AccessLab

Regional Labour Market Adjustments in the Accession Candidate Countries

Workpackage No. 6

Thiess Büttner (ZEW)
Peter Egger (University Innsbruck)
Peter Huber (WIFO)
Anna Iara (ZEI)
Michael Pfaffermayr (University Innsbruck)
Johannes Rincke (ZEW)
Yvonne Wolfmayr-Schnitzer (WIFO)

The Impact of Integration on Wages and Employment in Border Regions

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Thiess Büttner (ZEW)
Peter Egger (University Innsbruck)
Peter Huber (WIFO)
Anna Iara (ZEI)
Michael Pfaffermayr (University Innsbruck)
Johannes Rincke (ZEW)
Yvonne Wolfmayr-Schnitzer (WIFO)

Assistance: Maria Thalhammer, Andrea Hartmann, Andrea Grabmayer

Project Partners:

WIFO - Austrian Institute of Economic Research (Lead)
CPB - Netherlands Bureau for Economic Policy Analysis
DIW - German Institute for Economic Research
EI - Hungarian Academy of Sciences - Institute of Economics
IZA – Institute for the Study of Labour
UCL/SSEES - University College London - School of Slavonic and East European Studies
ZEI - Centre for European Integration Studies
ZEW - Centre for European Economic Research

AccessLab

The 5th framework programme research project ACCESSLAB researches the capability of candidate countries' regions to deal with asymmetric shocks. Its goal is to provide analysts and policy makers with research results relevant to the process of enlargement. The project takes a broad and comparative view of labour market adjustments to address these issues. It examines the topic from both a macroeconomic and microeconomic viewpoint. It considers different adjustment mechanisms in depth and compares results with the European Union. It draws on a) the experiences in transition countries in the last decade, b) the experience of German integration and c) the experiences of border regions to gain insights on the likely regional labour market effects of accession of the candidate countries.

Web Page: http://accesslab.wifo.ac.at/

e-mail: huber@wifo.ac.at

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The Impact of Integration on Wages and Employment in Border Regions: Summary and Policy Conclusion

Peter Huber

Introduction

Border regions are usually considered to be more strongly affected by integration than inland regions. The traditional cross-border flows of trade, migration and FDI's, influence these regions more strongly, since they are usually distance dependent, and certain cross-border activities such as commuting, cross-border shopping and cross-border rendering of services with limited market areas, only impact on border regions. In the public debate, where EU-enlargement has generated substantial interest in the effects of integration on border regions recently, the net effects of these factors remain disputed, however. On the one hand, concerns are often voiced about potential negative wage and employment effects due to increased competitive pressures as well as capital and labour mobility. On the other hand, it has been repeatedly argued that integration alleviates the disadvantages of limited market access in border regions and should thus have particularly favourable effects.

Recent economic theories in the tradition of “geography and trade” models, suggest that determining, which of these arguments is true may be difficult to assess from a purely theoretical perspective. In these models the combination of increasing returns and localised externalities as well as agglomeration and transport costs leads to two countervailing effects when cross border transport costs are reduced (which is a synonym for increased integration in these models). On the one hand the increased demand potential leads to border regions becoming more attractive locations for production, because a larger demand potential can be accessed at low transport costs after integration. On the other hand this "market access effect" is countervailed by a market crowding effect which arises because firms located across the border will now also have improved access to the home market. This, ceteris paribus, will create incentives to move production away from the border in order to escape from more severe competition.

Recent theoretical contributions suggest that the likelihood of beneficial effects on border regions increases the smaller are the pre-existing centres in a country, the higher is the relative cost advantage of border regions in accessing new markets, the higher is the market potential across the border, the lower is the competitiveness of regions across the border, the lower is the extent of mobility of factors within the country and the lower is the

share of mobile sectors in a country. Finally, institutional aspects of integration may be of importance. In particular western European in contrast to North American integration has been characterised by allowing for migration.

Theory thus suggests that the effects of integration on border regions may be highly specific to the case studied. Recent empirical evidence corroborates this suggestion. For instance Hanson (1996, 1997 and 1998) finds that trade liberalisation and integration of Mexico led to more rapid wage and employment growth in Mexican border regions, but finds no effects on US production. This may be attributed to the fact that the Mexican market potential was to small to matter relative to the sizeable US market. Similarly, the few studies on European integration which focus primarily on the opening of Central and Eastern Europe or German unification in the 1990's (see Niebuhr and Stiller, 2004 and van Houtem 2004 for surveys) find that investments and firm start-ups in border regions have been only weakly affected by trade liberalisation.

The Contents of this Report

This report on Workpackage six of the AccessLab Project brings together three case studies on the effects of integration of border regions and the regional distribution of economic activity. These case studies include analyses of: the effects of previous enlargements on employment, wage and population growth as well as investment rates (chapter 1), the effect of German unification on the former border regions on western German regional labour markets in the time period from 1987 to 2000 (chapter 2), the effect of the opening of candidate countries in the 1990s on gross and net employment changes and firm creation in border regions of Austria (chapter 3). Together these contributions comprise deliverable 15 of the AccessLab project. In these case studies regional data is used for an assessment of the consequences of the border removal and integration on border regions with the aim of identifying integration shocks at the supply and the demand side of the labour market, determining how labour markets in border regions adopted to the integration and drawing conclusions on the effects of enlargement from the point of view of border regions.

Furthermore, this report comprises three research papers focusing on long run regional growth in the new EU member states and accession candidate countries. The common theme of these papers is to identify potential effects of integration on regional disparities in candidate countries. In particular in chapter 4 Huber, Pfaffermayr and Wolfmayr-Schnitzer measure the current size of border effects on the regional wage structure and attempt to forecast the potential effects of integration on regional wages for some of the new member states. In chapter 5

Iara explores the factors determining regional growth in Hungary paying particular attention to the role of foreign direct investments in shaping regional growth experiences, while in chapter 6 Egger, Huber and Paffermayr conduct a cross country study on the role of trade openness to foreign trade in causing regional disparities (chapter 6).

Results concerning the effects of Integration on border regions and the effects of Integration on regional development in candidate countries and new member states

Despite the obvious heterogeneity of the cases analysed and the wide research focus of the Workpackage a number of general conclusions can be drawn from the analysis. These can be summarised as follows:

1. In contrast to the effects of North American integration, which has moved industrial production in Mexico nearer to the border, effects of European Integration on border regions are more difficult to find, in general. In the European context integration seems to have a neutral effect on the regional distribution of economic activity, although examples of positive effects (which, however, are often small) and even negative effects on some border regions can be found. For instance the analysis of previous enlargements of the European Union by Greece, Spain and Portugal and Northern Enlargement by Huber (chapter 1) shows that over a seven year period after enlargement few significant effects relative to the period before accession can be found. But some evidence of higher wage and investment growth in border regions can be found over longer observation periods. The Austrian experience after the opening of Central and Eastern Europe after 1989 by Huber (chapter 3) by contrast shows that integration has had insignificant effects on firm creation but a small positive effect on employment growth, which is owed to reduced job destruction in border regions and in the case of German unification analysed by Büttner and Rincke (chapter 2) border regions were characterised by a fall in relative wage position and an increase in unemployment, even after controlling for the reduction in investment subsidies in these regions.

2. There is some evidence that integration effects may vary over time and regions. Concerning differences over time periods evidence on previous enlargements (chapter 1) suggests that border regions do not immediately profit from integration but that in the long run increased wages may be a result of integration for incumbent countries. Concerning differences in region types theory would suggest that border regions with a larger market potential across the border, weaker competition effect across the border, a high relative cost advantage in accessing the market potential and low migration and capital mobility across the borders,

should be more likely to profit from integration. The empirical papers presented in this work package find some evidence for this prediction. In particular the case study on Austria By Huber (chapter 3) finds significant effects only for the immediate border regions, that is those regions having the highest relative cost advantage in accessing the market.

3. Despite these small effects of previous integrations on European border regions, borders still are an important impediment to economic activity. The estimates of border effects in the wage structure presented by Huber, Pfaffermayr and Wolfmayr-Schnitzer (chapter 4) suggest that neighbours within the EU15 but in different countries affect each others wages significantly, but that for the EU15 regions the purchasing power of Non-EU15 regions is still an unimportant determinant of the wage level. Thus there are still significant border effects between EU15 and non-EU15 countries.
4. The returns to reducing these border effects could be high. Huber, Pfaffermayr and Wolfmayr-Schnitzer (chapter 4) estimate that wage effects due to a reduction of cross border transaction costs (border effects) in the process of EU enlargement are of a much higher magnitude for the new EU member states in the sample than for EU15 countries and that regions closest to the borders of the "old" and "new" EU are to gain most in terms of wage increases. In particular, our simulations suggest that wages in regions in the new member states near to the EU15 border should increase by 30% to over 100% if border effects were of the same magnitude as within the EU15. Regions more distant from the borders of the EU15 would also have higher wages in this case. For the old member states effects would be much smaller. Regions near the old EU15 border should experience wage increases between 0,4% and 1,56%. At the country level, the results for EU15 countries indicate the most pronounced wage effects for Austria (0,6%), followed by Germany (0,4%), Denmark, Sweden and Italy. Within the group of the new member countries the Czech Republic is to be most affected.
5. In the new member states of the European Union aside from location near the borders other processes associated with integration are also important for regional growth. This is evidenced by Iara's case study on the determinants of regional growth in Hungary since 1994 in chapter 5. This finds that high regional disparities have also been caused by the substantially faster growth in the western border regions of Hungary. However, factors other than location seem to also have an important impact on regional development. Regional growth has been positively influenced by the degree of export openness of a region

and FDI inflows. Furthermore this case study also shows that regions with a high share of Agricultural employment (i.e. rural regions) have shown by far the weakest growth performance in the last decade.

6. While increased integration in the international division of labour increases regional growth rates, not all regions will be able to achieve this goal to the same degree. Thus, trade liberalisation and or FDI inflows may well contribute to increasing regional disparities. This is shown for the case of increased foreign trade by Egger, Huber and Paffermayr (chapter 6). They find that the speed with which regional disparities within candidate countries and new member states have increased is positively correlated with the increase in trade volumes. Thus trade liberalisation has contributed to increased regional disparities in the new member states as well.

Policy Conclusions

On the policy side these results have a number of important implications. In particular the results suggest that benefits from integration for border regions relative to inland regions will not arise automatically, and that national borders still represent a major barrier to regional economic integration in the European Union. Thus active intervention may be needed to guarantee the maximum benefits of integration for border regions. Our results also suggest that some border regions will be more in need of such help than others:

- First, border regions of the newly joining countries to the old member states will in all likelihood profit more from integration than most other regions. Thus removing the barriers to integration through improving cross-border regional policy and increasing integration as are foreseen in the framework of objective III in the next structural funds period could potentially yield high rewards for regional policy. In particular the foreseen policies to improve the institutions delivering cross-border regional policies could be of high relevance in this context.
- Second, while policies that maximize the benefits from integration are needed the findings also raise a series of other important policy issues. In particular our findings also imply that more eastern regions, at the new external border of the EU – which already belong to the most deprived regions in the EU - will fall even further behind. Given this expectations it seems that effective policies to address the problems of these regions may have to be implemented. The principle options for such a policy could be either to increase integration through exports and foreign direct investments – which have gone to more Western regions in the new member states, - increase endogenous development potentials in the regions or to

enhance adjustment through emigration from these regions. While our results indicate that the first option may be more promising in general, it seems unlikely that these easternmost regions of the EU will recover from their adjustment problems rapidly (see also the results on Workpackage 5 on this point) since they are far from western European markets, have a lower endowment with infrastructure and are often characterised by a number of problems typical of many rural-peripheral regions.

- Third, one may expect that benefits from integration are hardest to achieve in regions which are structurally weak and not competitive and where the market potential across the border is low. A number of our results suggest cases in which particular policy intervention may be necessary. In particular rural-peripheral regions are facing problems. Furthermore, our results also indicate that migration may further increase adjustment problems in these regions. A number of old EU member states regions at the border to the CEEC in particular at the German-Polish border are characterised by structural problems and relatively high wages which impede on their competitiveness. This indicates that these regions may have substantial labour market adjustments ahead of them. Increasing the flexibility of regional labour markets and the adaptability of the work force in these regions may be an important element in remedying the potential problems of these regions.
- Fourth, our results suggest that benefits to integration to border regions accrue neither immediately nor automatically and that increased integration will reinforce tendencies of divergence in the new member states and candidate countries. Thus some policy measures may be needed to help the transitory adjustment problems of border regions. Furthermore we would argue that aside from posing institutional challenges to regional administrations, increased cross-border co-operation will also necessitate a review of national policies which impede on cross-border exchange.

This implies that some intervention in order to support border regions both at internal and external borders may be necessary also in the future. However, we would argue, that such an intervention directed at border regions should focus more directly on the causes of the border impediments and increased flexibility of the workforce. Thus the primary focus of such policy should be oriented to providing institutional support to cross-border governance and reducing institutional barriers to cross border exchange as well as increased efforts at improving the human capital base of those living in these regions.

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An Empirical Analysis of the Regional Effects of European Integration

Peter Huber
Austrian Institute of Economic Research (WIFO)
Arsenal Objekt 20
1030 Wien
e-mail: huber@wifo.ac.at

Abstract

This paper analyses the effects of three previous enlargements of the European Union on newly joining and old member states. We find that overall the effects of enlargements on regional employment, wage and population growth, as well as investment rates were small. We also find substantial heterogeneity between different accession episodes, stronger effects on wages than on employment and differences in long-term and medium term effects.

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Introduction

In the public debate the net effects of integration on the regional distribution of economic activity remain disputed. This applies in particular to border regions. On the one hand, concerns are often voiced about potential negative wage and employment effects due to increased competitive pressures as well as capital and labour mobility. On the other hand, it has been repeatedly argued that integration alleviates the disadvantages of limited market access in border regions and should thus have particularly favourable effects on these regions.

Recent economic theories analysing the effects of integration on regional economies provide some basis for both arguments. Starting from the assumption that the economic geography of a country is shaped by centripedal and centrifugal forces, where centripedal forces may arise from the interaction of (internal or external) economies of scale and the aim of producers to economize on transport costs, while centrifugal forces arise from increasing costs of immobile factors in central locations, non-pecuniary negative externalities and/or higher competition and thus lower mark-ups among producers in the centre, these "new economic geography models" (see: Fujita et al, 1999) suggest that integration and trade liberalisation have two coutervailing effects on regional economies.

On the one hand, as cross border transport costs fall, – which is a synonym for integration in these models, – market access to regions across the border improves. As a consequence of this "market access effect" (see: Otaviano and Robert-Nicoud, 2004), incentives to locate production in regions remote from the country's centre increase even when regions are equidistant from the border. The reason for this is that as the foreign market becomes more accessible it becomes less important to locate near home market demand centres, and more attractive to serve the foreign market from a location, such as the periphery, with lower prices for immobile factors. In consequence employment, productivity and wage growth should increase in regions further away

from a countries centre after integration and factor flows (i.e. investments and migration) to these regions should increase relative to the period before integration.[1]

On the other hand, due to the fall in transport costs, competition from producers across the border will also increase. When regions are equidistant from the border this "market crowding" effect will ceteris paribus create incentives for firms to relocate to central locations in order to exploit productivity enhancing externalities in the centre. Thus increased concentration of economic activity (i.e. lower employment, wage and productivity growth as well as lower factor fows relative to the situation before integration) may be a consequence of integration.[2]

These issues become more involved when regions are not equidistant from the national border and thus may (as in the case of border regions) attain an advantage of market access to the foreign market relative to other regions as a consequence of integration. Recently, Crozet and Koenig-Souberain (2002 and 2004) and Bruelhart, Crozet, Koenig, (2004) present a model which treats this additional complication. The results indicate that for a large set of parameters the market access effect will dominate. This tendency may, however, be broken if the advantages of increased market access are small relative to the costs of increased competition from abroad, which may be the case when the market potential that can be reached from the external border region is small relative to the internal market potential, or if cost advantages of the border regions relative to the countries centre in accessing the foreign market is small (i.e. countries are small) or if the pre-existing centres in the countries are large in terms of relative demand.

[1] Krugman and Livas (1992) and Fujita et al, (1999, Chapter 18) formalize this "market access effect" by assuming that the centrifugal force arises from the immobility of land. In their model a reduction in cross border transport unambiguoulsy increases incentives for firms to locate far from the county's centre.

[2] Paluzzie (2002) and Monfort and Nicolini (2000) present models, which incorporate both effects. In these the effect of integration on location is ambiguous but centralisation is predicted for a wide range of parameters.

Thus the central predictions of new economic geography models concerning the impact of integration on the regional structure of production are that depending on the relative strength of market access and market crowding effects, integration may lead to either increased concentration and a shift of production away from the border, or to increased decentralisation of production and a shift of production towards border regions.

Which of these tendencies prevails is an empirical issue. In consequence empirical estimates of regional integration effects are an important aspect of determinig the relvance of these theories. Despite this insight, evidence on the effects of integration on border regions is rare.[3] Among the exceptions Hanson (1996, 1998) uses the example of Mexico, to show that after trade liberalisation wages and employment increased more rapidly in Mexican regions closer to the border of the US. Hanson's analysis, however, concentrates on a particular case of integration of a developing country with one of the most highly developed countries in the world. Thus there is a need for testing the generality of these results in different institutional contexts. This has only been done in few cases only and results often contradict Hanson's. Hanson (1998a) reports much weaker effects of integration for Canada and the United States, Barjak and Heimpold (1999), Heimpold (2004) and Engel (1999) focus on investments and firm start-ups in the Polish – German border region and find no or only weak evidence of integration effects. Mayerhofer (2004) and Huber (2004) look at the effects of opening of Eastern Europe on Austrian border regions and find some evidence for small positive integration effects on employment growth, job creation and GDP per capita, but most other indicators used in these studies show no positive impact of integration. Finally, Büttner and Rincke (2005) find that German – German integration had negative effects on West German border regions.

In this paper we extend this literature to an analysis of the effects of EU integration on regional development both for existing as well as newly joining EU member states. This

[3] Research concentrated on measuring border effects, on case studies of individual border regions, while there is little comparative work of regions in a country (see van Houtem, 2000 and Niebuhr and Stiller 2002 for surveys).

is important not only because it delivers additional insights on the generality of previous results, but also because with the enlargment of the European Union by 10 countries in May 2004 issues of the regional effects of integration have recieved renewed interest in the policy arena. The analysis of previous enlargments could help shape expectations in this debate.

Data

We use annual Eurostat regional data at the NUTS II level provided to us by Cambridge Econometrics reaching from 1975 to 2000. These data allow us to assess the regional impact of European integration on NUTS II level employment, productivity, investments, as well as on wage and population growth for both existing and new member states, for three episodes of enlargement: Enlargement by Greece, in 1981, Southern Enlargement (by Spain and Portugal) in 1986 and Northern Enlargement (by Austria, Finland and Sweden) in 1995. We arrange this data so as to consider the 5 years before and 7 years after accession. Furthermore, for both Southern and Northern Enlargement we also focus on effects of integration on nearby member states. In the case of Southern Enlargement we choose France[4] as a neighbouring member state and in the case of Northern enlargement these are Denmark and Italy.[5]

These cases provide substantial variance with respect to the institutional circumstances of integration, the size, geographic structure and level of development of both the integrating countries as well as the nearby old member states.[6] In particular later entries

[4] We exclude French obverseas territories from the analysis.

[5] We do not include Germany because of lacking data for some indicators and because German – German integration in the 1990's may cause Germany to be a special case.

[6] The cases also differ from the US-Mexico case analysed by Hanson (1996, 1998). In contrast to this, European integration allowed for increased cross border labour mobility and new member states were often small, developed countries.

joined a successively more integrated European Union.[7] While this would suggest more sizeable effects of integration in later accessions, Northern Enlargement also differs from previous enlargements in that the countries joining the European Union in 1995 were already members of the European Economic Area since 1991, so that these countries not only joined a more deeply integrated Union, but were also more deeply integrated into the Union before accession. This suggests that effects of integration may have been smaller.

Furthermore, in the case of Southern Enlargement derogation periods on the freedom of movement of labour were negotiated. By contrast for Northern Enlargement no such derogation periods were needed. This may have implications on results because as noted by Büttner and Rincke (2004), if cross – border migration is allowed benefits from integration could potentially conentrate on only one side of the border.

Finally, these integration cases also included countries of very different levels of development and sizes (see table 1). Enlargement by Greece and Southern Enlargement included poorer countries (per capita GDP of Greece, Spain and Portugal ranged between 50% and 75% of the EU average when they joined the Union), while Northern Enlargement included richer countries (Austrian and Swedish per capita GDP levels exceeding the Unions average and Finland approached this level). This implies that the market potential of the European Union was larger relative to the domestic market potential in Southern Enlargment and Enlargement by Greece than in Northern Enlargement. As shown in column 2 of table 1 the additional market potential becoming accessible through integration remained small for the old member states and varied substantially for acceding countries. This would lead one to expect to find larger effects in the first two enlargement rounds.

Similar observations apply to the potential cost advantages of locating nearer to the border. Many of the acceding countries analysed in this paper were small in terms of area. Thus one would expect relatively low effects on border regions. Furthermore, in

[7] Greece joined before the completion of the single European Act. Spain and Portugal joined in the year of the single European Act, and Northern Enlargement occured after treaty of Amsterdam was signed.

the case of Greece a country was integrated, which is distant from the EU and shares no common land border with the EU, this would also suggest that the market access effect in this integration was limited.

Table 1: Descriptive Statistics of analysed Countries

	Per capita GDP in % of EU average at accession	Total GDP of the EU in percent of the GDP of the joining country[1)]	Area in thousand km²
Southern Enlargement			
Spain	69	1093.29	504.8
Portugal	54	6381.04	90.9
Greece	75	4109.97	131.6
Northern Enlargement			
Austria	113	2827.06	83.9
Sweden	101	2565.95	410.9
Finland	91	5186.92	304.5
France*	111	10.71	544.0
Italy**	115	3.54	301.3
Denmark	114	5.83	43.1

Notes 1) For France, Italy and Denmark this column displays the total GDP of the newly joining countries in percent of the GDP of the nearby ol member state country, Source: Eurostat

Due to this heterogeneity we do not pool data across countries, but analyse each case separately by focusing on five variables: employment growth, productivity growth, wage growth, investments and immigration. We measure employment growth as the change of the log of average annual employment, wage growth as the change in average log compensation per employee in a region, and investment rates as investment expenditure in % of gross value added. Furthermore as a proxy for migration we use population growth as the log change in working age population in a region.[8] The structure of these data differ somewhat for some of these indicators. For employment and productivity growth we have available indicators for each region for a total of 14 industries, while for population, investments and wages, we only have available regional averages across all sectors.[9]

[8]) We use first differences since prior testing suggests variables in levels are integrated but first differences are not, and because differencing removes any effects on the indicators arising from region fixed effects such as may be due to amenities or abundance of natural ressources.

[9]) Aggriculture is ommitted from the analysis, since it is not considered a mobile sector.

Table 2: Descriptive Statistcs for dependent Variables

		T (N)[1)]	Employment Growth[3)]	Productivity Growthr[3)]	Investment Rate[2)]	Wage Growth[3)]	Population growth[3)]
Greece	Before	5	0.0195	0.0622	-1.4617	0.2227	0.0016
		(13)	(0.0586)	(0.1026)	(0.0824)	(0.0311)	(0.0176)
	After	7	-0.0018	0.0143	-1.7096	0.1948	0.0103
		(13)	(0.1568)	(0.1962)	(0.1010)	(0.0523)	(0.0064)
Southern Enlargement	Before	5	-0.0086	0.0049	-1.7195	0.0685	0.0092
		(25)	(0.0882)	(0.1540)	(0.5360)	(0.0670)	(0.0097)
	After	7	0.0147	0.0178	-1.5587	0.0945	0.0053
		(25)	(0.1484)	(0.1714)	(0.4717)	(0.0627)	(0.0213)
Northern Enlargement	Before	5	-0.0027	0.0218	-1.5953	0.0272	0.0051
		(23)	(0.0603)	(0.1039)	(0.1664)	(0.0648)	(0.0062)
	After	7	0.0023	0.0219	-1.5812	0.0305	0.0028
		(23)	(0.0484)	(0.0675)	(0.1189)	(0.0374)	(0.0069)
France	Before	5	-0.0003	0.0236	-1.6392	0.0690	0.0112
		(22)	(0.0433)	(0.0709)	(0.0417)	(0.0286)	(0.0033)
	After	7	-0.0020	0.0201	-1.5628	0.0532	0.0035
		(22)	(0.0353)	(0.0861)	(0.0465)	(0.0176)	(0.0037)
Italy and Denmark	Before	5	-0.0011	0.0257	-1.6018	0.0507	0.0023
		(23)	(0.0694)	(0.1230)	(0.0715)	(0.0420)	(0.0044)
	After	7	0.0047	0.0160	-1.5518	0.0463	0.0003
		(23)	(0.0362)	(0.0587)	(0.0720)	(0.0495)	(0.0082)

Note: Table displays unweighted means across regions, values in brackets are standard deviations. 1) first line states number of time periods (T) second line states the number of regions (N). For employment and productivity growth there are observations on 14 sectors per region. 2) looged investments relative to GDP 3) Varaibles are measured in log differences. Excluding French overseas territories.

Table 2 presents descriptive statistics for the indicators used and devides the observation period into a period before and after EU accession. This table suggests that integration did not significantly change aggregate economic growth within countries. Performing tests for the equality of means in the two periods, we cannot reject the null of equal employment, wage, population and productivity growth as well as investment rates before and after accession for any of the accessions analysed. Furthermore, the table also suggests substantial variance in the regional growth and investment rates among regions both before as well as after integration.

Empirical Framework

The central concern of this paper is with this regional variance. We want to see whether, integration either had an effect on regions nearer to the border or led to decentralisation of production in the newly joining as well as the nearby old member states. This would be the case if border regions or regions more distant from the country centre experienced higher employment, productivity and wage growth as well as higher

investments and immigration, relative to other regions in the time period after integration. We thus follow Hanson (1998) and estimate regressions of the form:

$$Y_{it} = \alpha + \beta_1 * DB_i + \beta_2 * DC_i + \gamma_1 * AC_t * DB_i + \gamma_2 * AC_t * DC_i + \lambda Z_{it} + \zeta_{it} \quad (1)$$

for each accession analysed. In this regression Y_{it} is an indicator measuring factor flows or economic activity in a region, DB_i is the (log) distance to Brussels, DC_i the (log) distance to the countries capital, where both are measured as the crows fly distance to the respective NUTSII regions's capital, AC_t is a dummy variable which takes on the value 1 if the year under consideration lies after the accession of the respective country. Z_{it} is a vector of potential further explanatory variables, which in our baseline specification are a family of industry as well as industry -time fixed effects where applicable.[10]

For the neighbouring countries (i.e. France, Italy, Denmark) considered we run analogous regressions, where DB_i is the distance to the capital of the nearby new member states (i.e. to Madrid for France, to Vienna for Italy and to Stockholm for Denmark) and all other variables are defined equivalently to above.

In equation (1) a necessary condition for signficant integration effects is that the parameters γ_1 and γ_2 differ significantly from zero. If γ_1 is positive, regions further away from Brussels (or the acceding country's capital) experienced an increase in employment wage, productivity and population growth or investment rates relative to regions closer to the border. This would indicate that reallocation took place away from border regions. If by contrast the coefficient is negative, this implies that border regions experienced a better development. If γ_2 is significantly negative this would indicate, that integration resulted in a decentralisation of production away from the countries centre, while in the opposite case centralisation would be indicated.

[10] The inclusion of region effects is precluded because the distance variables are time invariant. We also experimented with the inclusion of region-sector dummy variables. These proofed to be jointly insignificant. Thus they were excluded to avoid overparametrisation.

