Czech Economic Society, where parts of this paper were presented, for helpful comments. I am particularly grateful to Joachim Möller (University of Regensburg) and Uwe Blien (IAB) for very valuable advice and suggestions as well as to Daniel Münich (CERGE-EI, Prague), who helped me a lot in getting to know the data. Any errors, however, remain my sole responsibility.

* E-mail: michael.moritz@iab.de, phone: +49 (0)911-179-2133, Institute for Employment Research, Regensburger Straße 104, D-90478 Nuremberg, Germany

Abstract

Hardly analysed in the literature the fall of the Iron Curtain had also effects on the regional structures of the labour markets in the Central and Eastern European Countries (CEEC). Focusing on the Czech Republic I analyse whether during the undoubtedly increasing integration of markets the Czech border region close to the Western European high-wage countries benefited from its geographical position. Even without transnational free labour mobility, free trade and outsourcing of production activities can lead to shifts in the labour demand and wage structure with respect to different skill groups. According to the theoretical background these integration effects should be stronger in border regions.

Regarding the theoretical assessment about the development of labour demand in transition countries the Feenstra-Hanson model suggests that in CEEC regions close to EU-15 countries wages should increase above-average for higher skilled employees. In contrast to new trade theory new economic geography models try to predict the spatial consequences of international integration caused by different regional effects on the market potential within a country. Explicitly differentiating between interior and border regions and regarding skill groups the border regions will above all attract activities where direct import competition is unlikely to be strong.

Using data from the Czech Microcensus and quarterly district level data I investigate what impact the fall of the Iron Curtain has had on the regional differences in unemployment, the skill structure of employment and the wages in the Czech Republic.

According to my results there are no indications of disproportionate shifts in the economic structure as well as in the skill structure in the Czech districts neighbouring Bavaria and Austria compared to non-border districts. However, regarding wage differentials between workers employed in the border region and workers in the rest of the country I find evidence that from 1996 until 2002 the workers with the lowest skill degree exhibit in the border region a positive wage differential of around 12% compared to their counterparts in the non-border region, while all other skill groups in the border region feature negative values, the spatial wage gap being higher the higher the skill level is.

Keywords:

regional labour markets, border regions, international trade, employment, wage inequality

JEL-Code: R23, J31, F16

1. Introduction

Though hardly considered in the literature the fall of the Iron Curtain had not only effects on Western European labour markets, but also on the transition countries. The employees in the Central and Eastern European Countries (CEEC) had to undergo deep changes during the first years on the way from plan to market. Not only broke the formerly dependable delivery areas of the COMECON away, but also were many state-owned enterprises not ready for competition. As Egger/Egger (2002:83) critically note "… the theoretical analysis and empirical assessment … of international outsourcing is rather new and at least concerning its implications for developing countries it seems to be still in its infancy."[1] Obviously, investigating integration effects in former Eastern Bloc countries is quite different from analysing Western European countries. Until the fall of the communist regimes a real labour "market" did not exist, i.e. unemployment was basically hidden and education-related wage differentials were extremely low (Münich et al. 2005). Moreover, in contrast to the research on Western European labour markets, due to a lack of suitable data it is not possible to approach spatial differences in Eastern European countries by stressing the "natural experiment" situation before and after the introduction of free trade and capital mobility. Datasets containing appropriate regional information provide only data from the beginning of the 1990s onward.

However, it is exceedingly interesting whether during the undoubtedly increasing integration of markets regions close to the Western European high-wage countries benefit from their geographical position. In this paper I analyse the spatial impact of the opening of the border on the Czech labour market against the background of one of the world's highest wage differentials between Western Germany/Austria and the Czech Republic. Regarding the economic structure, the shares of skill groups of employed and unemployed persons and the development of wage differentials I confront the districts close to Bavaria and Austria with the rest of the country. It is important to notice that even without transnational free labour mobility (which will probably be restricted for Czech workers until 2011), outsourcing of production activities can lead to shifts in the labour demand and wage structure regarding different skill groups. According to my hypothesis these integration effects should be stronger in border regions. Using two data sources I investigate whether free trade with Western European countries led to special effects on the labour market in the districts neighbouring Bavaria and Austria.

The existing literature does not provide clear-cut results. Regarding the theoretical assessment about the development of labour demand and wages in developing and transition countries the

[1] See also Pusterla/Resmini (2007: 839): "The Central and Eastern Europe region has been only marginally considered in the empirical literature on firm location choice."

Feenstra-Hanson model (1996) suggests that in CEEC regions close to EU-15 countries labour demand and wages should increase above-average for higher skilled employees. Due to comparative advantages production activities that in the perspective of the transition country use skilled labour relatively intensively are supposed to be outsourced from the high-wage country, above all in near border areas. Feenstra/Hanson (1997) find evidence that this was the case in Mexican border regions after trade liberalisation in the 1980s when US firms went offshore to the so-called maquiladoras. However, in recent studies the implications of the Feenstra-Hanson model are contradicted by results for the 1990s stating that actually in the Mexican border region returns to human capital were decreasing compared to other regions (Airola/Juhn 2005, Chiquiar 2008). Interestingly, these papers refer to traditional trade theory and Stolper-Samuelson effects.

In contrast to international trade models new economic geography (NEG) models try to predict the spatial consequences of international integration caused by different regional effects on the market potential within a country. The model of Brülhart et al. (2004) explicitly differentiates between an interior and a border region. Generally, the issue of reduced centripetal and centrifugal forces is addressed. If the effect of decreasing trade costs on centrifugal forces is stronger, the probability rises that production activities will concentrate in the border region (unless the border region is relatively small prior to integration). Basically, NEG models do not distinguish between different skill groups. Thus, all employees in the border region should either benefit or lose from integration, regardless of their education. However, Brülhart et al. implicitly account for comparative advantages and skill differences between countries, stating that the border region will above all attract industries where direct import competition is unlikely to be strong. Though the model in the first instance refers to EU-15 countries facing labour market effects of the EU enlargement, it can also be applied for accession countries. Some studies show results indicating that the accession of the CEEC leads only to a small rise in welfare or the market potential of EU-15 regions respectively (Bröcker 1998, Niebuhr 2008). By contrast, for the new EU member states the simulated additional market potential is considerable (Huber et al. 2006). Thus, due to the reduction of transaction costs CEEC border regions close to EU-15 countries should become preferred location sites.

Summarising the theoretical background the ongoing integration process between Germany and the Czech Republic should lead to changes on the Czech labour market, which are supposed to be more noticeable in the borderland. Based on new trade and NEG models branches of economic activity which have comparative advantages in the Czech Republic should gain importance above-average in the districts near Bavaria and the Czech Republic. While increasing relative wages for higher-skilled border region employees can be derived from the Feenstra-

Hanson model, the Brülhart et al. model predicts relative gains for employees in the borderland above all for lower skilled workers, since import competition from Western European countries is relatively unimportant.

The paper is organised as follows: Data and basic definitions are described in section 2. Section 3 contains descriptive evidence on some labour market indicators in the Czech border region compared with the development at national level. Section 4 analyses qualification trends using an econometric model. Section 5 also introduces econometric models to test the theoretical predictions on spatial wage differentials and presents the results. Section 6 concludes.

2. Data and Basic Definitions

Concerning useful data sets for the Czech Republic with respect to my research question there are not so many options. The data have to embrace an adequate time period and regional information must be available. Moreover, in order to estimate wage differentials I need individual data containing relevant variables about individual characteristics.

Regarding the territorial structure of the Czech Republic the following levels can be distinguished, corresponding to the EU statistics (Hanousek/Münich 2000, Turnovec 2001):

- the local level (NUTS 5 level): 6,196 independent rural and urban municipalities which are enforced by law to act in their own name in juridical relations and bear full responsibility for their activities.
- the lower intermediate level (NUTS 4 level): 77 districts (*okresy*) − on average about 130,000 inhabitants and 1,000 square kilometres − whose administrators are appointed by and responsible to the government in Prague, i.e. they do not play a role with respect to self-administration. Regarding their size they can be compared to the German rural districts (*Landkreise*), however, this analogy is not valid concerning their authority to decide.
- In 1997 14 regions (*kraje*) were formally established as the so-called upper intermediate and NUTS 3 level. Since the elections for regional parliaments in November 2000 they are self-governing. However, the competences of these regions are basically restricted to school and street administration and some excise taxes.
- From January 1, 2000 eight regions were formally established for the purposes of European statistics (NUTS 2 level). The 14 NUTS 3 level regions are integrated in these eight regions, i.e. one NUTS 2 level region consists of one or two NUTS 3 level regions.

By now, several statistics exist containing information about the Czech labour market, among others in the framework of the quarterly Labour Force Survey (LFS) and the International Social

Survey Program (ISSP). However, most datasets set in not before the end of the 1990s and/or comprise information only at NUTS 2 level. Besides this, there are some statistics on average wages at NUTS 3 level. The only data source which meets all criteria regarding my research issue is the Czech Microcensus. I therefore use the data of the Microcensus and in addition, in order to check whether the results are reasonable, I apply aggregated district data on unemployment.

The data of the Czech Microcensus are conducted by the Czech Statistical Office in the years 1992, 1996 and 2002. The dataset consists of a household census and a census on individuals and focuses on household incomes. Wages are available amongst others in form of the annual gross and net wage in the regular occupation. Unfortunately, the gross wage is not available in 1992 and the variable "net wage" has a lot of missings in 2002. The data provide information about demographic characteristics, e.g. age, education, marital status, economic status, occupation and place of residence at NUTS 4 level (77 districts). Regarding the occupational status the individuals are ordered by the International Standard Classification of Occupations (ISCO). This schedule was composed by the International Labour Organization (ILO) according to a person's duties and responsibilities in order to make statistics comparable at the international level. The current version ISCO-88 distinguishes between ten major groups, from which I exclude in my analyses the group of the armed forces. For the years 1996 and 2002 an additional variable with information about the industrial branch exists, which classifies the economic activity of the individuals according to the Nomenclature of Economic Activities (NACE). From the original 17 industrial branches (ordered from A to Q) I exclude the branches P (private households with employed persons) and Q (extra-territorial organisations and bodies), since there are too few observations in the dataset. Besides this, I combine branches A (agriculture, hunting and forestry) and B (fishing), i.e. I eventually differentiate between 14 branches. Investigating the shifts in the decade between 1992 and 2002 I restrict the analysis to full-time workers in dependent employment. In focusing on earnings from full-time jobs I am neglecting only a small segment of the Czech labour market, because most Czech men and − compared to other EU countries − an extraordinary high proportion of women work full-time. In order to represent the total population weights are used in all calculations. Table 1 shows the sample size in the different years.

As a second data source I use quarterly unemployment data from 1992 to 2006, which are made available by the district labour offices also at NUTS 4 level. This data set covers the absolute number of registered unemployed persons in each of the 77 districts. In addition, the figures are

split up according to age, sex and education and provide information about persons receiving benefits and taking part in retraining programmes.

