Where Have All the Migrants Gone?
Reconciling Falling Migration Rates with Rising Regional Disparities during Transition[Ñ]

Jan Fidrmuc[*] and Peter Huber[**]

July 2003

Abstract

We investigate the potential reasons behind the fall in migration that occurred on the background of rising regional disparities in the Czech Republic in the course of the 1990s. We consider two alternative explanations: First, responses of migrants to wage differentials and other factors affecting migration may have changed. Second, determinants of migration other than wages may have changed so as to countervail rising wage disparities. We find that the decline in migration can be fully explained by changes in migrants' behavior. The impact of wage differentials on migration flows has increased, but this was countered by increasing importance of distance as barrier to migration and lower impact of unemployment and vacancy rates.

JEL – Classification: F22, J61, P23

Key Words: Migration, Unemployment, Regional Shocks

[∇] We benefited from comments and suggestions by Martin Falk, Mihail Hazans, Alexander Hobza, Patrick Puhani and Ken Smith, as well as participants of an ACE Phare workshop in Bratislava and ACCESSLAB workshops in at ZEI Bonn and University of Budapest. This research was supported by the ACCESLAB 5[th] framework Project

[*] Corresponding author. ECARES, Université Libre de Bruxelles; Center for European Integration Studies (ZEI), University of Bonn; CEPR, London; and WDI, University of Michigan. Address: ECARES, Université Libre de Bruxelles, CP 114, 1050 Bruxelles, Belgium. Email: JFidrmuc@ulb.ac.be. Phone: +32-2-650-4462, Fax: +32-2-650-3369.

[**] Austrian Institute for Economic Research (WIFO), Arsenal, Objekt 20, 1030 Wien, Austria. E-mail: huber@wifo.ac.at.

1 Introduction

At the outset of transition, the Czech Republic inherited a very egalitarian regional earnings distribution. In 1990, average wage in the richest district exceeded that in the poorest one by 28%. By 1998, this gap grew to 76%. Regional differences in unemployment rates changed in a similar fashion. In 1990, district-level unemployment rates ranged between 0.1% and 1.9%. In 1998, the lowest rate was 1.6%, while the highest climbed to 15.6%. In the presence of such dramatic increases in regional disparities, potential gains from migrating from depressed to more prosperous regions should have grown; one would thus expect migration to have risen. Yet, in 1998 the migration rate was in fact 15% lower than in 1992. Falling migration rates in the face of increasing regional disparities in transition are, however, not specific to the Czech Republic. Fidrmuc (2003) observes similar patterns in Poland and Slovakia. Despite this apparent puzzle, the literature has so far largely focused on documenting and explaining regional disparities in transition economies (see: Profit, 1999, Boeri and Scarpetta,1996, Burda and Profit, 1996, Gorzelak, 1996) without giving much consideration to inter-regional migration.

This paper contributes to filling this gap by using place-to-place migration data at the level of Czech districts from 1992 to 1998. While a number of studies investigate migration in the context of developed countries (se for example Wall, 2001; Juarez 2000, Crozet, 2001 and Daveri and Faini, 1999), the Czech Republic moved from being a planned economy to becoming an OECD member and a candidate country of the European Union during the period analyzed. We explore the factors behind the unexpected decline in migration, assessing two alternative explanations. First, variables affecting migration behavior other than wages may have countervailed the increased migration incentives from wage divergence. Second, the behavior of migrants, and in particular their response to wage and unemployment differentials, may have changed – an explanation which seems particularly relevant in the context of the substantial changes experienced in the candidate countries of the European Union.

In the next section we show that the decline in migration rates in the Czech Republic was associated with an increasing share of net migration, reduced long distance migration and a higher share of urban-suburban migration. In section three we present a model, which serves as guidance for our empirical investigation. Section four presents the data used. In section five then we estimate a place-to-place migration model for the overall time period as well as for two separate time periods (1992 to 1994 and 1996 to 1998) and perform the Oaxaca – Blinder decompositions of the decline in migration. We find the decline in migration between 1992 and 1998 is entirely due to parameter changes. In particular wage differentials have become more important in shaping migration and distance was a more important deterrent to migration in 1998 than in 1992. By contrast access to jobs as measured by the vacancy and unemployment rates has become less important. This leads us to conclude, in section six, that most of the fall in migration in the Czech Republic in the 1990's was due to changes in the behavior of migrants.

2 The Puzzle and Some Stylized Facts

The place-to-place migration data used in this study are based on the register of residents and were obtained from the Czech statistical office. The data exclude moves from and to other countries (including Slovakia), thus separation of Czechoslovakia has no effect on findings. They pertain to 76 districts (77 after 1996) (called *okresy* in Czech). In 1996, however, the district of Jesenik was newly created from parts of Sumperk and Bruntal; we thus exclude these districts from estimation, to provide estimates on a consistent set of regions. Figure 1 reports the share of migrants as a percentage of the country's population and the coefficient of variation of average regional wages. This simple comparison of regional mobility with the regional variation in wages clearly documents the fall in migration that occurred on the background of rising regional disparities in the Czech Republic.

{Figure 1 around here}

An inspection of the migration data (Table 1) reveals that the decline in overall migration was primarily due to a reduction in long-distance moves. Migration flows involving a distance of more than 100 kilometers declined steadily from 1992 onwards with the decline being more pronounced with increasing distance. In 1998 moves over less than 50 kilometers were 50% above their 1992 levels, while those over a distance of more than 200 kilometers were 43% below the 1992 value. This suggests that matching of workers and jobs across space has become more difficult in the course of transition in the Czech Republic.

{Table 1 around here}

Gross migration may be a misleading indicator of migratory behavior, however, because, as in most empirical migration data, net migration flows only account for a fraction of total gross flows in the Czech Republic. For instance, in 1992, 1563 people migrated from the suburban districts of Prague East and Prague West to the city of Prague while 2023 migrated in the opposite direction.[1] In Table 2, we decompose migration into net and gross flows. Falling gross migration rates have been primarily accompanied by decreasing churning flows, so that net flows as a percentage of population and as a percentage of total flows increased. Since most macro-economic models focus on net rather than gross migration as an equilibrating device for regional disparities, this suggests that the early phases of transition may have been characterized by excessive churning. The level of net-migration, however, remained low throughout transition. Even in 1998 only 22% of the bilateral migration flows were net-migration flows while 78% were churning flows.[2]

{Table 2: Around here}

The high share of churning flows as well as falling long distance migration may be due to residential choices of migrants. A change of the place of residence is not necessarily associated with a change of employment. For instance one can move from a city to a suburb without changing the place of employment. Such migration is obviously not motivated by income or unemployment disparities between two regions, but is mainly due to better living conditions in the receiving region. In the Czech Republic such moves can be isolated by separating migration between the four "city districts" of Prague, Brno, Plzen, and Ostrava and their respective suburban districts (Prague West and Prague East for Prague; Plzen South and

Plzen North for Plzen; Brno venkov for Brno; and Opava, Frydek-Mystek, Novy Jicin and Karvina for Ostrava.). Movements within these urban regions have become increasingly important in total Czech migration (Table 3), accounting for between a quarter and a fifth of total migration. Furthermore, although throughout the period of observation the "city districts" were characterized by higher wages and lower unemployment rates than their respective environs, they started to lose population as of 1994 (with the exception of Ostrava[3]). This was particularly pronounced in Prague where by 1998 three times as many migrants moved from Prague to the suburbs than in the opposite direction.

{Table 3 around here}

3 The Model and Estimation

Descriptive statistics thus suggest that falling gross migration in the Czech Republic has been associated with an increasing share of net migration, reduced long distance migration and a higher share of urban-suburban migration. While this is suggestive of some potential explanations for falling migration rates, it does not provide us with definitive answers. We therefore construct a simple model of place-to-place migration to find out which factors underlie mobility flows. Consider an individual (n) residing in region *i* and deciding in which region $j \in \{1 \ldots J\}$ to live. Each potential destination region is associated with a certain utility that derives from the expected earnings, Y_j, and region specific amenities, A_j. Furthermore, assume that moving from region *i* to *j* is associated with migration costs, or disutility, C_{ij}. Finally, we assume that the individual's utility function contains also a random component, m_i^n, which can either be thought of as capturing heterogeneity in taste (as in Wall, 2001) or as a random draw from a distribution of moving costs (as for instance in Burda and Funke, 1993) The expected utility of a person currently living in region *i* and contemplating to move to region *j* is thus given by:

$$U_{ij} = U(A_j, Y_j, C_{ij}, m^n{}_j)$$

with $C_{ij}=0$ if $i=j$. The individual will chose the location, which yields the highest utility. The probability P_{ij} of moving from region i to j is thus given by:

(2) $$P_{ij} = P\{U_{ij} = \max(U_{i1},..U_{iJ})\}$$

We assume that the utility function can be log linearised such that $U_{ij} = a_1 \ln A_j + a_2 \ln Y_j + a_3 \ln C_{ij} + e_i^n$, with $e_i^n = \ln(m_i^n)$. As shown by McFadden (1973) under the provision that the random components, ε, are all independently identically Weibull distributed, the probability of an individual moving from region i to j is given by:

(3) $$P_{ij} = \frac{e^{a_1 \ln A_j + a_2 \ln Y_j + a_3 \ln C_{ij}}}{\sum_{j \in \{1...J\}} e^{a_1 \ln A_j + a_2 \ln Y_j + a_3 \ln C_{ij}}}$$

To move from micro level to aggregate migration we follow Fields (1979) and consider the log probability of a move from region i to region j (P_{ij}) relative to the probability of staying (P_{ii}). Using equation (3), it follows that $\ln(\frac{P_{ij}}{P_{ii}}) = a_1(\ln A_i - \ln A_j) + a_2(\ln Y_i - \ln Y_j) + a_3 \ln C_{ij}$. Note that the expected number of moves (M_{ij}) from i to j is equal to N_iP_{ij} (with N_i the resident population in the sending region), so that the above can be rearranged to:

(4) $$\ln(M_{ij}) = \ln(M_{ii}) + a_1(\ln A_i - \ln A_j) + a_2(\ln Y_i - \ln Y_j) + a_3 \ln C_{ij}$$

This model thus suggests that when estimating equation (4), the coefficient on $\ln(M_{ii})$ should be unity and sending and the receiving region effects should be symmetric. Both these predictions may be too strong, however. For instance, Hunt (2000) argues that if aside from migration individuals have the possibility to commute this may lead to more people remaining resident in their region than in a model which assumes that the individuals live where they work. Furthermore, the symmetry of sending and receiving region effects is based on the assumption of symmetric information of agents about conditions in receiving and sending regions and perfect capital markets. If there are information asymmetries about sending and receiving region characteristics, the coefficient of the sending region variable will differ from that of the receiving region. If, by contrast, financial markets are imperfect, current income will play an important role in financing the move, which will lead to wages at the origin having a higher value than at the destination (see Vanderkamp, 1971). Finally, Fields (1979) argues that empirical models allowing sending and receiving region coefficients to differ yield higher explanatory power than when parameters are constrained. These considerations suggest that equation (4) should be generalized to:[4]

(5) $$\ln(M_{ij}) = a_0 \ln(M_{ii}) + a_{11} \ln A_i - a_{12} \ln A_j + a_{21} \ln Y_i - a_{22} \ln Y_j + a_3 \ln C_{ij}$$

For simplicity and to avoid problems associated with the logarithm of zero (see below) we rewrite this as $M_{ij} = e^{qY_{ij}}$

In estimating equation (5), it has become customary to include fixed effects to control for time invariant characteristics of regions such as the various amenities or the psychological and financial costs associated with migration – all of which are difficult to measure. Two specifications have been used: First, bilateral fixed effects can be included for every sending and receiving region pair. In this case (5) can be written as:

(6) $$M_{ijt} = e^{qY_{ijt} + \sum_{j=1}^{J} \sum_{i \neq j} f_{ij} + \sum_{T} t_t + V_{ijt}}$$

where ϕ_{ij} is a set of *Jx(J-1)* fixed effects for each sending and receiving region pair, τ_t a fixed effect for each time period and ζ_{ijt} the error term. Alternatively fixed sending and receiving region fixed effects can be chosen. In this case (5) can be reformulated as:

(7) $$M_{ijt} = e^{qY_{ijt} + \sum_{j=1}^{J} j_j + \sum_{i=1}^{J} w_i + \sum_{T} t_t + V_{ijt}}$$

with φ_j and ω_i standing for a set of *J* fixed effects for each region when it is the sending (ω_i) or receiving (φ_j) region, respectively. Under specification (6) time invariant measures (such as distance or contingency effects) and under specification (7) time invariant variables for individual regions (such as the area) cannot be identified separately. We estimated both models and compared the model fit. Although the bilateral fixed effects specification leads to a substantial increase in the log likelihood of the estimates, (which is, however, to be expected when including around 5500 more parameters) the Schwartz information criterion slightly favors equation (7). For this reason results concerning (6) were relegated to the appendix and are discussed only to clarify the robustness of the results.

{Table 4 around here}

An additional problem is posed by the fact that many bilateral migration flows in our data are zero or very low (see Table 4). As we use a rather fine regional grid, it is not at all surprising that pairs of small and distant regions often have zero or very low bilateral migration flow. Estimating equation (7) by OLS would ignore that gross migration flows between two regions cannot become negative as well as the count data structure of the data. This would result in both biased and inefficient estimates (see Greene 1997). We thus estimate a negative binomial regression model (Cameron and Trivedi, 2001)[5] by assuming that the observed migrant flow M_{ij} is drawn from a Poisson distribution with parameter $l_{ij} = e^{qY_{ijt} + \sum_{j=1}^{J} j_j + \sum_{i=1}^{J} w_i + \sum_T t_t} x_{ij}$ where $x_{ij} = e^{V_{ij}}$ is a random individual unobserved effect, which is gamma distributed with mean 1.0 and variance δ. The distribution of migrant flows M_{ij} conditional on Y_{ij} and ξ_{ij} is thus given by: $f(M_{ij} | Y_{ij}, x_{ij}) = \frac{e^{-l_{ij}} l_i^{M_{ij}}}{M_{ij}!}$. As shown by Cameron and Trivedi (1986), under these assumptions the unconditional distribution of migration flows ($f(M_{ij} | Y_{ij})$) is a form of the negative binomial which has an expected number of moves between two regions ($E(M_{ij})$) of $e^{qY_{ij}}$ and variance $e^{qY_{ij}}(1 + de^{qY_{ij}})$ with δ as the over-dispersion parameter. The derivative of $E(M_{ij})$ with respect to any element (k) of Y_{ij} is thus given by $\frac{\partial E(M_{ij})}{\partial Y_{ij}^k} = q^k E(M_{ij})$ and in the case of a double logarithmic specification as (4) can be interpreted as a standard elasticity (i.e. the expected percent change in migration given a certain percentage ceteris paribus change in the dependent variable).

4 Determinants of Migration

Data on regional developments for this analysis were taken from various issues of the regional statistical yearbooks of the Czech Republic. We focus on four sets of variables, closely related to inter - regional migration:

First, to capture differences in expected life-time earnings in the two localities we consider the differences in average wages between sending and receiving regions as well as differences in unemployment rates. Inclusion of these variables is motivated by standard migration theory such as Harris and Todaro (1970), which argues that the wage level can be considered a proxy for income when employed while the unemployment rate measures the probability of finding employment. Unemployment rates, however, may be considered an imperfect proxy for the probability to find employment. For this reason, we follow Jackman and Savouri (1992) and include also the vacancy rate in a region (as percentage of total employment) as an additional indicator of labor market tightness.

Second, since a substantial part of migratory movements in the Czech Republic may be associated with housing motives, we use indicators to measure housing availability in the regions. Unfortunately, data on housing prices and the housing stock used in much of the literature (see Westerlund, 1997, Jackman and Savouri, 1992, Cameron and Muellbauer, 2001) are not available for the Czech Republic. We therefore proxy housing availability with construction indicators (see also Decressin, 1994). Specifically, we use the number of dwellings per inhabitant completed over the last three years as an indicator of housing stock.

Third, as measures of the potential costs associated with migration from a region to another, we employ the distance between these two regions, measured as the road distance between the district capitals in kilometers (obtained from the ANWB Route Planner (www.anwb.nl). Distance has proven to be the uniformly the most important in explaining place to place migration patterns in many countries (see Fields, 1979). In addition since short distance migration is high in the Czech Republic and some authors (see e.g. Crozet, 2001) found adjacency effects important in explaining interregional migration, we include a dummy variable, which takes on the value one if two regions are adjacent to each other and zero otherwise. Furthermore, Jackman and Savouri (1992) argue that labor migrants may find it difficult to move across sectors (for instance agricultural workers will face difficulties finding employment in industry and industrial workers may encounter problems when attempting to find employment in services). Therefore, we also control for the difference in structural specialization between districts as a further indicator.[6] Finally, a dummy variable taking on the value of one if the flow is between Moravia and Bohemia was included to account for the potential cultural differences between these two regions, which may increase psychological moving costs.

Finally, since regional development in the Czech Republic was closely associated with sectoral developments (see Scarpetta and Huber, 1995) we also include the share of agricultural and industrial employment in the sending and receiving region as control variables.