There are a number of methodological problems that may be expected to arise in the context of a regression such as shown in equation (1). First, shocks to one region or industry may have effects on other regions or industries, which would imply cross sectional dependence in the error terms. Second, some of the variables in our regressions are measured at different levels of aggregation, this applies in particular to all regressions where industry-region information is utilized. In these distance is measured at the regional level only. As pointed out amongst others by Blien (1996) this will induce some cross sectional dependence in error terms by definition. Third, as recently shown by Bertrand, Duflo and Mullainathan (2004) in the context of difference-in-difference estimates, equation (1) may yield autocorrelation in error terms. In consequence we estimate variance–covariance matrices which are robust to both serial as well as spatial autocorrelation by applying the method proposed by Driscoll and Kraay (1998).[11]

A further complication arises from the fact that significance of estimated coefficients in the regression represent a necessary but not sufficient condition for integration to have had an effect of the regional structure of production. This paired with the substantial uncertainty concerning the time period within which the integration effects may be identified[12] makes it difficult to establish causality in the specified regression. Again this point has been made in the literature on difference in difference estmation (see Angrist and Krueger, 1999). We tackle this problem by extensively checking on the robustness of our results. In our baseline specification we focus on a period of 5 years

[11]) This is an extension of the variance-covariance estimator developed in Newey and West (1987) which is consistent irrespective of the form of cross-sectional dependence provided of the autocorrelation of the error term gets smaller at longer lags. It requires that the lag length for the residuals be determined ex ante. We use a lag length of one in all results below although results are robust to increasing this to two. Dricoll and Kray (1998) present simulations, which yield reliable results for data of the size we use.

[12]) It has for instance been argued (see Boeri and Brücker, 2001) that the effects of integration may have been felt prior to enlargement as economic actors foresaw the development.

before integration and 7 years after and estimate both equation (1) and an additional specification, in which we interact distance to the border and distance to the capital city with year dummies to analyse to what degree there is a robust relationship between the estimated coefficients. Furthermore, we also extend the regression results to the complete observation horizon available to us (i.e. 1975 to 2000)

Results

Table 3 presents results concerning the regional effects of integration on employment growth in both acceding countries as well as nearby old member states. The top panel (entitled total employment growth) presents results when estimating equation (1) for all sectors. We find only very weak evidence to support the view that European integration had any effect on the regional distribution of employment growth in the acceeding countries. The interaction of the dummy variable for the time period after accession and distance to Brussels is negative (thus indicating more rapid growth in regions closer to the border), but remains insignificant for all cases studies. The evidence on the concentration of production by contrast suggests significantly higher concentration was a result of integration in the case of Southern Enlargement only, while all other coefficients also remain insingifcant.

This finding is reconfirmed both when focusing exclusively on manufacturing or service employment growth. Concerning manufacturing employment growth (in the second panel of table 3), we again find that regions nearer to Brussels experienced larger manufacturing employment growth in all acceeding countries and the existing member states except for France. This effect is, however, insignificant. Significant concentration can once more only be found for Southern Enlargement. For services (see panel 3 of table 3) the coefficient for the accession and distance to Brussels interaction as well as the distance to capital interaction is insignificant in most cases. The only exceptions are Northern Enlargement where service employment grew significantly more rapidly in regions closer to the border after integration and France where regions further away from the capital experienced more rapid service employment growth after integration.

Table 3: Regression Results for Sectoral Employment Growth

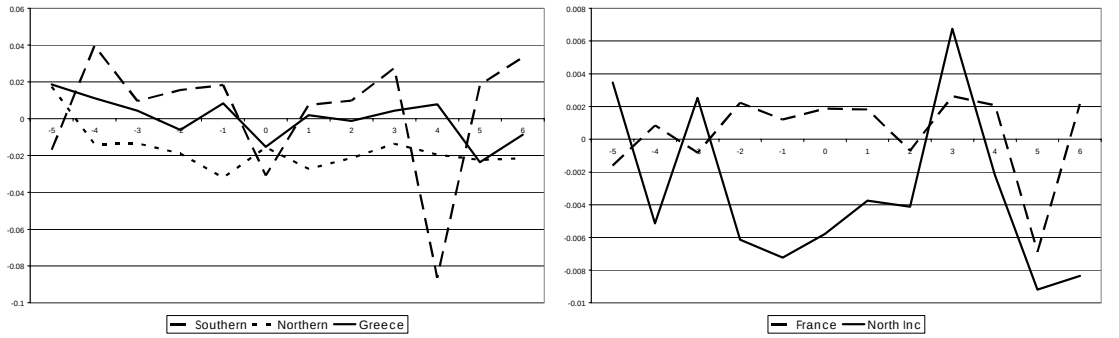
	Distance to Brussels	Distance to Capital	Accession X Distance to Brussels	Accession X Distance to Capital	Number of Observations (R^2)
			Total Employment Growth		
Greece	0.0222***	-0.0036***	-0.0085	0.0017	2184
	(0.0034)	(0.0005)	(0.0066)	(0.0015)	(0.592)
Southern Enlargement	-0.0002	-0.0005	-0.0196	0.0024**	4200
	(0.0069)	(0.0007)	(0.0205)	(0.0012)	(0.142)
Northern Enlargement	0.0019	0.0008	-0.0045	-0.0007	3864
	(0.0067)	(0.0007)	(0.0072)	(0.0008)	(0.238)
France	-0.0009	-0.0001	0.0025	-0.0003	3696
	(0.0006)	(0.0010)	(0.0040)	(0.0012)	(0.354)
Italy and Denmark	0.0013	0.0001	-0.0020	0.0001	3864
	(0.0020)	(0.0003)	(0.0031)	(0.0004)	(0.164)
			Manufacturing Employment Growth		
Greece	0.0218***	-0.0030***	-0.0144	0.0027	1248
	(0.0042)	(0.0006)	(0.0105)	(0.0024)	(0.578)
Southern Enlargement	0.0035	-0.0010	-0.0168	0.0023**	2400
	(0.0098)	(0.0011)	(0.0271)	(0.0012)	(0.107)
Notrhern Enlargement	-0.0041	0.0017	-0.0031	-0.0013	2208
	(0.0112)	(0.0017)	(0.0116)	(0.0017)	(0.203)
France	-0.0006	-0.0004	0.0024	-0.0008	2112
	(0.0018)	(0.0019)	(0.0077)	(0.0022)	(0.278)
Italy and Denmark	0.0006	-0.0006	-0.0011	0.0006	2484
	(0.0027)	(0.0005)	(0.0047)	(0.0007)	(0.141)
			Service Employment Growth		
Greece	0.0229***	-0.0044***	-0.0006	0.0003	936
	(0.0059)	(0.0008)	(0.0062)	(0.0010)	(0.571)
Southern Enlargement	-0.0052	0.0000	-0.0232	0.0025	1800
	(0.0084)	(0.0003)	(0.0237)	(0.0020)	(0.195)
Northern Enlargement	0.0099***	-0.0003	-0.0065**	0.0001	1656
	(0.0014)	(0.0013)	(0.0035)	(0.0013)	(0.229)
France	-0.0013	0.0013	0.0021	-0.0012***	1584
	(0.0017)	(0.0002)	(0.0035)	(0.0003)	(0.509)
Italy and Denmark	0.0025	0.0005	-0.0026	-0.0005	1656
	(0.0038)	(0.0009)	(0.0038)	(0.0010)	(0.286)

Note: All regression include sector and sector –time dummies. Values in brackets are (heteroskedasticity serial and spatial correlation robust) standard errors (see: Driscoll and Kray, 1998) *, **, *** signify significance at the 10% (5%) (1%) level. For France distance to Madrid is replaces distance to Brussels, For the nearby Member States in Northern Enlargement in Italy distance to Vienna, Denmark distance to Stockholm is used as the distance to the nearest capital of a joining country. Excluding French overseas territories.

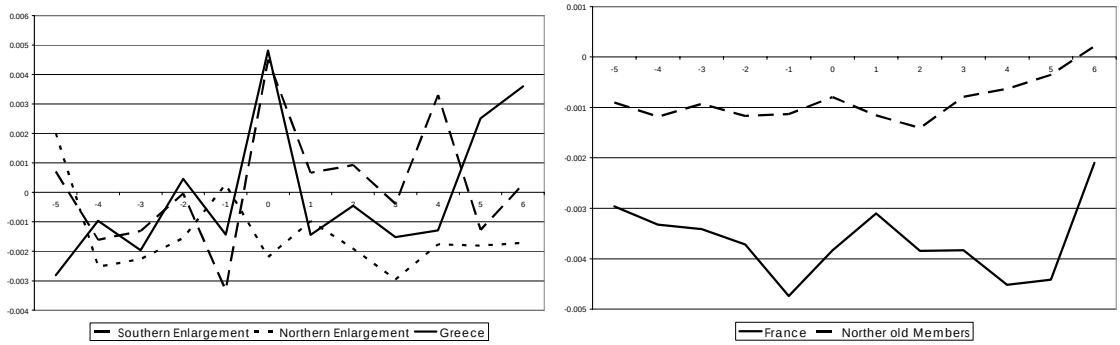
Finally, when considering the results of year by year regressions (in Figure 1) no general pattern emerges. Coefficients of total employment growth, fluctuate substantially over time periods, are insignificant and comparable in magintude both before and after accessions.

Figure 1: Coefficients of interaction terms between years and distance to Brusells and year and distance to capital in total employment growth regressions

a) Years and distance to Brusells interaction



b) Years and distance to capital interaction



Note: Figures displays coefficients of a regression as displayed in equation (1) but replacing Act*DBi variable with year * distance to capital as well as the Act*DCi variable with year * distance to brussels interaction dummy variables.

Results for sectoral productivity growth (see table 4) also suggest rather mild implications of integration of on the regional structure of productivity. In particular coeffecients on the interaction of the dummy variable for accession and distance to Brussels are insignificant for all cases and all sectors analysed – although they are positive in general and thus have the oposite sign as in the employment growth regressions. Furthermore, the coefficient for the interaction of the dummy for the period after accession and the distance to the capital city indicate significant deconcentration in the case of Greece and Northern Enlargement (i.e. those cases where no concentration was found in employment growth).

Year and distance to Brusells interaction terms reconfirm this result. They are highly inrobust and provide little additional insights. Year and distance to capital interaction terms, however, show a clear pattern in the case of Northern Enlargement and Greece

only (i.e. the cases where coefficients are significant in table 4). In these cases they start falling (indicating increased productivity growth in regions further away from the capital) the year (Northern Enlargment) or the year before (Southern Enlargement) integration and then settle at a lower level two years after integration.

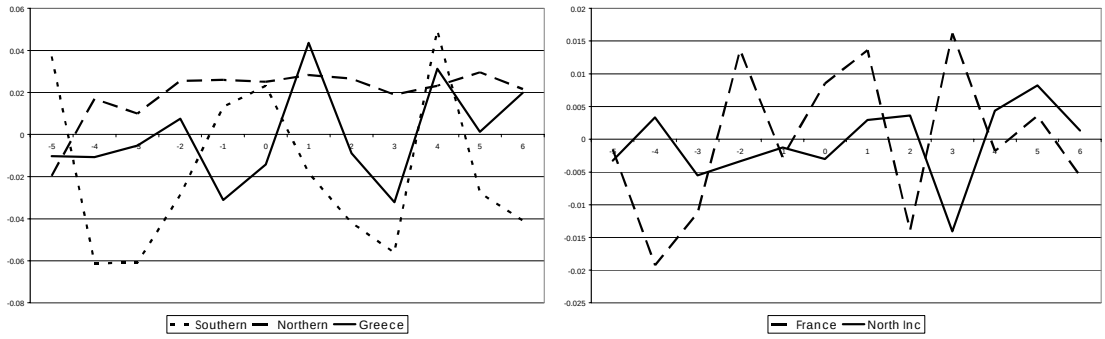
Table 4: Regression Results for Sectoral Productivity Growth

	Distance to Brussels	Distance to Capital	Accession X Distance to Brussels	Accession X Distance to Capital	Number of Observations (R^2)
			Total Productivity Growth		
Greece	-0.0182***	0.0122***	0.0137	-0.0078**	2184
	0.0074	0.0028	0.0134	0.0036	0.475
Southern Enlargement	0.0096	0.0002	0.0115	-0.0019	4200
	0.0195	0.0007	0.0256	0.0025	0.235
Northern Enlargement	-0.0039	-0.0001	0.0091	-0.0015**	3864
	0.0063	0.0005	0.0065	0.0007	0.201
France	-0.0055	-0.0003	0.0069	0.0008	3696
	0.0068	0.0008	0.0082	0.0018	0.204
North inc	-0.0025	0.0004	0.0003	-0.0012	3864
	0.0014	0.0015	0.0029	0.0016	0.243
			Manufacturing Productivity Growth		
Greece	-0.0182***	0.0084***	0.0020	0.0001	936
	0.0055	0.0020	0.0080	0.0036	0.656
Southern Enlargement	0.0100	0.0000	0.0085	-0.0023	1800
	0.0080	0.0007	0.0227	0.0026	0.220
Notrhern Enlargement	-0.0059	0.0011	0.0055	-0.0020	1656
	0.0042	0.0014	0.0055	0.0015	0.172
France	0.0014	0.0010	-0.0028	-0.0004	1584
	0.0033	0.0014	0.0058	0.0023	0.485
North inc	-0.0027	0.0003	0.0011	-0.0009	1656
	0.0033	0.0007	0.0036	0.0009	0.317
			Service Productivity Growth		
Greece	-0.0182***	0.0150***	0.0225	-0.0136***	1248
	0.0108	0.0043	0.0234	0.0048	0.433
Southern Enlargement	0.0093	0.0004	0.0138	-0.0015	2400
	0.0338	0.0015	0.0399	0.0028	0.231
Notrhern Enlargement	-0.0024	-0.0011	0.0118	-0.0011	2208
	0.0088	0.0012	0.0091	0.0014	0.155
France	-0.0108	-0.0014	0.0126	0.0016	2112
	0.0157	0.0020	0.0173	0.0026	0.149
Italy	-0.0012	0.0003	-0.0018	-0.0009	2484
	0.0037	0.0030	0.0053	0.0031	0.224

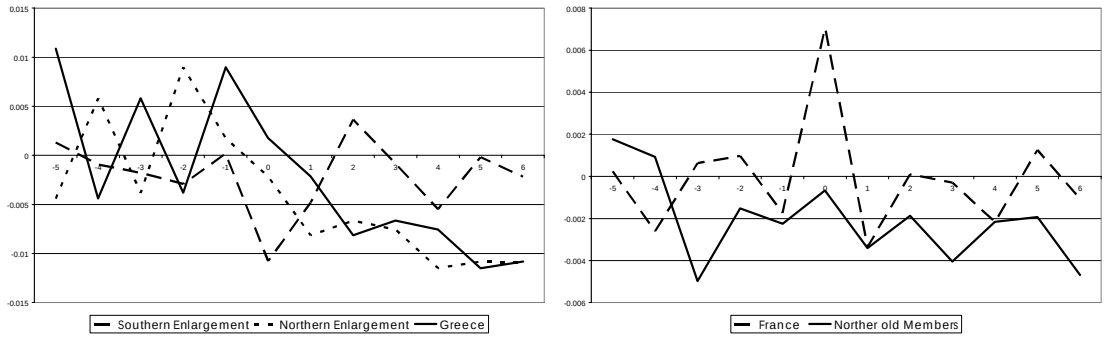
Note: All regression include period, sector and sector –time dummies. Values in brackets are (heteroskedasticity serial and spatial correlation robust) standard errors (see Driscoll and Kray, 1998) *, **, *** signify significance at the 10% (5%) (1%) level. For France distance to Madrid is replaces distance to Brussels, For the nearby Member States in Northern Enlargement in Italy distance to Vienna, Denmark distance to Stockholm is used as the distance to the nearest capital of a joining country

Figure 2: Coefficients of interaction terms between years and distance to Brusells and year and distance to capital in total productivity growth regressions

a) Years and distance to Brusells interaction



b) Years and distance to capital interaction



Note: Figures displays coefficients of a regression as displayed in equation (1) but replacing Act*DBi variable with year * distance to capital as well as the Act*DCi variable with year * distance to brussels interaction dummy variables.

Results this far thus suggest that the link between regional employment growth and integration has been substantially weaker in the EU than in the US-Mexico case analysed in Hanson (1998). The evidence presented in tables 3 and 4, however, also suggests that geography played only a minor role in shaping employment growth prior to accession in any of the countries analysed. Both the coefficients on the distance to Brussels as well as the distance to the capital are insignificant in the majority of the cases. Interestingly, the coefficient on distance to Brussels is significantly positive and that on the distance to the capital city negative for all regressions for the case of Greece. Thus in Greece regions further from Brussels and closer to the capital cities showed higher employment growth in both manufacturing and services throughout the period analysed. In Table 5 we focus on population growth - which we employ as proxy for migration flows - and regional wage growth as well as investment rates. Although these indicators are not available at a sectoral level, the results in general support the

hypothesis of at most modest effects of integration on regional development in European integration. For wage growth we find no significant effects of integration on regions closer to the border and for population growth effects are insignificant (although negatively signed) in all countries but Greece and France. This suggests that some migration in the direction of border regions occurred after integration in these two countries. We, however, find that in both cases analysed regions nearer to the borders of newly joining countries in the nearby old member states experienced a decline in relative investment rates in both cases analysed.

Enlargement also had a more important effect on the distribution of wages between centres and peripheral regions than on border regions. Wage growth in regions further away from the capital significantly increased in enlargement by Greece and Northern Enlargement as well as in France. Effects concerning other indicators, however, seem to be limited to indivual cases. We find increased concentration of population growth after Enlargement in Greece and deconcentration in investments but increased concentration in population growth for the nearby old member states in Northern Enlagrement.

Finally, in contrast to the employment growth regressions, location explains a substantial part of the variance in population growth as well as for investment rates. In particular regions both nearer to the capital city and closer to Brussels had higher wage growth already prior to enlargement. Furthermore, in Southern Enlargement regions both closer to the capital and Brussels experienced higher investment rates. With respect to other indicators analysed there seems to be substantial heterogeneity in outcomes. In Southern Enlargment regions both closer to the capital and Brussels had higher investment rates throughout, while in France regions further from the capital city experienced higher population growth and regions both closer to Madrid and further from the national capital had higher investment rates. For Northern Enlargement population growth was significantly higher in regions far from the capital.

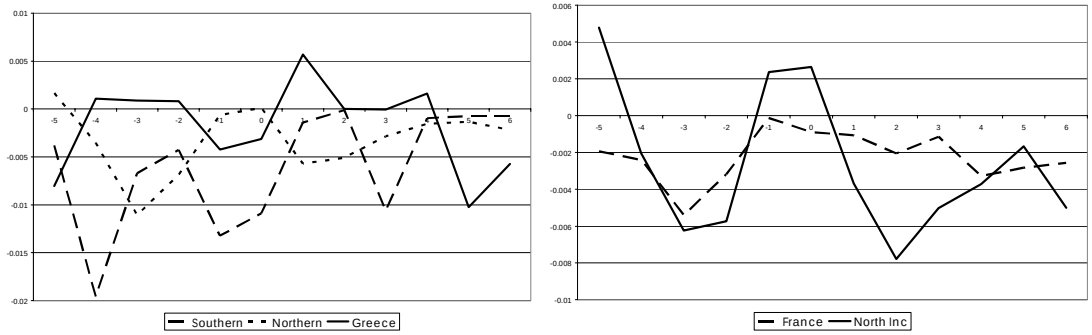
Table 5: Regression results concerning aggregate Investments, Population Growth and Wage Growth

	Distance to Brussels	Distance to Capital	Accession X Distance to Brussels	Accession X Distance to Capital	constant	Number of Observations (R^2)
Population Growth						
Greece	0.0100***	-0.0055***	-0.0040***	0.0053***	-0.0381	156
	0.0031	0.0003	0.0007	0.0005	0.0241	0.428
Southern Enlargement	0.0014	-0.0001	-0.0002	-0.0003	-0.0020	300
	0.0010	0.0000	0.0009	0.0002	0.0088	0.014
Northern Enlargement	0.0024**	0.0003**	0.0001	-0.0004	-0.0177	276
	0.0009	0.0001	0.0001	0.0002	0.0075	0.094
France	0.0002	0.0004***	-0.0006***	-0.0003	0.0066	264
	0.0002	0.0001	0.0001	0.0001	0.0019	0.546
North incumb	-0.0002	0.0000	-0.0002	0.0000	0.0036	276
	0.0005	0.0004	0.0005	0.0005	0.0030	0.018
Wage Growth						
Greece	-0.0083	0.0071	-0.0014	-0.0021***	0.2355	156
	0.0022	0.0004	0.0029	0.0009	0.0162	0.157
Southern Enlargement	-0.0112	0.0004	0.0020	0.0011	0.1614	300
	0.0118	0.0010	0.0051	0.0016	0.1051	0.040
Northern Enlargement	-0.0028	0.0011	0.0018	-0.0016***	0.0427	276
	0.0032	0.0008	0.0028	0.0008	0.0186	0.045
France	-0.0042**	0.0003	0.0003	-0.0023***	0.1024	264
	0.0019	0.0007	0.0014	0.0009	0.0175	0.117
North incumb	0.0013	0.0014***	0.0008	-0.0015	0.0296	276
	0.0028	0.0004	0.0028	0.0011	0.0289	0.766
Investment Rate						
Greece	-0.0133	0.0036	-0.0434***	0.0145***	-1.3800	165
	0.0141	0.0031	0.0086	0.0030	0.0921	0.663
Southern Enlargement	0.5131***	0.0333***	0.0289	-0.0117	-6.3579	300
	0.0937	0.0056	0.0205	0.0126	0.7946	0.321
Northern Enlargement	0.0095*	0.0010	0.0004	0.0016	-1.6841	276
	0.0055	0.0036	0.0073	0.0034	0.0747	0.065
France	-0.0116***	0.0026***	0.0097***	-0.0010	-1.5592	264
	0.0034	0.0005	0.0045	0.0013	0.0178	0.427
North incumb	-0.0090**	0.0043***	0.0140***	-0.0091***	-1.5586	276
	0.0047	0.0021	0.0054	0.0025	0.0436	0.142

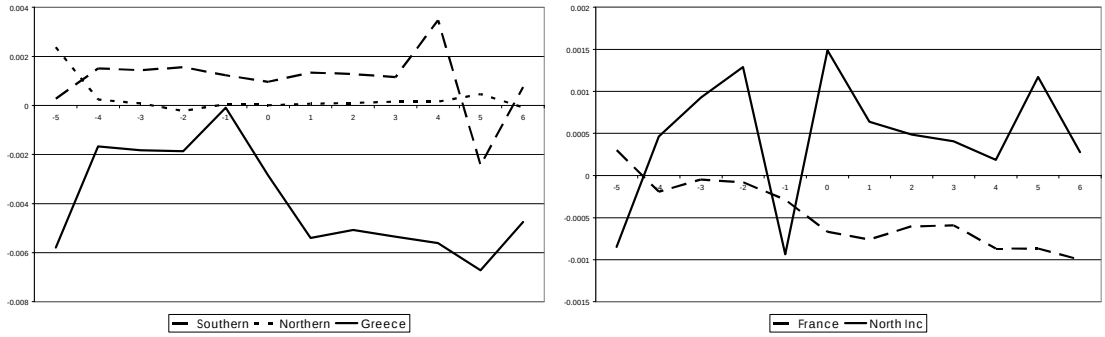
Note: Values in brackets are (heteroskedasticity serial and spatial correlation robust) standard errors (see Driscoll and Kray (1998) *, **, *** signify significance at the 10% (5%) (1%) level. For France distance to Madrid is replaces distance to Brussels, For the nearby Member States in Northern Enlargement in Italy distance to Vienna, Denmark distance to Stockholm is used as the distance to the nearest capital of a joining country

Figure 3: Coefficients of interaction terms between years and distance to Brusells and year in wage growth, population growth and investment rate regressions

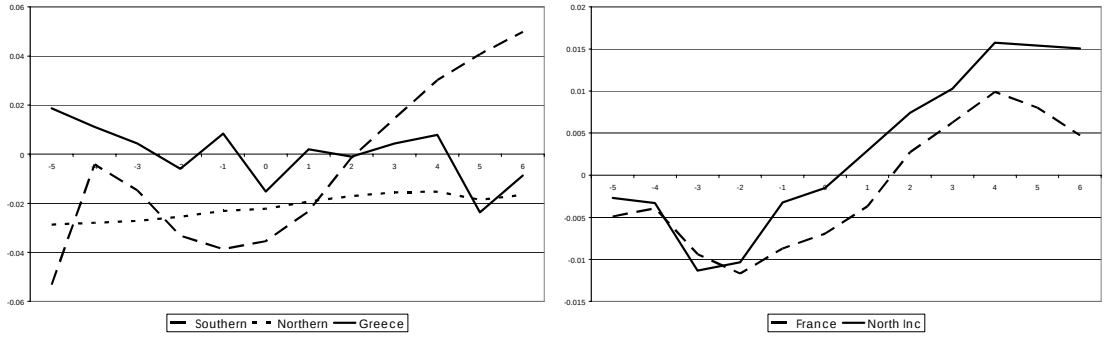
a) Wages



b) Population



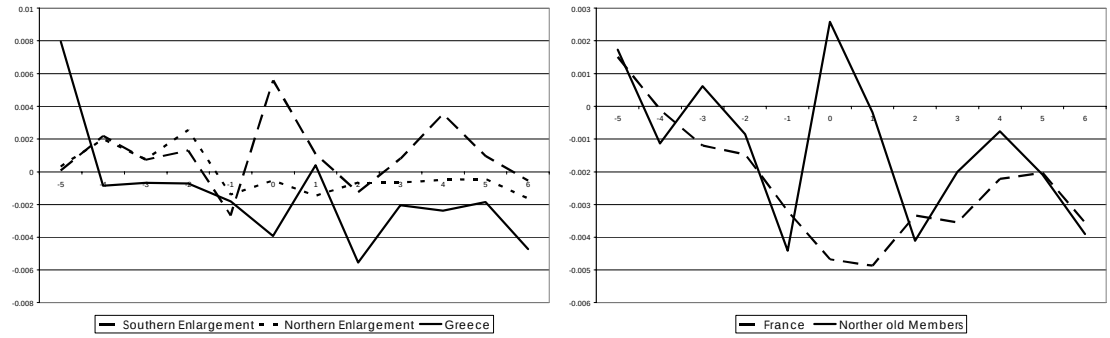
c) Investment rate



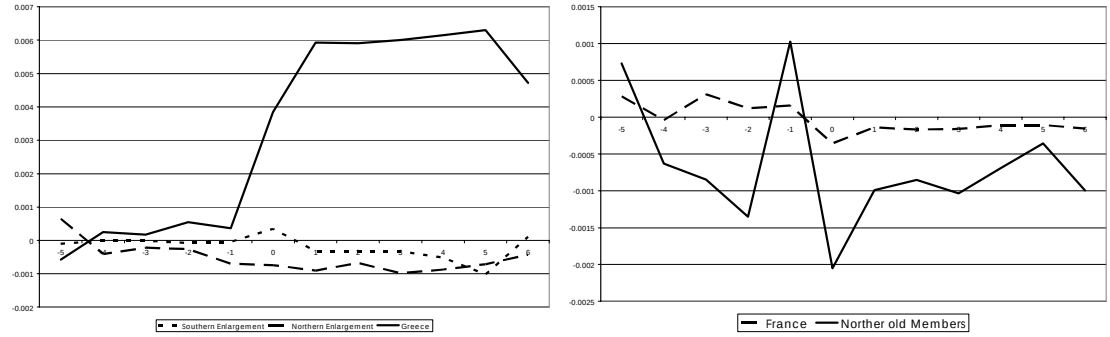
Note: Figure displays coefficients of a regression as displayed in equation (1) but replacing Act*DBi variable with year * distance to capital as well as the Act*DCi variable with year * distance to brussels interaction dummy variables.