Since the classification of the educational structure coincides in both datasets I am able to use the same grouping for employed and unemployed persons. I distinguish between four skill groups, which are listed in table 2.

year	sample	N	full-time employees
1992	0.5 %	43573	12964 (29,8 %)
1996	1 %	64492	19522 (30,3 %)
2002	0.25 %	19002	4880 (25,7 %)

Table 1: Sample size of the Czech Microcensus in 1992, 1996 and 2002
Data source: Own calculations with Czech Microcensus 1992, 1996, 2002.

unskilled	people with at most primary education
low-skilled	people with (lower) secondary (technical) education without a certificate of upper secondary education (*w/o maturita*)
medium-skilled	people with professional, general or special secondary higher (technical) education with a certificate of upper secondary education (*maturita*)
high-skilled	people holding a Bachelor's, university or Ph.D. degree

Table 2: Classification of Czech skill groups

In order to evaluate spatial effects of the integration of the Czech economy with Western Europe I generate a border region dummy which equals 1 if the districts are close to Bavaria and/or Austria and 0 otherwise. Thus, the term "border region" is used in this paper as a synonym for the Czech districts close to Bavaria and/or Austria. According to my definition the districts neighbouring eastern Germany do not fall in the category "border region", since the conditions of economic integration are there quite different compared to the cases of Bavaria and Austria. Likewise, the districts near Slovakia and Poland belong in the framework of my analysis to the non-border (or also called interior) region, i.e. the rest of the country.

In my definition a district belongs to the border region, if the next international border crossing shared with Bavaria or Austria is reachable within at most 60 minutes by car. Therefore I calculate the required driving time by means of an Internet route planner. Table 3 contains the distances (in minutes) from the capital city of each of the 77 districts to the next international border crossing.

District	min	border crossing	District	min	border crossing
1. Praha	120	*Waidhaus*	40.Liberec	194	*Waidhaus*
2. Benešov	114	*Grametten*	41.Semily	195	*Waidhaus*
3. Beroun	90	*Waidhaus*	42.Hradec Králové	191	*Grametten*
4. Kladno	119	*Waidhaus*	43.Jičín	184	*Waidhaus*
5. Kolín	147	*Grametten*	44.Náchod	227	*Grametten*
6. Kutná Hora	131	*Grametten*	45.Rychnov nad Kněžnou	189	*Drasenhofen*
7. Mělník	156	*Waidhaus*	46.Trutnov	232	*Grametten*
8. Mladá Boleslav	155	*Waidhaus*	47.Chrudim	148	*Grametten*
9. Nymburk	153	*Waidhaus*	48.Pardubice	167	*Grametten*
10.Praha-východ	120	*Waidhaus*	49.Svitavy	116	*Drasenhofen*
11.Praha-západ	120	*Waidhaus*	50.Ústí nad Orlicí	155	*Drasenhofen*
12.Příbram	105	*Phillipsreut*	51.Havlíčkův Brod	94	*Grametten*
13.Rakovník	119	*Waidhaus*	52.Jihlava	86	*Kleinhaugsdorf*
14.České Budějovice	41	*Wullowitz*	53.Pelhřimov	61	*Grametten*
15.Český Krumlov	33	*Wullowitz*	54.Třebíč	68	*Kleinhaugsdorf*
16.Jindřichův Hradec	24	*Grametten*	55.Žďár nad Sázavou	103	*Drasenhofen*
17.Písek	88	*Wullowitz*	56.Blansko	84	*Drasenhofen*
18.Prachatice	42	*Phillipsreut*	57.Brno-město	49	*Drasenhofen*
19.Strakonice	56	*Phillipsreut*	58.Brno-venkov	49	*Drasenhofen*
20.Tábor	76	*Grametten*	59.Břeclav	27	*Drasenhofen*
21.Domažlice	19	*Furth i.W.*	60.Hodonín	50	*Drasenhofen*
22.Klatovy	47	*Furth i. W.*	61.Vyškov	65	*Drasenhofen*
23.Plzeň-město	52	*Waidhaus*	62.Znojmo	15	*Kleinhaugsdorf*
24.Plzeň-jih	52	*Waidhaus*	63.Jeseník	205	*Drasenhofen*
25.Plzeň-sever	52	*Waidhaus*	64.Olomouc	100	*Drasenhofen*
26.Rokycany	66	*Waidhaus*	65.Prostějov	81	*Drasenhofen*
27.Tachov	26	*Waidhaus*	66.Přerov	107	*Drasenhofen*
28.Cheb	13	*Schirnding*	67.Šumperk	149	*Drasenhofen*
29.Karlovy Vary	54	*Schirnding*	68.Kroměříž	87	*Drasenhofen*
30.Sokolov	35	*Schirnding*	69.Uherské Hradiště	110	*Drasenhofen*
31.Děčín	199	*Schirnding*	70.Vsetín	160	*Drasenhofen*
32.Chomutov	104	*Schirnding*	71.Zlín	126	*Drasenhofen*
33.Litoměřice	164	*Waidhaus*	72.Bruntál	162	*Drasenhofen*
34.Louny	134	*Schirnding*	73.Frýdek-Místek	165	*Drasenhofen*
35.Most	126	*Schirnding*	74.Karviná	203	*Drasenhofen*
36.Teplice	152	*Schirnding*	75.Nový Jičín	141	*Drasenhofen*
37.Ústí nad Labem	168	*Schirnding*	76.Opava	169	*Drasenhofen*
38.Česká Lípa	202	*Waidhaus*	77.Ostrava-město	168	*Drasenhofen*
39.Jablonec nad Nisou	185	*Waidhaus*			

Table 3: Distance from district capital to next Bavarian or Austrian international border crossing (in minutes by car)

District: 77 Czech NUTS 4 level districts; min: distance in minutes by car; border crossing: next Bavarian or Austrian international border crossing

Source: Own calculations by means of Internet Route Planner ViaMichelin.

According to these figures the Czech borderland consists of the western and southern parts of Bohemia and the southern parts of Moravia, finally 24 out of 77 NUTS 4 districts (see also figure 1). Regarding population density the distribution in the non-border and border districts is fairly balanced: the non-border region includes the capital city of Prague as well as the 3rd, 5th

and 6th largest city of the country (Ostrava, Olomouc, Liberec), while the 2nd, 4th and the 7th largest city (Brno, Plzeň [Pilsen], České Budějovice [Budweis]) belong to the border region. On the other hand, both areas of observation contain relatively sparsely populated districts like the Bohemian Forest and some districts close to Poland respectively.

Figure 1: Czech NUTS 3 and NUTS 4 regions

border region districts: České Budějovice**,** Český Krumlov, Jindřichův Hradec, Prachatice, Strakonice, Domažlice, Klatovy, Plzeň-město, Plzeň-jih, Plzeň-sever, Rokycany, Tachov, Cheb, Karlovy Vary, Sokolov, Jihlava, Pelhřimov, Třebíč, Brno-město, Brno-venkov, Břeclav, Hodonín, Vyškov, Znojmo.

3. The Labour Market in the Czech Republic: some Descriptive Evidence

Undoubtedly, the early transition years in the Czech Republic can be denoted as a successful period from the economic point of view. Due to the voucher privatisation, i.e. the selling of shares of former state-owned enterprises to the common people using so-called vouchers, the country achieved promising results. The Czech Republic was after the separation of the Slovak Republic seen as a model country of transition and belonged since the early 1990s to the first group of CEEC candidates concerning EU enlargement. However, problems emerged in 1997 when the privatisation of large concerns and banks was approached. What followed was a period of disillusionment characterised by a shrinking economy and growing unemployment which lasted until 2000. Since then the Czech economy gathered momentum again, while the European integration process reached a first highlight in the accession into the EU on May 1, 2004.

Regarding regional aspects the Czech economy is affected by the outstanding role of the capital city of Prague. Regional disparities are strong: on the one hand there is booming Prague, the prosperous districts around the capital and some relatively well-off districts and large cities, most of them in the south and west of the country. The industrial structure is relatively diversified there and the share of the service sector is high. On the other hand, there are the unprogressive districts which have for decades been dependent on monostructural activities, e.g. the coal mining regions in northern Bohemia and Moravia, where unemployment rates at times exceed the 20 percent level. Moreover, things get worse due to the weakly developed ambitions of unemployed persons to move to places where they could find employment (Fidrmuc 2004). Another factor, which refers to my research issue, is the geographical position of a district. Locations close to the Western European markets are in a favourable situation compared to the areas close to Poland and the Slovak Republic where purchasing power beyond the border is far lower. Otherwise, the districts close to Germany and Austria face due to the lower distance a higher risk of "brain drain", i.e. outward commuters could deepen the lack of qualified personnel in these areas.

3.1 Relative Employment Share and Structural Change

In order to gain a prima facie impression of the Czech border region I firstly calculate some basic figures opposing the border districts to the non-border districts (figure 2). The share of full-time workers who are employed in the border region indicates the relative importance of the border districts as economic location. While in 1992 26.5% of all fully employed persons worked in the border region, the proportion increased up to 28.6% in 1996 and then slightly declined to 28.3 % in 2002, i.e. in the early transition years the districts near Bavaria and Austria gained relatively in attractiveness as location for employers and employees. From 1996 to 2002 the non-border districts including Prague recaptured three tenths of a percentage point of relative employment. Since the outstanding importance of Prague and Mladá Boleslav[2] possibly distorts the outcome I also calculate the border region share without these districts. In this case the proportion of employees working in the border region is naturally far higher. However, the conclusion does not change. Starting from an employment share in the border region of 32.1% in 1992 the proportion rose to 34.3% in 1996 and again fell to 34.1% in 2002 signifying the stabilisation of the regional employment share.

[2] The automotive manufacturer Škoda Auto a.s. has its main production location in Mladá Boleslav employing around 20,000 staff members.

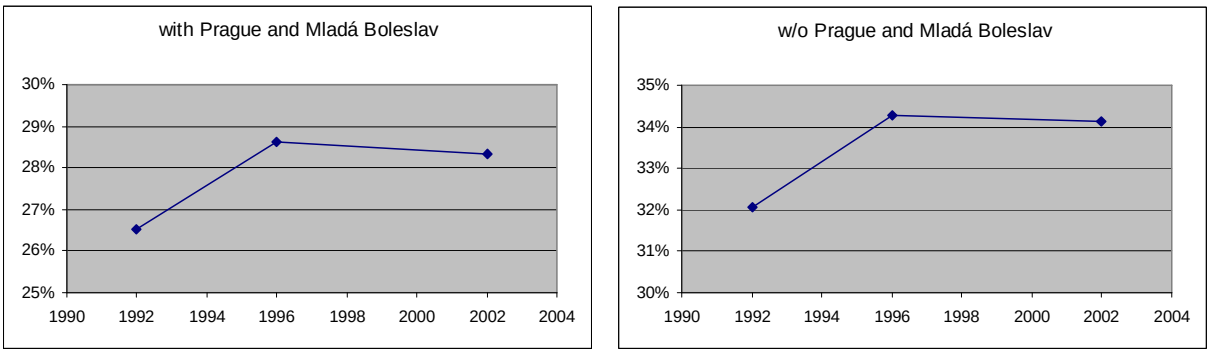

Figure 2: Share of full-time employees working in the Czech border region: (a) including Prague and Mladá Boleslav, (b) w/o Prague and Mladá Boleslav (as %)
Data source: Own calculations with Czech Microcensus 1992, 1996, 2002.