Table 5 reports summary statistics for these data. They reflect the findings of the empirical literature on regional development in the Czech Republic. Aside from declining migration rates, the Czech Republic experienced also declining employment. The average district lost about 2.000 employees from 1992 to 1998 with the lowest employment levels reached in 1996 and followed by a partial recovery. This decline was primarily due to declining employment in industry and agriculture, whereas service employment increased. The unemployment rate, however, remained below the 10% mark throughout the transition period and was very low until 1996. Low unemployment rates were accompanied by high vacancy rates, which also started to decline only after 1996. Furthermore, the construction of new apartments fell substantially until 1996 and remained low until 1998.

{Table 5 around here}

5 Results

Results for the full sample

Estimating equation (7) for the entire time period (see Column 1 of Table 6) points to the relatively low importance of labor market conditions in determining migration. Only the vacancy rate is significant – an increase in the vacancy rate of the receiving region by 1% increases bilateral migration by 0.07%. Given that migration flows from all districts should increase by 0.07%, this effect is economically significant. However, neither unemployment nor wages (in sending or receiving regions) significantly affect migration, although wage in the receiving region and unemployment in the sending region do have the expected signs. Interestingly, wage in the sending region appears with a positive (albeit not significant) coefficient, which might indicate that liquidity constraints are a barrier to migration. Housing availability in the receiving region has the expected effect and an increase in the number of completed dwellings per inhabitant (over the last three years) by 1% raises the bilateral migration flow by around 0.06%.

Sectoral specialisation has a significant impact on migration in the Czech Republic. A high share of agricultural employment in the receiving region significantly reduces migration, while the share of industry had a negative but insignificant impact. People thus tend to migrate to regions with a high share of service sector employment, which accords with our finding that the service sector was the only sector to expand employment in the time period from 1992 – 1998.

The uniformly most important variables determining migration, however, are the various distance measures. On average, bilateral migration flow falls by 1.2% for each 1% increase in the distance between regions. Migration between adjacent regions is on average 2.6 times (exponential of 0.959) higher than among similar non-adjacent regions whereas migration between two regions is lower by 24% in case one of them is in Bohemia and the other in Moravia. Finally, migration is higher between regions that differ more strongly in terms of the sectoral composition.[7]

Furthermore, we find that time dummies are jointly significant and become increasingly more negative each year from 1992 to 1995. Interpreting the coefficients on year dummies as measuring "autonomous migration", this was around 17% below the 1992 level in 1993, 32% lower in 1994, and 42% lower in 1995. After 1996, autonomous migration stabilized at about 50% of the 1992 level.

{Table 6 around Here}

Results for Sub-Periods

The time pattern of migration discussed above suggests that the declining migration rate is largely a phenomenon specific for the pre-1996 period and thus associated with the early transition period. This decline in early transition could be attributed either to changes in the explanatory variables or due to changes in the behavior of migrants (i.e. changes in the estimated parameters of the model). The latter possibility seems particularly relevant in the context of transition economies because of the on-going dramatic institutional changes during transition. Transition is also likely to bring about important restructuring and learning processes both on the side of individuals and firms. This too may have led to changes in migrants' behavior.

To explore the possibility of a changing pattern of migration, we re-estimated (7) for two separate time periods (1992 to 1994 and 1996 to 1998).[8] We find indeed that several coefficients have changed substantially. In particular, migrants have become more sensitive to wage differentials and less sensitive to differences in labor-market tightness. While wages in the receiving and sending regions remain insignificant for 1992 – 1994, in the sub-period 1996 to 1998 a 1% increase in the receiving-region wage increases migration by around 1%. By contrast, the significant effect of the vacancy rate in the receiving region disappears in the second period. Furthermore, unemployment, which although insignificant has the correct signs in the 1992-94 regression, appears with the wrong signs (positive in the receiving and negative in the sending region) in the 1996-98 regression, although they are still not significant. This suggests that at the outset of transition, when uncertainty about the eventual outcome of the reform effort was relatively high, Czechs were apparently more concerned about employment prospects than potential earnings gains.

Furthermore, distance becomes a more important deterrent to migration in the later period, thus pointing to increasing problems of spatial matching in the Czech Republic. The elasticity of migration with respect to distance increased from 1.14 to 1.2. Although this change may seem small in absolute terms, the two coefficients are significantly different from each other. The impact of structural factors (employment in industry and agriculture) has changed considerably too – share of agricultural employment in the receiving region in particular seems to discourage migration in the early years but encourage it later.

A Decomposition of Flows

To assess the relative importance of parameter changes and changes in explanatory variables we perform decomposition in the spirit of Oaxaca (1973). Starting from equation (7) and denoting as $(\hat{q}_{92/94}, \hat{f}_{92/94}, \hat{w}_{92/94})$ as the estimated parameters for the period 1992 to 1994 and as $(\hat{q}_{96/98}, \hat{j}_{96/98}, \hat{w}_{96/98})$ those for the time period 1996 to 1998, the difference in the forecasts of the sum of log of migration over all regions for the two sub-periods may be written as:

$$(8)\quad \begin{aligned}&\sum_i \sum_j (\ln \hat{M}^{98}{}_{ij} - \ln \hat{M}^{92}{}_{ij}) = \left\{ \sum_i \sum_j [\hat{q}_{96/98}(Y_{ij98} - Y_{ij92})] \right\} + \\ &\left\{ \sum_i \sum_j [(\hat{q}_{96/98} - \hat{q}_{92/94}) Y_{ij92}] - \sum_j (\hat{j}_{j96/98} - \hat{j}_{j92/94}) + \sum_i (\hat{w}_{i96/98} - \hat{w}_{i92/94}) \right\}\end{aligned}$$

where the first term on the right hand side of (8) in compound brackets measures the change in migration which would have occurred if parameters had stayed constant at the (96/98) values throughout and only the values of variables had changed. The second term by contrast gives the predicted change in migration if variable values had been at their 1992 levels and only parameters had changed.[9] Furthermore, since the problem is linear we can further decompose the first effect for each of the k variables in the Y_{ijt} such that: $CiV^k = \sum_i \sum_j q^k_{96/98}(Y^k_{ij98} - Y^k_{ij92})$ with CiV^k the change in variable effect for this subgroup of variables.[10]

Performing this decomposition (table 7 column 1) we predict a reduction in the sum of log migration of 1632 relative to an actual decrease of 1354. Therefore, although our model slightly overestimates the decline in migration the overall fit seems satisfactory. Furthermore, results indicate that changes in behavior (parameter changes) were the most important factor responsible for falling migration in the Czech Republic whereas changes in determinants of migration in fact worked in the direction of increasing migration. If coefficients had been at their 1998 level in 1992, migration should have been lower in 1992 than in 1998. A substantial part of this change was due to increasing wage differentials. Of the total predicted increase due to variable changes of 3974 over 95% can be explained by the combined effect of sending and receiving region wages, and a further 10% are due to increasing regional disparities in unemployment rates and vacancy rates, while changes in dwellings and differences in employment structure actually worked to reduce migration.

{Table 7 around here}

Robustness of Results

Our results thus suggest that the decline in migration in the Czech Republic in the period 1992 to 1998 was primarily due to changes in the behavior of migrants – specifically, changes in their response to factors determining migration. Although wage disparities have become more important for migratory movements, distance has become a stronger deterrent to migration and unemployment and vacancy rates have become insignificant. These results are robust to including bilateral rather than sending and receiving region fixed effects (results obtained when estimating equation (6) are reported in Table A1 in the Appendix). The results with bilateral fixed effects are very similar to those reported above. In particular in all specifications the stylized facts of increased significance of wage differentials, reduced significance of unemployment and vacancy rates as well as a lower coefficient on distance between regions hold. Furthermore, performing the Oaxaca decompositions yields similar results as above (see column 2 of Table 7). Migration would have increased rather than decreased if parameters had remained at their 1992/1994 levels, with most of this predicted increase accounted for by wage divergence. Increasing unemployment and vacancy rate disparities would have contributed to increasing rather than decreasing migration and the effect of dwellings construction should have reduced migration. The only variable on which results disagree is the sectoral specialisation.[11]

6 Conclusions

This paper explores potential explanations of the falling intensity of migration that occurred in the Czech Republic (and, similarly, in other transition economies) despite increasing regional disparities. We show that the decline in the extent of migration between 1992 and 1998 is primarily driven by falling long-distance migration. By contrast, short distance migration remained more or less stable and migration between cities and their environs has in fact increased. Furthermore, while gross migration has fallen, net migration has increased. These stylized facts suggest that declining migration reflects increased problems of spatial matching between job opening and workers.

When analyzing determinants of bilateral migration between 1992 and 1998, we find evidence of important changes in the behavior of migrants, which can fully account for the decline in migration in the Czech Republic. Although wage disparities have become more effective in inducing inter-regional migration, the impact of labor-market tightness (measured by vacancy and unemployment rates) on migration has weakened. Moreover, distance has become a stronger barrier to migration over time.