Figure 4: Coefficients of interaction terms between years and distance to capital and year in wage growth, population growth and investment rate regressions

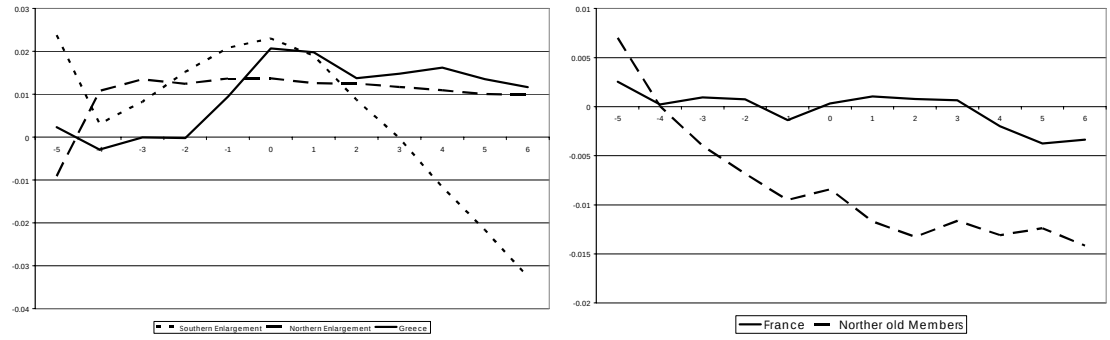
a) Wages



b) Population



c) Investment rate



Note: Figure displays coefficients of a regression as displayed in equation (1) but replacing Act*DBi variable with year * distance to capital as well as the Act*DCi variable with year * distance to brussels interaction dummy variables.

Comparing these results to the year by year development (see Figures 3 and 4) suggests that some of these effects can be attributed to enlargement. Relative investment rates started rising in regions further from the capital one year before enlargement and then increased over the complete estimation period in the nearby old member states. The evidence in Figure 3 also provides some additional insight in that similar patterns to the nearby old member states concerning investment rates can also be found in Southern

Enlargement. By contrast findings on the cases where relative population growth increased in the border regions (i.e. enlargment by Greece and old member states in Northern Enlargement), suggest a much less clear pattern in the development of coefficients.

By contrast, results on the development of the interaction of year dummies with distance to the capital indicate that in cases where coeffecients are significant this effect may not be due entirely to enlargment. In particular in the case of wages both the significant effects in enlargement by Greece and in the nearby old member states in Northern Enlargment are due to a more long rung increase in relative wage growth in regions further away from the border. Similar arguments apply to the development of investment rates of nearby old member states of Northern Enlargment.

Results for total period

In tables 6 to 8 we show results of specifications in which we lengthen the estimation period to the complete obeservation period available to us (i.e. to the time period 1975 – 2000). As previously for employment growth (table 6) integration had prediominantly, insignificant effects on relative employment growth and productivity growth in regions closer to Brussels and a significant negative effect on concentration in Southern Enlargement only. Also in the case of productivity growth regressions (see table 7) we find a similar pattern of significance as when analysing the shorter time period. The only deviation from previous results is that in France a marginally significant deconcentration of service sector employment growth is found.

Results concerning wage growth, population growth and investment rate regressions, however, deviate somewhat from previous findings. In particular when lengthening the observation horizon to the complete time period, we find somewhat more significant effects of integration on the regions closer to Brussels concerning wage growth and investments. Regions closer to Brussels experienced significantly larger wage growth and investments after enlargement. (The coefficients are now significant or at least on

the verge of significance in all cases but that of Northern Enlargment[13] for wage growth and all nearby member states in the case of investment rates.) This suggests that wage and investment reactions in the face of accession may be more long run than covered by our original estimation period.

For the previously old member states by contrast, our evidence suggests that the market access effect was weaker than the market crowding effect. We find significant increases in investment rates in regions further away from the border in all cases for the newly joining countries.

At the same time focusing on the more long run developments reconfirms the finding that integration aside from having long run effects on regions closer to the border also led to some effects on concentration and deconcentration. In general these effects are found for the same cases as when focusing on short run developments. The exception to this, however, investment rates in Southern and Northern enlargement.

[13] This may however be attributed to the fact that in this accession we have a very short observation horizon after integration.

Table 6: Regression Results for Sectoral Employment Growth

	Distance to Brussels	Distance to Capital	Accession X Distance to Brussels	Accession X Distance to Capital	Number of Observations (R^2)
Total Employment Growth					
Greece	0.0222***	-0.0036***	-0.0120	0.0018	4914
	0.0034	0.0005	0.0274	0.0041	0.211
Southern Enlargement	-0.0059	-0.0002	-0.0022	0.0022**	8750
	0.0064	0.0005	0.0113	0.0013	0.204
Northern Enlargement	0.0001	0.0002	-0.0027	-0.0001	8694
	0.0022	0.0003	0.0031	0.0004	0.254
France	0.0017	0.0011***	-0.0008	-0.0004	8316
	0.0013	0.0003	0.0019	0.0007	0.456
Italy	0.0003	0.0004	-0.0007	-0.0006	7560
	0.0020	0.0008	0.0033	0.0009	0.206
Denmark	-0.0107***	0.0005	0.0047	-0.0006	1134
	0.0042	0.0005	0.0072	0.0006	0.879
Manufacturing Employment Growth					
Greece	0.0229***	-0.0044***	-0.0093	0.0019	2808
	0.0059	0.0008	0.0213	0.0035	0.229
Southern Enlargement	-0.0106*	0.0001	-0.0030	0.0008	5000
	0.0068	0.0003	0.0137	0.0011	0.189
Notrhern Enlargement	0.0042***	-0.0004	-0.0008	0.0001	4968
	0.0016	0.0004	0.0035	0.0006	0.252
France	0.0009	0.0008	0.0005	0.0001	4752
	0.0020	0.0005	0.0034	0.0012	0.352
Italy	0.0002	0.0007	-0.0001	-0.0013	4860
	0.0025	0.0010	0.0048	0.0011	0.161
Denmark	-0.0145**	0.0004	0.0100	-0.0003	729
	0.0058	0.0007	0.0104	0.0009	0.801
Service Employment Growth					
Greece	0.0218***	-0.0030***	-0.0141	0.0017	2106
	0.0042	0.0006	0.0335	0.0048	0.194
Southern Enlargement	-0.0024	-0.0005	-0.0016	0.0033*	3750
	0.0079	0.0008	0.0147	0.0025	0.170
Notrhern Enlargement	-0.0030	0.0006	-0.0041	-0.0002	3726
	0.0034	0.0006	0.0043	0.0008	0.239
France	0.0027***	0.0014***	-0.0024**	-0.0010***	3564
	0.0003	0.0002	0.0013	0.0003	0.586
Italy	0.0010	0.0002	-0.0011	-0.0001	3240
	0.0028	0.0009	0.0029	0.0010	0.281
Denmark	-0.0058*	0.0001	0.0001	-0.0009*	486
	0.0034	0.0004	0.0047	0.0006	0.897

Note: All regression include period, sector and sector –time dummies. Values in brackets are (heteroskedasticity serial and spatial correlation robust) standard errors (see Driscoll and Kray (1998) *, **, *** signify significance at the 10% (5%) (1%) level. For France distance to Madrid is replaces distance to Brussels, For the nearby Member States in Northern Enlargement in Italy distance to Vienna, Denmark distance to Stockholm is used as the distance to the nearest capital of a joining country

Table 7: Regression Results for Sectoral Productivity Growth

	Distance to Brussels	Distance to Capital	Accession X Distance to Brussels	Accession X Distance to Capital	Number of Observations (R^2)
	Total Productivity Growth				
Greece	-0.0182	0.0122	0.0132	-0.0111	4914
	0.0074	0.0028	0.0287	0.0054	0.339
Southern Enlargement	0.0076	-0.0003	0.0023	-0.0017	8750
	0.0126	0.0006	0.0150	0.0016	0.236
Northern Enlargement	-0.0023	-0.0012	0.0075	-0.0004	8694
	0.0047	0.0005	0.0051	0.0007	0.270
France	-0.0026	0.0016	0.0010	-0.0018	8316
	0.0093	0.0013	0.0096	0.0015	0.300
Italy	-0.0007	-0.0001	-0.0023	-0.0002	7560
	0.0021	0.0009	0.0037	0.0012	0.396
	Manufacturing Productivity Growth				
Greece	-0.0182	0.0084	0.0124	-0.0045	2106
	0.0055	0.0020	0.0208	0.0043	0.431
Southern Enlargement	0.0104	-0.0003	0.0003	-0.0007	3750
	0.0076	0.0006	0.0126	0.0014	0.237
Notrhern Enlargement (1995)	-0.0055	-0.0002	0.0051	-0.0006	3726
	0.0050	0.0007	0.0060	0.0009	0.317
France	-0.0058	0.0004	0.0040	0.0002	3564
	0.0040	0.0004	0.0045	0.0008	0.566
Italy	-0.0016	-0.0006	0.0004	-0.0001	3240
	0.0029	0.0009	0.0033	0.0011	0.328
	Service Productivity Growth				
Greece	-0.0182	0.0150	0.0139	-0.0161	2808
	0.0108	0.0043	0.0369	0.0071	0.320
Southern Enlargement	0.0056	-0.0004	0.0038	-0.0025	5000
	0.0211	0.0011	0.0242	0.0029	0.234
Northern Enlargement	0.0010	-0.0023	0.0035	0.0005	4968
	0.0070	0.0008	0.0083	0.0011	0.195
France	-0.0003	0.0025	-0.0012	-0.0034	4752
	0.0135	0.0021	0.0142	0.0024	0.236
Italy	-0.0004	0.0000	-0.0039	0.0004	4860
	0.0027	0.0014	0.0050	0.0018	0.367

Note: All regression include period, sector and sector –time dummies. Values in brackets are (heteroskedasticity serial and spatial correlation robust) standard errors (see Driscoll and Kray (1998) *, **, *** signify significance at the 10% (5%) (1%) level. For France distance to Madrid is replaces distance to Brussels, For the nearby Member States in Northern Enlargement in Italy distance to Vienna, Denmark distance to Stockholm is used as the distance to the nearest capital of a joining country

Table 8: Regression results concerning aggregate Investments, Population Growth and Wage Growth

	Distance to Brussels	Distance to Capital	Accession X Distance to Brussels	Accession X Distance to Capital	Constant	Number of Observations (R^2)
	Population Growth					
Greece	0.00495*	-0.00513***	-0.00485***	0.00600***	0.00129	351
	0.00289	0.00025	0.00062	0.00046	0.02240	0.109
Southern Enlargement	0.00049	-0.00025**	-0.00031	0.00015	0.00462	625
	0.00096	0.00012	0.00043	0.00017	0.00812	0.038
Notrhern Enlargement	0.00221***	0.00009	0.00001	-0.00022*	-0.0151***	621
	0.00057	0.00012	0.00013	0.00015	0.00499	0.034
France	0.00020	0.00026***	-0.00007	-0.00002	0.00172	594
	0.00024	0.00005	0.00012	0.00007	0.00250	0.009
Italy	-0.00031	0.00023***	-0.00017	-0.00040***	0.00528***	540
	0.00018	0.00008	0.00027	0.00009	0.00187	0.155
	Wage Growth					
Greece	-0.00178	0.00664***	-0.00882**	-0.00049	0.18492	351
	0.01090	0.00091	0.00353	0.00240	0.08410	0.128
Southern Enlargement	-0.00206	0.00063	-0.00335**	-0.00030	0.09259*	625
	0.00679	0.00087	0.00173	0.00120	0.06085	0.052
Northern Enlargement	-0.00148	0.00022	-0.00213*	-0.00084*	0.06584***	621
	0.00240	0.00040	0.00158	0.00048	0.01882	0.051
France	-0.00173	0.00112	-0.00472***	-0.00345**	0.11952***	594
	0.00297	0.00063	0.00084	0.00114	0.03007	0.414
Italy	0.00044	0.00040	-0.00253	-0.00021	0.06284**	540
	0.00187	0.00106	0.00322	0.00118	0.02671	0.029
	Investment Rate					
Greece	0.01003	0.00183	-0.02821***	0.00522*	-1.5607***	531
	0.01267	0.00293	0.00925	0.00370	0.08017	0.365
Southern Enlargement	0.23141**	0.03995***	-0.05998***	-0.03851***	-3.9573***	621
	0.12761	0.00653	0.01835	0.01282	1.06441	0.036
Northern Enlargement	-0.02554**	-0.00429**	-0.00631*	0.00513**	-1.3142***	621
	0.01309	0.00274	0.00475	0.00271	0.11686	0.009
France	0.00014	0.00093**	-0.00227	0.00031	-1.5761***	594
	0.00174	0.00047	0.00279	0.00079	0.01833	0.017
Italy	0.00134	0.00107***	-0.00243	-0.00139**	-1.5586***	540
	0.00137	0.00034	0.00367	0.00046	0.01981	0.067

Note: Values in brackets are (heteroskedasticity serial and spatial correlation robust) standard errors (see Driscoll and Kray (1998) *, **, *** signify significance at the 10% (5%) (1%) level. For France distance to Madrid is replaces distance to Brussels, For the nearby Member States in Northern Enlargement in Italy distance to Vienna, Denmark distance to Stockholm is used as the distance to the nearest capital of a joining country

Conclusions

This paper analyses the regional effects of previous enlargements of the European Union for three cases of enlargement. We argue that there are a number of reasons to expect these effects to differ from cases analysed in previous literature. We find that the effects of enlargements on regional employment wage, and population growth, as well as investments have been small. In particular focusing on regional development seven years after integration, we find very few significant effects and substantial heterogeneity among individual cases analysed which leads us to conclude regional integration effects do not materialise automatically.

We also find some evidence that effects on regional wage levels and investment rates are stronger than on employment, productivity and wage growth at least in the long run. This suggests that in the low internal migration context of European integration wage effects are more likely to materialise than employment and productivity growth effects.

Finally, we find some differences in results concerning long-term developments and the 7 year post accession period. Focusing on the complete observation period we find stronger evidence of increased wage growth in border regions after accession, which concentrate mainly on the newly joining member states and, our results weakly support the view that in newly acceding countries regions closer to the border of the EU may expect higher investments and higher wage growth in the long run. In the old member states by contrast integration of new member states has weaker effects.

From these results we would argue that the likely effects of integration of the Central and Eastern European Countries into the European Union on the spatial structure of employment may be less strong than often argued. While border regions in the candidate countries may expect modestly higher increases in investments and wages than inland regions in the long run, the regional structure of existing member states should remain largely unaffected both in the short and the long run.

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Appendix: Robustness of Results

Table A1 : Regression Results for Sectoral Employment Growth

Total Prod	ginireg	rconcentr	distock	discap	_lmemX disto_1	_lmemX disca_1	Nobs (r2)
Greece	0.7767	-0.3877***	0.0217	-0.0044***	-0.0067	0.0013	2184
	0.8009	0.1025	0.0034	0.0007	0.0063	0.0014	0.610
Southern Enlargement	0.2364	0.2576	-0.0015	-0.0004	-0.0192	0.0024**	4200
	2.5487	0.1956	0.0076	0.0005	0.0204	0.0012	0.144
Northern Enlargement	-2.7501	0.3278	0.0011	0.0006	-0.0044	-0.0007	3862
	5.8513	0.2728	0.0064	0.0009	0.0072	0.0008	0.243
France	9.7027	-0.0718	0.0021	0.0008	0.0025	-0.0003	3696
	3.7561	0.1343	0.0015	0.0009	0.0040	0.0012	0.362
North inc	-0.0196	-0.0004	0.0001	0.0000	0.0000	0.0000	3864
	0.0004	0.0004	0.0000	0.0000	0.0000	0.0000	0.151
Manuf Prod							
Greece	-7.0190	-1.7188***	0.0195	-0.0030***	0.0058	-0.0016	936
	0.5573	0.3047	0.0056	0.0007	0.0060	0.0008	0.667
Southern Enlargement	4.6852	0.3027	-0.0010	-0.0001	-0.0226	0.0024	1800
	2.8818	0.7079	0.0086	0.0009	0.0236	0.0020	0.203
Notrhern Enlargement (	-8.1916	0.2587	0.0091	-0.0007	-0.0068	0.0001	1656
	5.2370	0.2241	0.0015	0.0012	0.0035	0.0013	0.247
France	8.9286	0.1056	0.0016	0.0023	0.0021	-0.0012	1584
	3.8025	0.1493	0.0009	0.0006	0.0036	0.0003	0.528
North inc	-3.6613	0.0034	0.0029	0.0003	-0.0026	-0.0005	1656
	2.4974	0.0679	0.0037	0.0009	0.0038	0.0010	0.295
Service Prod							
Greece	6.3574	-0.2203***	0.0230	-0.0060***	-0.0132	0.0025	1248
	1.2275	0.1014	0.0044	0.0010	0.0103	0.0023	0.621
Southern Enlargement	-3.2501	0.2048*	-0.0017	-0.0006	-0.0167	0.0023	2400
	4.2705	0.1457	0.0124	0.0009	0.0270	0.0012	0.110
Notrhern Enlargement	3.1381	0.5555	-0.0053	0.0016	-0.0021	-0.0014	2208
	11.4349	0.5637	0.0106	0.0021	0.0114	0.0017	0.208
France	9.3989	-0.0865	0.0027	0.0006	0.0023	-0.0008	2112
	7.7380	0.1236	0.0033	0.0017	0.0077	0.0022	0.2824
Italy	-0.6951	0.1164	0.0008	-0.0007	-0.0011	0.0006	2484
	2.7334	0.1756	0.0028	0.0006	0.0047	0.0007	0.1415

Note: All regression include period, sector and sector –time dummies. Values in brackets are (heteroskedasticity serial and spatial correlation robust) standard errors (see Driscoll and Kray (1998) *, **, *** signify significance at the 10% (5%) (1%) level. For France distance to Madrid is replaces distance to Brussels, For the nearby Member States in Northern Enlargement in Italy distance to Vienna, Denmark distance to Stockholm is used as the distance to the nearest capital of a joining country

While the results in the main paper are suggestive, a number of methodological criticisms could be levelled against them. In particular one could argue that measuring all effects on the regional distribution of employment, population and wage growth as well on investments through dummy variables may lead to ommitted variables problems. For this reason Hanson 1998 suggests using a series of further proxies for the

influences of regional employment. These include the share of employment of a particular industry in a region and the gini coefficient in a region (see tables 9 and 10).

Table A2: Regression Results for Sectoral Productivity Growth

Total Prod	ginireg	rconcentr	distock	discap	_lmemX disto_1	_lmemX disca_1	Nobs (r2)
Greece	1.4699	0.5145***	-0.0167	0.0122	0.0113	-0.0073**	2184
	2.8045	0.1792	0.0079	0.0034	0.0132	0.0036	0.484
Southern Enlargement	-2.1821	-0.2643	0.0087	0.0002	0.0112	-0.0018	4200
	4.0885	0.3034	0.0229	0.0007	0.0257	0.0025	0.236
Northern Enlargement	-1.7872	-0.1362	-0.0037	-0.0002	0.0090*	-0.0015**	3862
	4.8786	0.2414	0.0063	0.0005	0.0065	0.0007	0.202
France	3.1498	-0.0159	-0.0054	-0.0003	0.0068	0.0008	3696
	7.7872	0.2600	0.0066	0.0011	0.0081	0.0018	0.362
North inc	5.9879	-0.2222	-0.0031	0.0007	0.0003	-0.0012	3864
	3.2710	0.1726	0.0015	0.0015	0.0029	0.0016	0.151
Manuf Prod							0.2469
Greece	5.9984	1.2876***	-0.0155	0.0070	-0.0028	0.0014	936
	2.3153	0.3379	0.0054	0.0020	0.0070	0.0034	0.695
Southern Enlargement	-2.6087	-0.3332	0.0082	-0.0002	0.0077	-0.0023	1800
	3.3674	0.5110	0.0083	0.0011	0.0232	0.0027	0.188
Notrhern Enlargement	-2.1967	0.1158	-0.0062	0.0010	0.0053	-0.0019	1656
	7.2139	0.3160	0.0048	0.0016	0.0053	0.0015	0.133
France	-2.0922	-0.0056	0.0008	0.0008	-0.0028	-0.0004	1584
	5.3029	0.2667	0.0029	0.0011	0.0058	0.0023	0.459
North inc	3.1874	-0.2844	-0.0024	0.0004	0.0012	-0.0009	1656
	2.1436	0.2345	0.0034	0.0007	0.0036	0.0009	0.323
Service Prod							
Greece	-1.7501	0.4237***	-0.0173	0.0164	0.0203	-0.0132	1248
	3.8562	0.1994	0.0117	0.0053	0.0230	0.0048	0.442
Southern Enlargement	-1.8610	-0.2624	0.0092	0.0004	0.0137	-0.0015	2400
	6.0505	0.3011	0.0393	0.0013	0.0399	0.0028	0.232
Notrhern Enlargement	-4.2328	-0.4848	-0.0015	-0.0011	0.0109	-0.0010	2208
	7.9298	0.3282	0.0085	0.0013	0.0089	0.0014	0.117
France	2.2504	0.0143	-0.0102	-0.0012	0.0126	0.0016	2112
	14.3049	0.2198	0.0154	0.0024	0.0173	0.0026	0.1492
Italy	8.7998	-0.0899	-0.0022	0.0007	-0.0018	-0.0009	2484
	3.6700	0.3767	0.0038	0.0031	0.0053	0.0031	0.2267

Note: All regression include period, sector and sector –time dummies. Values in brackets are (heteroskedasticity serial and spatial correlation robust) standard errors (see Driscoll and Kray (1998) *, **, *** signify significance at the 10% (5%) (1%) level. For France distance to Madrid is replaces distance to Brussels, For the nearby Member States in Northern Enlargement in Italy distance to Vienna, Denmark distance to Stockholm is used as the distance to the nearest capital of a joining country

In general the results change very little about the general findings. The effect of integration on regions more diistant from Brussels remain insignificant for both the employment growth as well as the productivity growth regression and a concentration of production can be found only in the case of employment growth in southern

enlargement while in the case of Northern Enlargement and enlargement by Greece regions further away from the capital city showed higher productivity growth.

The results provide additional insights in so far as they suggest that both regional concentration and specialisation as measured through the gini coefficient and the regional concentration remained insignificant determinants of regional growth experiences in most countries analysed. We find that only increased regions in which an industry was more concentrated showed significantly higher productivity growth but lower employment growth.

Labor Market Effects of Economic Integration – The Impact of Re-Unification in German Border Regions [†]

Thiess Buettner[‡]

ZEW, Mannheim University, and CESifo

and

Johannes Rincke

ZEW and Mannheim University

Abstract: The paper argues that economic integration causes problems for the labor market of high-wage countries due to cross-border labor mobility and the accompanying increase in labor supply. Empirical evidence is provided from an analysis of regional labor market effects of German re-unification. In the aftermath of the re-unification shock, despite of some gain in employment, border regions situated at the former German-German border are found to have experienced a fall in the relative wage position and an increase in unemployment relative to other West-German regions. As this points to adverse labor supply effects for resident workers due to cross-border labor mobility this result is bad news for EU regions situated at the border with the Accession countries in Central and Eastern Europe.

Key Words: Economic Integration; Border Regions; EU Enlargement; German Re-Unification; Differences in Differences Estimation

JEL Classification: J61, R23, F15

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[‡]Address: ZEW
L7, 1
D-68161 Mannheim
Germany

Phone: +49 621 1235 160
Fax: +49 621 1235 223

E-mail: buettner@zew.de

1 Introduction

In its recent past Europe has seen the opening up of several internal borders and with the accession of new members states in Central and Eastern Europe to the European Union further borders are bound to fall. This fast unexpected movement has been welcomed by many as a relief from suppression. The probably best known single event is the border removal in the city of Berlin in 1989; the pictures of people from both parts of the border celebrating have been noticed throughout the world. However, in difference to this focal point of history the expected removal of further barriers to mobility at the EU's eastern border is regarded with mixed emotions: the removal of the border is welcomed as it is an impediment to travel and trade, but at the same time the competition with cheap labor from across the border is feared as a threat to the labor market conditions faced by the resident workers. Whereas estimates of the inflow of immigrant workers point to a relatively modest expansion of labor supply (*e.g.*, Boeri and Bruecker, 2001), it is important to note that due to relatively small distances other forms of cross-sectional labor mobility such as weekly or daily commuting is likely to be important. This becomes particulary obvious in the case of Berlin - situated only about 50 miles from the German / Polish border.

Regardless of the actual size of the labor supply expansion in the course of European Enlargement, in order to assess its labor market consequences one might nevertheless consult the literature about the impact of immigration on the labor market of host countries. According to surveys of the literature such as Friedberg and Hunt (1995) or Zimmermann (1995) existing empirical evidence on the impact of immigration on the employment opportunities of native workers shows only quite moderate effects. However, many studies

rely on cross-sectional differences in immigrant density across local labor markets, where it is quite difficult to identify the labor supply effect of immigration. As recently emphasized in Borjas (2003) if immigrants select themselves into specific labor markets with favorable conditions, empirical results with respect to adverse supply effects on resident workers are likely to be biased and some additional information is needed for identification.

Given this background this paper sheds light on the labor market effects of economic integration, and, in particular, on the impact of cross-border labor mobility. It exploits the significant reduction in impediments to labor mobility in the process of the German re-unification in order to identify labor supply shocks in the West German labor market. More specifically, based on the assumption that cost of mobility are increasing in distance, we focus on the impact of the border removal in the regions situated at the German-German border against the reference case of regions in the hinterland. German re-unification is probably one of the most interesting cases of economic integration and its impact on the labor market in recent history, because the impediments to mobility mainly consisted in the border itself. Other impediments to mobility which are often encountered at international borders are largely absent. People at both sides of the border share a common language and the same cultural background. Possibly even more important, due to their formal status as West-German citizens people from East-Germany could immediately enter the West-German labor market even before German re-unification was established at the constitutional level. At the same time re-unification constituted a rather unexpected event, which can be considered as a quasi-experiment for the border regions.

Surprisingly little is known about the consequences of this unique experiment of integra-

tion in the border regions. Jung (2002) and Kruesemann (2002) provide some descriptive evidence for the eastern border of Lower Saxony pointing towards a deterioration of labor market conditions. However, aside of those case studies, to the best of the authors' knowledge this paper provides the first systematic analysis of the labor market integration shock experienced in the regions at the western side of the former German-German border.

The paper proceeds as follows. The following section provides a theoretical discussion of the possible labor market effects of economic integration, yielding several testable empirical predictions. In particular, it shows that a significant reduction in transaction cost which could possibly arise from a border removal will lead to an employment expansion accompanied with a decline in wages and a rise in unemployment in the high-wage region. Section 3 lays out the investigation approach to test these predictions empirically. Section 4 presents the results, which confirm that in comparison with the labor market development in other parts of West Germany and controlling for other possibly interfering developments, the border regions have in fact seen an increase in employment, a reduction in wages, and an increase in unemployment. The last section provides a conclusion.

2 Theoretical Considerations

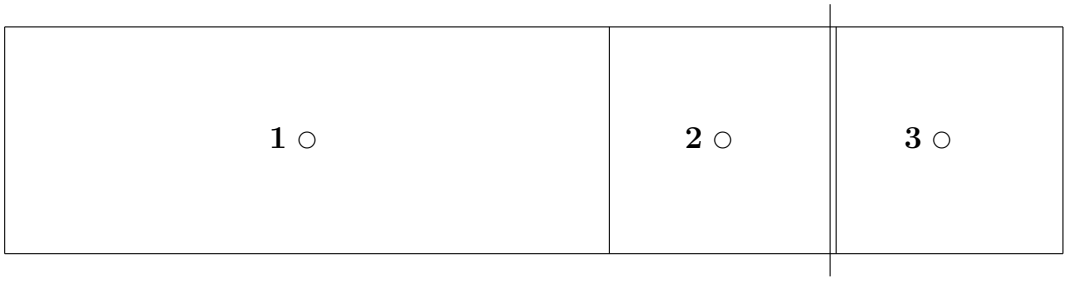
Basically a border defines the geographic area for which a set of public institutions is defined. As a consequence, by crossing the border an agent may face significant changes in the institutional environment under which he or she operates. As this will often tend to undermine the effectiveness of policies many borders, national borders in particular, constitute significant barriers to mobility. In the present context, we will focus on the

latter aspect of a border and, thus, the following treats the border simply as an institution which imposes (sometimes prohibitive) transaction cost on the exchange of goods and services between regions or countries.