In a next step I inspect the Czech Microcensus with respect to the structural change and specialisation in the border and non-border region respectively. Of course, since I have only two points in time containing information about industrial branches I am not able to observe a structural change indicator over time using this variable. However, alternatively it is possible to analyse the changes using the differences in the distribution of occupations. At first I take a look at the relative shares of occupational as well as industrial branches. Due to the predictions of the models of Feenstra/Hanson and Brülhart et al. free trade should lead to spatial effects regarding the distribution of economic activities within a country. Particularly the border region should attract economic activities having comparative advantages with respect to trade with the foreign country (Barjak/Heimpold 2000), in this case Germany. The two theoretical strands point in the same direction: while the Feenstra-Hanson model refers to activities which are offshored from the high-wage country, the NEG model suggests a relative increase in sectors where import competition from Germany and Austria is supposed to be relatively low. In any case, the effects should be reflected in the descriptive figures and in indicators displaying structural change and specialisation.

	ISCO-88 major groups	**non-border region**			**border region**		
		1992	1996	2002	1992	1996	2002
1	Legislators, senior officials and managers	3.45	2.95	3.57	2.74	2.36	3.87
2	Professionals	7.13	5.87	7.77	7.04	5.22	9.76
3	Technicians and associate professionals	20.44	19.74	24.89	20.17	19.20	24.84
4	Clerks	10.47	12.78	13.74	10.51	14.32	6.94
5	Service workers and shop and market sales workers	10.20	10.44	13.35	9.95	10.21	12.98
6	Skilled agricultural and fishery workers	1.29	1.52	1.07	2.26	2.15	1.61
7	Craft and related workers	25.95	26.08	19.48	26.12	27.25	21.94
8	Plant and machine operators and assemblers	12.14	11.83	9.86	11.18	11.53	13.06
9	Elementary occupations	8.94	8.79	6.26	10.03	7.75	5.00

Table 4: Employment shares of occupations in the Czech non-border and border region (as %)
Data source: Own calculations with Czech Microcensus 1992, 1996, 2002.

Concerning occupations table 4 shows the employment shares of the nine ISCO major groups in the three years of observation separated in the border region and the rest of the country. Not surprisingly, as the Czech proficiency with respect to engineering and manufacturing is well-known, technicians and craft workers (major groups 3 and 7) constitute a bulk of the workforce followed by clerks, service workers and plant and machine operators (major groups 4, 5 and 8). As the ISCO corresponds to the International Standard Classification of Education (ISCED) it pays off to analyse the shifts in this context, too. Elementary occupations (major group 9) are defined as the lowest skill level. Major groups 4-8 are considered to be at the second level, major group 3 forms the third level and major group 2 the highest level. There is no skill reference for major group 1, since this group embraces significant skill differences.

Obviously there are no exceeding differences between the districts near Bavaria and Austria and the rest of the Czech Republic. From 1992 until 2002 major groups 1-5 exhibit increasing employment shares in the non-border region as well as in the border region (with one exception), while the shares fell in major groups 6-9 in both objects of investigation (with one exception). This indicates a general professional skill upgrading which interestingly did not happen from 1992 until 1996, but only from 1996 until 2002. The employment shares remained relatively stable in the early transition years, but after the recession years the occupations which correspond to higher skill levels recorded higher values. Possibly, employment relationships were relatively stable in the upswing years, but the years from 1997 onward brought a lot of restructuring. I will come back to this point below. Another striking figure is the severely decreasing share of clerks in the border region from 1996 until 2002. This has apparently to some extent to do with the advancement of Prague as financial centre, since the share in the non-border region falls from 1996 until 2002, too, if Prague is excluded from the dataset. Contrariwise, the share of plant and machine operators and assemblers (major group 8) rose in the border region in contrast to the rest of the country. The increase in this occupation group is potentially connected with some cross-border relations in industrial branches which are also important at least in the Bavarian borderlands.

In table 5 the shares of 14 branches of economic activity subject to the NACE classification are recorded for border and non-border districts. Though this variable is not available in 1992, it is nevertheless interesting to investigate the shifts between 1996 and 2002, since this period embraces the years of recession and as the figures for occupations have shown, a lot of changes happened during this space of time. First of all − as in the case of occupations − the relative figures are very similar between the border and the non-border region. As it is also common in transition countries most branches in the primary and secondary sector relatively lost, while the

shares of the service branches in the tertiary sector increased. The sign of the change is identical in the non-border and the border region in 11 of the 14 branches, which indicates that the structural change proceeded in the same direction. Only in the branches E (electricity, gas and water supply), G (wholesale and retail trade etc.) and N (health and social work) rose the share in the non-border region, but declined in the border region. The only really outstanding change is the relative shrinking of the largest branch, which comprises all sorts of manufacturing. This branch decreased about 8 percentage points in the non-border districts, but only marginally in the border districts. Possibly − as mentioned above − the dominant position of manufacturing in the border region is maintained due to trade relations of large manufacturing locations, as for instance Pilsen which is closely affiliated with the Bavarian industry.

	NACE branches	**non-border region**		**border region**	
		1996	2002	1996	2002
AB	Agriculture, hunting and forestry & Fishing	4.51	3.65	6.37	5.16
C	Mining and quarrying	3.53	1.18	1.31	0.65
D	Manufacturing	35.16	27.20	32.94	32.18
E	Electricity, gas and water supply	2.32	2.55	2.63	2.34
F	Construction	8.42	7.31	9.75	7.26
G	Wholesale and retail trade; repair of motor vehicles, motorcycles and personal and household goods	10.21	11.62	9.32	8.71
H	Hotels and restaurants	2.12	3.46	2.56	2.66
I	Transport, storage and communication	7.37	8.16	7.37	8.23
J	Financial intermediation	2.34	3.21	1.68	1.69
K	Real estate, renting and business activities	2.85	3.52	2.86	4.35
L	Public administration and defence; compulsory social security	6.55	8.96	6.92	8.79
M	Education	5.72	7.14	6.32	7.74
N	Health and social work	5.28	6.73	6.70	6.61
O	Other community, social and personal service activities	3.63	5.30	3.26	3.63

Table 5: Employment shares of industrial branches in the Czech non-border and border region (as %)
Data source: Own calculations with Czech Microcensus 1996, 2002.

Table 6 comprises the values for an Indicator of Structural Change (ISC) and the Krugman Specialisation Index (KSI). The Indicator of Structural Change measures the absolute deviations of the employment shares of occupations or industrial branches respectively in year t+1 from the figures in year t. Adding up all absolute deviations and dividing by 2 the ISC equals 0, if the shares in t+1 are identical to the shares in t and equals 1, if the structure in t+1 deviates maximally from the structure in t. The values for the occupational structure are higher in the border region for both time periods, which potentially can be traced back to the fewer observations in this area. The ISC for the industrial structure, which can only be calculated once,

however, has a higher value for the non-border region, probably caused by the high decrease of manufacturing.

The KSI adds the absolute deviations of the employment shares in the border region from the employment shares in the rest of the country for all occupational or industrial branches respectively in year t. The index equals 0, if the employment shares in the two areas are identical and equals 1, if the structure in the border region deviates maximally from the structure in the non-border region. Regarding occupations as well as industrial branches the KSI exhibits increasing values, i.e. the specialisation of the border region grew over the years. Including the data of tables 4 and 5 this development can be explained by a higher persistence of manufacturing occupations (e.g. major group 8 in table 4) and industrial branches (table 5) in the border region, while the change towards the tertiary sector is stronger in the non-border region. Moreover the results of both indices (ISC and KSI) corroborate the impression that in the uneasy years after 1996 the economy underwent more change than in the four years before.

			1992/1996	**1996/2002**
Indicator of Structural Change (occupations)	non-border		0.029	0.056
	border		0.115	0.160
Indicator of Structural Change (industrial branches)	non-border			0.123
	border			0.061
		1992	**1996**	**2002**
KSI (occupations)		0.023	0.033	0.085
KSI (industrial branches)			0.063	0.080

Table 6: Indicator of Structural Change and Krugman Specialisation Index for occupations and industrial branches in the Czech Republic

Data source: Own calculations with Czech Microcensus 1992, 1996, 2002.

3.2 Skill Structure of Employed Persons

Regarding the distribution of skills I investigate whether there is a different development in the skill structure between border and non-border districts. While in the previous subchapter the predictions of the two models were consistent, with respect to the skill structure of the labour demand they are not: according to Feenstra-Hanson the activities which are shifted to the foreign low-wage country should lead to a skill upgrading process, since these production steps are relatively skill-intensive there. If distance matters, border regions will be affected particularly and the demand for higher skilled labour is supposed to increase above-average in the districts near Bavaria and Austria. In contrast, on the basis of the NEG model above all lower skilled labour should have comparative advantages in the borderland, as import competition from beyond the frontier is relatively low for activities requiring relatively less human capital.

The descriptive figures are contained in figure 3. The share of unskilled employees generally decreases from about 12% in 1992 to about 6% in 2002, in the border as well as in the non-border districts. Only in 1996 unskilled workers are slightly overrepresented in the districts close to Bavaria and Austria. Regarding low-skilled workers the share remains fairly stable from 1992 to 1996 oscillating around 45% in the both regions under review, but then in 2002 it declines to 42.7% in the non-border districts and to 40.1% in the border districts. While the fraction of medium-skilled employees identically shifts from about 30% in 1992 to 40% in 2002, the 12% proportion of high-skilled workers initially falls from 1992 to 1996, but until 2002 rises up to 13.2% in the non-border region and 11.4% in the border region. After all, lower skilled workers are slightly overrepresented in the border districts at the end of the observation period, but a sensible difference in the development of skill group shares is not identifiable. Disregarding the decreasing share of high-skilled from 1992 until 1996 the figures give evidence of a skill upgrading process in the Czech Republic which is in line with the relative changes in the ISCO major groups (see chapter 3.1). The share of lower skilled workers declines over time, while the share of higher skilled employees rises.