These results suggest that as the Czech Republic moved from central planning to market, spatial matching between workers and jobs has become increasingly difficult. Other potential explanations are rising migration costs and liquidity constraints. Given that Czech migration rates are already very low even by European standards, this development is worrying. In a market economy, migration plays a crucial role by reducing economic disparities among regions. Future research should therefore focus on identifying the deterrents to mobility at the aggregate and individual level alike.

References

Boeri, Tito and Stefano Scarpetta (1996) Regional mismatch and the transition to a market economy, Labour Economic, 3, pp. 233 – 254

Burda, Michael C. and Profit Stefan (1996) Matching Across Space: Evidence on Mobility in the Czech Republic, Labour Economics, 3, pp. 233 - 254.

Burda, Michael C. and Michael Funke (1993) German Trade Unions after Unification – Third Degree Wage Discriminating Monopolists?, Weltwirtschaftliches Archiv, pp 537-559

Cameron, Colin A. and Pravin K. Trivedi, (1986) .Econometric Models Based on Count Data: Comparisons and Applications of Some Estimators and Tests, Journal of Applied Econometrics; pp. 29-53.

Cameron, Colin A. and Pravin K. Trivedi, (2001) .Essentials of Count Data Regression, in Badi Baltagi (ed.) A Companion to Theoretical Econometrics, Blackwell, Oxford ; pp. 331 - 348.

Cameron, Gavin and John Muellbauer (1998) The housing Market and Regional Commuting and Migration Choices, Scottish Journal of Political Economy, Vol. 45, pp. 420 –446.

Crozet, Mathieu (2001) Do Migrants Follow Market Potentials, manuscript, University of Paris 1 Pantheon – Sorbonne

Daveri, Franceso and Riccardo Fianni (1999) Where do Migrants go? Oxford Economic Papers, Vol. 51, pp. 595 – 622.

Decressin, Jörg W. (1994), "Internal Migration in West Germany and Implications for East-West Salary Convergence," Weltwirschaftliches Archiv **130** (2), 231-257.

Fidrmuc, Jan (2003) Migration and Regional Adjustment to Asymmetric Shocks in Transition Economies, CEPR Discussion paper No. 3798

Fields, Gary S. (1979) Place to Place Migration: Some new Evidence, Review of Economics and Statistics, Vol. LXI, pp. 21 – 32.

Gorzelak G. (1996) The regional Dimension of Transformation in Central Europe, Regional Studies Association, London

Greene, W. H. (1997), Econometric Analysis, 3rd edition, Upper Saddle River, New Jersey.

Harris, J.R. and M.P. Todaro (1970), "Migration, Unemployment and Development: A Two Sector Analysis," *American Economic Review* **60** (1), 120-142.

Hunt, Jennifer (2000) Why do People Still Live in East Germany, CEPR Discussion Paper No. 123, London.

Juarez, Juan Pablo (2000) Analysis of interregional Labour Migration in Spain using Goss Flows, Journal of Regional Science, Vol. 40, pp. 377 – 399

Jackman, Richard and Savvas Savouri (1990) An Analysis of Migration Based on the Hiring Function, Applied Economics Discussion Paper Series No. 98, University of Oxford

Jones, F.L. (1983) On Decomposing the Wage Gap – A Critical Comment on Blinder's Method, Journal of Human Resources, pp.126-130

Mc Fadden D. (1973) Conditional Logit Analyses of Qualitative Choice Beahvior, in Frontiers in Econometrics, Academic Press, New York

Molho, Ian (2001) Spatial Search, Migration and Regional Unemployment, Economica, Vol. 69, pp. 269 – 283

Oaxaca, R. (1973) Male-female wage differentials in urban labour markets, International Economic Review, pp. 5 –21.

Oaxaca, Ronald L. and Michael R. Ransom (1994) On discrimination and decomposition of wage differentials, Journal of Econometrics, pp 5 - 21

Profit, St. (1999) Divergence in regional Unemployment: An Empirical Investigation of Job Matching in the Czech Republic, in G. Crampton (Ed.) Regional Unemployment, Job Matching and Migration, Pion, London, S 11-34

Scarpetta, Stefano and Peter Huber (1995) Regional Economic Structures and Unemployment in Central and Eastern Europe: An Attempt to Identify Common Patterns in Stefano Scarpetta and Andreas Wörgötter Eds. The Regional Dimension of Unemployment in transition Economies, OECD, Paris.

Vanderkamp, J. (1971) Migration Flows and the Effects of Return Migration, Journal of Political Economy, pp 1012 – 31.

Wall, Howard J. (2001) Voting with your feet in the United Kingdom: Using Cross migration Rates to estimate relative living Standards, Papers in Regional Science, Vol.80, pp. 1 – 23

Westerlund, Ole (1997) Employment Opportunities, Wages and Interregional Migration in Sweden 1970 – 1989, Journal of Regional science 37(1), pp. 55-73

ENDNOTES

[1] Such churning can result from individual heterogeneity in skill levels and occupation, preferences or life cycle position (e.g. students migrating to places of education) and differences in the structure of regional labour demand (see Fields, 1979). Also, spatial search models (Jackman and Savouri, 1990, Molho, 2001) predict churning as a result of stochastic matching.

[2] Net migration can be calculated by: $N = \frac{1}{2}\left[\frac{\sum_i |O_i - M_i|}{\sum_i POP_i}\right]$ where O_i and M_i stand for outflows and inflows, respectively, and POP_i is the population in region i. This leads to the following relationship between gross and net flows $\left[\frac{\sum_i (O_i + M_i)}{\sum_i POP_i}\right]\left[\frac{\sum_i |O_i - M_i|}{\sum_i (O_i + M_i)}\right] = \left[\frac{\sum_i |O_i - M_i|}{\sum_i POP_i}\right]$ with the first term in brackets on the left hand side being the gross migration rate and the second the share of net flows in total flows.

[3] This exception may be due to regions bordering on the town (Opava, Karvina, Novy Jicin, and Frydek Mystek) not being typical suburban districts but having a high share of industrial employment themselves.

[4] The hypothesis of $\alpha_{11}=\alpha_{12}$ and $\alpha_{21}=\alpha_{22}$ can be rejected for all significant variables in our specifications.

[5] The negative binomial distribution, is derived from Poisson distribution, this is appropriate since the expected number of migrants from region i to j is binomially distributed which can be approximated by a Poisson distribution with $\lambda_{ij}=N_iP_{ij}$ if N_i is large. It was chosen since in raw data indicates over-dispersion (i.e. the variance of migration is larger than its mean).

[6] This is measured as the sum of absolute differences of the shares of agriculture, industry and services between two regions

[7] We tested whether the over-dispersion parameter (δ) was significant. This was the case for each and every specification. The null of sending and receiving region fixed effects jointly equalling zero can be rejected at all conventional significance levels.

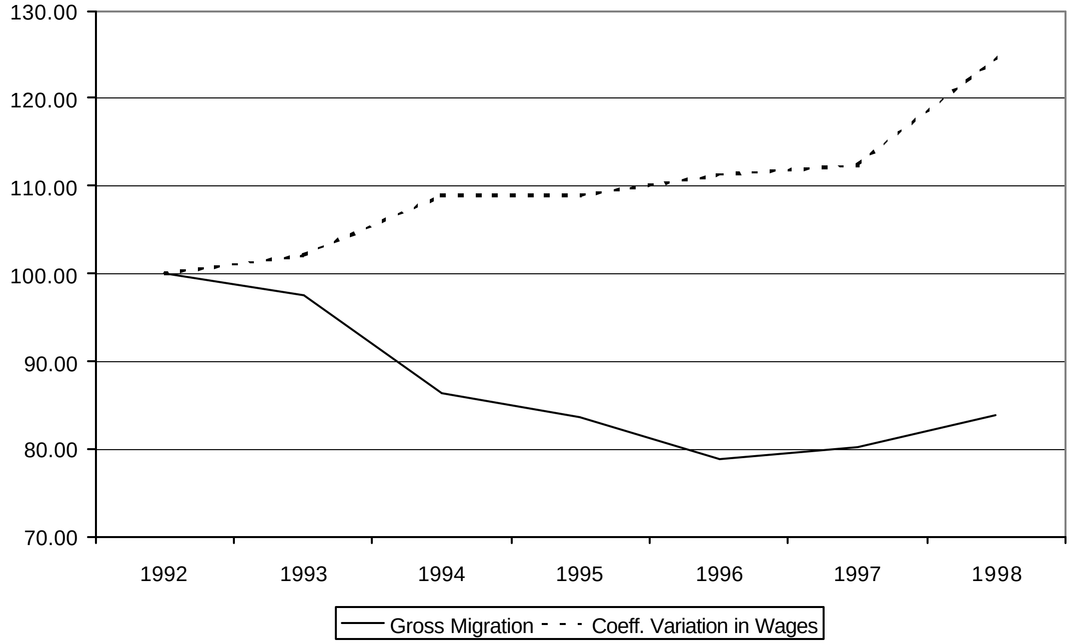
[8] We omit the year 1995 since for some of our estimation results we find a significant change in this year and for others not (see appendix). Results are, robust to adding 1995 to both the first or the second period.