A removal of a border will significantly expand the opportunities of regions to engage in trade as well as to demand or supply factor services from one region to the other. Hence, the removal of a border can be seen as a discrete change in the degree of integration of goods and factor markets. It is obvious that the reduction of transaction cost may be important for all markets. But in order to focus on local labor market effects consider a simple small open economy which trades goods at internationally fixed prices and lends or supplies capital at a common rate of interest. In this economy, without further assumptions the opening up of the border with another small country which may or may not be open for trade with the rest of the world does not affect the price vector.

To be more precise, let us focus on a country with two regions, a main region (denoted as (1) in Figure 1) and a border region (2). The latter is adjacent to a third region (3), which is part of another country. For simplicity, let regions 2 and 3 be of equal size. In each

Figure 1: Stylized Map of the Regions



region there is a set of households distributed in space such that the households differ in terms of their cost of mobility. Consider households with place of residence within region

i. Regarding the option to work in region j the spatial distribution of households gives rise to a distribution of the cost of mobility m_{ij}. In addition to household-specific cost of mobility further cost result from the imposition of the border between region 2 and 3. Due to the border, mobility between regions 2 and 3 is burdened with additional cost of δ.

For simplicity, assume that cost of mobility are additive. A household faces mobility cost within the region

$$m_{i,i} = \omega.$$

Let ω be distributed across households with density $g(\omega)$ in all regions, where $\omega \in [0, \infty]$ and $g(\omega) > 0 \, \forall \, \omega \in [0, \infty]$. If an individual travels to a neighboring region it faces additional mobility cost $\mu \in [0, \infty]$, such that the total cost of the transfer from region i to region j is

$$m_{i,j} = \mu + \omega, \quad |i - j| = 1.$$

Again, let the additional component μ be distributed identically in all regions. The density of μ is denoted as $f(\mu)$ with $f(\mu) > 0 \, \forall \, \mu \in [0, \infty]$. With regard to mobility to more distant regions we assume that for each individual total cost is higher

$$m_{i,j} > \mu + \omega, \quad |i - j| > 1.$$

In order to simplify the analysis, we focus in the following on the case where, initially, the wage in region 3 is lower than the wage in regions 1 and 2, and where wages in regions 1 and 2 are equal. In other words we look at the impact of integration between a low-wage country, represented by region 3, and a high-wage country, consisting of a border region (2)

and a region in the hinterland (1). With the assumption that $w_1 = w_2 > w_3$ a household from region 1 will supply labor in region 1 if

$$\omega \quad < \quad w_1, \tag{1}$$

where w_1 is the market wage in region 1; otherwise the household abstains from participating. Supplying labor to region 2 or 3 is not attractive as wages there are not higher. Similarly, a household from region 2 will supply labor to region 2 if

$$\omega \quad < \quad w_2; \tag{2}$$

otherwise the household is not participating. In the initial situation, supplying labor to region 1 or 3 is not attractive as wages there are not higher. Only for households from region 3 the initial situation is such that some may want to supply labor to region 2. Households from region 3 supply labor to the low-wage region 3 if

$$\mu \quad \geq \quad w_2 - \delta - w_3 \quad \text{and} \quad \omega < w_3, \tag{3}$$

but to region 2 if

$$\mu \quad < \quad w_2 - \delta - w_3 \quad \text{and} \quad \omega + \mu < w_2 - \delta. \tag{4}$$

Consequently, the supply of labor in region 3 is

$$L_3^S(w_2, w_3, \delta) = \int_{w_2-\delta-w_3}^{\infty} \int_0^{w_3} f(\mu)\, g(\omega)\, d\omega d\mu = G(w_3)[1 - F(w_2 - \delta - w_3)], \quad (5)$$

where G and F are the cdf's of ω and μ, respectively. For region 2 the supply of labor is determined by

$$L_2^S(w_2, w_3, \delta) = \int_0^{w_2} g(\omega)\, d\omega + \int_0^{w_2-\delta-w_3} \int_0^{w_2-\delta} h(\lambda, \mu)\, d\lambda d\mu,$$

where $\lambda = \omega + \mu$ and $h(\mu, \lambda)$ is the joint distribution of mobility cost within and across regions. Noting that $h(\lambda, \mu) = h(\lambda|\mu) f(\mu)$, and $h(\lambda|\mu) = g(\lambda - \mu)$ we can simplify this expression to

$$L_2^S(w_2, w_3, \delta) = G(w_2) + \int_0^{w_2-\delta-w_3} \int_0^{w_2-\delta-\mu} f(\mu)\, g(\omega)\, d\omega d\mu. \quad (6)$$

Finally, the supply of labor at 1 is simply

$$L_1^S(w_1) = \int_0^{w_1} g(\omega)\, d\omega. \quad (7)$$

In order to determine the impact of the transaction cost δ on the level of wages we need some assumptions about labor demand. Suppose that employment is chosen such that the marginal product equals the wage rate and suppose that production is determined by a function $F(L_i, \xi_i)$, where L_i is the labor input and ξ_i is a region-specific factor of production. Then, labor market equilibrium is determined by a set of wages w_1, w_2, w_3

which obey

$$L_1^D(w_1, \xi_1) = L_1^S(w_1) \tag{8}$$

$$L_2^D(w_2, \xi_2) = L_2^S(w_2, w_3, \delta) \tag{9}$$

$$L_3^D(w_3, \xi_3) = L_3^S(w_2, w_3, \delta), \tag{10}$$

where L_i^D is the labor demand in region i. In this setting we can derive the comparative static effect of a change in the transaction cost on wages and participation in region 2 relative to region 1. This effect is of particular interest since both regions are assumed to be part of a high-wage country. However, in our setting they differ with respect to their exposure to labor supply shocks resulting from a reduction in the cost of crossing the border between regions 2 and 3.

To avoid further case distinctions, we assume in the following that the mobility cost δ is less than prohibitive. With 'less than prohibitive' we mean $\delta < w_2 - w_3$ such that in all situations considered there is always a strictly positive share of individuals from region 3 supplying labor in region 2.

First, it is helpful to state the partial impact of the transaction cost on labor supply.

Lemma 1 *Given wages, a decrease in the transaction cost of mobility δ will raise labor supply in the border region of the high-wage country.*

In order to show that Lemma 1 holds we simply have to differentiate (6). This yields

$$\frac{\partial L_2^S}{\partial \delta} = -f(w_2 - \delta - w_3)\, G(w_3) - \int_0^{w_2-\delta-w_3} f(\mu)\, g(w_2 - \delta - \mu)\, d\mu.$$

The statement follows since the expression is strictly negative.

The labor supply increase in the border region following from a decline in mobility cost is at the expense of the low-wage region which is necessarily loosing labor supply. Formally, this can be stated by a Lemma as well.

Lemma 2 *Given wages, a decrease in the transaction cost of mobility will lower labor supply in the low-wage region. The decrease of labor supply in the low-wage region is always smaller than the increase of labor supply in the border region of the high-wage country.*

Differentiation of (5) yields

$$\frac{\partial L_3^S}{\partial \delta} = f\left(w_2 - \delta - w_3\right) G\left(w_3\right).$$

The first statement in Lemma 2 holds since the derivative is strictly positive. The second statement follows since the sum of the partial derivatives from lemmas 1 and 2 is strictly negative:

$$\frac{\partial L_2^S}{\partial \delta} + \frac{\partial L_3^S}{\partial \delta} = -\int_0^{w_2-\delta-w_3} f\left(\mu\right) g\left(w_2 - \delta - \mu\right) d\mu.$$

With regard to the impact of wages in the border region on labor supply, we can state the following:

Lemma 3 *A decrease of the wage rate in the border region of the high-wage country will lower labor supply in this region and raise labor supply in the low-wage region. The decrease*

of labor supply in the border region of the high-wage country is always larger than the increase of labor supply in the low-wage region.

To show that Lemma 3 holds, we differentiate (6). This gives us

$$\frac{\partial L_2^S}{\partial w_2} = g(w_2) + f(w_2 - \delta - w_3) G(w_3) + \int_0^{w_2-\delta-w_3} f(\mu) g(w_2 - \delta - \mu) d\mu.$$

Accordingly, labor supply in region 2 decreases if w_2 is lowered. Differentiation of (5) yields

$$\frac{\partial L_3^S}{\partial w_2} = -f(w_2\delta - w_3) G(w_3),$$

which confirms the increase in labor supply in region 3 following from a reduction of the wage rate in region 2. The sum of the two effects is

$$\frac{\partial L_2^S}{\partial w_2} + \frac{\partial L_3^S}{\partial w_2} = g(w_2) + \int_0^{w_2-\delta-w_3} f(\mu) g(w_1 - \delta - \mu) d\mu,$$

which is strictly positive under our assumptions.

Now we are in a position to derive the impact of the transaction cost of mobility δ on wages.

Proposition 1 *Suppose the slope of the labor demand function is negative. A marginal reduction in the transaction cost of mobility will then reduce the wage rate, raise employment and lower participation in the border region of the high-wage country.*

Proof: Differentiating equations (9) and (10) yields

$$\begin{aligned}\frac{\partial L_2^D}{\partial w_2}dw_2 &= \frac{\partial L_2^S}{\partial w_2}dw_2 + \frac{\partial L_2^S}{\partial w_3}dw_3 + \frac{\partial L_2^S}{\partial \delta}d\delta \\ \frac{\partial L_3^D}{\partial w_3}dw_3 &= \frac{\partial L_3^S}{\partial w_2}dw_2 + \frac{\partial L_3^S}{\partial w_3}dw_3 + \frac{\partial L_3^S}{\partial \delta}d\delta.\end{aligned}$$

Solving for $dw_2/d\delta$ yields

$$\begin{aligned}\frac{dw_2}{d\delta} &= \frac{\frac{\partial L_2^S}{\partial \delta} + \gamma\frac{\partial L_3^S}{\partial \delta}}{\frac{\partial L_2^D}{\partial w_2} - \frac{\partial L_2^S}{\partial w_2} - \gamma\frac{\partial L_3^S}{\partial w_2}}, \\ &\text{where} \\ \gamma &\equiv \frac{\frac{\partial L_2^S}{\partial w_3}}{\frac{\partial L_3^D}{\partial w_3} - \frac{\partial L_3^S}{\partial w_3}} = \frac{f\left(w_2-\delta-w_3\right)G\left(w_3\right)}{-\frac{\partial L_3^D}{\partial w_3} + f\left(w_2-\delta-w_3\right)G\left(w_3\right) + g\left(w_3\right)\left[1-F\left(w_2-\delta-w_3\right)\right]}.\end{aligned}$$

Note that $0 < \gamma < 1$. From Lemma 1 and 2 we know that the sum of the two terms in the numerator is negative, even if γ were unity. With Lemma 3 also the denominator is negative. This implies that

$$\frac{dw_2}{d\delta} > 0.$$

The increase of employment in the high-wage country follows from the negative slope of the labor demand function. The decline in participation in region 2 simply follows from the cdf. of the reservation wage. ■

Our model thus demonstrates that the reduction or removal of barriers at the border will have a differential effect on regional labor markets in the high-wage country. In our model, under the simplifying assumption of initially equal wages in both regions of the high-wage country, the region which is not adjacent to the low-wage region is not affected by a marginal reduction in the transaction cost of mobility from the low-wage region to

the high-wage country. The border region, however, is affected due to an increase in labor supply from the low-wage region. Our empirical approach will exploit exactly this difference between border and non-border regions in the high-wage country.

In a more general model, the differential effect of a labor supply shock on border and non-border regions could be discussed in more detail. If, for instance, there is a positive wage differential between region 1 and region 2 possibly arising from a center-periphery structure, a sort of domino–effect will arise where the integration shock is propagated spatially by the labor supply behavior of residents as is discussed in the case of U.S. immigration (*e.g.*, Filer, 1992, Borjas, Freeman, and Katz, 1997, and Card, 2001). Another interesting extension could refer to the productivity differences ξ_1, ξ_2 and ξ_3 which have been taken as given, so far. One might argue that with the removal of the border the attraction of labor to the high-wage country will give rise to agglomeration effects and further increases in productivity (Hanson, 1997). However, for the present purpose of studying the integration effect on a border region's labor market, the analysis presented already provides us with a sufficient set of empirical implications.

3 Investigation Approach

Empirical evidence on the impact of the removal of barriers at the border on the labor market is obtained from a panel of counties in West Germany. From the total of 327 counties in West Germany (excluding West-Berlin - because of its specific geographic situation) 20 counties are directly situated at the inner-German border. Invoking the above concept of spatial transaction cost δ it can be assumed that the decline in spatial transaction cost

relative to East Germany is particularly effective in these regions. Hence, they should have been exposed more than other regions to the integration shock from re-unification. The empirical analysis exploits the variation in the geographic situation of the counties by means of a "differences in differences" approach, that is we look at the change in the position of labor market indicators in regions at the border relative to other regions. In several respects the labor market integration effects of re-unification in the regions directly situated at the German-German border are a promising subject for this approach. As pointed out by Angrist and Krueger (1999) this approach is "[...] well suited to estimating the effect of sharp changes in the economic environment or government policy." (*ibid.*, p.1296). Certainly, the entire removal of the inner-German border qualifies as such a sharp and drastic change.

Before re-unification, due to the erection of the Berlin Wall in 1961 and the corresponding enforcement of border controls in East Germany, mobility from East to West Germany was severely suppressed.[1] But, when the Berlin Wall tumbled in November 1989 people from East Germany were free to leave their country.[2] In the subsequent months, re-unification was put forward in a quick succession of events. Commuting cost across the border were quickly lowered by improving, or reviving, roads, public transport and communication systems. The political decision process accompanying re-unification had its most remarkable points in the treaty concerned with the creation of the monetary and economic union be-

[1]Whereas in the 12 years between 1949 and 1961 approximately 2.7 Million people moved to the west, in the period between 1962 and 1989 only 0.6 Million people came (Sinn and Sinn, 1992).

[2]Already in 1989 a total of about 0.39 Million individuals moved to West Germany, followed by nearly 0.4 Million in 1990 (Statistisches Bundesamt, 1999). The mass exodus had begun already before November 9 across the Hungarian-Austrian border and via the West German embassies in Prague and Budapest, but the majority of people who left the GDR in 1989 came across the German-German border after the lifting of the "Iron Curtain".

tween both German States, which came into force on July 1, 1990, and the treaty concerned with the political re-unification, three months later on October 3.

Already before 1990 citizens from East-Germany were formally treated as German citizens in West Germany. Thus, with the barriers to entry falling in November 1989 East German citizens could immediately enter the West-German labor market at drastically reduced transaction cost. As the West German labor market was and still is characterized by significantly higher wages, and since unemployment quickly rose in East Germans due to the collapse of socialist economy, it seems reasonable to expect an expansion of labor supply in the West-German labor market after re-unification, in particular, in the border regions. A further, important characteristic of German re-unification is the high degree of unexpectedness. Although it seems hard to understand nowadays, still in 1989 the vast majority of Germans - at least in the West - did not take the opening up of the German-German border as a serious possibility. All this justifies to consider the removal of barriers at the German - German border as a sharp change in the economic environment of the border regions and, therefore, a differences in differences approach seems appropriate in order to test for its labor market effects.

Basically, the analysis summarizes the development of key labor market indicators before and after the re-unification shock by regressions of the following type

$$\begin{aligned} y_{i,t} &= \beta_2 \left(d_{2,t} \times Border_i\right) + \cdots + \beta_T \left(d_{T,t} \times Border_i\right) \\ &+ \theta_2 d_{2,t} + \cdots + \theta_T d_{T,t} + \pi_{i,t} + \alpha_i + u_{i,t} \end{aligned} \tag{11}$$

To capture common trends for each dependent variable $y_{i,t}$ we include a set of time dummies

$d_{2,t}, \ldots, d_{T,t}$ such that $d_{s,t} = 1$ if $s = t$, and zero otherwise. Time-invariant characteristics of regions are captured by the fixed regional effect α_i. In difference to the well known study of Card (1990) on the "Mariel boatlift" the exposition to the shock is not captured by a single variable, but by a couple of interaction terms between the geographic situation of a county at the border and the respective year. This reflects the fact that the economic integration between the two parts of Germany constituted not just a single shock in 1990, after the border fell, but rather a sequence of shocks. The setting deviates further from the study of Card (1990) in introducing an explicit control variable, which reflects the availability of investment subsidies due to German regional policy. More specifically, we introduce a dummy variable $\pi_{i,t}$ which is unity if a county encloses locations eligible for investment subsidies. Note that this variable is time-varying at the local level as the regional policy is revised annually and has been reorganized substantially in the aftermath of re-unification.[3]

In order to test for the effects of integration as outlined in Section 2 the empirical analysis uses a variety of different indicator variables for the development of local labor markets, including not only wages, salaries, and employment, but also the local unemployment rate. The latter variable is important because no other indicator of the participation of the resident population is available; employment figures refer to the location of the employer

[3]In West Germany, regional policy before 1989 was focussed on two types of regions. Firstly, a program called 'Improvement of regional economic structure' for regions with poor economic performance or suffering from structural change is in place since 1969. The main tool of this program is investment subsidies. Secondly, regional policy has been concerned with regions at the German-German border, the so-called 'Zonenrandgebiet'. They were considered to be severely disadvantaged by their location and given access to all measures of the 'Improvement (...)' program. After re-unification, the focus of German regional policy shifted to East Germany. The concept of 'Zonenrandgebiet' was effectively dropped in September 1991, and already since October 3, 1990 all regions in East Germany had access to the 'Improvement (...)' program. However, also after 1990 there have always been several regions in West Germany, both in the former 'Zonenrandgebiet' and outside, that had access to measures of German regional policy.

and not to the place of residence of the household. Thus, they are not indicative of the participation of the resident population.

Table 1: Descriptive Statistics

	Nobs	Mean	Std Dev	Min	Max
Unemployment rate (in %)	4562	8.25	3.11	2.27	20.9
Employment per capita	4890	.331	.116	.126	.942
Population (in 1000)	4890	192	163	33.0	1710
Hours per empl. (Manuf.)	3272	1.15	.840	.321	12.1
Investment per empl. (Manuf.) [a]	3273	11.9	5.07	2.89	65.7
Wage (per day) [a]	3912	124	27.8	70.5	198
Salary (per day) [a]	3911	158	35.8	81.6	246
Regional policy	4890	.445	.494	.00	1.00

[a] measured in Deutsche Mark and 2000-Prices. Sample size varies due to missing values.

4 Results

The first column in Table 2 reports results for the rate of unemployment as the dependent variable. Starting in 1990, border regions show a significant increase in unemployment relative to 1987 and the differential grows to 2.28% in 2000. Thus, the results indicate that the opening of the border resulted in a strong, persistent and significant disadvantage of border regions relative to the base year 1987 in terms of unemployment. The dummy for regional policy is positive and significant, indicating that unemployment is higher in regions subject to special investment incentives provided by regional policy. However, note that the coefficient reflects both the distribution of investment subsidies as well as their impact on the economy. Thus, it is not clear whether the positive significance indicates a failure of regional policy to reduce unemployment or just the selection of regions into the program.

Columns (2) to (4) in Table 3 depict results for total employment and population. The employment series shows a positive development after re-unification. For the period between 1991 and 1997 the employment differential relative to the base year is significantly positive. However, at the end of the time period analyzed a decline in employment - albeit not significant - is found. Despite of the, at least, temporary increase in employment, population shows a growing negative differential in the border regions. In 2000 the population is reduced by almost 3 % relative to the period 1986. Taking together, employment per capita is significantly increased in the periods after re-unification.

In order to see whether further employment effects in terms of hours have occurred after re-unification, column (5) reports some statistics for the hours worked (for blue-collar workers only) in the manufacturing industry scaled with the number of employees (including white-collars). However, no significant increase in hours is found. The scaling of hours worked by the total number of employees is certainly a problem, but the number of blue-collar workers was not available.

In order to interpret the border development as indicative of the integration effect on the labor market it is important to control for the presence of investment subsidies due to regional policy, in particular, because of the cutback of those subsidies in the aftermath of re-unification. Therefore, all regressions employ the dummy for presence of those subsidies already mentioned before. To test whether this dummy is in fact able to control for the cutback of investment subsidies an alternative regression has been carried out for investment per employee in manufacturing. If regional policy is sufficiently captured by this dummy variable the investment series scaled with employment and conditional on the regional policy dummy should not display a significant difference in the development of the

Table 2: Estimation Results

Dep. Variable	Unemp.	log Emp.	log Pop.	log $\frac{\text{Emp.}}{\text{Pop.}}$	log $\frac{\text{Hrs.}}{\text{Emp.}}$	log $\frac{\text{Inv.}}{\text{Emp.}}$
	(1)	(2)	(3)	(4)	(5)	(6)
Border×(year=87)		-.002	-.008	.006		
		(.015)	(.013)	(.010)		
Border×(year=88)	.247	-.008	-.014	.006		
	(.441)	(.014)	(.012)	(.010)		
Border×(year=89)	.598	-.011	-.017	.007		
	(.394)	(.013)	(.011)	(.010)		
Border×(year=90)	1.16 **	-.000	-.015	.014	.009	-.067
	(.370)	(.013)	(.011)	(.010)	(.030)	(.102)
Border×(year=91)	1.34 **	.028 **	-.019 *	.047 **	.190	-.032
	(.362)	(.013)	(.011)	(.010)	(.201)	(.110)
Border×(year=92)	1.19 **	.027 **	-.022 **	.049 **	.009	.037
	(.363)	(.013)	(.010)	(.010)	(.039)	(.112)
Border×(year=93)	1.22 **	.028 **	-.022 **	.050 **	.023	-.083
	(.376)	(.012)	(.010)	(.010)	(.030)	(.104)
Border×(year=94)	1.18 **	.035 **	-.021 **	.056 **	.023	-.019
	(.409)	(.012)	(.010)	(.010)	(.030)	(.106)
Border×(year=95)	1.36 **	.040 **	-.021 **	.060 **	.024	-.060
	(.419)	(.012)	(.010)	(.010)	(.029)	(.097)
Border×(year=96)	1.70 **	.031 **	-.022 **	.053 **	.039	-.072
	(.419)	(.013)	(.011)	(.010)	(.031)	(.109)
Border×(year=97)	1.90 **	.030 **	-.020 **	.050 **	.039	-.043
	(.384)	(.014)	(.012)	(.010)	(.031)	(.113)
Border×(year=98)	1.98 **	.021	-.021 **	.042 **	.023	-.162
	(.371)	(.015)	(.012)	(.010)	(.029)	(.115)
Border×(year=99)	2.08 **	.010	-.023 **	.032 **	.036	-.110
	(.387)	(.017)	(.013)	(.011)	(.031)	(.132)
Border×(year=00)	2.28 **	-.010	-.029 **	.018		
	(.385)	(.017)	(.014)	(.011)		
Regional policy	.124 **	-.037 **	-.015 **	-.022 **	.012	.081 **
	(.049)	(.002)	(.001)	(.002)	(.014)	(.020)
Time period	87-00	86-00	86-00	86-00	89-99	89-99
R^2	.937	.996	.999	.988	.442	.602
Nobs.	4,562	4,890	4,890	4,890	3,272	3,273

Heteroskedasticity consistent standard errors in parentheses. A star denotes significance at the 10%-level, two stars denote significance at 5%-level. All estimations include a full set of regional and time fixed effects.

border regions. Column (6) reports corresponding results. On the one hand, investments in manufacturing in border regions show no systematically different reaction to the integration shock than investments in non-border regions. On the other hand, the provision of investment incentives proves highly significant suggesting that, in fact, regional policy has been effective in creating investment. Thus, the results confirm that the dummy variable for regional policy is a sufficient indicator of investment incentives in our specification.

The results for wages and salaries of low and medium skilled employees are presented in Table 3. Columns (7) and (8) report results for simple regressions following the "differences in differences" methodology. From 1991 on, wages are significantly lower in border regions compared to non-border regions. Once more, the effects are persistent and highly significant. From 1991 to 1997, the average wage in border regions is between 2.1% and 4.2% lower than in the base period. Also for salaries a negative development is found, although the interaction terms between the border and period effects are not significant.

Columns (9) and (10) report further results on wages and salaries obtained from regressions using individual data. These regressions include some additional controls for the characteristics of the workers in terms of age and education as in a standard Mincer-type wage regression. In addition, these regressions exploit the information about the industry affiliation of each worker and introduce controls for the industry as well as indicators for hours worked in the considered industry and negotiated wages according to the corresponding industry level wage agreement.[4] The negative development in the wage level is still confirmed, even though the individual characteristics as well as the industry charac-

[4]This variable is taken from Buettner and Fitzenberger, 2002.

Table 3: Estimation Results, continued

Dep. Variable	log Wage (7)	log Salar. (8)	log Wage (9)	log Salar. (10)
log Hours			.551 **	
			(.055)	
log Contract wage			.377 **	.029
			(.043)	(.052)
Skill			.088 **	.090 **
			(.001)	(.004)
Age			.333 **	.698 **
			(.003)	(.006)
Age, squared			-.037 **	-.073 **
			(.000)	(.001)
Border×(year=87)	-.005	-.002	- .005	-.001
	(.008)	(.015)	(.007)	(.009)
Border×(year=88)	-.010	-.010	- .007	-.015
	(.008)	(.012)	(.008)	(.010)
Border×(year=89)	-.012	-.000	- .008	-.016 **
	(.008)	(.010)	(.007)	(.007)
Border×(year=90)	-.010	.013	-.010	.001
	(.008)	(.012)	(.007)	(.009)
Border×(year=91)	-.021 **	.004	- .015 *	.004
	(.007)	(.010)	(.006)	(.008)
Border×(year=92)	-.025 **	-.003	- .013 *	-.004
	(.007)	(.015)	(.006)	(.011)
Border×(year=93)	-.026 **	-.008	- .022 **	-.019 **
	(.007)	(.012)	(.006)	(.008)
Border×(year=94)	-.022 **	-.007	-.018 **	-.023 **
	(.008)	(.011)	(.007)	(.008)
Border×(year=95)	-.039 **	.000	- .026 **	-.018
	(.008)	(.013)	(.007)	(.012)
Border×(year=96)	-.042 **	-.015	- .028 **	-.024 **
	(.008)	(.011)	(.007)	(.010)
Border×(year=97)	-.032 **	.002	- .027 **	-.021 **
	(.008)	(.014)	(.007)	(.019)
Regional policy	-.006 **	.005 *	-.004 **	.003 *
	(.001)	(.003)	(.001)	(.002)
Time period	86-97	86-97	86-97	86-97
R^2	.978	.935	.366[a]	.416[a]
Nobs.	3,912	3,911	555,578	280,254

If indexed with [a] R^2 refers to the data after within transformation. Columns (7) and (8) report heteroskedasticity consistent standard errors in parentheses. Columns (9) and (10) report standard errors obtained from a Huber / White Sandwich estimator taking account of the dependence within regions. A star denotes significance at the 10%-level, two stars denote significance at 5%-level. All estimations include a full set of regional and time fixed effects. Columns (9) and (10) also include industry dummies.

teristics are highly significant, pointing to the typical age and education effects and to a significant impact of industry characteristics. This shows that the simple "differences in differences" approach is not yielding spurious results: differences in the composition of the workforce cannot explain the observed trend towards lower wages in the border region in the aftermath of re-unification.