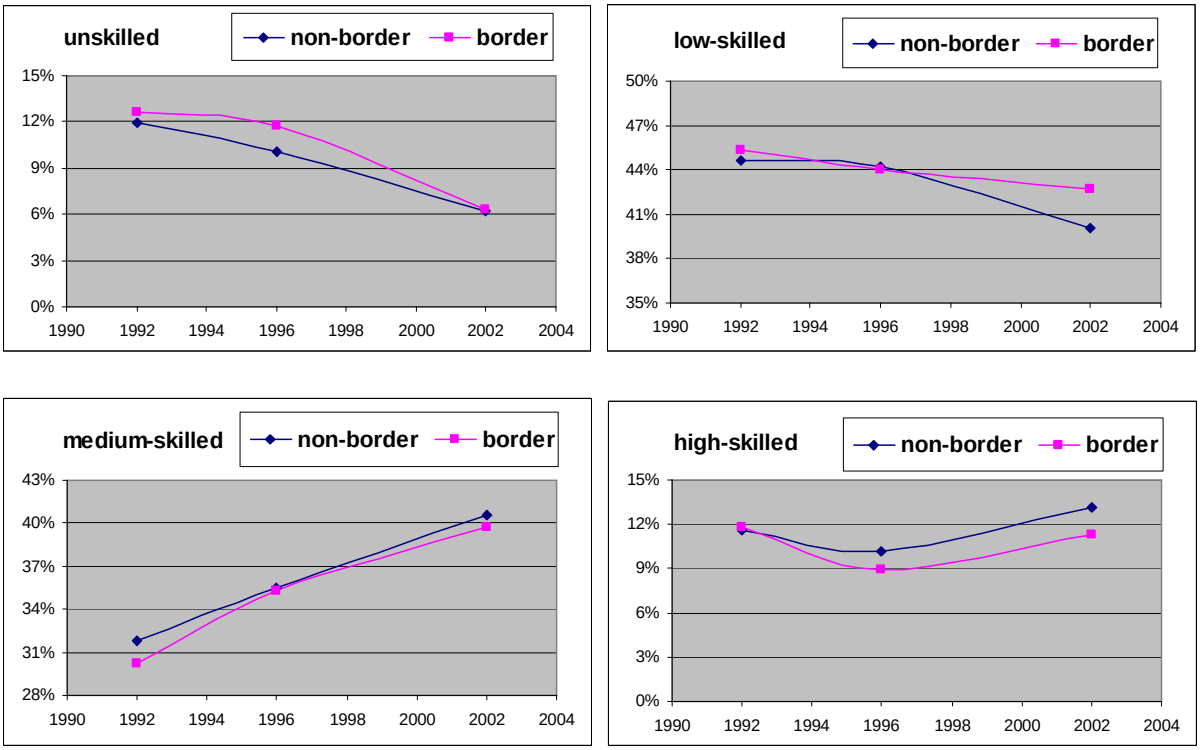

Figure 3: Shares of skill groups of full-time workers comparing the Czech border region to the rest of the country (as %)

Data source: Own calculations with Czech Microcensus 1992, 1996, 2002.

3.3 Skill Structure of Unemployed Persons

Using quarterly unemployment data provided by the district labour offices I take in a similar way a look at the shares of unemployed people in a manner of investigating whether the distribution of skill groups in the two areas of observation exhibits fundamental differences compared to the figures for employed persons in chapter 3.2. The absolute numbers show the tremendous growth in unemployment across all skill groups in the late 1990s recession years (figure 4). The number of unskilled unemployed increased from below 60,000 persons in the beginning of the 1990s up to above 160,000 persons ten years later. The number of low-skilled unemployed, which also was about 60,000 persons in 1992 has risen even to nearly a quarter of a million people in the first years of the new century. The groups of medium-skilled and high-skilled unemployed quadrupled from approximately 30,000 to nearly 120,000 persons (medium-skilled) and from below 5,000 up to almost 20,000 persons (high-skilled) respectively.

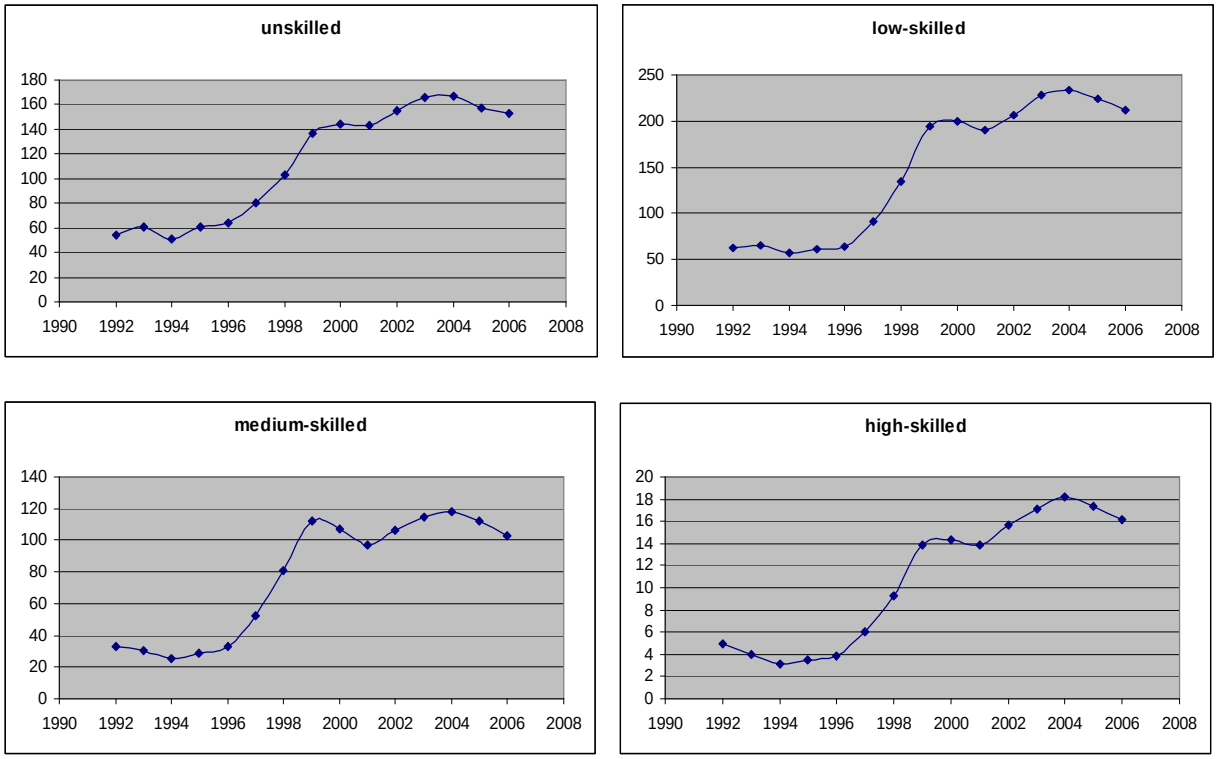

Figure 4: Development of unemployment for different skill groups (persons '000)
Data source: Own calculations with quarterly unemployment data of Czech district labour offices; (1/1992 – 2/2006).

Interestingly, the development of the shares of the different skill groups in unemployment seems prima facie quite surprising (figure 5). The share of unskilled persons within total unemployment declines – after a rise in the early 1990s – from nearly 40% to 30%. Equivalently, the fractions of the other three skill groups increased in the recession years. While the proportion of medium-skilled unemployed fell after 1998, the share of low-skilled and high-skilled unemployed

moderately grew. Taking into account the economic transformation process in the Czech Republic, the figures are quite plausible. Before 1997, unemployment was rather an exception. The recession has affected a much larger spectrum of the labour force across education groups and the growing denominator (growing faster than the number of unskilled unemployed) led to a lower share of unskilled. The pool of unskilled persons is limited and given that most members of this skill group were unemployed already before 1997, the proportion of unskilled unemployed could not grow so fast. Simply said, unemployment became an issue of "masses" as common in other EU countries. After the recession years the proportion of unskilled persons in total unemployment increases again. Comparing the border region to the non-border districts the fraction of un- and low-skilled unemployed in the border districts remains slightly below the level in the rest of the country, while it is the opposite way around for medium- and high-skilled jobless persons. Bringing to mind the figures for employees (see chapter 3.2) the results could indicate a slightly higher labour demand for higher skilled persons in the non-border region. This is quite clear intuitively, since Prague belongs to the non-border region and possibly absorbs qualified personnel from other parts of the country. In the econometric part of the paper I will control for this and other factors.

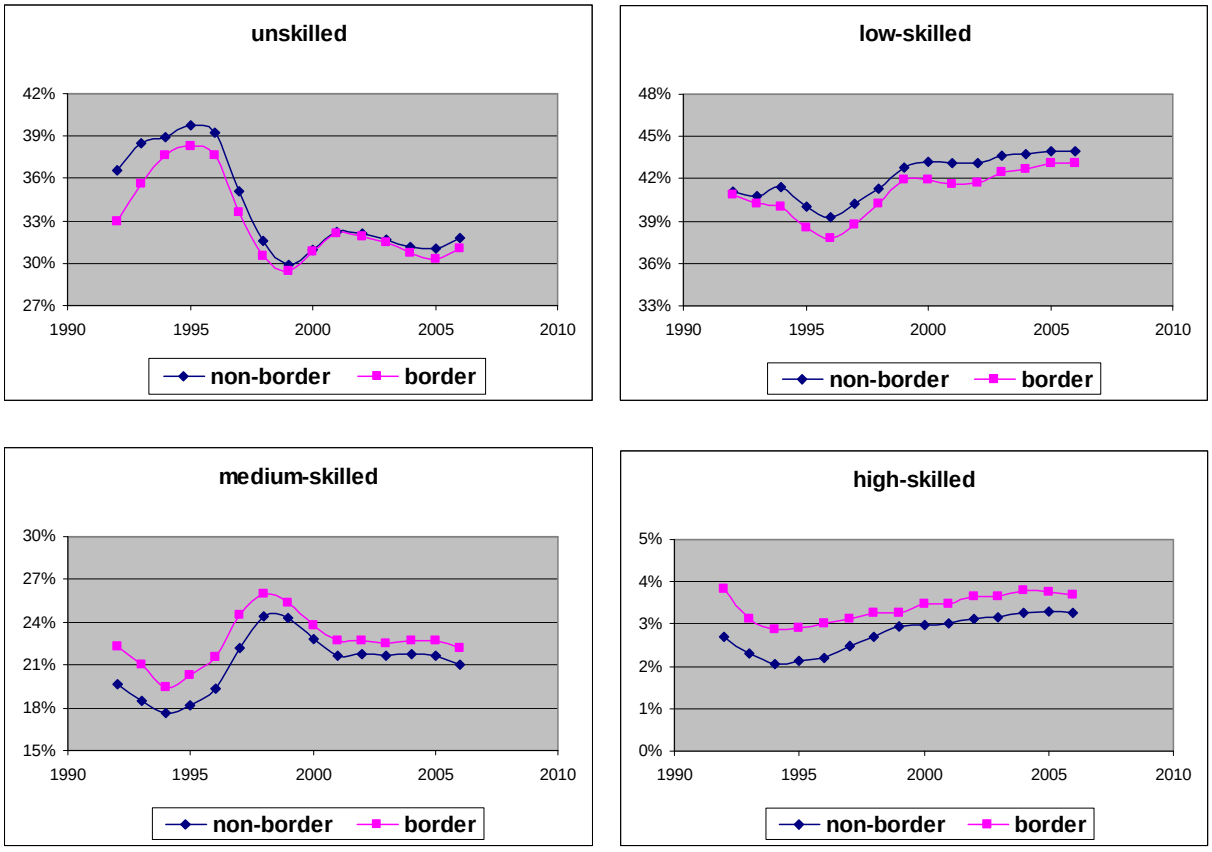

Figure 5: Relative shares of skill groups of unemployed persons comparing the Czech border region to the rest of the country (as %)

Data source: Own calculations with quarterly unemployment data of Czech district labour offices; (1/1992 – 2/2006).

3.4 Wage Differentials between Border and Non-Border Region

Differences in the labour demand are supposed to be also reflected in the development of wages. As mentioned in the previous subchapters in the border region relative labour demand and thus relative wages compared to non-border districts should rise for higher skilled employees if the Feenstra-Hanson trade effects play a dominant role. Contrariwise, according to the model of Brülhart et al. above all lower skilled workers are supposed to benefit in the borderlands due to the higher market potential and relatively low import competition.