[9] This decomposition assumes that the 1996/98 coefficients are undistorted (see: Oaxaca and Ransom, 1994). This is plausible, since as shown above post 1996 migration rates did not change significantly

[10] The effect of changes in parameters can not be further decomposed since results would depend on choice of base categories for dummies and standardisations of variables (see: Jones, 1983)

[11] In addition we also experimented with including environmental variables (NO_X, SO_2 and solid waste emissions), population as well as population density and the number of schools as proxies for amenities and congestion effects in the regression. Also the number of licensed enterprises per 100 inhabitants was included to proxy for the size of the newly formed private sector and indicators of the population structure (the share of female population, the share of handicapped unemployed and the share of unemployed school leavers) were included to correct for potential differences in search intensities of the populations of the sending region. These variables were insignificant in regressions for sub-periods. In the overall regression only environmental variables were significant but had the wrong sign, since aside from amenities they also proxy for industrial production decline in a region. Inclusion of these additional variables, however, had no effect on the qualitative findings presented above.

Figure 1: Development of Gross Migration Rates, Coefficient of Variation of Wages and Unemployment Rates across 74 districts in the Czech Republic



Note: 74 regions (okresy), excluding Sumperk, Bruntal and Jesenik.

Table 1: Place to place migration in the Czech Republic by distance and year

Distance [a)]	1992	1993	1994	1995	1996	1997	1998
<50	9204	15133	13599	13574	12749	13506	14009
50 to 100	15758	14680	13194	12628	11881	11943	12432
100 to 200	14250	10621	9443	9063	8427	8389	8522
200 to 300	5913	4602	3851	3715	3460	3436	3508
300 to 400	2364	1888	1712	1557	1437	1502	1583
400 to 500	1674	818	699	651	645	629	621
Total	49162	47741	42498	41188	38699	39403	40774

Note: The table reports the total number of moves between regions for 74 regions (okresy) excluding Sumperk, Bruntal and Jesenik a) Measured in Kilometres between district (okres) capitals

Table 2: Decomposition of Total Gross floss in the Czech Republic

	Gross Flows	Net Flows	Share of Net flows in Gross Flows
1992	0.56	0.05	9.82
1993	0.63	0.07	10.42
1994	0.47	0.05	11.13
1995	0.44	0.06	12.83
1996	0.42	0.06	13.73
1997	0.43	0.08	18.44
1998	0.44	0.10	21.96

Note: All figures are a percentage of total population for 74 regions (okresy) excluding Sumperk, Bruntal and Jesenik

Table 3: Migration in the main urban regions

	Prague		Plzen		Brno		Ostrava		Total moves in Agglomerations
	Suburbs to City	City to Suburbs	Suburbs to City	City to Suburbs	Suburbs to City	City to Suburbs	Suburbs to City	City to Suburbs	
1992	1563	2023	1121	1091	1189	1090	2505	2895	13477
1993	1778	2028	990	982	1046	1117	2044	2588	12573
1994	1481	2004	763	1040	873	1045	1819	2106	11131
1995	1359	2209	795	968	815	1283	1784	1838	11051
1996	1274	2250	649	991	796	1183	1694	1985	10822
1997	1128	2607	631	1079	811	1458	1569	1991	11274
1998	1055	3075	584	1307	785	1341	1641	2179	11967

Note: The environs of the respective cities were defined as follows Prague: Prague East and Prague West; Plzen: Plzen South, Plzen North and Rokycany; Brno: Brno-venkov; Ostrava: Novy Jicin, Opava Karvina, Frydek Mystek.

Table 4: Distribution of Observations by Number of Migrants

Number of migrants	No of Observations	Frequency	Cumulative Frequency
0	5226	12.77	12.77
1-10	25763	62.93	75.70
11-100	8553	20.89	96.59
101-1000	1373	3.35	99.95
>1000	22	0.05	100.00
Total	40937	100.00	

Note: 74 regions (okresy) excluding Sumperk, Bruntal and Jesenik

Table 5: Means and Standard Deviations of regression variables by year

Variable	1992	1993	1994	1995	1996	1997	1998
Migration	1447	1378	1222	1185	1116	1139	1179
	(1254)	(1287)	(1203)	(1283)	(1236)	(1320)	(1486)
Population	135727	135967	135962	135931	133966	133814	133701
	(137697)	(137952)	(137637)	(137413)	(136303)	(135748)	(135105)
Employment	45086	45060	43246	41100	39346	44701	43366
	(57427)	(49307)	(48465)	(49067)	(48912)	(57462)	(55565)
Employment in Agriculture	6583	4057	4113	2741.63	3798.63	2755.08	2516
	(2721)	(1885)	(1928)	(1450)	(1890	(1508)	(1356)
Employment in Industry	20870	22059.20	20960.74	15788.18	14820.06	17160.95	16670
	17978	(17938.69)	(16382.93)	(11621.31)	(10975.49)	(12276.76)	(11423.00)
Nominal Wages	4376	5557.53	6509.84	7669.11	9072.39	10001.01	10827
	(343)	(442.08)	(549.60)	(652.03)	(888.93)	(1000.87)	(1054.00)
Unemployment rate	2.90	3.90	3.38	3.12	3.79	5.63	7.81
	(1.40)	(1.93)	(1.72)	(1.65)	(1.90)	(2.51)	(3.04)
Vacancies	1044	710	1008	1159	1091	809	489
	(2101)	(1566)	(1632)	(1603)	(1316)	(835)	(591)
Dwellings completed	1585	1413	1105	782.17	538	503	621
during the last 3 years	(2045)	(2109)	(1831)	(1400)	(947)	(625)	(822)
Flow from Moravia to	0.44	0.44	0.44	0.44	0.44	0.44	0.44
Bohemia [a)]							
Neighbor [a)]	0.06	0.06	0.06	0.06	0.06	0.06	0.06

Note: a) Indicator variables standard deviation is given by sqrt(mean*(1-mean)), all data for 74 regions (okresy) excluding Sumperk, Bruntal and Jesenik

Table 6: Estimation results for the equation 7

	1992-1998	1992 – 1994	1996 - 1998
ln (staying population)	1.215***	1.189***	1.151***
	(0.096)	(0.172)	(0.202)
ln (distance)	-1.172***	-1.143***	-1.204***
	(0.009)	(0.014)	(0.014)
Neighbour	0.959***	0.971***	0.940***
	(0.016)	(0.025)	(0.025)
Moravia – Bohemia	-0.267***	-0.283***	-0.263***
	(0.011)	(0.017)	(0.017)
structural difference	0.020***	0.020***	0.026***
	(0.005)	(0.009)	(0.008)
ln wage in sending region	0.241	-0.141	-0.217
	(0.154) [a)]	(0.307)	(0.473)
ln wage in receiving region	0.206	0.162	1.001**
	(0.157) [a)]	(0.327)	(0.493)
ln unemployment rate sending region	0.029	0.017	-0.016
	(0.019)	(0.040)	(0.046)
ln unemployment rate receiving region	0.001	-0.070	0.081
	(0.021)	(0.045)	(0.054)
ln vacancy rate in sending region	0.001	-0.013	-0.021
	(0.014) [c)]	(0.027)	(0.024)
ln vacancy rate in receiving region	0.071***	0.072**	0.005
	(0.014) [c)]	(0.028)	(0.024)
ln housing availability in sending region	0.001	-0.027	-0.017
	(0.016) [c)]	(0.045)	(0.036)
ln housing availability in receiving region	0.060***	-0.015	0.027
	(0.016) [c)]	(0.053)	(0.036)
ln industrial employment share in sending region	0.011	0.169*	0.039
	(0.058)	(0.102)	(0.140)
ln industrial employment share in receiving region	-0.067	-0.069	-0.186
	(0.057)	(0.102)	(0.141)
ln agricultural employment share in sending region	0.006	0.006	0.012
	(0.018)	(0.048)	(0.027)
ln agricultural employment share in receiving region	-0.045***	-0.104*	0.050**
	(0.018)	(0.049)	(0.027)
y98	-0.688***		
	(0.205)		
y97	-0.679***		0.075
	(0.187)		(0.068)
y96	-0.641***		0.143
	(0.165)		(0.147)
y95	-0.541***	-0.271	
	(0.125)	(0.186)	
y94	-0.380***	-0.118	
	(0.091)	(0.113)	
y93	-0.188***		
	(0.057)		
Log Likelihood	-120109	-61064	-67672
No- Observations	37807	16203	16203

Notes: Data on 74 regions (okresy) excluding Sumperk, Bruntal and Jesenik. Values in brackets are standard errors of the estimate, specification includes fixed effects for each sending and each receiving region as in (7) these are not reported, the log-likelihood of an estimation with only sending and receiving region fixed effects is -131572 and its Pseudo R2 0.04*** (**) (*) signify significance at the 1%, 5% and 10% level, respectively. a) b) c) Indicate that for the respective variable the coefficient of the sending region variable differs significantly from that of receiving regions at the 10%, 5%, 1% level respectively.