Following conventional practice the results have been obtained relying on robust inference with regard to heteroscedasticity and random group effects (*e.g.*, Moulton, 1990) in case of individual data. Recently, Bertrand, Duflo, and Mullainthan (2004) have criticized this practice for its neglect of possible autocorrelation. They show that the conventional approach in presence of autocorrelation tends to overreject the null-hypotheses of no-treatment effect. As a particularly simple but effective remedy against false rejections of the null-hypothesis they suggest to first run a basic regression without the treatment effect, and then to test for the treatment effect using aggregates of the residuals before and after the shock.[5]

Aside of its simplicity this approach is appealing due to its transparency and reliance on

[5]Formally, the approach starts with estimating

$$y_{i,t} \quad = \quad \theta_2 d_{2,t} + \cdots + \theta_T d_{T,t} + \pi_{i,t} + \alpha_i + u_{i,t}. \tag{12}$$

The estimated residuals are then aggregated into two periods, one before ($\widehat{v}_{i,1}$) and the other after ($\widehat{v}_{i,2}$) the re-unification shock starting in period s,

$$\widehat{v}_{i,1} \equiv \frac{1}{p}\sum_{t=1}^{p} \widehat{u}_{i,s-t} \qquad \widehat{v}_{i,2} \equiv \frac{1}{1+q}\sum_{t=0}^{q} \widehat{u}_{i,s+t}.$$

Finally, the aggregated residuals are regressed on the border effect and time- as well as region-specific fixed effects in the two-period panel regression

$$\hat{v}_{i,t} \quad = \quad \beta\left(d_{2,t} \times Border_i\right) + \theta d_{2,t} + \alpha_i + \epsilon_{i,t} \quad t = 1, 2, \tag{13}$$

where period 1 is before and period 2 is after re-unification such that β captures the treatment effect.

Table 4: Estimation Results based on Residual Aggregation

Dep. Variable	Unemp.	log Emp.	log Pop.	log $\frac{\text{Emp.}}{\text{Pop.}}$	log $\frac{\text{Hrs.}}{\text{Emp.}}$	log $\frac{\text{Inv.}}{\text{Emp.}}$
	(1)	(2)	(3)	(4)	(5)	(6)
Border×(year=90)	.937 **	.029 **	-.010 *	.038 **	.046	.033
	(.292)	(.007)	(.053)	(.006)	(.045)	(.046)
R^2	.446	.652	.680	.552	.150	.598
Nobs.	652	652	652	652	455	448

Dep. Variable	log Wage	log Salar.	log Wage	log Salar.
	(7)	(8)	(9)	(10)
Border×(year=90)	-.017 **	.003	-.011 **	.008
	(.005)	(.010)	(.005)	(.010)
R^2	.240	.242	.955	.895
Nobs.	652	651	652	652

Results of estimations following the suggestions of Bertrand, Duflo, and Mullainthan (2004), see text for further explanation. Heteroskedasticity consistent standard errors in parentheses. A star denotes significance at the 10%-level, two stars denote significance at 5%-level. All estimations include a constant, a time-specific fixed effect and a full set of regional fixed effects.

standard procedures. Table 4 displays corresponding results for each of the series analyzed above. In order to restrict attention to the re-unification effect the estimates focus on the period in the first five years after re-unification (1990-1994) relative to the periods before re-unification using up to four periods (1986-1989).[6] Nevertheless, all of the previous results are clearly confirmed. In the period after re-unification, unemployment and employment are significantly higher, and wages are significantly lower in the border regions. Note that as in the above results salaries do not show a significant effect.[7]

[6]Sensitivity analysis reveals that extending or reducing the post-unification period considered has little effects on the results.

[7]Note the high R^2 in specifications (9) and (10), which reflects the control for individual characteristics in the underlying regressions using individual data.

Taking together the results are clearly in accordance with the predictions of our theoretical model. If in fact the removal of the border barriers has contributed to a higher labor supply in the regions situated in West-Germany close to the German-German border, total employment should have increased. At the same time wages should be reduced, relatively, and, furthermore, the participation of the residents in these regions should fall, possibly causing an increase in the local unemployment rate. The empirical analysis has shown that all of these predicted trends are supported in the data. The adverse population trend is in accordance with the decline in the relative attractiveness of the labor market of border regions and highlights, once again, the importance of cross-border mobility other than migration.

5 Conclusion

From the analysis presented in this paper we can conclude that labor market competition from across the border is a plausible explanation for the joint movement of labor market conditions in West German border regions in the aftermath of German re-unification. More specifically, the results suggest that in line with the predictions from the theoretical analysis workers from East Germany commuting but not necessarily migrating to West German border regions expanded labor supply and led to lower wages and higher unemployment among resident workers even though employment in these regions has been increased.

The results cast doubts about the prospects for the labor markets in EU regions situated at the EU border with the Accession countries in Central and Eastern Europe in the course of EU Enlargement. One has to be careful, however, in translating the findings of

the present paper to the case of EU Enlargement. One important difference between EU Enlargement and the integration at the German-German border is that the accession of the Central and Eastern European Countries is an expected event individuals and firms have begun to anticipate years before integration itself is now going to take place. Workers from these countries already today commute across the border into the EU, and goods markets are already today at least partly integrated. Therefore, we would expect to find less pronounced integration effects for the EU border regions to Central and Eastern Europe after the accession of these countries to the EU. However, even though it is difficult to say to which extent the integration effect in the labor market has already taken place, the results presented suggest that there is a cost of EU-Enlargement to the EU countries as, *ceteris paribus*, resident workers suffer from a deterioration of labor market conditions due to cross-border labor mobility.

Data Sources and Definitions

The dataset consists of all 327 counties and independent cities (*Kreise und kreisfreie Städte*) in West-Germany. The city of Wolfsburg is excluded due to some data restrictions.

Annual population is the average of quarterly figures, official projections based on census data and resident registration information.

Unemployment rate is the official annual figure for the city or county as reported in the statistics provided by the Federal Employment Service.

Total employment refers to the number of employed at the end of June at each year at

local establishments as reported in the employment statistics based on the complete set of social security accounts.

Manufacturing employment refers to employment in manufacturing establishments (Produzierendes Gewerbe) as reported by the Statistical Offices of the German States.

Wages and Salaries: The wage rate refers to the gross daily wage for a male full-time (blue-collar) worker with low or medium skill level as taken from the IABS-REG scientific use file of a 1% random sample of the social security accounts. As the data are top-coded at the upper social security threshold, we restrict attention to low and medium skilled workers. Specifications (7) and (8) employ means of the daily remuneration as of June 30th in the considered region and period. Specification (9) and (10) use the underlying individual data.

Age and skill: The age is the individual age as reported in the IABS-REG. Skill is a dummy reflecting the existence of a vocational training degree. Note that highly skilled employees, *i.e.* with a technical college ("Fachhochschule") or university degree, are removed entirely from the dataset in order to avoid problems from the top-coding of the remuneration figures.

Industry dummies for 40 manufacturing and non–manufacturing sectors according to the industry classification used by the Federal Labor Office.

Hours: Average weekly hours paid at the industry level for 40 manufacturing and non–manufacturing sectors (for male blue collar workers only). Source: German Statistical Office ("Statistisches Bundesamt", FS 16,2, Segmente 1612-1615, 5565-5568).

Contract wages of blue collar workers: Industry specific index of hourly contract wages of male blue collar workers (1991=100). Source: German Statistical Office ("Statistisches Bundesamt", FS 16,4.3, Segment 2561).

Contract wages of white collar workers: Industry specific index of monthly contract wages of male white collar workers (1991=100). Source: German Statistical Office ("Statistisches Bundesamt", FS 16,4.3, Segment 2554).

Regional policy is a dummy variable for counties enclosing locations eligible for investment subsidies. For all years up to 1991, it is set to unity if for county i in year t at least one of the following two conditions was satisfied:

1. The county encloses locations eligible for investment subsidies from the 'Improvement of regional economic structure'-programm.
2. The county encloses locations which belong to the so-called 'Zonenrandgebiet'.

For all years after 1991, the second condition is dropped since from the year 1992 onwards belonging to the former 'Zonenrandgebiet' does no longer affect on the eligibility for investment subsidies. If all locations in county i lose their status of being eligible for subsidies during year t, π_{it} was set to $m/12$, where m is the number of months in year t in which firms could still apply for subsidies. All information concerning eligibility was taken from the annual report 'Rahmenplan der Gemeinschaftsaufgabe Verbesserung der regionalen Wirtschaftsstruktur'.

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Wage and Employment Effects of opening of the CEEC on Austrian Border Regions

Peter Huber
Austrian Institute of Economic Research (WIFO)
Arsenal Objekt 20
1030 Wien
e-mail: huber@wifo.ac.at

Abstract

This paper extends the analysis of integration effects on border regions to the case of the effects of opening of the Central and Eastern European countries on Austria. We find that after controlling for other factors influencing regional development in the time period considered, border regions did not differ from other regions with respect to employment growth, job creation, job destruction and firm birth and death rates. The only exception to this is the year 1990 in the immediate border regions, where a higher employment growth was registered. This has been primarily due to an expansion of employment in existing firms in particular in services.

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Introduction

Border regions are usually considered to be more strongly affected by integration than inland regions. The traditional cross-border flows of trade, migration and FDI's, influence these regions more strongly, since they are distance dependent, and certain cross-border activities such as commuting, cross-border shopping and cross-border rendering of services with limited market areas, only impact on border regions. In the public debate, where EU-enlargement has generated substantial interest in the effects of integration on border regions recently, the net effects of these factors remain disputed, however. On the one hand, concerns are often voiced about potential negative wage and employment effects due to increased competitive pressures as well as capital and labour mobility. On the other hand, it has been repeatedly argued that integration alleviates the disadvantages of limited market access in border regions and should thus have particularly favourable effects.

Recent economic theories in the tradition of “geography and trade” models (see: Fujita et al, 1999), suggest that determining, which of these arguments is true may difficult from a purely theoretical perspective. In these models the combination of increasing returns and localised externalities as well as agglomeration and transport costs leads to two countervailing effects when cross border transport costs are reduced (which is a synonym for increased integration in these models. On the one hand the increased demand potential leads to border regions becoming more attractive locations for production, because a larger demand potential can be accessed at low transport costs after integration. On the other hand this "market access effect" (see: Ottaviano and Robert-Nicoud, 2004) is countervailed by a market crowding effect which arises because firms located across the border will now also have higher access to the home market. This ceteris paribus will create incentives to move production away from the border in order to escape from more severe competition.

Recent theoretical contributions (Monfort and Nicolini, 1998, Paluzzie, 2001, Krugman and Livas, 1992, Crozet and Koenig-Soubeyran, 2003, Bruellhart, Crozet and Koenig-Soubeyran 2002, Alonso Villar, 1999, Fujita et al 1999, Chapter 18) suggest that the likelihood of beneficial effects on border regions increases the smaller are the pre-existing centres in a

country, the higher is the relative cost advantage of border regions in accessing new markets, the higher is the market potential across the border, the lower is the competitiveness of regions across the border, the lower is the extent of mobility of factors within the country and the lower is the share of mobile sectors in a country. Finally, institutional aspects of integration may be of importance. In particular western European in contrast to North American integration has been characterised by allowing for migration. This may cause negative wage and employment effects for natives residing in a region (see: Büttner and Rincke, 2005).

Theory thus suggests that the effects of integration on border regions may be highly specific to the case studied. Recent empirical evidence corroborates this suggestion. For instance Hanson (1996, 1997 and 1998) finds that trade liberalisation and integration of Mexico led to more rapid wage and employment growth in Mexican border regions, but finds no effects on US production. This may be attributed to the fact that the Mexican market potential was to small to matter relative to the sizeable US market. Similarly, the few studies on European integration which focus primarily on the opening of Central and Eastern Europe or German unification in the 1990's (see Niebuhr and Stiller, 2004 and van Houtem 2004 for surveys) find that investments and firm start-ups in border regions have been only weakly affected by trade liberalisation.

In this paper we focus on the experience of Austrian border regions after the opening of Central and Eastern European Countries (CEEC). This is an interesting case because in contrast to other integration cases studied in the literature, the political changes which led to the opening of the CEEC were rapid and unexpected,1 thus facilitating the identification of integration effects. Furthermore, this case differs from both the US –Mexico case and German Unification in a number of respects. Our results suggest these differences provide substantial variation on the affectedness of border regions relative to inland regions in Austria in comparison to previous literature.

Our case may also be of interest because previous research on Austrian regional development (e.g. Geldner 1994 and Krajasits and Delapania, 1997) has unanimously found that regional growth patterns shifted to the favour of eastern border regions in the post 1990 period, which

was often attributed to the effects of opening of Central and Eastern Europe. This led many analysts to hold relatively optimistic views on the effects of accession of the CEEC on Austrian border regions. This view, however, has recently been challenged by Palme and Mayerhofer (2003), Mayerhofer (2004) and Heschl (2002). Mayerhofer (2004) using aggregate district data, for instance, finds a structural break in employment growth in the 1990's for rural border regions, only. He argues that the higher employment growth of rural border regions may have been caused by the combined effects increased suburbanisation of major cities near the Eastern border, a deconcentration of the location of business services and the easier market access of service firms in rural region to the large cities, rather than the opening in border regions. Our findings corroborate and extend upon Mayerhofer (2004). Using more disaggregate data we analyze the evolution of employment growth, job creation, job destruction and firm birth and death rates in the border regions relative to non-border regions. In contrast to Mayerhofer (2004) our data allows us to control for time invariant district specific effects, differences in affectedness of industries by the business cycle and time varying impacts of the vicinity to large urban centres in Austria. We find that after controlling for these factors there is little indication of a change in regional growth patterns in the early 1990s. Only the year 1990 seems to have been a special case. Furthermore, we find that this lack of an integration effect also applies to different industries and regions and to all indicators analysed in this paper.

Finally, this paper extends previous literature on the effects of integration on border region, by focusing both on net and gross job and firm flows. This allows analysing the regional adjustment processes in reaction to integration in more detail. Our results suggest that effects on employment growth in border regions were primarily due to increased job creation in existing firms. Furthermore, we find little evidence of increased churning (of either jobs or firms) as a reaction to integration. This is interesting because it implies that structural change induced by integration may also have been limited.

The Circumstances of Integration

The case of integration studied in this paper differs in a number of respects from the cases analysed in the existing literature. In particular in contrast to German Unification, Austrian trade liberalisation with Central and Eastern Europe was not associated with monetary union and the freedom of movement of labour and in contrast to the US-Mexico case, the Austrian case concerns integration of a small open developed market economy in a classical European institutional setting of low internal factor mobility and substantial labour market rigidities.

There are also a number of reasons to believe that the effects of the opening of CEECs on the regional structure of Austrian production should have been small. These reasons apply both to the institutional setting in which integration occurred as well as to theoretical considerations. On the institutional side integration effects may have been small because integration with the CEEC was limited in the early years of transition, trade was only liberalised in the European accords in 1992 and because at the same time as integration with the CEECs occurred Austria was also preparing for its accession to the European Union. In 1991 Austria joined the European Economic Area and in 1995 it became a full member of the European Union. This may have had an impact on the location of economic activity because the market potential offered by neighbouring EU countries exceeded that in the CEECs by a factor of 5. To the degree that producers anticipated the accession to the European Union this may have led them to locate in the West of Austria rather than in the East.

On the theoretical side low integration effects may also have been expected because of the economic geography of Austria. Austria is characterised by a relatively large part of the labour force (around 23%) residing in the capital of Vienna. As shown by Bruellhart, Crozet and Koenig (2004) this ceteris paribus would lead us to expect that the profits from decentralising production to the periphery would have been small. Furthermore the economic centre of Austria is located relatively far to the East. The capital of Vienna is located only 60km from the border to Slovakia and 90km from the border of the Czech Republic. This implies that the relative cost advantages of border regions in accessing the market potential in the CEEC are small.

Method

To motivate our approach we consider a competitive labour market where labour demand (L^{D}_{ijt}) for workers of industry i and region j at time t is given by:

(1) $$L^{D}_{ijt} = X_{ijt}\Pi + Y_{ijt}\mathrm{T} + \delta w_{ijt} + \xi^{D}_{ijt}$$

and labour supply (L^{S}_{ijt}) by

(2) $$L_{ijt}{}^{S} = \lambda w_{ijt} + Z_{ijt}\Gamma + \xi^{S}_{ijt}$$

with X_{ijt} a vector of nation specific variables and Y_{ijt} a vector of foreign variables, which shift labour demand, and Z_{ijt} capturing other variables shifting labour supply. The reduced form regression equations for the equilibrium industry – region employment and wage levels are given by:

(3) $$w_{ijt} = X_{ijt}\gamma_1 + Y_{ijt}\gamma_2 - Z_{ijt}\gamma_3 + \eta_{ijt}$$

and

(4) $$L_{ijt} = X_{ijt}\alpha_1 + Y_{ijt}\alpha_2 - Z_{ijt}\alpha_3 + \varsigma_{ijt}$$

Some factors associated with the regional effects of integration captured in Y_{ijt} may be hard to measure. Examples include the relative increase in market potential after trade liberalisation and the increase in market area for non tradables. For this reason we identify the impact of integration similarly to Hanson (1997) by an interaction term between a dummy variable, which takes on the value one if the region under consideration is an immediate border region and a time dummy variable.

Furthermore, a large number of variables other than integration shifting labour demand and supply curves may enter the vectors X and Z in equations (3) and (4) and will thus influence the regional distribution of employment and wages. In particular industries may be characterised by different long run growth paths and affectedness by the business cycle and

regions differ in wage and employment levels due to amenities. Since omitting these variables may bias results, we control for all time invariant differences between regions and industries though region and industry fixed effects and for differences in business situation among industries by an interaction between industry and time fixed effects. In addition to accommodate for the results of previous research on the role of suburbanisation in regional development in Austria we include the distances of district capitals interacted with time dummies to the major cities of Austria (Vienna, Graz, Linz).

Our baseline specification thus reads:

$$V_{ijt} = \sum_t \lambda_t DC_j * J_t + \sum_t \varpi_t B_j * J_t + \sum_j \omega_j R_j + \sum_i \sum_t \varpi_{it} I_i J_t + \zeta_{ijt} \quad (5)$$

where V_{ijt} is the log of the dependent variable, DC_j is a vector of distances to the large Austrian cities (Vienna, Linz and Graz), B_j is a dummy variable which takes on the value 1 if the region is a border region and J_t, R_j and I_i are a series of dummy variables to indicate period, industry and region fixed effects.

In this specification the effect of integration on border regions is identified via the parameter vector ϖ_t which can be interpreted as the percentage difference between border and non-border regions in a particular period t after controlling for all other relevant factors. If this parameter is significantly larger (smaller) in the time period after integration, then border regions have benefited (suffered) from integration. Furthermore, if ϖ_t increases (decreases) for all time periods after integration this implies a permanent shift in wages or employment, while a one time increase represents a short run impact only.

Data

Our data stem from the records of the Austrian Social Security System. They contain annual information on industry affiliation, compensation (excluding bonuses) and region of employment for all employees, who were officially employed for at least one day in the time

period from 1985 to 1995.[2] Since they are not published at the level of disaggregation necessary for our purposes, we constructed employment and median wage levels for 20 industry groups in 91 regions for the years 1985 to 1995 from individual data. We exclude from our analysis public sector employment (since our data does not provide information on tenured public sector employees) and persons working at firms for which we do not know the region or industry in which they operate[3]. These selections leave us with a usable number of in average 1.4 million employment relationships at 140.000 firms per year.

We focus on employment growth and wages where as wage indicators we use the median wage in each industry-district cell.[4] Furthermore, we calculate annual firm level job creation and job destruction measures for each industry – region cell. These are defined analogously to Davis and Haltiwanger (1999): Given S^+ is the set of all firms (k) in industry i and region j at time t, whose employment (B_{ijkt}) was higher at t than at t-1 (including those newly created), job creation in period (JC_{jit}) is given as:

$$(6) \qquad JC_{jit} = \sum_{k \in S^+} (B_{ijkt} - B_{ijkt-1})$$

Job Destruction by contrast is given by the sum of all employment changes in shrinking or closed firms. Defining as S^- the set of all firms, which had a lower employment at time t than at t-1 (including closed firms), job destruction (JD_{jit}) can be defined as:

$$(7) \qquad JC_{jit} = -\sum_{k \in S^-} (B_{ijkt} - B_{ijkt-1})$$

We measure both job creation and destruction relative to average employment in a region. Finally, we measure firm birth and closure rates (relative to the total number of firms) in each industry-region cell, by encoding a closure if a given firm reports zero employment for a year running. Birth occurs at the time a firm appears in the data for the first time.

Table 1 provides a comparison of employment growth, job and firm turnover in border regions and inland region in Austria in the time period from 1986 to 1993. We define as border regions all regions contingent to one of the CEEC bordering on Austria (i.e. Czech Republic, Hungary, Slovakia and Slovenia). In accordance with the findings of much of the

literature on regional development in Austria in the 1980's and 1990's border regions were characterised by lower employment growth throughout the second half of the 1980's. In 1990 – i.e. the year after the opening of the iron curtain - net employment growth differentials between border and non border regions jumped from 0.19 to -1.31 percentage points, and border regions employment growth remained above the levels of inland regions (with the exception of 1991) for the period to 1993.

Thus as previous literature our data indicate a reversal in regional growth trends in Austria in the time period after the fall of the iron curtain. Differences in job creation and destruction rates and firm birth and death rates between border and non border regions, however, oscillated substantially, making a distinction between the causes for the growth processes difficult. Differences in job creation rates between border and inland regions oscillated at around +1.6 and -0.7 percentage points throughout the time period. Job destruction rates started more than a percentage point higher in border regions in the late 80's and reduced to levels between -0.3 percent point lower and +0.7 percentage points higher than in the inland regions after 1989. Finally, both new enterprise formation and firm closures relative to inland regions oscillated substantially over both the time period before and after 1990.

{Table 1: Around here}

Similarly wage differentials between border and non-border regions (see table 2) suggest a far from obvious connection of wage developments to the opening of Central and Eastern Europe. Median wage disparities between border and non-border regions increased from the mid 1980s onwards, then decreased in 1990 to increase for two more years after which they declined again.

Results

Aggregate Effects

Thus visual inspection of the data suggests that while employment growth differentials between border and non-border regions were reversed in the post 1990 period in Austria, it is not immediately visible, which factors account for this reversal. Furthermore, the stylised facts found above may also be caused by other influences such as suburbanisation and differences in cyclical responses among regions. To disentangle these effects from the integration effect, we estimate equation (5) for two definitions of border regions. First, as above, we define as the border region all regions contingent to any of the accession countries. We refer to this region as the immediate border region.[5] Second, we follow Palme and Mayerhofer (2004) and define as the border region all districts whose capital city is within 90 minutes in car transport of the border. We refer to this as the larger border region.

Results for the indicators analysed (see table 2) suggest few effects of integration on border regions. After controlling for other influences a significant increase in employment growth rates relative to the pre 1990 levels occurred only in the immediate border region in 1990. But this effect rapidly loses significance and already in 1991 coefficients of the regional growth rate do not differ significantly from pre - 1990 levels any more. Furthermore, the evidence presented in column 2 suggests that the increase in employment growth is due to increased job creation in 1990, while job destruction and both enterprise birth and death rates were not affected. This accords with an interpretation that the opening of the CEEC led to an immediate additional labour demand in border regions by existing firms. The effects of the opening of the CEEC on the spatial structure of Austria were, however, limited to a one time increase in employment levels and did not result in a change in long run growth or increased new firm creation. Furthermore, the coefficients in table 2 suggest a one time increase in employment by 1.3% relative to inland regions in the immediate border regions in 1990 and job creation was higher by 11.8% relative to inland regions in the same year.

Further, doubt concerning the causal link between shifts in regional employment growth and opening of borders arises, when looking at results for the larger border region. Here the

significant change in 1990 vanishes and parameters remain insignificant throughout the period.[6]

{ Table 2 Around here}

Distributional Effects

Theoretical models in the geography and trade literature often argue that agglomerative and disagglomerative forces may differ among industries. This may imply that different branches react to integration differently. Aggregate results may thus be distorted due to a composition effects. To test for this possibility we estimated equation (5) separately for manufacturing and services in both the immediate and larger border regions. In table 3 we report results for the immediate border region, while results for the larger border region are relegated to the appendix. As can be seen disaggregating these two sectors changes little of our results. For the immediate border region we find a significant deviation of employment growth and in job creation in the service sector only. Thus short-run effects on employment growth arose mainly from higher employment growth in existing firms in services. By contrast all other coefficients remain insignificant for both manufacturing and services.

{Table 3 Around Here}

A further source of composition effects could be the fact that different region types could have reacted to integration in different ways. Mayerhofer (2004) finds a significant shift in growth behaviour of Austrian border regions only for peripheral border regions. We thus use the regional typology due to Palme and Mayerhofer (2003) to compare development in d urbanised and other border regions located in the larger border region to the development of

inland regions in table 4.[7] Once more we find no effects on any of the variables concerned in either of the two region types.

{Table 4 Around Here}

Conclusions

In this paper we analyse the wage and employment effects of the opening of the Eastern border regions on Austria. We find that after controlling for other factors influencing regional development in the time period considered, border regions did not differ from other regions with respect to employment growth, job creation, job destruction and firm birth and death rates. The main effect of integration seems to have been a one time increase in border regions employment levels caused by an increase in growth of existing firms in the service sector. Furthermore, our results indicate that this increase was limited to the immediate border region. Finally, we find no effect of integration on job destruction as well as firm creation and closures.

Our results are thus in contrast to the sizeable effects of integration on border regions found in Hanson (1998) for the case of the Mexican border region, but differ only marginally to previous analysis of other western European integration cases and Henson's results for the US. In consequence the Austrian experience suggests that benefits from integration for border regions arise far from automatically. In particular in cases of small countries with large urban centres such as Austria, where the advantages of market access of border regions relative to inland regions are small and the additional market potential becoming accessible to the border region was small relative to the existing market potential in the EU market, integration may have very little effect on border regions. From a policy perspective our analysis suggests that when designing policies for border regions affected by integration, particular care must be given to the circumstances under which integration takes place, before shaping expectations

on its effects. Finally, our results also suggest that European Enlargement by the CEEC will only have small effects on Austrian border regions.