Regarding wage differentials between the Czech border and non-border region at the descriptive level I use the gross wages available from the Microcensus in 1996 and 2002 and confront the figures of the two areas. Table 7 shows that the annual nominal gross wages increased in the observation period substantially for all three calculated deciles and region types with growth rates from about 32 to 62 percent. In 1996 the wage gap between non-border and border districts widens for all skill groups monotonically with the decile considered. The relative wage gap in the groups of medium- and high-skilled is higher (from about 3 to 11 percent), while the only decile in which border region employees are ahead is the second decile for low-skilled workers. In 2002 the wage differential widens for three skill groups in all deciles. However, concerning unskilled employees the trend is completely different. For all deciles regarding this skill group the values for the border region are higher with a maximum difference of 15.1% for D5. The differences between the years of observation are shown graphically in figure 6.

Regarding wage differentials between different skill groups I calculate the skill premium for adjacent skill groups (table 8). In most cases the wage differentials are higher at the top of the distribution. The highest differences exist between high-skilled and medium-skilled employees though with lower values for D2 and D5 in 2002. With the exception of low-skilled vs. unskilled workers in 1996 the skill premium is higher in the non-border region. With respect to the previous results it is not surprising that the wage gap concerning unskilled employees decreases considerably in the border region in 2002.

Summarising the results for the descriptive wage differentials I conclude that the border districts suffered relative wage losses in three out of four skill groups. Interestingly, in the group of unskilled workers the development differentiates substantially. However, the informative value of these figures is restricted, since e.g. the non-border region contains Prague and Mladá Boleslav featuring special developments which I have to control for in the econometric analysis.

	unskilled			**low-skilled**		
1996	D2	D5	D8	D2	D5	D8
non-border	62800	84700	113100	75000	103300	136800
border	62200	82150	109000	76200	101700	132300
difference (as %)	1.0	3.1	3.8	-1.6	1.6	3.4
2002	D2	D5	D8	D2	D5	D8
non-border	90654	112042	161307	109533	148708	200984
border	96000	132000	166752	106318	138958	180762
difference (as %)	-5.6	-15.1	-3.3	3.0	7.0	11.2
	Change 2002/1996					
non-border	44.4	32.3	42.6	46.0	44.0	46.9
border	54.3	60.7	53.0	39.5	36.6	36.6
	medium-skilled			**high-skilled**		
1996	D2	D5	D8	D2	D5	D8
non-border	90600	121200	166500	132300	177800	255600
border	87500	115600	156200	123900	164500	230600
difference (as %)	3.5	4.8	6.6	6.8	8.1	10.8
2002	D2	D5	D8	D2	D5	D8
non-border	136920	188804	260000	187071	250757	415152
border	129536	168673	229567	170352	221119	340824
difference (as %)	5.7	11.9	13.3	9.8	13.4	21.8
	Change 2002/1996					
non-border	51.1	55.8	56.2	41.4	41.0	62.4
border	48.0	45.9	47.0	37.5	34.4	47.8

Table 7: Gross wages in the non-border and the border region (in Kč)
Data source: Own calculations with Czech Microcensus 1996, 2002.

	low-skilled versus unskilled				medium-skilled versus low-skilled				high-skilled versus medium-skilled			
1996	D2	D5	D8	D8-D2	D2	D5	D8	D8-D2	D2	D5	D8	D8-D2
non-border	19.4	22.0	21.0	1.5	20.8	17.3	21.7	0.9	46.0	46.7	53.5	7.5
border	22.5	23.8	21.4	-1.1	14.8	13.7	18.1	3.2	41.6	42.3	47.6	6.0
Difference	-3.1	-1.8	-0.4	2.7	6.0	3.7	3.6	-2.3	4.4	4.4	5.9	1.5
2002												
non-border	20.8	32.7	24.6	3.8	25.0	27.0	29.4	4.4	36.6	32.8	59.7	23.0
border	10.7	5.3	8.4	-2.3	21.8	21.4	27.0	5.2	31.5	31.1	48.5	17.0
Difference	10.1	27.5	16.2	6.1	3.2	5.6	2.4	-0.8	5.1	1.7	11.2	6.1
	Change in percentage points 2002/1996											
non-border	1.4	10.8	3.6	2.2	4.2	9.6	7.7	3.4	-9.4	-13.9	6.2	15.6
border	-11.8	-18.5	-13.0	-1.2	7.0	7.7	8.9	1.9	-10.1	-11.2	0.8	10.9

Table 8: Skill bonus by region type (as %)
Data source: Own calculations with Czech Microcensus 1996, 2002.

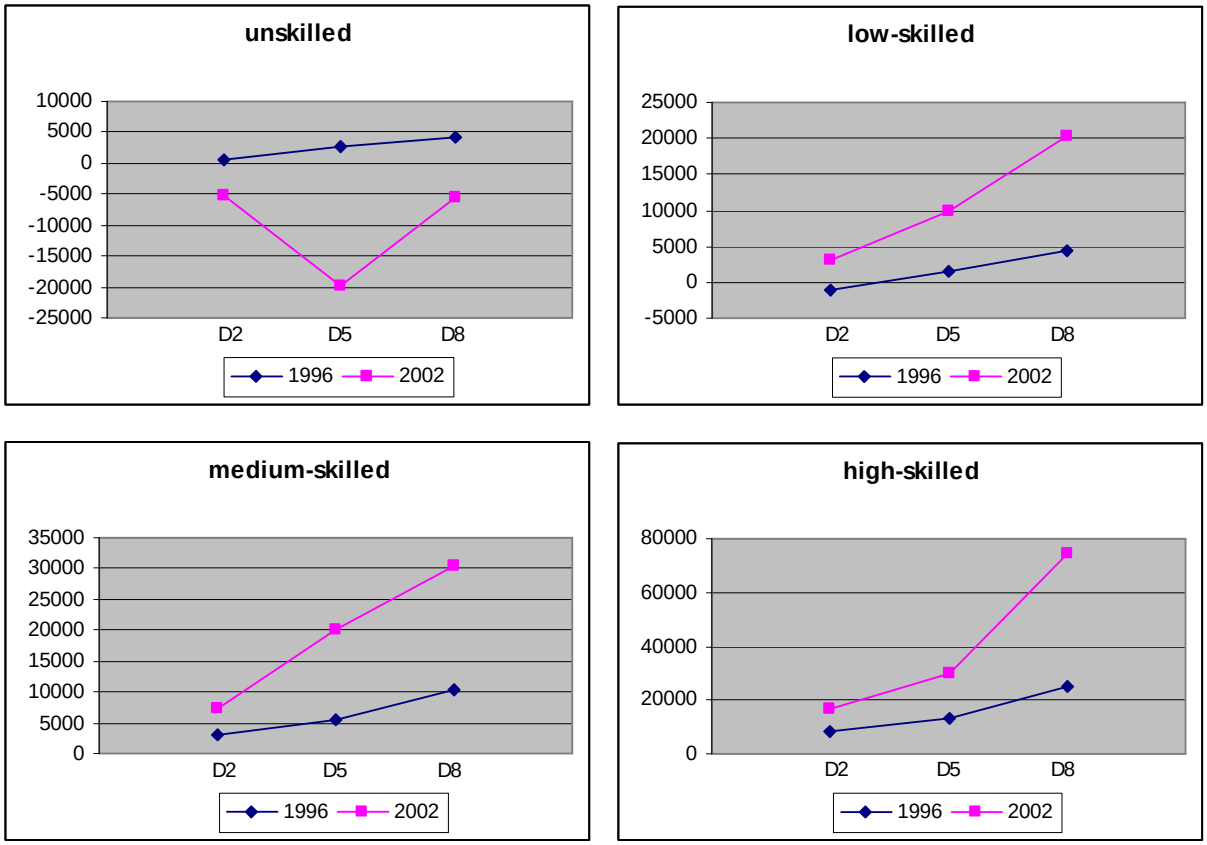

Figure 6: Wage differential between Czech non-border and border region (in Kč)
Data source: Own calculations with Czech Microcensus 1996, 2002.

4. Econometric Analysis of Qualification Trends

4.1 Employed Persons

In order to check more precisely whether there are significant differences in the qualification trends between border and non-border region I apply an econometric model. In a first step I calculate therefor the shares of the employees in the four skill groups for each district in 1992, 1996 and 2002. Since in this case I do not aggregate the Prague districts into one district and there are more Prague districts in 2002 than in the periods before I do not have an exact balanced panel, but five more districts in 2002. Then I take these shares and regress them separately on the following variables:

$$\begin{aligned}
UN_SKILL_{rt} &= \alpha + \beta POPDENS_{rt} + \gamma PRAHA_r + \delta_1 YEAR1996_t + \delta_2 YEAR2002_t \\
&\quad + \tau_1 BORREG_r + \tau_2 BORREG * YEAR1996_{rt} + \tau_3 BORREG * YEAR2002_{rt} \\
LOW_SKILL_{rt} &= \alpha + \beta POPDENS_{rt} + \gamma PRAHA_r + \delta_1 YEAR1996_t + \delta_2 YEAR2002_t \\
&\quad + \tau_1 BORREG_r + \tau_2 BORREG * YEAR1996_{rt} + \tau_3 BORREG * YEAR2002_{rt} \\
MEDIUM_SKILL_{rt} &= \alpha + \beta POPDENS_{rt} + \gamma PRAHA_r + \delta_1 YEAR1996_t + \delta_2 YEAR2002_t \\
&\quad + \tau_1 BORREG_r + \tau_2 BORREG * YEAR1996_{rt} + \tau_3 BORREG * YEAR2002_{rt}
\end{aligned} \quad \textbf{(1)}$$

$$HIGH\_SKILL_{rt} = \alpha + \beta POPDENS_{rt} + \gamma PRAHA_{r} + \delta_1 YEAR1996_{t} + \delta_2 YEAR2002_{t} + \tau_1 BORREG_{r} + \tau_2 BORREG * YEAR1996_{rt} + \tau_3 BORREG * YEAR2002_{rt}$$

UN_SKILL$_{rt}$ (*LOW_SKILL*$_{rt}$, *MEDIUM_SKILL*$_{rt}$, *HIGH_SKILL*$_{rt}$) denote the share of unskilled (low-skilled, medium-skilled, high-skilled) in district r in year t (as %). As control variable for agglomerations I use data from the Czech Statistical Office for the variable *POPDENS* (population density of the districts) and − accounting for the special labour market situation − a dummy variable (*PRAHA*), which takes the value 1 for the districts of Prague and Mladá Boleslav and 0 otherwise. Moreover I include dummy variables for the years 1996 and 2002 (with the reference year 1992), which equal 1 in the respective year and control for the changes in time (*YEAR1996, YEAR2002*). The variables I am interested most in are the border region dummy *BORREG* and the interaction terms *BORREG*YEAR1996* and *BORREG*YEAR2002*. *BORREG* equals 1 if the district lies in the border region and 0 if the district is remote from Bavaria and Austria. This variable estimates the difference of the share of the respective skill group for districts in the border region in the basic period 1992. The interaction terms control for changes of this difference in 1996 and 2002.

variable	unskilled		low-skilled		medium-skilled		high-skilled	
	coef.	t-Stat.	coef.	t-Stat.	coef.	t-Stat.	coef.	t-Stat.
POPDENS	-0.00002***	-3.85	-0.00007***	-6.23	0.00004***	4.33	0.00005***	5.23
PRAHA	0.0082	0.60	-0.0164	-0.63	-0.0162	-0.70	0.0243	1.06
YEAR1996	-0.0154**	-2.12	-0.0079	-0.65	0.0368***	3.57	-0.0136**	-1.99
YEAR2002	-0.0604***	-8.76	-0.0340**	-2.07	0.0798***	5.91	0.0145	1.45
BORREG	0.0055	0.42	-0.0115	-0.69	-0.0063	-0.38	0.0123	1.19
BORREG~96	0.0104	0.65	-0.0022	-0.11	0.0074	0.36	-0.0156	-1.25
BORREG~02	-0.0040	-0.23	0.0070	0.24	0.0064	0.24	-0.0094	-0.49
Constant	0.1287***	22.39	0.4950***	57.14	0.2976***	37.65	0.0787***	15.78
	Test statistics							
N	245		245		245		245	
R^2	0.3849		0.4333		0.3358		0.5444	

Table 9: Estimation results for the share of skill groups of Czech employees
Dependent variable: share of relevant skill group
Data source: Own calculations with Czech Microcensus 1992, 1996, 2002.
Notes: Regression with heteroskedasticity-robust standard errors; */**/*** significant at the 10/5/1 percent level.