Table 7: Results of a Decomposition of the decline in Migration

	Baseline model[a)]	Bilateral fixed effects[b)]
Parameter Changes	- 5607.51	-5676.47
Variable Changes Combined Effect of		
Population of sending district	15.18	11.32
Structural differences	5.14	2.17
Sending and receiving region wages	3835.18	3464.24
Sending and receiving region unemployment rates	373.03	421.74
Sending and receiving vacancy rates	47.86	23.08
Sending and receiving region dwellings	-51.09	-114.95
Sending and receiving region industry share	106.95	424.23
Sending and receiving region agriculture share	-357.46	-3.46
Total Variable Change	3974.79	4228.38
Total Predicted Change (variables and parameters)	- 1632.72	- 1448.09
Actual Change	- 1335	- 1335

Note: The table reports predicted increase in log of migration from 1992 to 1998. a) see table 6 for full model b) see table A1 in the appendix for results with bilateral fixed effects.

Appendix: Table A1: Estimation results for an Alternative Model with bilateral fixed effects

	Overall Time Period	1992 –94	1996 – 98
ln (staying population)	0.711***	0.897***	0.858***
	(0.034)	(0.066)	(0.073)
structural difference	0.011	0.026*	0.011
	(0.008)	(0.014)	(0.014)
ln wage in sending region	0.143	0.080	-0.402
	(0.088) c)	(0.209)	(0.283) c)
ln wage in receiving region	0.332	0.355*	1.214***
	(0.197) c)	(0.211)	(0.248) c)
ln unemployment rate receiving region	-0.075***	-0.132***	0.060*
	(0.014) b)	(0.029) c)	(0.031) a)
ln unemployment rate sending region	0.028**	-0.009	0.022
	(0.013) b)	(0.030) c)	(0.030) a)
ln vacancy rate in receiving region	0.071***	0.076***	0.018
	(0.011) c)	(0.020) b)	(0.017)
ln vacancy rate in sending region	-0.010	-0.019	-0.009
	(0.011) c)	(0.020) b)	(0.018)
ln in housing availability in sending region	0.004	-0.011	-0.004
	(0.012) c)	(0.036)	(0.025)
ln housing availability in receiving region	0.049***	-0.037	0.028
	(0.012) c)	(0.034)	(0.025)
ln industrial employment share in sending	0.009	0.254***	-0.086
region	(0.037) c)	(0.067)	(0.091)
ln industrial employment share in receiving	-0.189***	-0.298***	-0.509***
region	(0.037) c)	(0.065)	(0.088)
ln agricultural employment share in	-0.012	-0.027	0.001
sending region	(0.012) c)	(0.027) c)	(0.019)
ln agricultural employment share in	-0.110***	-0.179***	0.002
receiving region	(0.011) c)	(0.026) c)	(0.018)
y98	-0.982***		
	(0.121)		
y97	-0.979***		0.143
	(0.111)		(0.141)
y96	-0.897***		0.328
	(0.099)		(0.287)
y95	-0.790***		
	(0.073)		
y94	-0.512***	-0.448***	
	(0.055)	(0.122)	
y93	-0.260***	-0.219***	
	(0.034)	(0.071)	
log Likelihood	-80146	-24028	-25998
No- Observations	37807	16203	16203

Notes: Values in second row are standard errors of the estimate, specification includes bilateral fixed effects *** (**) (*) signify significance at the 1%, 5% and 10% level, respectively. a) b) c) Indicate that for the respective variable the coefficient of the sending region variable differs significantly from that of receiving regions at the 10%, 5%, 1% level respectively

Appendices (not for Publication)

Appendix 2: Results for further variables & excluding the Moravia-Bohemia variable

Aside from the results reported in the main text we experimented with a number of additional variables which could be deemed important in migration. In particular to proxy for differences in regional amenities between regions various indicators on the differences in emission of hazardous wastes between different locations. Emission of solid waste, SO2 and NOx in tons per square kilometre were employed. To capture differences in amenities associated with the provision of public infrastructure the number of upper secondary education institutions per inhabitant as were included. Finally, the number of licensed enterprises was employed as an additional proxy for expectations of future development, since literature suggests that enterprise formation is high where expectations of the future are good.

Table A1.1. displays the descriptive statistics for these variables and documents increasing private sector activity as measured by the number of licensed private enterprises – a fact which results from the substantial number of new start-ups registered at the beginning of transition, and decreasing emissions of hazardous wastes, which can in part be attributed to declining industrial production and in part to increased investments in environmental quality.

Table A1.1: Means and Standard Deviations of regression variables by year

Variable	1992	1993	1994	1995	1996	1997	1998
No of licensed	13298	14915	12692	16362	16531	16213	19729
Entrepreneurs	(23450)	(22920)	(17584)	(29901)	(22770)	(22400)	(26396)
Emission of Solid Wastes	9.10	7.13	5.81	4.27	2.64	2.35	1.40
(tons per square kilometre)	(24.19)	(20.26)	(15.69)	(12.26)	(7.98)	(7.52)	(4.34)
Emission of SO2 (tons per	28.37	24.15	22.37	19.74	18.74	16.08	12.55
square kilometre)	(68.58)	(59.70)	(56.54)	(54.96)	(52.33)	(42.78)	(31.70)
Emission of Nox (tons per	10.83	9.77	7.54	4.66	4.52	4.04	3.56
square kilometre)	(25.35)	(22.46)	(17.49)	(10.65)	(10.82)	(9.85)	(8.75)
Number of upper secondary	11.35	11.91	14.02	16.39	18.34	15.27	14.55
schools	(10.50)	(13.18)	(16.31)	(19.73)	(21.66)	(20.58)	(19.17)

Results concerning the impact of environmental variables on migration show that higher NOx emissions as well as higher solid waste emissions in the receiving region lead to higher immigration and higher emissions of SO_2 in the sending region lead to lower emigration. Thus on net, migration was from less to more polluted regions rather than in the opposite direction. This may be explained by potential co-linearities with other important aspects of regional development in the Czech Republic. In particular in the early phases of transition urban regions and agglomerations developed substantially better than other regions. To the extent that pollution captures such agglomerations, this could explain results. Also the reductions in emissions in the Czech Republic to some degree reflect the economic development in industry, again this may lead to measurement problems, since it was often argued that the absence of restructuring in the early phases in transition kept unemployment artificially low. The unexpected sign in emission could reflect production losses – and thus hidden unemployment – rather than differences in environmental quality. The differences in the number of schools per inhabitant between sending and receiving regions and the number of private enterprises per inhabitant, remained insignificant.

Table A1.2: Full Estimation results for the full observation Period (including environmental variables, school availability and privatization indicators)