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Table 1: Regional Labour market indicators in border and non border regions (Austria 1986 – 1993)

Year	Employment Growth	Job Creation Rate	Job Destruction Rate	Firm Birth Rate	Firm Closure Rate	ln (wage)
			Inland Regions			
1986	-0.15	8.81	8.96	10.82	10.21	9.349
1987	-0.97	9.05	10.03	10.40	10.00	9.389
1988	0.79	10.39	9.61	10.35	10.08	9.421
1989	1.02	10.78	9.77	10.55	9.92	9.455
1990	1.91	11.29	9.41	9.66	9.34	9.512
1991	1.35	10.65	9.32	10.27	10.04	9.575
1992	-0.21	9.83	10.05	9.07	10.23	9.638
1993	-1.98	9.23	11.25	9.91	10.81	9.686
			Border Regions			
1986	-0.98	9.54	10.53	9.23	8.78	9.240
1987	-0.82	10.34	11.17	8.71	8.06	9.283
1988	0.21	10.85	10.64	8.64	7.84	9.307
1989	0.83	10.43	9.60	8.12	8.66	9.337
1990	3.22	12.29	9.17	8.93	8.11	9.404
1991	1.08	10.95	9.88	8.52	8.58	9.464
1992	0.52	10.86	10.34	8.44	9.09	9.525
1993	-1.09	10.82	11.92	8.54	9.13	9.590
			Difference			
1986	0.83	-0.73	-1.57	1.58	1.43	0.109
1987	-0.14	-1.29	-1.14	1.69	1.94	0.106
1988	0.58	-0.45	-1.03	1.70	2.24	0.114
1989	0.19	0.35	0.16	2.43	1.26	0.118
1990	-1.31	-1.00	0.24	0.73	1.23	0.108
1991	0.27	-0.30	-0.56	1.75	1.45	0.111
1992	-0.73	-1.03	-0.30	0.63	1.14	0.113
1993	-0.89	-1.59	-0.67	1.37	1.68	0.097

Notes: Border regions = immediate border region (i.e. all regions bordering directly on the CEEC), inland regions all other regions. Regional level of disaggregation, Austrian districts (98 units)

Table 2: Aggregate Regression Results

	Employment Growth	Job Creation Rate	Job Destruction Rate	Firm birth rate	firm death rate	log median wage
			Immediate Border Region			
border*	0.0069	0.0119	-0.0719	-0.1268	-0.1239	0.0135
1987	(0.0061)	0.0580	0.0653	0.0664	0.0594	0.0128
border*	0.0068	-0.0434	-0.0936	-0.1178	-0.0997	-0.0003
1988	(0.0061)	0.0577	0.0660	0.0662	0.0594	0.0128
border*	0.0026	-0.0473	-0.0761	-0.1087	-0.0019	0.0032
1989	(0.0061)	0.0576	0.0661	0.0672	0.0596	0.0128
border*	0.0128**	0.1183**	-0.1001	-0.0521	-0.0234	0.0017
1990	(0.0061)	0.0574	0.0665	0.0667	0.0595	0.0128
border*	0.0042	-0.0048	-0.0562	-0.0378	-0.0084	0.0062
1991	(0.0061)	0.0579	0.0658	0.0674	0.0592	0.0128
border*	0.0074	0.0779	-0.0438	-0.0215	0.0863	0.0015
1992	(0.0061)	0.0578	0.0657	0.0665	0.0588	0.0128
border*	0.0080	0.0309	0.0060	-0.0369	0.0560	0.0115
1993	(0.0061)	0.0584	0.0659	0.0668	0.0595	0.0128
			Larger Border Region			
border*	0.0059	0.0092	0.1134**	0.0040	-0.0013	-0.0318
1987	(0.0159)	0.0053	0.0501	0.0570	0.0572	0.0517
border*	-0.0076	0.0026	0.0968	0.0023	-0.0540	-0.0788
1988	(0.0157)	0.0053	0.0498	0.0572	0.0578	0.0519
border*	0.0106	0.0069	0.0814	-0.0311	-0.0321	-0.0174
1989	(0.0148)	0.0053	0.0498	0.0572	0.0580	0.0520
border*	0.0178	0.0047	0.1464**	0.0237	0.0068	-0.0126
1990	(0.0143)	0.0053	0.0496	0.0575	0.0580	0.0517
border*	-0.0042	-0.0019	0.0881	0.0271	-0.0479	-0.0096
1991	(0.0148)	0.0053	0.0501	0.0572	0.0577	0.0517
border*	-0.0104	0.0011	0.1178**	0.0327	-0.0273	-0.0541
1992	(0.0150)	0.0053	0.0500	0.0570	0.0576	0.0514
border*	-0.0067	0.0047	0.0876	0.0440	0.0204	0.0281
1993	(0.0175)	0.0053	0.0503	0.0570	0.0577	0.0518

Notes: Immediate Border Region = all regions contingent to the CEE, larger border region= all regions within 90 Minutes travelling time from the border. Values in brackets are standard errors of the estimate, *, **, *** signify significance at the 10%, 5%, 1% level. Regressions are performed using outlier robust estimation see Berk(1990), Godall (1983)

Table 3: Regression Results for Manufacturing and Services in the immediate Border Region

	Employment Growth	Job Creation Rate	Job Destruction Rate	Firm birth rate	firm death rate	log median wage
			Manufacturing			
border*	0.0145	0.1990	0.0681	0.1990	0.0138	0.0001
1987	0.0093	0.1004	0.1091	0.1004	0.0894	0.0178
border*	-0.0018	0.1346	0.0666	0.1346	-0.0114	0.0143
1988	0.0094	0.1000	0.1103	0.1000	0.0895	0.0178
border*	0.0068	0.1345	-0.0052	0.1345	-0.0086	0.0175
1989	0.0094	0.0996	0.1102	0.0996	0.0909	0.0177
border*	0.0086	0.1594	-0.0455	0.1594	-0.1044	0.0066
1990	0.0093	0.0991	0.1106	0.0991	0.0896	0.0177
border*	0.0016	0.1315	0.0292	0.1315	-0.1319	0.0033
1991	0.0093	0.1004	0.1104	0.1004	0.0898	0.0178
border*	-0.0017	0.1747	0.0716	0.1747	-0.0749	0.0034
1992	0.0094	0.1009	0.1095	0.1009	0.0887	0.0178
border*	-0.0046	0.0910	0.0561	0.0910	0.0041	0.0059
1993	0.0094	0.1023	0.1091	0.1023	0.0903	0.0178
			Services			
border*	0.0067	0.0111	-0.0517	0.0268	-0.0714	0.0046
1987	0.0067	0.0511	0.0622	0.0763	0.0648	0.0142
border*	0.0028	-0.0015	-0.0501	-0.0813	-0.1209	-0.0056
1988	0.0067	0.0509	0.0618	0.0773	0.0652	0.0142
border*	0.0156	0.0263	-0.1336	0.0045	0.0009	-0.0036
1989	0.0067	0.0510	0.0622	0.0766	0.0647	0.0142
border*	0.0065	0.0594	-0.0262	-0.0163	0.0688	-0.0134
1990	0.0067	0.0509	0.0624	0.0774	0.0648	0.0142
border*	0.0017	0.0249	-0.0192	-0.0367	0.0717	-0.0131
1991	0.0067	0.0510	0.0620	0.0764	0.0642	0.0142
border*	-0.0004	0.0853	-0.0014	0.0907	-0.0285	-0.0121
1992	0.0067	0.0510	0.0618	0.0769	0.0642	0.0142
border*	0.0140**	0.0418	-0.0567	0.0596	0.0617	-0.0023
1993	0.0067	0.0510	0.0621	0.0765	0.0646	0.0142

Notes: Results are for the immediate Border Region = all regions contingent to the CEE, results for larger border region (= all regions within 90 Minutes travelling time from the border) are reported in the appendix. Values in brackets are standard errors of the estimate, *, **, *** signify significance at the 10%, 5%, 1% level. Regressions are performed using outlier robust estimation see Berk (1990), Godall (1983)

Table 4: Regression Results for Industry and Services

	Employment Growth	Job Creation Rate	Job Destruction Rate	Firm birth rate	firm death rate	log median wage
			Urban Regions			
border*	0.0006	0.1174	0.0401	-0.1444	0.0165	-0.0105
1987	0.0072	0.0720	0.0809	0.0837	0.0763	0.0161
border*	0.0030	0.2024	0.0323	-0.1605	-0.0258	-0.0023
1988	0.0072	0.0717	0.0812	0.0851	0.0768	0.0161
border*	-0.0045	0.0999	0.0590	-0.1096	0.0367	-0.0011
1989	0.0072	0.0717	0.0811	0.0859	0.0770	0.0161
border*	0.0034	0.1833	0.0172	-0.0106	-0.0098	-0.0161
1990	0.0072	0.0711	0.0813	0.0849	0.0766	0.0161
border*	-0.0107	0.0993	0.1571	-0.1080	0.0006	-0.0072
1991	0.0071	0.0716	0.0811	0.0850	0.0762	0.0160
border*	-0.0003	0.1937	0.0540	-0.1229	-0.0276	-0.0030
1992	0.0072	0.0717	0.0806	0.0845	0.0754	0.0160
border*	-0.0027	0.1063	0.0854	-0.0378	-0.0203	-0.0039
1993	0.0071	0.0722	0.0804	0.0849	0.0767	0.0160
			Other Regions			
border*	0.0039	0.1231	0.0248	0.1301	0.0104	-0.0090
1987	0.0076	0.0760	0.0849	0.0905	0.0813	0.0174
border*	0.0022	0.1224	0.0241	0.1211	-0.1293	0.0096
1988	0.0077	0.0756	0.0855	0.0917	0.0815	0.0174
border*	0.0117	0.1281	-0.0680	0.1046	-0.1225	0.0062
1989	0.0077	0.0752	0.0852	0.0912	0.0812	0.0174
border*	-0.0084	0.0834	0.1280	-0.0034	-0.0493	-0.0045
1990	0.0077	0.0756	0.0853	0.0933	0.0810	0.0174
border*	0.0008	0.1249	-0.0652	0.0342	-0.0888	-0.0101
1991	0.0077	0.0767	0.0856	0.0905	0.0812	0.0175
border*	-0.0022	0.0420	-0.0631	0.0477	-0.0793	-0.0092
1992	0.0077	0.0762	0.0850	0.0919	0.0801	0.0175
border*	0.0092	0.1235	-0.0514	0.1025	-0.0833	-0.0084
1993	0.0077	0.0762	0.0851	0.0904	0.0812	0.0174

Notes: Results are for the larger border region (= all regions within 90 Minutes travelling time from the border) . Values in brackets are standard errors of the estimate, *, **, *** signify significance at the 10%, 5%, 1% level. Regressions are performed using outlier robust estimation see Berk (1990), Godall (1983)

Table A1: Regression results for Industry and Services in the larger border region

	Employment Growth	Job Creation Rate	Job Destruction Rate	Firm birth rate	firm death rate	log median wage
			Manufacturing			
border*	0.0112	0.0748	-0.0863	-0.0602	-0.1169	0.0156
1987	0.0107	0.1173	0.1248	0.1112	0.1032	0.0203
border*	0.0061	-0.2046	-0.1947	-0.0173	-0.1464	0.0010
1988	0.0108	0.1165	0.1283	0.1121	0.1040	0.0204
border*	-0.0009	-0.1424	-0.0315	-0.0176	-0.0176	0.0039
1989	0.0107	0.1159	0.1276	0.1144	0.1047	0.0203
border*	0.0206**	0.2216**	-0.3115**	-0.0970	-0.0533	0.0088
1990	0.0107	0.1150	0.1289	0.1148	0.1034	0.0204
border*	0.0109	-0.0992	-0.0473	0.0059	-0.1178	0.0156
1991	0.0108	0.1168	0.1269	0.1159	0.1045	0.0204
border*	0.0095	0.0641	-0.1586	0.1002	0.1102	0.0146
1992	0.0108	0.1178	0.1271	0.1122	0.1027	0.0205
border*	0.0009	-0.0693	0.0071	-0.0120	0.0939	0.0259
1993	0.0108	0.1185	0.1272	0.1139	0.1031	0.0204
			Services			
border*	0.0059	-0.0568	-0.1097	-0.1635	-0.0712	0.0094
1987	0.0076	0.0576	0.0703	0.0874	0.0747	0.0161
border*	0.0049	-0.0371	-0.0464	-0.1465	-0.0395	0.0002
1988	0.0076	0.0576	0.0700	0.0877	0.0745	0.0161
border*	0.0068	-0.0425	-0.0843	-0.0690	0.0538	0.0028
1989	0.0076	0.0577	0.0706	0.0882	0.0743	0.0161
border*	0.0019	0.0777	0.0086	-0.0002	0.0164	-0.0054
1990	0.0076	0.0574	0.0707	0.0870	0.0744	0.0161
border*	0.0045	0.0398	-0.1104	0.0122	0.0909	-0.0043
1991	0.0076	0.0576	0.0701	0.0880	0.0735	0.0161
border*	0.0032	0.0412	-0.0372	-0.0413	0.1226	-0.0097
1992	0.0076	0.0576	0.0699	0.0875	0.0734	0.0161
border*	0.0074	0.0533	-0.0087	0.0177	0.0509	-0.0111
1993	0.0076	0.0576	0.0704	0.0879	0.0752	0.0161

Notes: Results are for the larger border region (= all regions within 90 Minutes travelling time from the border). Values in brackets are standard errors of the estimate, *, **, *** signify significance at the 10%, 5%, 1% level. Regressions are performed using outlier robust estimation see Berk(1990), Godall (1983)

Appendix 1: Definition of Border Regions

Figure 1: Definition of the Immediate Border Region

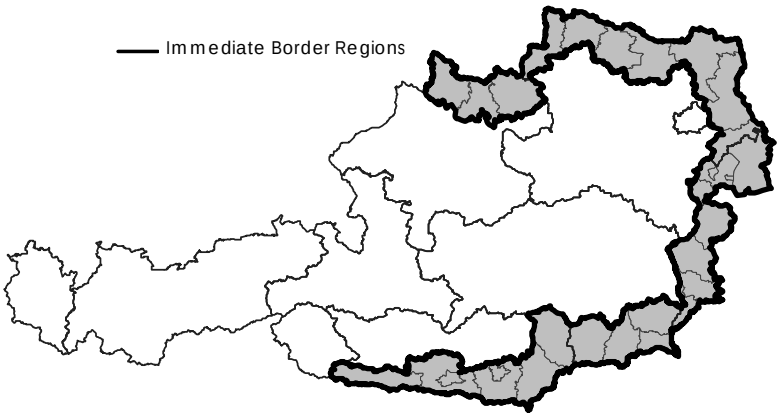
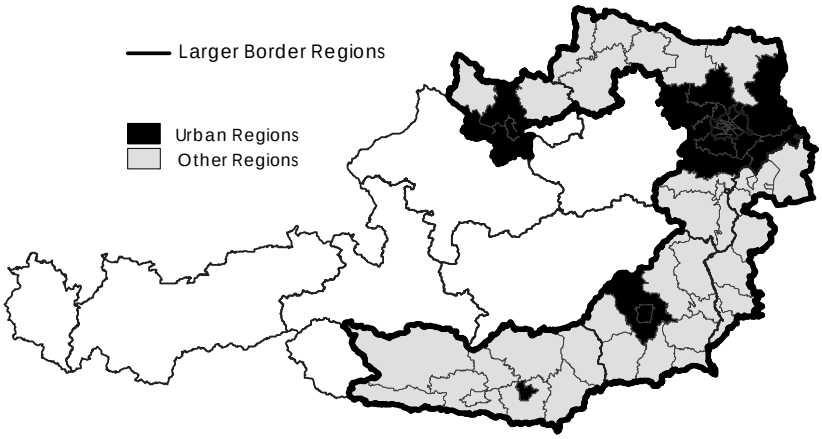


Figure 2: Definition of the Larger Border Region and Border Region Types



NOTES

[1] The opening of the CEEC was a consequence of unexpected and dramatic political changes, and led to a rapid pace of both export and FDI growth. From the time of the fall of the iron curtain in 1989 to 1994 imports from the CEEC to Austria almost tripled and export quadrupled, and by 1998, starting from a level of almost zero, 30% of all Austrian foreign direct investments abroad were invested in the CEEC.

[2] A detailed description of this data set is provided in Schöberl (2004)

[3] This may occur either if firms operate in more than one region, or industry or if inputting errors occur.

[4] We give preference to median wages over average wages because individual data are top coded at the maximum eligible for social security contributions.

[5] Maps of both definitions of border regions are provided in the appendix to this paper.

[6] These results are robust to a number of changes in specification. In particular we experimented with excluding the distance to major cities and regions fixed effects as well as including the distance to CEEC capital cities (Budapest) in the equation rather than the border dummy. All these changes lead to qualitatively similar results as reported above.

[7] This specification was only run for the larger border region since for the intermediate border region this would have resulted on a low number of observations

Market Potential and Border Effects in Europe

Michael Pfaffermayr, Peter Huber, Yvonne Wolfmayr*

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Abstract

We estimate a linear approximation of the market potential function derived in geography and trade models. Using a spatial econometric estimation approach, border effects can be identified by a differential impact of neighboring regions' purchasing power, depending on whether two regions are located in (i) the same country (ii) within the EU15 or (iii) outside the EU15. Our results suggest that there are substantial market potential effects on nominal wage rates. We also find significant border effects between EU15 and non-EU15 countries. Our estimation results suggests that the enlargement of the EU on May 2004 may lead to pronounced wage effects in the new member states, but to relatively small ones for the existing members.

Keyword: Market Potential, Border Effects, Spatial Econometrics

Jel: F10, R12, F12, C21

*Affiliation of all three authors: Austrian Institute of Economic Research, PO-Box 91, A-1103-Vienna, Austria, Michael Paffermayr is also affiliated at the Department of Economics at the University of Innsbruck. E-mail: Peter.Huber@wifo.ac.at, yvonne.wolfmayr@wifo.ac.at and Michael.Pfaffermayr@uibk.ac.at. We gratefully acknowledge financial support from the 5th Framework Project ACCESSLAB and the Austrain National Bank, Jubilaeumsfond Grant Nr. 10057.

1 Introduction

Since the fall of the Iron Curtain and the opening-up of Central and Eastern Europe (CEEC) at the beginning of the nineties major steps of economic integration have been undertaken between the EU and EFTA countries and the CEEC. Examples of this are the reduction of tariffs and other trade barriers with the completion of the Europe Agreements and the introduction of a pan-European cumulative tariff system which replaced the complex system of rules of origin in the European Union. These steps culminated in the accession of eight countries from the region in May 2004.

This accession has been associated with a number of concerns amongst which regional issues and labour market effects figured prominently. In the public debate concerns about the intensified competition for border regions often have been voiced. The majority of economic studies so far, however, mainly focussed on the analysis of wage and employment effects of trade integration for single countries (specifically, the US and the UK). The regional perspective is still under-researched, although new economic geography models suggest major regional impacts of integration. These models make two central predictions on the spatial structure of wages and the effects of integration on wages in border regions. First, falling transport costs across national borders (which is a synonym for integration in these models) may change the spatial structure of wage rates within the country (see: Krugman and Livas, 1992, Fujita, Krugman and Venables, 1999, Crozet and Koenig Soubeyran 2002, Paluzzie, 2001) as well as between countries. As recently pointed out for instance by Brülhart et al. (2004), the reduction in cross border transport costs embodied in EU enlargement may change the spatial structure of EU countries and accession countries. Second, economic geography models predict that regional wage levels follow a non-linear version of the market potential function proposed by Harris (1954). Following the seminal work by Hanson (1998, 2001), who based his estimates of the parameters of this market potential function on the Helpman (1998) version of the so-called Krugman (1991) core-periphery model, a number of contributions provide estimations of the market potential function for the EU15 (Niehbur, 2004) and individual EU countries (Roos, 2001, Brackman et al., 2002, De Bruyne, 2003, Mion 2003).

In this paper we use these two central predictions of economic geography models to test the significance of border effects of EU15-internal and external borders and to simulate a scenario of the potential spatial impact of EU-

enlargement. As in Mion (2003), we linearly approximate the non-linear potential function implied by the core-periphery model to derive a simple linear specification. This specification is estimated for a cross-section of NUTSII regions encompassing the EU15, the largest new EU member states as well as Switzerland and Norway. We extend previous analysis in two ways: First, we identify border effects both within the EU15 and between EU15 and Non-EU15 regions. This is important because our results indicate that there are (i) substantial interaction of wage rates across borders of countries within the EU15 and (ii) that external borders form a major impediment to trade and factor mobility, leading to pronounced extra-EU15 border effects. Second, we use our estimated specification to quantify the impact of the accession of the CEEC to the EU15 on regional wage rates by assuming that in the long run border effects between EU15 and new member states will converge to those found currently among the EU15. These calculations suggest that removing the borders between EU15 and accessions countries results in a significant increase of wage rates in the accessions countries, while those of the incumbent countries remain virtually unaffected.

2 The econometric specification of the market potential function

The starting point of our analysis is the structural market potential function, which relates the nominal wage rate (w_i) in region i to the spatially weighted sum of purchasing power (measured in terms of nominal GDP, y_i) in its neighboring regions. This relation is based on following equilibrium conditions of the Krugman (1991) model:

$$\frac{w_i}{T_i^{\mu}} = \frac{w_j}{T_j^{\mu}} \tag{1}$$

$$T_i = \left[\sum_{i=1}^{J} \lambda_j (w_j e^{\tau d_{ij}})^{1-\sigma}\right]^{\frac{1}{1-\sigma}} \tag{2}$$

$$w_i = \left[\sum_{i=1}^{J} Y_j (e^{-\tau(\sigma-1)d_{ij}}) T_j^{\sigma-1}\right]^{\frac{1}{\sigma}} \tag{3}$$

where subscripts i and j index regions. $\sigma > 1$ denotes the elasticity of substitution between any two variants of manufacturing goods. (1) states

that in equilibrium real wages are the same in all regions so that there is no incentive for workers to relocate. The price level in each region is given by T_i^{μ}, where μ denotes the expenditure share of the differentiated manufacturing good produced under increasing returns ($1-\mu$ percent of the budget are allocated to a agricultural, homogenous numeraire good). This good can be costlessly traded and its price is normalized to 1. Forward and backward linkages induce spatial concentration of workers and firms and constitute the well known centripetal and centrifugal forces in the model (Krugman, 1991). (2) illustrates that the price level of differentiated goods in region j depends on the share of manufacturing goods produced in j, denoted by λ_j, and the index spatially weighted wage rates of all other regions. A region's weight declines in distance (d_{ij}) at rate τ. Lastly, the equilibrium wage rate of region i is given by (3), which forms the basis of our econometric specification we intend to estimate. We take the logs of (3) to receive:

$$\begin{aligned} \ln w_i &= \frac{1}{\sigma} \ln \left(\sum_{j=1}^{J} Y_j (e^{-\tau(\sigma-1)d_{ij}}) T_j^{\sigma-1} \right) \\ &= \frac{1}{\sigma} \ln \left(\sum_{j=1}^{J} Y_j \widetilde{d}_{ij} T_j^{\sigma-1} \right), \end{aligned} \tag{4}$$

defining $\widetilde{d}_{ij} = e^{-\tau(\sigma-1)d_{ij}}$. Following Hanson (1998, 2001), Roos (2001), Niebuhr (2004) and others, we have to eliminate the empirically unobservable price index (T_j) in (3) to arrive at an estimable specification. Our assumptions to derive the basic specification are less restrictive than in the previous literature, which either assumes that real wages are the same in all regions or that the price indices are identical. Also, the model assumes an identical technology across regions, which is unrealistic. Our sample contains Central and Eastern European regions with productivity levels much lower than the EU15 average. There is also a considerable variance in productivity levels between EU15-regions. We assume that wages differ according to labor productivity and country group effects (Eastern European Countries, Non-EU15-EFTA countries and EU15 countries being the base). Formally,

let

$$\frac{w_i}{T_i^{\mu}} = \omega_i \tag{5}$$

$$\frac{w_j}{T_j^{\mu}} = \delta_i^{-1}\omega_i \Rightarrow \tag{6}$$

$$T_j = \left(\frac{w_j}{\omega_i}\delta_i\right)^{\frac{1}{\mu}} \tag{7}$$

where δ_i^{-1} is the correction for factor productivity differences for region i and it is defined as the percentage deviation from the overall mean. Under these assumptions, substituting equation (7) into (4) yields:

$$\begin{aligned}\frac{1}{\sigma}\ln(w_i) &= \frac{1}{\sigma}\ln\left(\sum_{j=1}^{J} Y_j \widetilde{d}_{ij}(\frac{w_j}{\omega_i}\delta_i)^{\frac{\sigma-1}{\mu}}\right) = \\ &= \frac{1-\sigma}{\sigma\mu}\ln(\omega_i) + \frac{1}{\sigma}\ln\left(\sum_{j\neq i}^{J} Y_j (w_j\delta_i)^{\frac{\sigma-1}{\mu}}\widetilde{d}_{ij}\right)\end{aligned} \tag{8}$$

To derive the empirical specification, we approximate linearly around the average yearly wage rate $\overline{w}$ on the left hand side and around the yearly averages on the right hand side. Hence, the linear approximation yields the market potential function in percentages of yearly means of the variables. It enables us to identify the border effects without a non-linear least squares

approach.

$$
\begin{aligned}
& \ln \overline{w}_t + \frac{(w_i - \overline{w})}{\overline{w}_t} && (9)\\
\approx\ & \frac{1-\sigma}{\sigma\mu} \ln(\omega_i) + \frac{1}{\sigma} \ln \left(\overline{Y} (\overline{w}\overline{\delta})^{\frac{\sigma-1}{\mu}} \sum_{j \neq i}^{J} \widetilde{d}_{ij} \right) && (10)\\
& + \frac{1}{\sigma} \frac{\sum_{j \neq i}^{J} (\overline{w}\overline{\delta})^{\frac{\sigma-1}{\mu}} \widetilde{d}_{ij} (Y_j - \overline{Y})}{\sum_{j \neq i}^{J} \overline{Y} (\overline{w}\overline{\delta})^{\frac{\sigma-1}{\mu}} \widetilde{d}_{ij}} \\
& + \frac{\sigma-1}{\sigma\mu} \frac{\sum_{j \neq i}^{J} \overline{Y} \overline{w}^{\frac{\sigma-1}{\mu}-1} \overline{\delta}^{\frac{\sigma-1}{\mu}} \widetilde{d}_{ij} (w_j - \overline{w})}{\sum_{j \neq i}^{J} \overline{Y} (\overline{w}\overline{\delta})^{\frac{\sigma-1}{\mu}} \widetilde{d}_{ij}} \\
& + \frac{\sigma-1}{\sigma\mu} \frac{\sum_{j \neq i}^{J} \overline{Y} \overline{w}^{\frac{\sigma-1}{\mu}} \overline{\delta}^{\frac{\sigma-1}{\mu}-1} \widetilde{d}_{ij} (\delta_i - \overline{\delta})}{\sum_{j \neq i}^{J} \overline{Y} (\overline{w}\overline{\delta})^{\frac{\sigma-1}{\mu}} \widetilde{d}_{ij}} \\
=\ & \frac{1}{\sigma} \sum_{j \neq i}^{J} \frac{\widetilde{d}_{ij} (Y_j - \overline{Y})}{\overline{Y}} + \frac{\sigma-1}{\sigma\mu} \sum_{j \neq i}^{J} \frac{\widetilde{d}_{ij} (w_j - \overline{w})}{\overline{w}} \\
& + \frac{\sigma-1}{\sigma\mu} \frac{(\delta_i - \overline{\delta})}{\overline{\delta}} + \frac{1-\sigma}{\sigma\mu} \ln(\omega_i) + K && (11)
\end{aligned}
$$

where we make use of the row normalized spatial weighting matrix with $\sum_{j=1}^{J} \theta_{ij} = 1$. K captures all remaining terms which are independent of i or j. In our empirical application this spatial weighting matrix possesses the typical element $\theta_{ij} = \frac{\exp(-d_{ij}/\gamma)}{\sum_{i \neq j}^{J} \exp(-d_{ij}/\gamma)}$ for $i \neq j$ and $\theta_{ij} = 0$ for $i = j$ and it follows $\sum_{i \neq j}^{J} \theta_{ij} = 1$. Lastly, $\widetilde{d}_{ij}$ is specified as $\rho\theta_{ij}$, ρ being a spatial parameter to be estimated. Adding the iid error term (or a spatially correlated error term) yields the specification, we estimate below.

$$
\begin{aligned}
\frac{w_i - \overline{w}}{\overline{w}} =\ & K + \frac{1}{\sigma} \frac{(Y_i - \overline{Y})}{\overline{Y}} + \frac{\sigma-1}{\sigma\mu} \frac{(w_i - \overline{w})}{\overline{w}} + \frac{\sigma-1}{\sigma\mu} \frac{(\delta_i - \overline{\delta})}{\overline{\delta}} \\
& \frac{\rho}{\sigma} \sum_{i \neq j}^{J} \frac{\theta_{ij} (Y_j - \overline{Y})}{\overline{Y}} + \frac{(\sigma-1)\rho}{\sigma\mu} \sum_{i \neq j}^{J} \frac{\theta_{ij} (w_j - \overline{w})}{\overline{w}} + \varepsilon_i
\end{aligned}
$$

or

$$\frac{w_i-\overline{w}}{\overline{w}} = \widetilde{K}+\frac{\mu}{\sigma(\mu-1)+1}\frac{(Y_i-\overline{Y})}{\overline{Y}}+\frac{\sigma-1}{(\sigma(\mu-1)+1)}\frac{(\delta_i-\overline{\delta})}{\overline{\delta}} + \frac{\rho\mu}{\sigma(\mu-1)+1}\sum_{i\neq j}^{J}\frac{\theta_{ij}(Y_j-\overline{Y})}{\overline{Y}}+\frac{\rho\,(\sigma-1)}{\sigma(\mu-1)+1}\sum_{i\neq j}^{J}\frac{\theta_{ij}(w_j-\overline{w})}{\overline{w}}+\varepsilon_i$$

We envisage the EU border effect as a differential impact of the neighbors' purchasing power (measured by ρ), depending on whether they are located in the same country, (ii) within the EU15 or (iii) outside the EU15. We use the follwing decomposition:

$$\sum_{i\neq j}^{J}\frac{\theta_{ij}(Y_j-\overline{Y})}{\overline{Y}} = \sum_{i\neq j,\ same\ country}^{J}\frac{\theta_{ij}(Y_j-\overline{Y})}{\overline{Y}}+\sum_{i\neq j,\ EU}^{J}\frac{\theta_{ij}(Y_j-\overline{Y})}{\overline{Y}} + \sum_{i\neq j,\ Non-EU}^{J}\frac{\theta_{ij}(Y_j-\overline{Y})}{\overline{Y}}$$

Now define the percentage deviation Y, and w from their overall means, e.g. $\widetilde{Y}_i=\frac{Y_i-\overline{Y}}{\overline{Y}}$. Then. in vector notation the linear approximation to be estimated reads[1]:

$$\begin{aligned}\widetilde{\mathbf{w}} = {} & \beta_1\widetilde{\mathbf{Y}}+\beta_2\mathbf{W}\widetilde{\mathbf{Y}}+\beta_3\mathbf{W}^{EU}\widetilde{\mathbf{Y}}+\beta_4\mathbf{W}^{NEU}\widetilde{\mathbf{Y}} \\ & +\beta_5\mathbf{W}\widetilde{\mathbf{w}}+\beta_6\mathbf{p}+\beta_7\mathbf{D}_1+\beta_8\mathbf{D_2}+\mathbf{u}\end{aligned} \tag{12}$$

where $\mathbf{W}^{EU}$ is identical to $\mathbf{W}$ if the two regions are located in different countries but within the borders of the EU15 and zero otherwise. $\mathbf{W}^{NEU}$ is identical to $\mathbf{W}$ if one region is in the EU15 and the other outside, or if both regions are in different Non-EU15 (NEU) countries. Hence, β_2 refers to the base of regions from within the same country. $\mathbf{W}$ is the block diagonal spatial weighting matrix with typical $N\times N$ matrix with row normalized spatial weights. $\mathbf{u}$ denotes the error term and we envisage $\mathbf{u}=\boldsymbol{\phi}\mathbf{W}\mathbf{u}+\boldsymbol{\varepsilon}$, $\varepsilon_j\sim iidN(0,\sigma_\varepsilon^2)$. $\mathbf{X}$ comprises additional controls such as productivity. We also introduce a Dummy for the Eastern European countries ($\mathbf{D}_1$) and one

[1]Note, that we have to correct the constant by adding $\left(\frac{\rho_{EU}\mu}{\sigma(\mu-1)+1}\mathbf{W}^{EU}+\frac{\rho_{NEU}\mu}{\sigma(\mu-1)+1}\mathbf{W}^{NEU}\right)\overline{\mathbf{Y}}$, where $\overline{\mathbf{Y}}$ is the vector of means. This correction is particularly important, when calculating counterfactuals.

for Non-EU15-EFTA countries (Switzerland and Norway, $\mathbf{D}_2$) to control for differences in wages due to country group effects. Since we have eight estimated parameters and only three in the theoretical model, identification of the latter is not possible. We thus confine our inference on the signs of the estimated reduced form parameters. Estimating border effects is still possible, however.