The results of the four regressions are shown in table 9. The outcome with values of R^2 ranging from 0.33 to 0.55 clearly shows the effect of the population density on the distribution of skills. Negative coefficient values for *POPDENS* in the case of unskilled and low-skilled workers and positive values for medium- and high-skilled employees indicate that higher skilled workers are represented above-average in more densely populated areas. This is in line with the hypothesis

that agglomerations attract higher skilled persons. However, the insignificant results for the variable *PRAHA* suggest that there is no special effect regarding Prague and Mladá Boleslav. The coefficients for the year dummy variable reflect − with the exception of the value for high-skilled in 1996 − the general skill upgrading in the Czech Republic, which was already transparent in the descriptive figures. With respect to the border region all relevant variables are insignificant. The coefficients for *BORREG*, *BORREG*YEAR1996* and *BORREG*YEAR2002*, signify that there were no outstanding differences in the distribution of skill groups in 1992 (*BORREG*) and also no material changes until 1996 and 2002 (interaction terms). In the end, the results confirm the descriptive statistics stating that the differences in the skill group shares between border and non-border region are only marginal over the whole period of observation.

4.2 Unemployed Persons

Concerning unemployed persons I analyse the development and the regional differences in unemployment in the same manner as in the preceding subchapter using the district labour office data. Since aggregated data are available for every district in every year from 1992 until 2006 I generate a trend variable *TREND* which takes the values *TREND*=1,…,15 beginning in 1992. This variable can be interacted with the border region dummy which then estimates the deviating trend in the districts close to the Western European countries (*TREND*BORREG*). The regression equations have now the following form:

$$
\begin{aligned}
UN\_SKILL_{rt} &= \alpha + \beta POPDENS_{rt} + \gamma PRAHA_{r} + \delta TREND_{t} + \tau_1 BORREG_{r} \\
&\quad + \tau_2 TREND * BORREG_{rt} \\
LOW\_SKILL_{rt} &= \alpha + \beta POPDENS_{rt} + \gamma PRAHA_{r} + \delta TREND_{t} + \tau_1 BORREG_{r} \\
&\quad + \tau_2 TREND * BORREG_{rt} \\
MEDIUM\_SKILL_{rt} &= \alpha + \beta POPDENS_{rt} + \gamma PRAHA_{r} + \delta TREND_{t} + \tau_1 BORREG_{r} \\
&\quad + \tau_2 TREND * BORREG_{rt} \\
HIGH\_SKILL_{rt} &= \alpha + \beta POPDENS_{rt} + \gamma PRAHA_{r} + \delta TREND_{t} + \tau_1 BORREG_{r} \\
&\quad + \tau_2 TREND * BORREG_{rt}
\end{aligned}
\qquad \textbf{(2)}
$$

Table 10 shows the results. Apart from the regression for unskilled the coefficient for the variable controlling the population density (*POPDENS*) takes highly significant values. Low-skilled unemployed are represented above-average in more sparsely populated districts, while in agglomerations higher skilled unemployed are overrepresented. These figures are in line with the results in section 4.1 in the sense that human capital is to a greater extent located in populous

places. Furthermore, higher skilled unemployed are represented above-average in Prague and Mladá Boleslav (*PRAHA*). Recalling the descriptive figures it does not surprise that the coefficient of the trend variable (*TREND*) takes a negative sign for unskilled unemployed, whereas it is positive for the other three skill groups. The border region dummy (*BORREG*) estimates the deviation of the relevant share in the border region from the non-border districts in the reference year 1992. For unskilled and medium-skilled workers the coefficient of this variable is insignificant. Significant values for low-skilled (-) and high-skilled employees (+) indicate the ceteris paribus higher representation of high-skilled unemployed in the border region in the beginning of the observation period. However, the coefficient of the most interesting variable (*TREND*BORREG*) takes insignificant values for all skill groups. This means that there are no fundamental differences in the development of the skill structure between the border region and the rest of the country over time. Along with the descriptive statistics in sections 3.2 and 3.3 and the results in subchapter 4.1 the figures give evidence that the skill structure in the Czech Republic has changed in an analogous manner in the border and the non-border region with respect to employed and unemployed persons.

variable	unskilled		low-skilled		medium-skilled		high-skilled	
	coef.	t-Stat.	coef.	t-Stat.	coef.	t-Stat.	coef.	t-Stat.
POPDENS	0.00000	0.65	-0.00004***	-13.81	0.00001***	3.60	0.00002***	13.77
PRAHA	-0.0367***	-3.94	-0.0202***	-4.10	0.0353***	6.02	0.0216***	8.77
TREND	-0.0062***	-8.80	0.0038***	9.98	0.0019***	4.76	0.0006***	5.98
BORREG	0.0108	0.81	-0.0208***	-2.60	0.0049	0.69	0.0051***	3.05
TR~BORREG	0.0001	0.05	0.0007	0.89	-0.0006	-0.89	-0.0002	-0.85
Constant	0.3794***	54.89	0.4020***	107.12	0.2021***	51.07	0.0165***	18.61
	Test statistics							
N	1140		1140		1140		1140	1140
R^2	0.1016		0.2322		0.0654		0.4805	0.1016

Table 10: Estimation results for the share of skill groups of Czech unemployed persons
Dependent variable: share of relevant skill group
Data source: Own calculations with quarterly unemployment data of Czech district labour offices; (1/1992 – 2/2006).
Notes: Regression with heteroskedasticity-robust standard errors; */**/*** significant at the 10/5/1 percent level.

5. Econometric Analysis of Wage Differentials

5.1 Standard OLS Regressions without Pooling Cross-Sections

Focusing on wage differentials between the borderland and the rest of the country I start with standard OLS regressions for every single year in the Microcensus. Since the dataset is relatively small I have in this case to merge the four original skill groups into two skill groups and in the end distinguish between lower (unskilled & low-skilled) and higher (medium-skilled & high-skilled) skilled workers. This grouping is feasible since the shares of the skill groups between the

two areas of observation differ only marginally (see section 3.2). In order to evaluate the changes in the wage differentials I estimate the following Mincerian wage equation (Mincer 1974) separately for the years 1992, 1996 and 2002:

$$\ln \mathrm{WAGE}_i = \alpha + \beta \mathrm{DFEM}_i + \gamma_1 \mathrm{EXPER}_i + \gamma_2 \mathrm{EXPER}_i^2 + \gamma_3 \mathrm{EXPER\_F}_i + \gamma_4 \mathrm{EXPER}^2\mathrm{\_F}_i + \sum_{j=1}^{J=3} \delta_j \mathrm{MARSTAT}_{ji} + \sum_{m=1}^{M=8} \phi_m \mathrm{OCCUP}_{mi} + \eta \mathrm{POPDENS}_i + \varphi \mathrm{PRAHA}_i + \tau \mathrm{BORREG}_i + \varepsilon_i \quad \textbf{(3)}$$

$WAGE_i$ denotes the individual i's annual gross wage in the regular occupation in the relevant year. Unfortunately, the gross wage is not collected in the year 1992. On the other hand, the variable for the net wages includes a lot of missings in 2002 (nearly two-thirds of 4,880 observations with full-time employment). Since in 1996 and 2002 net and gross wages are nearly perfectly correlated (correlation coefficient > 0.99) I decided to use the net wage in 1992 as a proxy for the gross wage.[3] In addition to the conventional variables of the Mincerian wage equation (*DFEM*, *EXPER*, *EXPER*^{2}, interaction terms) I use dummies for the marital status (*MARSTAT*) and the occupational status (*OCCUP*). In this estimation version I am not able to control for the branches of economic activity since this information was not collected in 1992. As in the estimations of qualification trends I control for the population density of the districts (*POPDENS*) and the special labour market situation in Prague and Mladá Boleslav (*PRAHA*). For a detailed definition of the variables see tables 11 and 12.

ln WAGE	logarithm of individual wage
DFEM	sex dummy (female=1)
EXPER	potential job experience
EXPER^2	potential job experience ^{2}/100
EXPER_F	potential job experience, female
EXPER^2_F	potential job experience ^{2}/100, female
MARSTAT*	3 marital status dummies (married, divorced, widowed)
OCCUP*	8 occupation dummies
BRANCH*	13 dummies for branches of economic activity (only in 1996 and 2002)
POPDENS	population density
PRAHA	Prague and Mladá Boleslav dummy
BORREG	border region dummy
Constant	constant

Table 11: Variables of the wage equation (Czech Republic)

[3] One possible explanation for the high value of the correlation coefficient is the fact that in socio-scientific surveys "people tend to respond by estimating net rather than gross earnings, even if they are asked for the latter" (Večerník 2006: 8). Nevertheless, I will do some sensitivity analyses (see below) in order to check whether the results are robust.