	Overall Period		1992-1994		1996-1998	
	Coefficient	Std. Error	Coefficient	Std. Error	Coefficient	Std. Error
ln (staying population)	1.273***	0.108	1.119***	0.203	0.886***	0.255
ln (distance)	-1.172***	0.009	-1.148***	0.014	-1.204***	0.014
Neighbour	0.959***	0.016	0.973***	0.025	0.940***	0.025
Moravia – Bohemia	-0.267***	0.011	-0.281***	0.017	-0.263***	0.017
structural difference	0.020***	0.005	0.021***	0.009	0.025***	0.008
ln wage in sending region	0.217	0.156[a)]	-0.118	0.315	-0.399	0.480
ln wage in receiving region	0.166	0.158 [a)]	0.150	0.339	0.789**	0.317
ln unemployment rate receiving region	0.000	0.021	-0.077*	0.046	0.083	0.054
ln unemployment rate sending region	0.025	0.019	0.036	0.042	0.009	0.052
ln vacancy rate in receiving region	0.074***	0.014 [c)]	0.071**	0.028	0.006	0.025
ln vacancy rate in sending region	0.000	0.014 [c)]	-0.015	0.028	-0.009	0.025
ln in housing availability in sending region	0.004	0.016 [c)]	-0.019	0.046	-0.010	0.036
ln in housing availability in receiving region	0.065***	0.016 [c)]	-0.022	0.053	0.031	0.036
ln in industrial employment share in sending region	0.012	0.059	0.192	0.104	0.098	0.142
ln in industrial employment share in receiving region	-0.053	0.058	-0.057	0.104	-0.181	0.143
ln agricultural employment share in sending region	0.013	0.018	-0.002	0.049	0.014	0.027
ln agricultural employment share in receiving region	-0.041**	0.018	-0.089*	0.049	0.039	0.027
Ln in nox emissions (sending region)	-0.029**	0.011 [c)]	-0.007	0.021	-0.043*	0.025
(Ln in nox emissions (receiving region)	-0.020*	0.011 [c)]	-0.038*	0.022	0.009	0.025 [a)]
Ln in solid waste emissions (sending region)	-0.025***	0.009[b)]	-0.028	0.019[a)]	-0.013	0.018 [a)]
Ln in solid waste emissions (receiving region)	-0.005	0.009[b)]	-0.019	0.019[a)]	-0.013	0.019
Ln in so2 emissions (sending region)	0.006	0.009[b)]	-0.008	0.020	0.012	0.017
Ln in so2 emissions (receiving region)	0.024***	0.009[b)]	0.034	0.021	0.028	0.017
ln in school provision (sending region)	0.016	0.024	0.046	0.053	0.070	0.047
ln in school provision (receiving region)	0.021	0.028	0.050	0.059	-0.103	0.071
ln in small scale enterprises (sending region)	-0.018	0.033	0.028	0.046	-0.148	0.101[b)]
ln in small scale enterprises (receiving region)	0.007	0.032	-0.037	0.045	-0.145	0.095 [b)]
y98	-0.680***	0.210			0.003	0.075
y97	-0.668***	0.190			0.059	0.151
y96	-0.641***	0.167	-0.311	0.194		
y95	-0.535***	0.126	-0.134	0.119		
y94	-0.370***	0.092				
y93	-0.169***	0.058				
log Likelihood	-106246		-47169		-43862	
Pseudo R2	0.22		0.22		0.23	
No- Observations	37807		16203		16203	
Schwartz IC	-184021		-60993		-58606	

Notes: Values in second row are standard errors of the estimate, specification includes sending and receiving region fixed effects *** (**) (*) signify significance at the 1%, 5% and 10% level, respectively. [a)] [b)] [c)] Indicate that for the respective variable the coefficient of the Sending region variable differs significantly from that of receiving regions at the 10%, 5%, 1% level respectively.

The main findings in the paper are confirmed by these additional estimates, however. The stylized facts of increased significance of wage differentials, reduced significance of unemployment and vacancy rates as well as a lower coefficient on distance between regions hold. This is also the case for specifications in which the dummy variable for migration between Moravia and Bohemia was excluded (see Table A2.3)

We also included additional characteristics of the sending regions, since we were concerned that if certain groups of the population are less mobile than others and if these groups are not evenly distributed across regions, this may result in biased estimates of the original specification. Since literature suggests that aside from macroeconomic variables, personal characteristics such as sex may have an important impact on the migration decision, we control for differences in the demographic composition of the sending regions population by including in our regressions the share of female population in a region as well as the share of handicapped, and school leavers among the unemployed, in order to control for differences in the search effectiveness of the unemployed of a region.

Table A2.3. Estimation results on (7) excluding dummy variable between Moravia-Bohemia

	Overall Period		1992-1994		1996-1998	
	Coefficient	Std. Dev	Coefficient	Std. Dev	Coefficient	Std. Dev
ln (staying population)	1.175***	0.097	1.153***	0.173	1.143***	0.204
ln (distance)	-1.299***	0.007	-1.279***	0.011	-1.329***	0.011
Neighbour	0.875***	0.016	0.881***	0.025	0.858***	0.024
Structdi	0.030***	0.005	0.032***	0.009	0.034***	0.008
ln wage in sending region	-0.109	0.113	-0.138	0.309	-0.193	0.478
ln wage in receiving region	-0.156	0.114	0.169	0.330	1.018**	0.498
ln unemployment rate receiving region	-0.011	0.020	-0.067	0.046	0.077	0.055
ln unemployment rate sending region	0.014	0.019	0.018	0.040	-0.019	0.047
ln vacancy rate in receiving region	0.070**	0.014	0.072**	0.028	0.005	0.024
ln vacancy rate in sending region	-0.002	0.014	-0.015	0.028	-0.020	0.024
ln in housing availability in sending region	0.009	0.016	-0.031	0.045	-0.018	0.036
ln in housing availability in receiving region	0.069***	0.016	-0.016	0.053	0.024	0.036
ln in industrial employment share in sending region	-0.009	0.058	0.165	0.103	0.042	0.142
ln in industrial employment share in receiving region	-0.095*	0.057	-0.075	0.103	-0.181	0.143
ln agricultural employment share in sending region	0.010	0.018	0.009	0.049	0.019	0.027
ln agricultural employment share in receiving region	-0.044**	0.019	-0.102***	0.049	0.054*	0.027
y93	0.001	0.017	-0.117	0.114		
y94	-0.077***	0.017	-0.271	0.187		
y95	-0.129***	0.026				
y96	-0.097***	0.028			0.140	0.149
y97	-0.053***	0.018			0.075	0.069
y98	-0.038	0.024				
log Likelihood	-106525		-47311		-43991	
No- Observations	37807		16203		16203	

Notes: Values in second row are standard errors of the estimate, specification includes sending and receiving region fixed effects *** (**) (*) signify significance at the 1%, 5% and 10% level, respectively.

These variables remain insignificant. Neither the share of handicapped unemployed and unemployed graduates in total unemployment nor the share of female population has a significant impact on the migration between regions in the Czech Republic. Furthermore, their impact on other variables in the regression remains small (see: Table A2.4).

Finally, we estimated a model where sending and receiving region parameters were restrained to be equal . This model too suggests increased significance of wage differentials, reduced significance of unemployment and vacancy rates as well as a lower coefficient on distance between regions.

Table A2.4. Results including sending region population Characteristics

	Overall Period		1992-1994		1996-1998	
	Coefficient	Std. Dev	Coefficient	Std. Dev	Coefficient	Std. Dev
ln (staying population)	1.223***	0.098	1.157***	0.181	1.129***	0.215
ln share of female population (sending region)	0.664	0.781	1.387	2.955	-4.105	5.689
ln share of handicapped unemployed (sending region)	-0.018	0.025	-0.101	0.044	0.015	0.063
Ln share of unemployed graduates (sending region)	0.005	0.016	-0.001	0.025	-0.025	0.057
ln (distance)	-1.172***	0.009	-1.143	0.014	-1.204	0.014
Neighbour	0.959***	0.016	0.972	0.025	0.940	0.025
Moravia – Bohemia	-0.267***	0.011	-0.283	0.017	-0.263	0.017
structural difference	0.020***	0.005	0.020	0.009	0.026	0.008
ln wage in sending region	0.215	0.158	-0.154	0.314	-0.181	0.495
ln wage in receiving region	0.206	0.157	0.161	0.327	0.996**	0.493
ln unemployment rate receiving region	0.001	0.021	-0.070*	0.045	0.081	0.054
ln unemployment rate sending region	0.021	0.021	-0.011	0.042	-0.012	0.049
ln vacancy rate in receiving region	0.071***	0.014	0.072**	0.028	0.005	0.024
ln vacancy rate in sending region	0.003	0.014	0.001	0.029	-0.015	0.025
ln in housing availability in sending region	0.001	0.016	-0.027	0.045	-0.015	0.036
ln in housing availability in receiving region	0.060	0.016	-0.015	0.053	0.027	0.036
ln in industrial employment share in sending region	0.003	0.058	0.197*	0.104	0.042	0.143
ln in industrial employment share in receiving region	-0.068	0.057	-0.070	0.102	-0.185	0.141
ln agricultural employment share in sending region	0.006	0.018	-0.018	0.049	0.012	0.027
ln agricultural employment share in receiving region	-0.045**	0.018	-0.103**	0.049	0.051*	0.027
y93	-0.180***	0.058	-0.123	0.114		
y94	-0.366***	0.093	-0.255	0.187		
y95	-0.522***	0.128				
y96	-0.615***	0.170			0.141	0.148
y97	-0.652***	0.191			0.073	0.068
y98	-0.658***	0.210				
log Likelihood	-106239		-47173		-43872	
No- Observations	37807		16203		16203	

Notes: Values in second row are standard errors of the estimate, specification includes sending and receiving region fixed effects *** (**) (*) signify significance at the 1%, 5% and 10% level, respectively.