3 Data and Estimation results

We use data for a total of 215 regions provided by Cambridge Econometrics, containing NUTSII level information from the Eurostat New Cronos database on regional GVA and wages for EU15 member states and a subset of the largest new EU member states (Hungary, Poland and the Czech Republic) as well as Switzerland and Norway. To avoid problems with non-contingent spaces (due to lacking data on the Balkans) we omitted Greece from the dataset. Furthermore for German regions wage data (compensation per employee) are available only at the level of NUTS I. In the cross-section estimates we draw data for the year 2001. As the dependent variable we use nominal compensation per employee. Regional income (purchasing power), is approximated by nominal GVA and regional differences in labor productivity are added as control variable. Finally, distance is measured as the crow fly distance between the capitals of each NUTSII region.

[Table 1]

Table 1 for each country in our data displays the average distance weighted purchasing power (GVA) of all accessible regions (in column 1). Furthermore, the average distance weighted purchasing power of regions either located (i) in another country but within the EU15 borders (column 2) (ii) in different countries along the EU15- non EU15 border and NonEU15-NonEU15 border (column 3) and finally (iii) in different countries along the border of the EU15 and the three new member states in the sample (column 4). The last column thus gives an indication on how much of regional purchasing power is relocated from outside to inside EU-internal borders after the accession of Hungary, Poland and the Czech Republic. This table corroborates the results of Brülhart, Crozet and Koenig-Souberain (2004) which indicate that the additional market potential of the new EU member states is small relative to the existing EU's market potential for the old member states. Austria

is the country which stands to gain most in terms of market potential by enlargement, but even here the market potential of the average Austrian region in the new member states amounts to less than 6% of the market potential in old EU member states. For countries more distant from the new member states such as Spain the market potential in the new member states is almost zero. In the new member states by contrast a substantial amount of the market potential is located in the old EU member states. In the Czech Republic, Hungary, and Poland around 90% of the total market potential is located in regions in the EU. This table thus suggests that enlargement of the EU could have a large effect on the spatial structure of at least the new member states.

[Table 2]

The old EU member states and the new ones have been integrating for more than a decade, suggesting that some of the potential adjustment may already have taken place in previous years. Specifically, this should materialize in cross-sectional estimates based on data from 2001.

We apply the spatial GM-estimator of Kelejian and Prucha (1999). Since $\mathbf{W}\widetilde{\mathbf{w}}$ is endogenous, we use the spatially lagged values of all exogenous variables as instruments, but we include only those which pass the Sargan overidentifcation test. Shea's R^2 as well as an F-test show that these instruments are relevant. Based on an initial IV-regression, we estimate $\boldsymbol{\phi}$ by solving the GM-conditions of Kelejian and Prucha (1999). The final estimation results are derived using a Cochrane-Orcutt type transformation $\mathbf{y}^*(\widehat{\phi}) = (I - \widehat{\phi}\mathbf{W})\mathbf{y}$ and applying 2SLS on the transformed data.

Table 2 presents results of estimating equation (12) in three versions, which differ with respect to the weight of distance in the spatial weighting matrix. Specification I assumes a medium decay of spatial dependence ($w_{ij} = \exp(\alpha d_{ij}) / \sum_j \exp(\alpha d_{ij}), \alpha = 0.01$), while specifications II and III look at $\alpha = 0.1$ and 0.004 (i.e fast and slow decay, respectively). For each weighting scheme, we estimate two variants, one without (a) and one with (b) an endogenous spatial lag, the former being interpreted as a reduced form of (12). The estimation results indicate significant spatial correlation of the error term (confer the significant Moran I-test of Kelejian and Prucha, 2001) and we prefer Specification I with $\alpha = 0.01$ for further interpretation. Specification II implies a faster decay in distance and leads to similar results, while Specification III with the lowest decay gives higher spatial parameters. In

qualitative terms, the different specifications yield similar estimation results. The estimation results also show that controlling for labor productivity is very important since the estimated coefficient is highly significant. Further, we find a small, but insignificant positive effect of own regional income (y) which is not in line with theory. One of the reasons could be the correlation with the productivity level. Using the spatially weighted average of the purchasing power of regions within the same country as the base, we identify border effects by the differential impact of the spatially weighted purchasing power of neighboring regions from within the EU15 as compared to those outside. The coefficient of the base (**Wy**) turns out to be negative in all specifications, in some even significantly. This does not come as a surprise, since within countries, wages are rather homogenous and inter alia determined by centralized wage bargaining combined with higher labor mobility. Furthermore, the correction for productivity may also be a reason behind this finding. The impact of the purchasing power from neighbors within the EU15 (**Wy**: EU-EU) is highest and turns out to be robust and significant. For EU15 regions the purchasing power of Non-EU15 regions is generally smaller, and in most specifications insignificant. The simple F-tests on border effects in Table 2 suggests significant differences in the impact of regions within the EU15 and outside the EU15 for Specification I and III. In Specification II both parameters are not estimated very precisely. Although the estimation results have to be interpreted with due care, there is some support that there are still substantial border effects between EU15 and Non EU15 regions. Since, most of the Non-EU15 regions are located in the accession countries, on can expect a positive impact on the wage rates in these countries following accession to the EU.

To gauge the potential impact of accession on the European regional wage structure, based on the cross sectional estimation results reported in Table 2, we perform a simulation, in which we use the estimated coefficient of the within EU15 market potential (**Wy**:EU-EU) of Specification Ib (assuming a medium decay of spatial dependence) for the newly joined member states (Czech Republic, Hungary and Poland) and calculate the percentage wage change resulting from this forecast.

[Table 3]
[Figure 1]

Figure 1 presents the simulated wage effects in the form of a map[2]. Table 3 summarizes the simulation results at the level of countries and compares results assuming different distance weights or distance decay functions ("medium decay" vs. "fast decay"). Three main findings emerge from the results. First, wage effects due to a reduction of cross border transport costs (border effects) in the process of EU enlargement are of a much higher magnitude for the new EU member states in the sample than for EU15 countries. Secondly, regions closest to the borders of the "old" and "new" EU are to gain most in terms of wage increases. In specific, our simulations suggest that wages in regions in the new member states near to the EU15 border should increase by 30% to 114% if border effects were of the same magnitude as within the EU15 (Figure 1). Regions more distant from the borders of the EU15 would also have higher wages in this case. As already stated, for the old member states effects would be much smaller. Regions near the old EU15 border should experience wages increases between 0,4% and 1,56%. At the country level, the results for EU15 countries indicate the most pronounced wage effects for Austria (0,6%), followed by Germany (0,4%), Denmark, Sweden and Italy. Within the group of the three new member countries the Czech Republic is to be most affected. Last not least, the absolute magnitude of the simulated wage changes is highly dependent on the assumed distance decay. A look at table 3 reveals that the simulated wage change is roughly cut to half assuming a fast distance decay and as such can be seen as representing a lower bound of wage impacts. Since the simulations are based on cross-section estimations the resulting wage effects reflect long run adjustments. Also, they reflect the influence of market potential and the change in border effects due to accession only, ignoring other major influences like productivity changes.

4 Conclusions

In this paper we estimate a linear approximation of the market potential function derived in geography and trade models, which relates the wage in a region to its own purchasing power and that of its neighbors. Using a

[2]We calculate the direct wage effects as $\frac{w'-w}{w} = \frac{\overline{w}}{w}(\beta_3 - \beta_4)\Delta\mathbf{W}^{EU}\widetilde{\mathbf{Y}} + \frac{\overline{w}}{w}(\beta_3 - \beta_4)\Delta\mathbf{W}^{EU}\overline{\mathbf{Y}}$, where $\Delta\mathbf{W}^{EU} = -\Delta\mathbf{W}^{NEU}$ is the difference between the old and the new distance matrix where the zeros for the Eastern European regions have been replaced by the corresponding weights. w' is the estimated counterfactual wage rate.

spatial econometric estimation approach, we identify border effects differing between regions located in (i) the same country (ii) different countries in the EU15 or (iii) outside the EU15. Our major finding is that the market potential located across the external borders of the EU15 exerts no significant impact on the regional wage structure, indicating that despite the integration process over the last decade, there are still substantial border effects between EU15 and Non-EU15 regions. Hence, one can expect an additional positive impact of enlargement of the EU15 on wages especially in the regions close to the EU15 borders. Our simulations suggest that the accession may lead to pronounced wage effects in the new member states, but to low ones for the existing members. The results which are based on a medium distance decay function suggest, that regions in the new member states nearest to the EU15 border should experience wage increases of as high as 30% to 114%. For regions located in the old member states effects would be smaller. Wages of regions in the old member states closest to the border should rise by 0,4% to 1,6%.

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Table 1: Market Potential by Country, 2001

	Distance weighted purchasing power[1)] of regions			
	total	outside the country but within EU15	outside the country and outside EU15	in 3 accession countries[2)]
	Wy	Wy: EU-EU	Wy: EU-NEU	Wy: EU-NEUOst; NEUOst-NEUOst
	bn €			
Austria	39.7	28.9	4.4	1.7
Belgium	47.2	39.7	1.0	0.1
Switzerland	56.2	0.0	47.3	0.0
Czech Republic	30.5	0.0	29.4	28.6
Germany	48.6	15.4	2.7	0.9
Denmark	39.7	31.2	2.0	0.6
Spain	28.8	9.6	0.2	0.0
Finland	23.1	8.2	1.0	0.2
France	49.7	23.6	3.0	0.0
Hungary	15.9	0.0	13.6	13.3
Ireland	38.4	37.2	1.2	0.1
Italy	44.7	13.1	3.0	0.3
Netherlands	46.9	35.7	0.6	0.1
Norway	21.8	0.0	15.0	0.0
Poland	15.9	0.0	11.9	11.7
Portugal	20.8	13.7	0.0	0.0
Sweden	25.0	11.7	3.5	0.5
United Kingdom	29.0	8.4	0.2	0.0

1) Gross Value Added (GVA). - 2) Czech Republic, Hungary, Poland.

Table 2: Cross-section Estimation

	(I)				(II)				(III)			
	wij: exp(αdij)/Σ(exp(αdij)											
	(α=0.01)				(α=0.1)				(α=0.004)			
	(a)		(b)		(a)		(b)		(a)		(b)	
	b	t	b	t	b	t	b	t	b	t	b	t
Ww	-	-	0.427	3.22 ***	-	-	0.213	2.68 ***	-	-	0.586	3.68 ***
y	0.004	0.57	0.002	0.25	0.0001	0.02	-0.001	-0.17	0.005	0.69	0.003	0.44
Wy	-0.146	-2.57 **	-0.199	-3.8 ***	-0.0151	-1.26	-0.023	-1.85 *	-0.184	-1.96 **	-0.269	-3.31 ***
Wy:EU-EU	0.201	3.37 ***	0.182	2.83 ***	0.1096	1.99 **	0.095	1.62 *	0.284	3.41 ***	0.277	3.13 **
Wy:EU-NEU; NEU-NEU	0.013	0.16	-0.065	-0.83	0.0492	1.54 #	0.033	0.96	-0.052	-0.4	-0.121	-1.08
Lprod	0.538	13.76 ***	0.538	14.13 ***	0.5523	15.24 ***	0.514	11.18 ***	0.544	13.98 ***	0.546	14.9 ***
D1-Eastern European Countries	-0.464	-6.87 ***	-0.263	-4.18 ***	-0.4023	-8.14 **	-0.261	-5.32 ***	-0.401	-4.74 ***	-0.226	-3.59 ***
D2-Non-EU EFTA-countries	-0.045	-0.66	-0.076	-1.19	-0.0922	-1.51 #	-0.111	-2.15 ***	-0.004	-0.05	-0.012	-0.18
R^2		0.78		0.84		0.81		0.89		0.80		0.85
σ		0.14		0.15		0.15		0.15		0.15		0.15
Moran I		6.34 ***		3.31 ***		4.76 ***		-1.09		5.06 **		1.18
ϕ		0.68		0.29		0.26		-0.24		0.96		0.45
Instruments												
Relevance (Shea R^2)		-		0.40		-		0.29		-		0.68
Validity: Sargan- test		-		6.495		-		36.70 ***		-		10.13
F-tests on border effects												
EU-EU vs. EU-NEU; NEU-NEU		4.40 **		8.71 ***		0.98		0.88		5.74 **		10.89 ***
EU-EU vs. Base		12.98 ***		16.32 ***		4.62 **		3.71 **		10.26 ***		14.69 ***
EU-NEU; NEU-NEU vs. Base		1.85		1.54		2.88 *		1.84		0.49		0.84

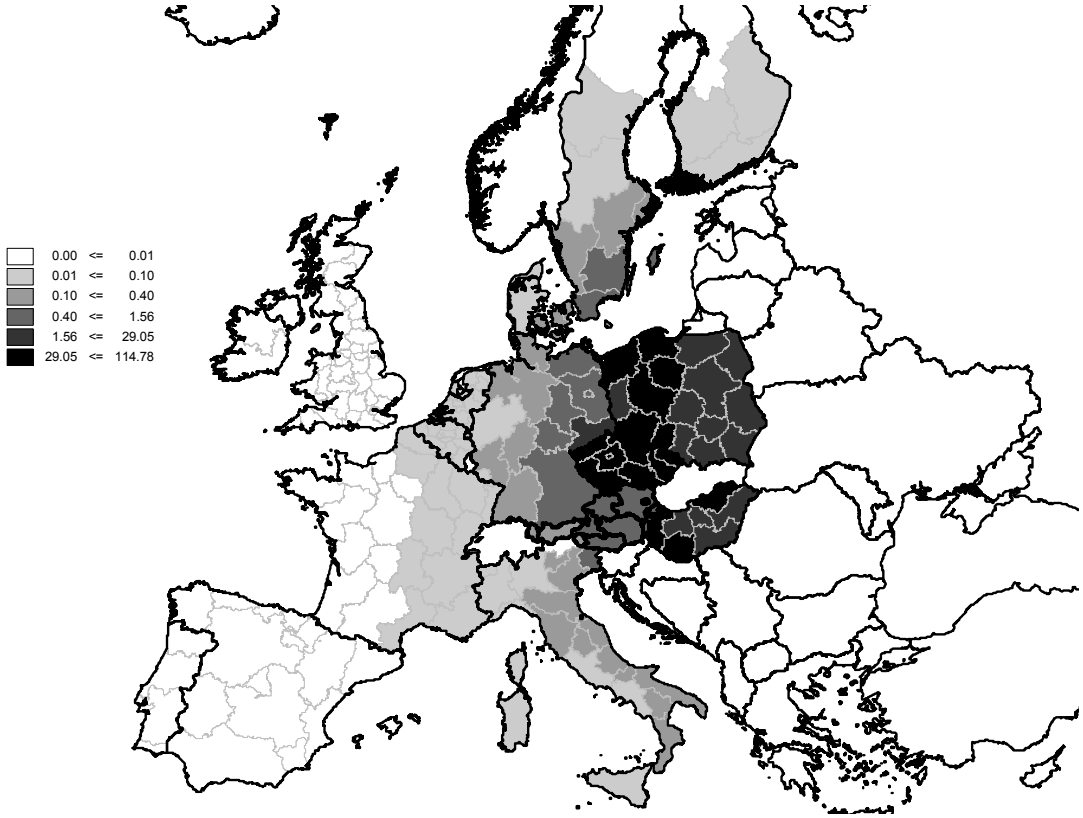
*** significant at 1%; ** significant at 5%; * significant at 10%; # significant at 15%;

Table 3: Estimated Impact of EU-Enlargement by Poland, the Czech Republic and Hungary on Wages

	Simulations based on regression results			
	Specification II "medium decay"		Specification IV "fast decay"	
	EU15	New members	EU15	New members
	Simulated wage change in percent			
Austria	0.61		0.32	
Belgium	0.02		0.01	
Switzerland	0.00		0.00	
Czech Republic		62.73		32.74
Germany	0.42		0.22	
Denmark	0.24		0.13	
Spain	0.00		0.00	
Finland	0.06		0.03	
France	0.02		0.01	
Hungary		27.57		14.39
Ireland	0.03		0.02	
Italy	0.15		0.08	
Netherlands	0.05		0.02	
Norway	0.00		0.00	
Poland		29.40		15.34
Portugal	0.00		0.00	
Sweden	0.21		0.11	
United Kingdom	0.00		0.00	
Total	0.12	38.02	0.06	19.84

Figure 1: Estimated Impact on Wages of the EU-Enlargement by Hungary, Poland and the Czech Republic

Simulation based on regression results for Specification II - medium decay
(Simulated wage change in percent)



Source: own calculations.

Determinants of regional growth in Hungary, 1994-2001*

*Anna Iara***
Center for European Integration Studies, University of Bonn, Germany

Abstract: During the 1990s, the economic integration of Hungary to the European economic area was widely implemented. At the same time, Hungary experienced considerable regional disparities in economic growth. Motivated by endogenous growth theory and new economic geography, in the present paper I investigate the impact of FDI intensity, export orientation, and regional specialisation on regional growth in Hungary. With panel data of the 20 Hungarian regions covering the years 1994-2001, I perform growth regressions with OLS, after finding regional fixed effects insignificant. I check for the robustness of the results to the omission of the capital region and to the correction for contemporaneous correlation across regions. I find that the share of agricultural employment and the change in export orientation of the regions are the paramount determinants of regional growth. Investment per capita, the change in the employment rate, FDI density and the change in regional specialisation are found to enhance regional growth in some but not all specifications.

1 Introduction

At the EU enlargement in May 2004, the economic integration of the Central European EU applicant countries to the European economic area had already been widely implemented. Specifically, trade reorientation from the East to the West since the collapse of the Council for Mutual Economic Assistance (CMEA) and the opening of the Central and Eastern European economies for the inflow of capital (in particular Foreign Direct Investment, FDI) generated intensive economic linkages between the old and the new EU members. Transformation and economic integration further resulted in changing patterns of regional specialization (Traistaru et al., 2003).

After an initial drop in output, the Central European economies experienced considerable economic growth (see European Bank for Reconstruction and Development 2003: 56). Annual growth rates above the EU average allowed them to embark upon the path of catching up. With transition and European integration however, these economies also witnessed the surge of regional, as well as social, inequality. An increase of socio-economic disparities across space in the 1990s has been widely documented for the Central Europe (Petrakos et al., 2004). In Hungary too, sizeable regional disparities opened up in the 1990s. Not only in levels, also in the rate of change does Hungary display differences of regional income. From the policy perspective, the identification of determinants of regional growth is a prerequisite of preventing the further increase of income differentials, in order to avert social disruption.

Standard neoclassical theory predicts that economic units grow the faster the further they are distant from their steady-state rate of growth of income per capita. Neither in absolute terms nor conditional on units' economic characteristics seems this prediction to be met by Hungarian regions: Convergence estimations show that it is regions with higher initial income levels that have enjoyed higher growth in the 1990s (Iara and Traistaru, 2003). This suggests to look for explanations of regional growth in Hungary beyond the neoclassical framework. Recent economic theories have highlighted the growth

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** Center for European Integration Studies, Walter-Flex-Str. 3, D – 53113 Bonn. Email: anna.iara@uni-bonn.de .

contribution of some factors that have played a paramount role in the process of European economic integration. In particular, endogenous growth theory approaches have hypothesised the growth-enhancing role of technology spillovers via foreign direct investment or production linkages. Similarly, the positive effect of increased competition on export markets on growth has been recognized. In another vein, new economic geography drew the attention on regional production structures.

The case of Hungary seems indeed to confirm the positive relation between some of the aforementioned factors and regional growth. Maffioli (2003) describes the relocation of economic activity and employment towards the West and out of the capital city between 1992 and 1999. He also demonstrates that unconditional productivity levels are positively related to the density of firms with foreign participation. Fazekas (2003) provides descriptive evidence that in Hungary, the regional pattern of employment has been driven by the spatial distribution of firms with foreign participation. He also argues that the concentration of firms with foreign ownership has been sustained by an increasing regional productivity gap, which may be related to spillovers from FDI-holding firms. He further finds that the distance to the Budapest-Vienna transportation axis and adjacency to the Western Border are significantly explaining job concentration among firms with FDI, while they are not significant as concerns purely domestic firms. This clearly illustrates the West-East dimension of FDI location and related labour market performance.

Regional productivity differentials and, in particular, the related role of FDI in Hungary have received attention in the analytical empirical literature already. Sgard (2001) investigates the effect of FDI on output with a large panel of manufacturing and construction firms. He finds that foreign ownership indeed contributes to higher productivity and in addition produces positive intra-sector spillover effects (measured by the sector share of foreign ownership). His results also show that the presence of FDI is enhancing productivity only in the exporting markets, while local firms in the domestic sector may face difficulties adjusting to the competition from foreign owned enterprises. Schoors and Van der Tol (2002) also assess the impact of FDI on firm productivity, using a cross-section of Hungarian firms 1997/98. They distinguish between inter- and intra-sector spillover effects and take into account the openness of regions and the absorption capacity of firms as well as potential endogeneity of FDI with respect to firm productivity. In line with Sgard (2001), they find a positive productivity effect of FDI. While they provide evidence on positive intra-sector spillover effects conditional on absorption capacity, they show that such effects are more characteristic of more open sectors. In addition, they reveal that inter-sector spillover effects can be more important, and that they are unambiguously positive in the very open sectors (i.e. manufacturing) only. Dall'erba et al. (2003) analyse components of productivity differentials relative to the EU-15 average in NUTS II regions of Hungary, the Czech Republic and Poland 1990-2000. First, they assess the contribution of productivity, employment rates and labour force participation to the variance in regional per capita GVA, concluding for the case of Hungary that regional income variation mostly stems from increasing differentials in labour force participation, whereas productivity plays a comparably little role. Their shift-share analysis confirms the finding of Traistaru and Wolff (2002) that region-specific factors are more important in determining the performance of regions than the industry mix.

This work relates to the one or the other aspect of the aforementioned papers. Here, regional growth is targeted in an aggregate framework, covering eight years of data (in levels) on 20 regions, 1994-2001. First the contribution of the neoclassical production inputs, labour and capital, to regional growth is assessed. Then variables explaining differences in total factor productivity suggested by various strains of the more recent theoretical and empirical growth literature are introduced, namely (1) FDI aimed at proxying international knowledge diffusion, (2) the absolute concentration of manufacturing industries, intended to proxy agglomeration externalities within industries, and (3) the export orientation of regions, which is assumed to relate to higher competition in foreign markets. The econometric analysis comprises the estimation of the growth equation by OLS with standard errors corrected for heteroskedasticity, and with standard errors corrected for contemporaneous correlation across panels (PCSE). The present study is based on Iara and Traistaru (2003). With an extended dataset, in the present paper I revisit the effect of FDI, regional specialisation and the openness of regions on regional growth in a neoclassical framework augmented by additional elements to explain total factor productivity growth. In particular, I include the change in production inputs, capital and

employment, in the regressions, which allows a clearer picture on the contribution of FDI to growth beyond the increase of the capital stock, and helps avoiding possible bias from omitting these arguments of the production function. Further, I investigate whether the explanatory variables focused upon have a growth effect in levels or differences. I find that regional export activities (in differences) have a strong effect on growth, a result that is robust across specifications. Besides, I find regional growth performance to be determined by the share of agriculture in the economy. The estimations indicate that controlling for capital accumulation, higher levels of FDI and the increase in regional specialisation may contribute to regional growth, but these findings are not robust to the inclusion of time dummies.

This paper is structured as follows. Section 2 outlines the theory framework and related empirical findings on which this research is based. Section 3 introduces the dataset and presents summary statistics. In section 4, estimation results are discussed. In section 5, I conclude.

2 Growth in Hungary: a conceptual framework

Neoclassical growth theory as elaborated by Solow (1956) and Swan (1956) derives growth from a standard production function with capital and labour as arguments. Assuming perfect competition and constant returns to scale, growth dynamics is determined by the development of the capital stock, while labour and total factor productivity are exogenous. While a change in the savings rate enhances the level of per capita output, it leaves its growth rate unaffected: A sustained change in growth is only possible through the increase in the rate of technical change, i.e. total factor productivity growth.[1]

The neoclassical approach predicts economies' rates of per capita income growth to converge to their steady-state values. The steady-state rate of growth per capita is independent of the initial conditions and equals the rate of technological progress. In the transition period, growth differentials are related to the distance from the steady-state rate of growth: The farther an economy is away the faster it grows. Since no barriers to technology diffusion and its adaptation are acknowledged, in the long run, rates of income growth across economic units (countries or regions) are predicted to equalize (Nijkamp and Poot 1998: 12). The lack of convergence across economies worldwide has directed the attention to the sensitivity of steady-state growth paths to initial conditions, leading to the concept of conditional convergence. This concept suggests that economies are heterogenous with respect to their steady state, so that economies grow the faster the larger the distance from their specific steady state is. In practice, this allows for infinitely maintained income disparities across space.