The workers' potential on-the-job experience (*EXPER*) is measured in years as age minus average duration of education minus six. I impose 6 years as the average duration of education for unskilled workers without primary education, 9 years for unskilled workers with primary education, 11, 12 and 13 years respectively for workers with secondary education depending on the level of secondary occupation and 15, 19 and 21 years for workers with higher technical education or university graduates.		
Qualification	**Potential experience**	**Skill group**
primary education not complete	EXPER = AGE – 6 – 6	unskilled
primary education	EXPER = AGE – 6 – 9	unskilled
occupational qualification with lower secondary education	EXPER = AGE – 6 – 11	low-skilled
occupational qualification with secondary education (without *maturita*)	EXPER = AGE – 6 – 12	low-skilled
occupational qualification with upper secondary education (with *maturita*)	EXPER = AGE – 6 – 13	medium-skilled
higher technical education	EXPER = AGE – 6 – 15	medium-skilled
University degree	EXPER = AGE – 6 – 19	high-skilled
PhD Degree	EXPER = AGE – 6 – 21	high-skilled

Table 12: Values of EXPER (Czech Republic)

The results of the coefficients for the control variables correspond to the theoretical expectations (table 13). Female workers earn ceteris paribus about 20% less in the lower skilled group and 25% less in the higher skilled group compared to male employees. These values hardly change over time. One additional year of potential experience yields a significant wage increase, but the significant negative coefficient for $EXPER^2$ signifies that the benefit of experience decays with time. For female workers these effects are less distinctive. There are wage premiums for married, divorced and widowed employees in 1992 and 1996, which interestingly disappear in 2002 in both skill groups. Maybe the first generation of young single employees, who were educated after the fall of communism, compensates with their higher productivity the wage premiums of non-singles.[4] Significant outcomes for nearly all occupation dummies indicate the differences between the various professions. The wage differential for workers in Prague and Mladá Boleslav increases over time, from 5.2% to 10.8% in the lower skilled group and from 7.3% to 19.1% in the higher skilled group. With the exception of one case the population density has a significant positive effect on the wage. The variable which I am mostly interested in, the border region dummy, indicates negative, but in three out of four cases, insignificant wage differentials for border region workers in 1992 and 1996 (table 13 and figure 7). In 2002 the wage gap seems

[4] Using net wages as endogenous variable (despite the high number of missings in 2002) does not change this result.

to disappear for lower skilled workers and to deepen for higher skilled employees in the districts near Bavaria and Austria. However, since there are far fewer observations in 2002 the confidence interval is very large in this year, so that it is not possible to derive deeper conclusions from this estimation. Therefore, in a next step I apply a difference-in-differences approach in order to get more exact results.

variable	lower skilled			higher skilled		
	1992	1996	2002	1992	1996	2002
FEM	-0.2277*** (-0.0242)	-0.2172*** (0.0211)	-0.2125*** (0.0516)	-0.2840*** (0.0300)	-0.2713*** (0.0256)	-0.2587*** (0.0481)
EXPER	0.0313*** (0.0019)	0.0177*** (0.0015)	0.0155*** (0.0036)	0.0296*** (0.0026)	0.0200*** (0.0023)	0.0190*** (0.0047)
$EXPER^2$	-0.0741*** (0.0042)	-0.0402*** (0.0032)	-0.0334*** (0.0081)	-0.0733*** (0.0064)	-0.0480*** (0.0055)	-0.0471*** (0.0114)
EXPER_F	-0.0266*** (0.0025)	-0.0143*** (0.0021)	-0.0146*** (0.0054)	-0.0175*** (0.0036)	-0.0062** (0.0029)	-0.0070 (0.0058)
$EXPER^2$_F	0.0651*** (0.0060)	0.0334*** (0.0049)	0.0354*** (0.0126)	0.0555*** (0.0095)	0.0189** (0.0074)	0.0175 (0.0148)
MARSTAT1 (married)	0.1754*** (0.0140)	0.1136*** (0.0106)	0.0298 (0.0222)	0.1612*** (0.0173)	0.0806*** (0.0141)	-0.0160 (0.0258)
MARSTAT2 (divorced)	0.1900*** (0.0189)	0.0977*** (0.0148)	0.0148 (0.0285)	0.1630*** (0.0245)	0.0504*** (0.0194)	-0.0186 (0.0311)
MARSTAT3 (widowed)	0.1877*** (0.0287)	0.1166*** (0.0260)	-0.0203 (0.0492)	0.1141*** (0.0372)	0.1475*** (0.0313)	-0.0104 (0.0760)
OCCUP*	yes	yes	yes	yes	yes	yes
PRAHA	0.0520*** (0.0175)	0.0708*** (0.0151)	0.1083*** (0.0361)	0.0733*** (0.0186)	0.0850*** (0.0157)	0.1910*** (0.0349)
POPDENS	0.00004*** (0.00001)	0.00006*** (0.00001)	0.00004** (0.00002)	0.00004*** (0.00001)	0.00005*** (0.00001)	0.00002 (0.00002)
BORREG	-0.0072 (0.0082)	-0.0087 (0.0065)	0.0009 (0.0157)	-0.0160 (0.0104)	-0.0152* (0.0085)	-0.0360* (0.0186)
Constant	10.6998*** (0.0769)	11.7313*** (0.0428)	12.1240*** (0.1103)	11.0280*** (0.0310)	12.1292*** (0.0279)	12.5134*** (0.0494)
	test statistics					
N	7479	10967	2190	5485	8555	2689
R^2	0.401	0.339	0.3301	0.3726	0.3598	0.3138

Table 13: Estimation results for lower and higher skilled workers
Dependent variable: ln Wage; Data source: Own calculations with Czech Microcensus 1992, 1996, 2002.
Notes: Regression with heteroskedasticity-robust standard errors; */**/*** significant at the 10/5/1 percent level.

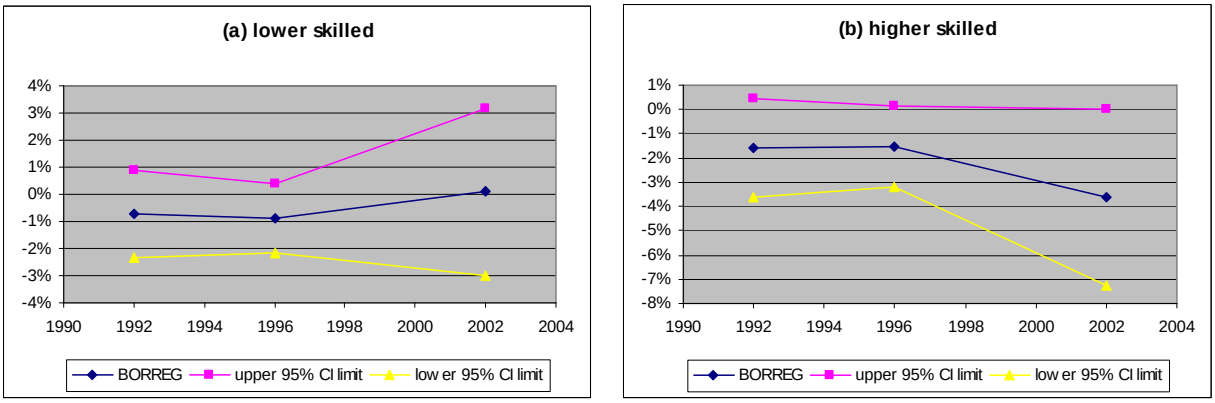

Figure 7: Wage effect for (a) lower and (b) higher skilled workers in the Czech border region (as %)

Data source: Own calculations with Czech Microcensus 1992, 1996, 2002.

5.2 Difference-in-Differences

In contrast to the former estimations I now do not run in each year a separate regression, but use all observations for each of the original four skill groups over time, i.e. I have an independently pooled cross-section for unskilled, low-skilled, medium-skilled and high-skilled employees. Estimating in each case only one equation leads to a larger sample size which in turn brings more precise estimators and test statistics with more power. Keeping the control variables of the previous regressions I include year dummies for the years 1996 and 2002 (*YEAR1996*, *YEAR2002*) with the reference year 1992. Furthermore I include interaction terms of the year dummies with the border region dummy. The variables *BORREG*YEAR1996* and *BORREG*YEAR2002* measure the change of the wage differential in the border region from 1992 to 1996 and 2002 respectively. The equation, which controls for the difference (over time) in the difference (wage gap in the border region) has now the following form:

$$\begin{aligned}\ln \mathrm{WAGE}_i = {} & \alpha + \beta\,\mathrm{DFEM}_i + \gamma_1 \mathrm{EXPER}_i + + \gamma_2 \mathrm{EXPER}^2_i + \gamma_3 \mathrm{EXPER\_F}_i + \gamma_4 \mathrm{EXPER}^2\mathrm{\_F}_i \\ & + \sum_{j=1}^{J=3} \delta_j\, \mathrm{MARSTAT}_{ji} + \sum_{m=1}^{M=8} \phi_m\, \mathrm{OCCUP}_{mi} + \eta\, \mathrm{POPDENS}_i + \varphi \mathrm{PRAHA}_i \\ & + \tau\, \mathrm{BORREG}_i + \upsilon_1\, \mathrm{YEAR1996}_i + \upsilon_2 \mathrm{YEAR2002}_i \\ & + \omega_1\, (\mathrm{BORREG}_i * \mathrm{YEAR1996}_i) + \omega_2\, (\mathrm{BORREG}_i * \mathrm{YEAR2002}_i) + \varepsilon_i\end{aligned} \qquad \textbf{(4)}$$

The results are shown in table 14. Also in this case the coefficient values of the control variables correspond to the theoretical expectations. The gender wage gap is most distinctive for unskilled workers, i.e. female unskilled employees earned ceteris paribus 36.9% less than their male counterparts. The differential for low-skilled female workers is only half as much, but then increases with the skill level. The coefficient values for the variables concerning experience indicate that one additional year of potential experience yields − depending on the skill group − a

wage increase, which mitigates over time and is smaller for female workers. With the exception of low-skilled workers, the wage bonus in Prague and Mladá Boleslav oscillates around 10%. The population density, which controls for agglomeration effects, has a positive, but only in the case of low- and medium-skilled significant effect on wages. The coefficient for *BORREG* shows for all skill groups a negative, but insignificant wage differential for employees in the districts near Bavaria and Austria in 1992. This wage gap did not change considerably until 1996, as the outcome for *BORREG*YEAR1996* exhibits. However, the values for *BORREG*YEAR2002* indicate that things have changed from 1996 until 2002. In adding the basic wage effect for the border region and the effect until 2002, which is captured by the interaction term, it turns out that unskilled workers in the border districts earned in 2002 about 12% more than employees in districts remote from Bavaria and Austria. In all other skill groups the wage differential for border region employees deteriorated over time. Though − apart from the unskilled − only the value for medium-skilled workers is significant at the 5 percent level it is striking that the wage differential deepens with the skill level. While the total wage effect in the low-skilled group amounts 1.9% in 2002, i.e. workers in the border region earned 1.9% less, the effect for medium- and high-skilled workers adds up to 5.1% and 6.1% respectively. This means that regarding skill levels until 2002 a clear structure with respect to wage differentials emerged: the higher the skill level, the more disadvantageous was it to be employed in the border region.

variable	unskilled		low-skilled		medium-skilled		high-skilled	
	coef.	t-Stat.	coef.	t-Stat.	coef.	t-Stat.	coef.	t-Stat.
FEM	-0.3688***	-6.58	-0.1975***	-10.37	-0.2446***	-9.55	-0.2768***	-5.97
EXPER	0.0109***	2.65	0.0257***	18.70	0.0238***	10.19	0.0210***	5.67
$EXPER^2$	-0.0255***	-3.10	-0.0592***	-19.32	-0.0543***	-10.21	-0.0525***	-5.39
EXPER_F	-0.0004	-0.08	-0.0236***	-11.42	-0.0125***	-4.42	-0.0071	-1.24
$EXPER^2$_F	0.0047	0.47	0.0588***	11.58	0.0356***	5.08	0.0330**	2.14
mar. status	yes		yes		yes		yes	
occ. status	yes		yes		yes		yes	
PRAHA	0.0993***	3.84	0.0650***	4.45	0.1116***	7.34	0.1013***	3.28
POPDENS	0.00001	0.91	0.00005***	7.99	0.00003***	5.15	0.00002	1.29
YEAR1996	0.8460***	68.23	0.8615***	136.79	0.9197***	114.51	1.0083***	59.88
YEAR2002	1.1759***	49.43	1.2279***	122.35	1.3457***	113.86	1.4054***	61.15
BORREG	-0.0190	-1.17	-0.0007	-0.08	-0.0075	-0.65	-0.0165	-0.80
BORREG~96	0.0009	0.04	-0.0053	-0.45	-0.0077	-0.54	-0.0053	-0.19
BORREG~02	0.1382***	3.07	-0.0187	-0.99	-0.0435**	-1.97	-0.0445	-1.04
Constant	11.0608***	71.53	10.7842***	245.63	11.0350***	375.89	11.1996***	282.95
	Test statistics							
N	4000		16636		12855		3874	
R^2	0.7697		0.7705		0.7606		0.7326	

Table 14: Difference-in-difference estimation in the Czech border region
Dependent variable: ln Wage
Data source: Own calculations with Czech Microcensus 1992, 1996, 2002.
Notes: Regression with heteroskedasticity-robust standard errors; */**/*** significant at the 10/5/1 percent level.