Table A2.5. Results of a model with equal sending and receiving region variables

	Overall Time Period		1992 –94		1996 – 98	
	Coefficient	Std. Dev	Coefficient	Std. Dev	Coefficient	Std. Dev
ln (staying population)	1.144***	0.085	1.132***	0.148	1.109***	0.169
ln (distance)	-1.172***	0.009	-1.144***	0.014	-1.204***	0.014
neighbour	0.960***	0.016	0.971***	0.025	0.939***	0.025
Moravia – Bohemia	-0.267***	0.011	-0.282***	0.017	-0.263***	0.017
structural difference	0.021***	0.005	0.021***	0.009	0.023***	0.008
ln wage differentials	-0.017	0.110	0.123	0.221	0.612**	0.337
ln unemployment rate differentials	-0.014	0.014	-0.039	0.029	0.048	0.035
ln vacancy rate differential	0.035***	0.010	0.043**	0.020	0.013	0.017
ln differentials in housing construction	0.029***	0.011	0.013	0.034	0.022	0.025
ln employment share in industry differential	-0.040	0.041	-0.116	0.072	-0.111	0.099
ln employment share in agriculture differential	-0.026**	0.013	-0.057*	0.034	0.019	0.018
y93	-0.091***	0.014	-0.087***	0.014		
y94	-0.202***	0.014	-0.195***	0.014		
y95	-0.267***	0.014				
y96	-0.323***	0.014			-0.015	0.014
y97	-0.316***	0.014			-0.020	0.014
y98	-0.301***	0.014				

log Likelihood	-106252	-47179	-43874
No- Observations	37807	16203	16203

Notes: Values in second row are standard errors of the estimate, specification includes sending and receiving region fixed effects *** (**) (*) signify significance at the 1%, 5% and 10% level, respectively.

Appendix 3: Influence of estimation period

In the main part of the text we omit the year 1995 from estimation. We were concerned that this may have an impact on results. For this reason we experimented with including the year 1995 in both the first and second sub-period in the main part of the paper (see: Table 3.1). This has only little impact on the estimation results.

Table A3.1 Results when changing sub-periods

1992 to 1995	Coefficient	Std Dev	1995 to 1998	Coefficient	Std Dev
ln (staying population)	1.226***	0.132	ln (staying population)	1.243***	0.166
ln (distance)	-1.152***	0.012	ln (distance)	-1.199***	0.012
neighbour	0.971***	0.022	neighbour	0.946***	0.021
Moravia – Bohemia	-0.274***	0.015	Moravia – Bohemia	-0.260***	0.015
structural difference	0.016	0.007	structural difference	0.021***	0.007
ln wage in sending region	-0.052	0.252	ln wage in sending region	-0.066	0.311
ln wage in receiving region	0.139	0.263	ln wage in receiving region	0.835**	0.196
ln unemployment rate receiving region	-0.032	0.032	ln unemployment rate receiving region	0.061	0.040
ln unemployment rate sending region	0.012	0.030	ln unemployment rate sending region	-0.008	0.035
ln vacancy rate in receiving region	0.044**	0.019	ln vacancy rate in receiving region	0.030	0.020
ln vacancy rate in sending region	-0.016	0.023	ln vacancy rate in sending region	-0.023	0.020
ln in housing availability in sending region	-0.013	0.031	ln in housing availability in sending region	-0.005	0.025
ln in housing availability in receiving region	0.007	0.035	ln in housing availability in receiving region	0.051**	0.025
ln in industrial employment share in sending region	0.091	0.082	ln in industrial employment share in sending region	-0.024	0.108
ln in industrial employment share in receiving region	0.025	0.082	ln in industrial employment share in receiving region	-0.086	0.107
ln agricultural employment share in sending region	0.011	0.030	ln agricultural employment share in sending region	0.016	0.024
ln agricultural employment share in receiving region	-0.110***	0.030	ln agricultural employment share in receiving region	0.023	0.024
y93	-0.087	0.091	y95	0.187	0.170
y94	-0.178	0.149	y96	0.055	0.096
y95	-0.236	0.210	y97	0.032	0.045
log Likelihood	-62142			-58796	
No- Observations	21604			21604	

Notes: Values in second row are standard errors of the estimate, specification includes sending and receiving region fixed effects *** (**) (*) signify significance at the 1%, 5% and 10% level, respectively.

Finally, we also estimated year by year regressions. In this case we are not able to identify a full set of bilateral variables. Our specification in thus reads $\ln(M_{ij}) = qY_{ij}$ (See tables A3.2). Substantial research (see: Alecke et al, 2001, Egger, 2002, Cheng and Wall, 2001) suggests that the omission of sending and/or receiving region fixed effects results in biased estimates due to omitted variables. The evidence presented in this appendix suggests that this bias is important. Relative to the results reported in the main part of the text a number of coefficients change signs while others lose significance and yet others gain significance. Furthermore, parameters become increasingly instable as we omit or include variables in these specifications. This suggest that not only do the specifications reported result in omitted variable bias, but they also increase the problem of multicolinearity in estimates

References

Alecke, Björn; Peter Huber and Gerhard Untiedt (2001) What A Difference A Constant Makes – How Predictable are International Migration Flows? in (J.P. Garcon ed.) Proceedings of The seminar on: Recent developments in migration and the labour market in Central and Eastern Europe in the context of the EU enlargement, OECD, Paris.

Cheng, I_Hui and Howard J. Wall (2001) Controlling for Heterogeneity in Gravity Models of Trade, Working Paper Series WP 1999-010B, Federal Reserve Bank of St. Louis,

Egger,-Peter (2002) ,An Econometric View on the Estimation of Gravity Models and the Calculation of Trade Potentials, World-Economy; pp. 297-312.

Table A3.1 Results of year by year regressions

	1992		1993		1994		1995		1996		1997		1998	
	Coeff.	Std Dev	Coeff.	Std Dev	Coeff.	Std Dev	Coeff.	Std Dev	Coeff.	Std Dev	Coeff.	Std Dev	Coeff.	Std Dev
ln (staying population)	0.522	0.036	0.701	0.034	0.716	0.034	0.745	0.033	0.789	0.033	0.777	0.034	0.771	0.038
ln (distance)	-1.004	0.025	-1.010	0.024	-1.040	0.025	-1.049	0.024	-1.022	0.024	-1.039	0.024	-1.020	0.024
neighbour	1.116	0.051	1.110	0.049	1.049	0.050	1.101	0.049	1.096	0.049	1.094	0.048	1.147	0.048
Moravia – Bohemia	-0.191	0.032	-0.334	0.031	-0.304	0.031	-0.276	0.031	-0.356	0.031	-0.327	0.030	-0.348	0.030
structural difference	-0.007	0.015	0.037	0.016	0.020	0.016	0.029	0.014	0.056	0.016	0.027	0.013	0.019	0.013
ln wage in sending region	1.182	0.224	0.831	0.238	-0.007	0.232	-0.227	0.236	0.323	0.248	0.335	0.223	-0.330	0.203
ln wage in receiving region	1.118	0.221	1.551	0.234	0.533	0.232	0.941	0.231	1.778	0.241	1.584	0.213	1.240	0.196
ln unemployment rate receiving region	0.014	0.024	-0.013	0.025	-0.017	0.023	0.067	0.022	0.050	0.027	0.116	0.033	0.203	0.040
ln unemployment rate sending region	0.155	0.023	0.156	0.025	0.112	0.022	0.130	0.022	0.205	0.027	0.257	0.032	0.271	0.040
ln vacancy rate in receiving region	-0.139	0.026	-0.140	0.028	-0.131	0.032	-0.016	0.034	-0.103	0.031	-0.010	0.031	-0.074	0.025
ln vacancy rate in sending region	0.056	0.028	0.008	0.029	0.051	0.033	0.059	0.034	0.084	0.031	-0.016	0.030	0.066	0.027
ln in housing availability in sending region	0.070	0.032	-0.007	0.029	-0.095	0.032	-0.122	0.037	0.074	0.037	0.159	0.039	0.131	0.043
ln in housing availability in receiving region	0.065	0.032	0.165	0.028	0.109	0.030	-0.085	0.037	-0.080	0.038	0.080	0.040	0.307	0.041
ln in industrial employment share in sending region	-0.835	0.063	-0.692	0.067	-0.665	0.074	-0.575	0.058	-0.354	0.058	-0.288	0.062	-0.353	0.061
ln in industrial employment share in receiving region	-1.220	0.060	-1.093	0.065	-0.918	0.074	-1.007	0.057	-0.731	0.058	-0.848	0.060	-0.955	0.056
ln agricultural employment share in sending region	-0.224	0.026	-0.139	0.026	-0.152	0.028	-0.117	0.021	-0.098	0.027	-0.111	0.020	-0.162	0.020
ln agricultural employment share in receiving region	-0.473	0.023	-0.358	0.024	-0.402	0.024	-0.275	0.019	-0.188	0.027	-0.190	0.019	-0.228	0.018
constant	-20.689	2.647	-23.878	2.852	-8.353	2.852	-11.452	2.894	-23.327	3.075	-20.758	2.753	-11.181	2.573
log Likelihood														
No- Observations														

Coeff-estimated coefficient, Std. Dev.- Standard deviation of the estimated coefficient