Some sensitivity analyses do not change this statement. Restricting the difference-in-differences approach to only two years of observation (1992&1996, 1992&2002, 1996&2002) yields very similar results. In the most interesting version, excluding the observations of 1992, it is possible to include dummy variables for the 14 industrial branches in the estimation. It could be important to control explicitly for branches as, for instance, manufacturing, which is notably represented above-average in the border region in 2002. However, the wage differentials for the different skill groups do not deviate substantially from the outcomes above (table 15): a remarkable relative wage gain of 13.2% for unskilled workers in the borderlands, while all other skill groups exhibit relative wage losses from 1996 until 2002 downgrading with the skill level. According to this version, the relative wage of medium-skilled workers in the border region decreased by more than 5 percentage points (significant at the 1 percent level) and the wage of high-skilled workers by more than 6 percentage points (significant at the 10 percent level).

variable	unskilled		low-skilled		medium-skilled		high-skilled	
	coef.	t-Stat.	coef.	t-Stat.	coef.	t-Stat.	coef.	t-Stat.
BORREG~96	-0.0029	-0.20	0.0106	1.45	0.0036	0.40	0.0112	0.50
BORREG~02	0.1317***	2.98	-0.0209	-1.21	-0.0512***	-2.65	-0.0646*	-1.67
	Test statistics							
N	2402		10755		8826		2418	2402
R^2	0.457		0.493		0.5022		0.4642	

Table 15: Wage effect in the Czech border region controlling for industrial branches (as %)
Dependent variable: ln Wage
Control variables: see table 11 + year dummy 2002
Data source: Own calculations with Czech Microcensus 1996, 2002.
Notes: Regression with heteroskedasticity-robust standard errors; */**/*** significant at the 10/5/1 percent level.

In an alternative specification I do not split the dataset according to skill groups but again according to the years. In contrast to the former estimations I now run regressions including all skill groups in one year. Thus, I generate dummy variables for low-skilled, medium-skilled and high-skilled employees (*L_SKILL*, *M_SKILL*, *H_SKILL*) with unskilled workers as the reference group. Furthermore I interact all skill group dummies with the border region dummy (*LSKILL*BORREG*, *MSKILL*BORREG*, *HSKILL*BORREG*). Consequently, I now analyse not only the deviations of the wage differential in the borderland, but also the development of the wage differentials between the different skill groups. The results for the variables with respect to the skill level and the region are summarised in table 16. The values for the coefficient of *BORREG* show that in 2002 unskilled workers in the border region earned significantly more (11.2%) than unskilled workers in the non-border region. The wage differentials between the skill groups increased above all in the early transition years from 1992 until 1996 and remained

nearly stable afterwards.[5] Regarding the interaction terms between the skill and the border region dummies the outcome yields significant results only in 2002. Based on the wage differential for the reference group (the unskilled workers) all other skill groups are in the border region in an inferior position, which is consistent with my previous results.

variable	1992		1996		2002	
	coef.	t-Stat.	coef.	t-Stat.	coef.	t-Stat.
BORREG	-0.0181	-1.11	-0.0170	-1.18	0.1121***	2.61
L_SKILL	0.0418***	3.69	0.0612***	6.32	0.0904***	3.66
M_SKILL	0.1635***	11.62	0.2169***	18.82	0.2299***	8.37
H_SKILL	0.3364***	16.32	0.4360***	24.79	0.4381***	12.09
LSKILL*BORREG	0.0164	0.88	0.0126	0.79	-0.1218***	-2.66
MSKILL*BORREG	-0.0028	-0.14	-0.0030	-0.18	-0.1481***	-3.17
HSKILL*BORREG	-0.0155	-0.63	-0.0053	-0.21	-0.1491**	-2.58

Table 16: Regression results for the qualificational wage differential in the Czech border region

Dependent variable: ln Wage
Control variables: see table 11 (without BRANCH*)
Data source: Own calculations with Czech Microcensus 1992, 1996, 2002.
Notes: Regression with heteroskedasticity-robust standard errors; */**/*** significant at the 10/5/1 percent level.

6. Conclusion

In this paper I analysed the development of several labour market indicators in the Czech Republic after the fall of the Iron Curtain comparing the districts close to Bavaria and/or Austria with the rest of the country. Hypotheses can be derived from two theoretical strands: the Feenstra-Hanson new trade model dealing with the skill intensity of outsourced production activities and the Brülhart et al. NEG model referring to the market potential and import competition.

In the early transition years (from 1992 until 1996) the relative employment share of the border region increased and then stabilised until 2002. Contrary to my hypotheses I do not find clear evidence of disproportionate shifts in the economic structure in the Czech districts bordering on Bavaria and Austria compared to the non-border districts. With respect to branches of economic activity as well as to occupations the shifts proceeded more or less in a similar way with some exceptions, e.g. clerks and the manufacturing sector. Calculating an indicator of structural change and a specialisation index yields higher values in the period from 1996 until 2002. This is not surprising not only because of the longer span of time, but also due to the troubling recession years.

[5] These results correspond to the findings of Večerník (2006: 7): "In the 1996-2002 period, the effect of education stagnated …"

In the period under review a skill-upgrading process took place all over the country. Distinguishing between four skill groups the skill structure of employed and unemployed persons changed in an analogous way in both areas of observation, i.e. the trend towards more skilled labour led to noticeable shifts in the Czech border region as well as in the remaining districts. The descriptive statistics are in each case (employed and unemployed) confirmed by the results of econometric estimations.

Regarding wage differentials between workers employed in the border region and workers in the rest of the country I first took a look at the descriptive figures and then ran several regressions getting robust results: in 1992 border region employees generally earned slightly less than in the non-border districts (about 1-2%). While there was not so much variation until 1996, the picture changed from 1996 until 2002. The workers with the lowest skill degree exhibit in the border region a positive wage differential of around 12% compared to their counterparts in the non-border region. All other skill groups in the border region feature negative values the spatial wage gap being higher the higher the skill level is. These results clearly contradict the predictions of the Feenstra-Hanson model, but go with the expectations of the NEG model according to which in the border region above all sectors are in a favourable position where import competition from Germany and Austria is low.

Of course, these results indicate only the effects of economic integration in an ongoing process which is far from being completed. The effects of the Czech Republics' accession into the EU have still to be analysed not to speak about the impact of free movement of labour which will at the latest 2011 bring new opportunities to the Czech workforce. Since the Czech Republic is surrounded by old and new EU member states the country is predestinated for further research on integration effects.

References

Airola, J., Juhn, C. (2005): Wage Inequality in Post-Reform Mexico, IZA Discussion Paper No. 1525, Institute for the Study of Labor (IZA), Bonn.

Barjak, F., Heimpold, G. (2000): Development Problems and Policies at the German Border with Poland – Regional Aspects of Trade and Investment, in: van der Velde, M., van Houtum, H. (eds.): Borders, Regions and People. European Research in Regional Science, vol. 10. Pion, London, p. 13-31.

Bröcker, J. (1998): How would an EU-Membership of the Visegrád Countries Affect Europe's Economic Geography?, *Annals of Regional Science*, vol. 32(1), p. 91-114.

Brülhart, M., Crozet, M., Koenig, P. (2004): Enlargement and the EU Periphery: The Impact of Changing Market Potential, *The World Economy*, vol. 27(6), pp. 853-875.

Chiquiar, D. (2008): Globalization, Regional Wage Differentials and the Stolper-Samuelson Theorem: Evidence from Mexico, *Journal of International Economics*, vol. 74(1), pp. 70-93.

Egger, H., Egger, P. (2002): How International Outsourcing Drives Up Wages in Eastern Europe?, *Review of World Economics/Weltwirtschaftliches Archiv*, vol. 138(1), p. 83-96.

Feenstra, R., Hanson, G. (1997): Foreign Direct Investment and Relative Wages: Evidence from Mexico's Maquiladoras, *Journal of International Economics*, vol. 42(3-4), p. 371-393.

Feenstra, R., Hanson, G. (1996): Foreign Investment, Outsourcing and Relative Wages, in: Feenstra, R., Grossman, G., Irwin, D. (eds.): Political Economy of Trade Policy: Essays in Honour of Jagdish Bhagwati, MIT Press, Cambridge, p. 89-127.

Fidrmuc, J. (2004): Labor mobility during transition: evidence from the Czech Republic, *Zeitschrift für ArbeitsmarktForschung*, Jg. 37, Heft 4, S. 437-450.

Hanousek, J., Münich, D. (2000): Czech Republic 2000 - Quo Vadis?, CERGE-EI, Prague.

Huber, P., Pfaffermayr, M., Wolfmayr, Y. (2006): Are there Border Effects in the EU Wage Function?, CESifo Working Paper No. 1880, Munich.

Mincer, J. (1974): Schooling, experience and earnings, National Bureau of Economic Research, New York.

Münich, D., Svejnar, J., Terrell K. (2005): Returns to Human Capital Under the Communist Wage Grid and during the Transition to a Market Economy, *Review of Economics and Statistics*, vol. 87(1), pp. 100-123.

Niebuhr, A. (2008): The Impact of EU Enlargement on European Border Regions, *International Journal of Public Policy*, vol. 3(3-4), pp. 163-186.

Pusterla, F., Resmini, L. (2007): Where do Foreign Firms Locate in Transition Countries? An Empirical Investigation, *The Annals of Regional Science*, vol. 41(4), p. 835-856.

Turnovec, F. (2001): Regional Reform in the Czech Republic and Regional Disparities in the Extending European Union, *Prague Economic Papers*, vol. 10(1), p. 24-36.

Večerník, J. (2006): Evolution or Revolution? Disparities in Earnings and Household Income in the Czech Republic 1988-2002, IES Occasional Paper 4/2006, Prague.

Medieninhaber (Verleger), Hersteller: Österreichisches Institut für Wirtschaftsforschung • Wien 3, Arsenal, Objekt 20 • A-1103 Wien, Postfach 91 • Tel. (43 1) 798 26 01-0 • Fax (43 1) 798 93 86 • http://www.wifo.ac.at/ • Verlags- und Herstellungsort: Wien