The concept of conditional convergence still predicts that, once specific conditions such as economic structures are appropriately controlled for, economic units at lower income levels enjoy higher growth. With similar data as used in the present paper, Iara and Traistaru (2003) have found that the growth rates of the Hungarian regions are positively related to their initial income levels, both in absolute terms and conditional on certain economic characteristics. This suggests that for economic growth in Hungary, other explanations than the neoclassical concept may be better suited.

Spurred by controversial empirical findings with regard to the predictions of neoclassical growth theory and the discomfort with leaving technical change as the ultimate determinant of growth unexplained, new growth theory evolved as a set of approaches endogenising technological progress. In the neoclassical model, knowledge is not explicitly considered: it could be regarded in this framework as a freely available public good that is part of exogenous total factor productivity #ref. New growth theory instead focuses on the role of knowledge for growth, its acquisition, and its accumulation. Technological change is considered the outcome of a knowledge production function that allows for increasing returns to scale (Romer 2001: 100). The reason is that existing knowledge can be replicated at no cost so that with a particular set of knowledge, doubling output can be achieved with doubling the other inputs only. While part of the new growth theory contributions focus on the production of knowledge in the R&D sector (e.g. Romer, 1990), others instead model the growth-

[1] For textbook reviews of the neoclassical growth model, see Barro and Sala-i-Martin (1995) and Romer (2001).

enhancing effect of knowledge by allowing for spillovers (i.e., the appropriation of knowledge by a greater community with no or only partial compensation to the producer – see Nijkamp and Poot 1998: 15).[2]

With the premises of new growth theory, growth differentials across spatial units can be related to differences in the share of resources devoted to the production of technology (Nijkamp and Poot 1998: 17), differences in the extent of knowledge spillovers within spatial units, and barriers to the diffusion of knowledge across these units (Romer 2001: 126). Besides of the production of knowledge, the diffusion of technology and the localised character of knowledge spillovers have been addressed in theory and empirical work. Along with the movement of goods, services and labour, a potential channel for cross-country technology diffusion is FDI. Blomström and Kokko (2003) provide a comprehensive discussion of the effects of FDI on the host economies. They review various mechanisms by which FDI may enhance domestic productivity. These include the transfer of know-how by demonstrating new technologies and training labour that may later flow to domestic firms, the boost of competition (although inflowing FDI may also create monopolies), the establishment of new standards of inventory, quality control, and standardization via production linkages, and the pressure on local firms to adopt higher managerial effort or better marketing techniques. Aside of the market structure argument, common to these effects is the presumption that foreign firms are systematically different from domestic firms insofar as they have hold of some superior knowledge that may eventually flow over to the domestic sector. In their discussion of the mixed empirical evidence on both intra-industry (Jacobian) and inter-industry (Marshall-Arrow-Romer) spillovers from firms with foreign participation, Blomström and Kokko (2003) underline the importance of human capital and an existing level of technology for the adaptation of the knowledge spillovers that emanate from FDI.

Concerning transition countries, Campos and Kinoshita (2002) investigate the growth effect of FDI in 25 countries in the 1990s within an augmented Solow model. They argue that FDI flows to transition countries are specifically obvious cases of technology transfer since these countries have suitably educated workforces to adopt new technologies, but had been deprived of international technology transfer. They find robust evidence for the positive impact of FDI on economic growth. On the NUTS II regional level, for five Central European countries including Hungary 1995-2000, Tondl and Vuksic (2003) find FDI to provide a strong contribution to regional growth, and the capability of the host region to adapt new knowledge from FDI, proxied by tertiary education, to be significant in this context too. Kertesi and Köllô (2002) find that in Hungary during the 1990s, the productivity gap of young versus old skilled workers has been considerably larger in foreign-owned than in domestic-owned firms. This demonstrates that foreign ownership has brought productivity-enhancing technologies to the country: these may via labour turnover and other channels spread to other firms.

In addition to technology transfer and knowledge externalities, systematic differences in regional growth can be expected from variations in regional economic structures. Recent new economic geography (NEG) approaches allow deriving hypotheses on how regional growth can be affected by changes in the economic structure of the regions. However, instead of growth, NEG is primarily concerned with endogenizing the location of economic activity and explaining agglomeration and specialization (de Groot et al., 2001). Growth outcomes can be indirectly inferred from NEG model implications.

A model particularly suited to the developments of the 1990s in Central and Eastern Europe is Fujita et al. (2000: 329ff.). Here, location changes are driven by two countervailing forces: The possibility of exploiting intra-industry linkages drives firms closer together, while consumer demand scattered across space makes them move apart. Diminishing external trade costs weaken both of these forces intra-nationally, since both demand for intermediaries and consumer demand are partially reoriented to the outside of the country. In a model with two different industries and two regions, Fujita et al. show that external trade liberalisation enhances regional specialisation. Indeed, the data used in the present

[2] For a definition of knowledge spillovers, see Caniels (2000: 6). Audretsch and Feldman (2003) provide a comprehensive overview of the literature on knowledge spillovers.

paper contain slight evidence for this prediction: From 1995, except 1997/98, the Hungarian regions experienced increasing regional specialisation on average.[3]

About the growth outcome of increasing specialisation, the NEG models do not make a direct statement. However, higher specialisation may be expected to produce higher growth, due to the exploitation of intra-industry knowledge spillover effects or due to economies of scale in markets of intermediaries. The pioneers of new economic geography do not concede knowledge spillover effects to be at work in the dynamics of firm location across space but they advocate the possibility of economies of scale in input markets instead (Caniels 2000: 27). Admitting the possibility of knowledge externalities, it has been suggested that high technology firms rather tend to cluster together given their higher reliance on knowledge. Audretsch and Feldman (1994) found differences in the spatial concentration patterns across industries related to the importance of knowledge in production. On the other hand, specialisation has been posited to affect growth positively regardless of the particular industry of specialisation, which is known as Smithian specialisation (Jungmittag, 2004).

In addition to the factors discussed above, theories of international trade and economic integration suggest that growth could be fostered by external trade. In addition to technology diffusion via the import of intermediaries, trade may affect growth via productivity improvements boosted by higher international competition, and by the exploitation of economies of scale implied by a larger market (Badinger and Tondl 2002: 7). For the NUTS II regions of ten EU countries in the 1990s, Badinger and Tondl (2002) find that both exporting and importing activity contribute to higher regional growth.

Parallel to the resurrected interest in growth, the robustness and straightforward interpretation of growth regressions has been subject to critique. Brock and Durlauf (2000) provide a review of the concerns about the empirical growth literature. Among others, they point at the inconclusiveness of empirical work that follows from "open-ended" theories: The list of variables affecting economic growth in theory is not closed, and the empirical assessment of their growth contribution is aggravated by collinearity. Additional caveats arise from the context of transition, where stable economic relationships may be slow to emerge. In addition, this empirical research is strongly limited by the short length of the time series. Therefore, the results presented below provide merely indicative evidence.

In the light of the above, in addition to growth differences related to changes in factor endowments as addressed by neoclassical theory, one can also expect some factors highlighted by more recent theories to enhance growth in the Hungarian regions. First, higher presence of FDI may be associated with higher growth due to the transfer of technology from abroad. Second, increasing regional specialisation can similarly be expected to bring about higher growth due to the facility of economies of scale and the possible presence of knowledge spillover effects. Finally, economic growth may be boosted by integration in international markets. I empirically study these possibilities in the framework of an augmented Solow growth model.

3 The data

Our dataset consists of annual data for the Hungarian capital city and the 19 counties called "megye" that form the NUTS III system of spatial units. The dataset covers the years 1994-2001, providing seven years of rates of change of these variables. GDP and capital are in constant 1995 prices, where CPI is used for deflation. The national deflator originates from the International Financial Statistics Yearbooks of the International Monetary Fund. The other data originate from various data releases from the Hungarian Central Statistical Office (HCSO). Details on the definitions of the data are given in Table 1 in the appendix.

[3] The rate of change in the specialisation level of regions was small, though. It remains to be empirically investigated whether intra-industry economies of scale and knowledge spillover effects respectively could be exploited for higher regional growth.

As dependent variable, GDP per capita is used. Since regional data on the capital stock of the Hungarian economy are unavailable, I calculate the regional capital stock and its changes from investment using the perpetual inventory method (for details, see Table 1), employing investment data going back until 1991. Following e.g. Badinger and Tondl (2002) for the Eurozone countries in the last quarter of the 20th century, I assume a depreciation rate of 5%. Due to the diminishing sensitivity of the calculated capital stock data to the initial year, optimally one should have a time series of calculated capital stock figures reaching back sizably longer than needed, however, I am constrained by the lack of data. Another shortcoming of the capital stock data is that the investment figures are recorded by the region of companies' headquarters instead of the region where they were carried out. The joint availability of investment data by headquarter and location in 1999 allows to check for the differences between the two series: Only in the case of Budapest is there a larger deviation (20% more investment by headquarter). For the other regions, the deviations are within the range of +/- 2.5%. By years, the two series are correlated by 0.95 and more.

Instead of regional employment figures, I have to use data on employees. Unfortunately, in the period considered, there have been changes in the data collection both as concerns the spatial assignment of the data and the collection treshold (see Table 1 for details).

Regional specialisation is measured with the Herfindahl index, calculated from data on employees in eight manufacturing branches (see Table 1). As an absolute index, the Herfindahl index does not include normalization by some benchmark specialization pattern.

I measure the export orientation of the Hungarian regions with the share of exports in their industrial output. Sure enough, this measure relates to the final step of the production process only; the potential export orientation of intermediaries for exported goods that may have been produced in other regions is not taken into account. The measure also disregards of agricultural exports.

As a measure of FDI intensity, the number of firms with foreign participation in subscribed capital in the total number of enterprises in the county is taken.

The employee data are also used for controlling for regional economic structures. As compared with the total number of persons employed, employee figures tend to contain higher shares of persons working in industry and lower shares in agriculture and services. Bearing this in mind, I use the share of agriculture and of industry (including construction) in the total number of employees respectively as control variables, leaving services as the base category.

Tables 2 to 9 and Figures 1 to 8 provide summary statistics on the variables employed and graphical presentations of their evaluation in time and correlation with the dependent variable.

Regional GDP per capita has increased in all years but 1995/96 on average. From an average 450,000 HUF in 1994, average real GDP per capita has increased to 565,000 HUF in 2001. This implies an average increase by 2.2% p.a. Throughout the period considered, there has been a widening gap between Budapest and the other regions with Budapest constantly producing over 100% higher per capita GDP levels than the other regions. 1997 to 2000, a gap has also opened between the regions of Fejér, Vas and Gyôr-Moson-Sopron and the rest of the regions that, however, diminished in 2001 due to a negative growth performance of these three regions. As until 2000, from 0.28 in 1994, the coefficient of variation of the per capita GDP levels has constantly increased to 0.40 until 2000, where it slightly diminished. The variation coefficient of the data without Budapest has been much lower, between 0.15 and 0.27.

Average investment amounted to 95,000 HUF per annum and capita in the years under review. Since investment has been registered by headquarters, unsurprisingly, Budapest has recorded around 150-250% more investment per head than the counties. On average, investment per head has increased in all years but 1998/99. With values between 0.4-0.7 (all regions) and 0.33-0.55 (without the capital), regional variation in investment per head has been constantly higher than in GDP per capita. There is a clear positive relationship between investment and GDP per capita, as well as between the change in the capital stock per capita calculated from the data and GDP growth, as shown in Figure 2.

Between 1994 and 2001, the share of employees in total population has been around 22% in the Hungarian regions. In the whole period, the employment rate is considerably higher in Budapest than

in the counties, even though employment is registered by headquarters since 1998 only. This may reflect extensive commuting activity to the capital. Until 1998, the employment rate has been decreasing on average and slightly increased from 1999 (the change in 1998 to 1999 is obscured by the change in the data definition, see Table 1). While higher employment coincides with higher GDP per capita, the correlation between the changes in these variables is insignificant (see Figure 3).

In 1994, there have been 12 firms with foreign participation per 1000 domestic enterprises. This rate peaked in 1998 at 19, diminishing thereafter to 16 in 2001. In 1994, Budapest hosted three times more establishments with foreign participation than the counties. Since 1996 however, the lag of the counties has continuously reduced. Even without the capital though, there has been a sizeable variation in FDI densities across the counties, with the variation coefficient averaging at 0.45 (counties only). The correlation of FDI levels is significant both with per capita GDP levels and its growth (for the latter, see Figure 4).

At 0.21, the Herfindahl index of specialisation of the Hungarian regions has been low in 1994. The index slightly increased until 2001 to 0.22 by 0.002 index points annually. The change in the index was positive in all years but 1994/95 and 1998/99 on average, with and without the capital. Throughout the period considered, the counties of Tolna and Vas were among the three most specialised regions. Fejér experienced a huge increase in its specialisation level in 1996 and has been since then, as the most specialised county, overtaken only in 1998 by Tolna. The group of the least specialised countries, with indices around 0.15-0.17, has been most of the time composed by the counties of Veszprém, Zala, Csongrád, and Borsod-Abaúj-Zemplén. From 0.15 in 1994, the variation coefficient of the regional specialisation levels of the regions doubled until 2001. The data show a highly significant but low positive correlation between per capita GDP and the Herfindahl index. Changes in GDP levels display a positive correlation of 0.13 with the change in the Herfindahl index that is significant at 12%. In contrast, GDP change is not correlated with the level of regional specialisation (see Figure 5).

Between 1994 and 2001, the Hungarian regions accomplished a considerable increase in manufacturing exports. In this period, from an average of 28%, the share of exports in manufacturing output rose to 50%. The export performance of Budapest has been steadily below the average of the counties. Gyôr-Moson-Sopron and Vas were the countries realising highest average exports in the period reviewed (at 35% and 53% 1994 and 80% and 78% in 2001 respectively), while Tolna and Baranya were the countries with lowest export shares (at 14% and 13% in 1994, rising to 26% in 2001). The correlations between the export share of industrial output and GDP levels (of 0.25) as well as between the export share and the log GDP change (0.16) and the log change in the export share and the latter (0.18) are highly significant (see Figure 6).

In 1994, 10% of the employees worked in agriculture on average. This share steadily dropped by 0.44 percentage points p.a. on average to 7% in 2001. Budapest has had the lowest share of employees in agriculture, at 5% on average, whereas counties' average without the capital has been at 9%. There is a highly significant correlation between the share of agriculture in employment and per capita GDP and its log change, of –0.45 and -0.25 respectively (see Figure 7).

In 1994, 38% of the employees in Hungary worked in industry and construction. Until 2001, this share increased by 0.42 percentage points on average (with decreasing shares in 1994/95, 1998/99, and 2000/2001). This share has been lowest in Budapest with 21-23%. With around 50% on average, Fejér, Vas and Komárom-Esztergom had the highest shares of industrial employment in the period considered. The correlation between the share of industrial employment and GDP per capita and its log change respectively is not significant (see Figure 8).

4 Econometric evidence

In specifying the estimation equation, I start from a neoclassical production function with Cobb-Douglas technology:

$$Y_t = F(K,L) = A_t K_t^{\alpha} L_t^{1-\alpha} \quad (1)$$

where Y_t is output, K_t is physical capital, L_t is labour, A_t is total factor productivity (TFP) at time t respectively, and α and $(1-\alpha)$ are the elasticities of output with respect to the inputs. In this formulation, returns to scale are assumed to be constant. Rewriting the function in per capita (i.e. per inhabitant) terms (denoted by lowercase letters), taking logs and first differencing, this approach results in the following equation:

$$\Delta \ln y_t = \Delta \ln A_t + \alpha \Delta \ln k_t + (1-\alpha)\Delta \ln l_t \quad (2)$$

In the empirical assessment of the growth contribution of the factors related to new theory approaches as discussed above, I assume these factors to affect total factor productivity:

$$A_t = f(X_{1,t}, X_{2,t}, X_{3,t}, ...) \quad (3)$$

with X_t being FDI intensity, export market orientation, and the degree of regional specialization respectively. Plugging A_t in equation (2) yields the following equation to be estimated:

$$\Delta \ln y_t = \alpha \Delta \ln k_t + (1-\alpha)\Delta \ln l_t + \beta_1 \Delta \ln X_{1,t} + \beta_2 \Delta \ln X_{2,t} + \beta_3 \Delta \ln X_{3,t} + \Delta \ln A_t' + \varepsilon_t' \quad (4)$$

In the econometric analysis of the determinants of regional growth in Hungary, a growth function with the regressors related to neoclassical theory only and an augmented version, including variables for FDI intensity, regional specialization and export orientation, are estimated. Results are presented for both versions with and without time dummies. In any of the specifications, F-tests of the joint significance of regional effects had p-values close to one. Therefore, I conclude that there are no systematic differences among the regions' total factor productivity growth related to their unobserved characteristics, and do not employ region specific effects. Correlations among the variables are presented in Tables 10 to 12.

Budapest has a predominant role in the Hungarian economy. While it accounts for around 20% of the population in Hungary, around one third of national GDP is produced here. Many of the variables used describe Budapest as different from the counties. To check whether the observations of Budapest bias the picture of the counties I present the estimated equations also with the capital region excluded.

Many of the variables used are originally in percentages. While taking these percentages directly would comfortably provide semi-elasticities (note that the coefficients remain the same if one writes (4) in levels), I prefer to take logs as required by the linearization of the model derived from the production function.[4]

Note that (4) hides a dynamic model: It can be reformulated as

$$\ln y_t = \ln y_{t-1} + \alpha \Delta \ln k_t + (1-\alpha)\Delta \ln l_t + \beta_1 \Delta \ln X_{1,t} + \\ + \beta_2 \Delta \ln X_{2,t} + \beta_3 \Delta \ln X_{3,t} + \Delta \ln A_t' + \varepsilon_t' \quad (5).$$

Consequently, the estimation methodology most suited to the nature of the growth equation is GMM for dynamic panels such as Arellano-Bond or Blundell-Bond. However, the limited size of the dataset at hand does not permit the use of such methods. On the other hand, the fixed effects have no explanatory power in the present model so that bias from the lack of strict exogeneity that is intrinsic to dynamic panel models does not seem to be a risk. An issue to be further investigated is the absence

[4] However, this does not apply to the sector shares of employment that are included for the sake of controlling for economic structures only.

of error autocorrelation in an estimated equation that is equivalent to a partial adjustment model. I check for this using the LM test for serial correlation of order one in the residuals discussed in Baltagi (2001: 90). For the models presented below, one can reject the presence of a common nonzero autocorrelation coefficient in the errors. Given the shortness of the time series at hand, panel-specific error autocorrelation cannot be tested for.

Some regressors, in particular investment (Bond et al., 2001), FDI intensity and the change in export orientation, may be endogenous. I checked for the possibility of endogeneity applying the Durbin-Wu-Hausman test (Davidson and McKinnon, 1993) where I used lagged values of the regressors as instruments in the auxiliary regression. In no specification has the test shown endogeneity to be a matter of concern.

As formulated in (4), the degree of FDI intensity, regional specialization and output orientation determine the level of total factor productivity so that it is their change that bears on regional growth. The growth-enhancing effects of FDI intensity and regional specialization may both be regarded as relating to knowledge spillovers. One could also assume that the presence of knowledge spillovers allows innovations to spread better and faster in the region. This would imply that in regions that are endowed with higher levels of FDI intensity or are more specialized total factor productivity systematically grows at a relatively higher rate. Consequently, these variables entered in (4) in levels. In the same vein, regarding the control variables for economic structure employed, sector shares in employment may bear on productivity suggesting that it is structural change that brings about growth effects, or alternatively, there may be sector-specific effects of productivity growth, implying a level effect of the sector control variables on growth. To discern whether these variables produce a growth effect in levels or changes in an initial specification I include these variables both in levels and in changes, and decide then based on the t-test statistics. These tests suggest considering the variables for economic structure, export orientation and regional specialisation in differences and FDI intensity in levels. This is done in the estimations reported below. The high correlation between contemporary and lagged values of these variables does not allow to perform a nested test of the joint significance of the respective variable in contemporary and lagged terms.

For error autocorrelation, no evidence has been found. However, the residuals may be not independent across units. To check for the robustness of the results against cross-sectional correlation in the residuals, that may point at spatial patterns in the data-generating process, I also present the panel corrected standard error (PCSE) estimates of the above specifications. The estimation results with all observations used are presented in Table 13 (OLS) and Table 15 (PCSE), while the results from the same estimations without the capital region are contained in Tables 14 (OLS) and 16 (PCSE). All variables have the expected signs with the occasional exception of the change in the employment rate that is, however, mostly insignificant. The specifications with and without the capital region and from OLS with White-corrected and with panel-corrected standard errors, respectively, reveal some robust findings but also notable differences. Below, the findings from OLS with White-corrected standard errors are discussed first.

The change in the capital stock is found significant when time-specific effects are not controlled for. The size and significance of the coefficients does not depend on the inclusion of the capital region. When significant, the coefficient tells that doubling investments per capita boosts the rate of regional GDP growth by 8-10%.

In the estimations with all regions the employment rate is insignificant. Excluding the observations for the capital region however, in the specifications with year dummies, the employment rate appears to be significant and shows a strong effect (in differences) on growth. A hypothetical doubling of the employment rate boosts regional growth by nearly 30%. The lack of stability of this coefficient across the specifications is not surprising, given that the employment variable is especially burdened with noise. However, the positive coefficient can be interpreted as evidence that for regional growth, employment raising economic activity overbalanced the productivity-enhancing effect of the cutback of over-employment and firm restructuring.

When included in a regression without year dummies, the share of firms with foreign participation in the total number of firms is significant at 10% suggesting a 1% increase in growth from a doubling of this share. Notably, FDI appears to have a level effect on growth, which may suggest that firms with

foreign owners maintain their technology advantage vis-à-vis other domestic firms still in the years after their establishment, be it by the constant inflow of superior technology or by the absence of knowledge spillover effects to domestic firms. However, the significance of the FDI density variable is not robust against the inclusion of year dummies and the exclusion of the capital region, even if specifications 5 and 6 in Table 13 that omit insignificant control variables attest some impact of the presence of FDI on regional growth.

Increased export orientation of the regions measured by the change of exports in industrial output has a clear impact on regional growth. The export share variable is highly significant and stable in size across all specifications, be it with or without year dummies and with or without the capital region. Regions with twice as high a share of exports in industrial output accomplish 7% higher growth rates. The Durbin-Hausman-Wu test with lagged levels of the variable as instruments shows no indication of endogeneity bias in the results.

In all estimations with heteroskedasticity-robust standard errors except for those with the full set of year dummies (including the insignificant too), the Herfindahl index of regional specialisation in differences is significant at the 10% level. In any of the specifications, the specialisation variable in differences performs much better than its level indicating that intra-industry knowledge spillovers cannot be exploited for a steadily higher pace of growth. These results remain the same if the observations for the capital region are excluded. When significant, the coefficient of the specialisation variable suggests that regions with specialisation levels twice as much as others incur regional growth that is higher by around 8-9%. In size, the effect is comparable to the effect of increased regional investment.

Finally, the share of agriculture in the number of employees is found to have a clear growth impact, but changes in the sector structure of employment are not found to affect growth. The employment share of agriculture proves significant at the 5% level in most specifications. Its estimated effect appears very strong: A region having twice as much employment in the agrarian sector as another appears to achieve a 20-25% lower growth rate.

Re-estimating the above set of models with panel-corrected standard errors shows that the findings concerning FDI intensity and regional specialisation are not robust against considering contemporaneous correlation between the regions. Columns 1-5 in Tables 15 and 16 show the same models as the respective columns in Tables 13 and 14 without correction for contemporaneous error correlation. Column 6 is the specification that results from dropping insignificant year dummies. With panel corrected standard errors, more year dummies remain significant. The specification that results from dropping insignificant year dummies in Table 15 (all regions) leaves us with the following: The impact of investment on growth is lower, with a doubling of investment per capita enhancing the growth rate by 6%. The coefficients of export orientation and the sector share of agriculture in employment remain significant with similar sizes as found before. However, the year dummies included effectuate that FDI density and the change in regional specialisation are no longer significant at conventional levels. This result also holds for the estimations with panel-corrected standard errors using a sample without the capital region. In addition, the investment rate is now insignificant. In contrast, the employment rate enters the regression highly significantly with a coefficient of 0.28.

In sum, our regression analysis shows that the share of agricultural employment and the change in export orientation of the regions are the paramount determinants of regional growth in Hungary. Investment per capita, the change in the employment rate, FDI density and the change in regional specialisation are found to enhance regional growth in some but not all specifications. Given the short time span of our data coverage, this does not imply strong evidence against the role of these factors in regional growth.

5 Conclusion

Based on Iara and Traistaru (2003), the present work re-assesses the contribution of FDI, regional specialisation and export activities to regional growth in Hungary in the period 1994-2001 in an augmented Solow model framework, seeking to explain total factor productivity growth by FDI levels, increased export activity, and increasing levels of regional specialisation. In addition to investment and increased employment, FDI is often argued to assist the inflow of superior technologies to the country that in turn may have spillover effects to the domestic economy. Regional specialisation may spur regional growth either by intra-industry spillover effects or by offering regional economies of scale in markets of inputs. External trade, finally, may bring by higher economic growth by enhancing productivity as an effect of higher competition in foreign markets.

Summarizing the findings of the above analysis, export activities and the sector composition of employment are found to matter most clearly for regional growth. In quantitative terms, the latter is especially relevant: A region having twice as high a share in agricultural employment than another produces only a growth rate that is 15-20% lower. Higher growth of the back-lagging regions in Hungary can thus be expected from onward structural change with labour moving out of the agrarian sector. This suggests that policies designed to address development issues in rural areas should be an important aspect of regional policy in new member states. Further to a low share in agriculture, regions experiencing high growth are also characterized by extensive export activity. Doubling the share of export in manufacturing output enhances the growth rate by around 7%. Therefore, from a policy perspective, promoting the orientation of the Hungarian economic actors towards foreign markets is likely to be beneficial for the boost of regional growth, too. FDI and increasing regional specialisation are not found significant for enhanced regional growth, once contemporaneous correlation across the regions or time specific effects were controlled for. The former suggests the presence of spatial correlation in the variables.

The present findings confirm the role of the composition of the regional economy for growth, as found in Iara and Traistaru (2003), even if increased employment and capital stocks are controlled for. However, the growth contribution of FDI is found less clear. In contrast, the present specifications assign an undoubted role of increased export activities to spurring regional growth.

The inconclusive findings on the growth effect from FDI do not match the clearly positive results in the studies with firm data or NUTS II data. In the above analysis, the variation in growth rates is however found dominated by time specific effects. It remains for further research to establish the growth effect of FDI in at the aggregate level of NUTS III regions, when, by adding to the length of the sample, time will help to discern more clearly how FDI bears on regional growth.

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Appendix

Table 1 Definition of variables

Variable	Abbreviation	Description
GDP per capita	GDP/POP	GDP per capita, in 1995 prices (CPI-deflated). Contains taxes and subsidies.
Capital stock per capita	CAP/POP	Own calculation from gross investment data $I_{1,...,T}$ using the perpetual inventory method: Initial year's capital stock $K_1=I_1/g$, where g is the average rate of growth of I in 1...T. Subsequent years: $K_t=K_{t-1}(1-\delta)+I_t$, with the depretiation rate δ=0.05 (see Badinger and Tondl, 2002). Investment data series starting 1991 used. Investment data refer to location of companies' headquarters; they contain public investment including social security funds.
Employment rate	EMP/POP	Number of employees in regional population. Until 1997, data refer to the location of workplaces (excep public administration). Since 1998, assignment by headquarters. Budgetary and social security organisations are included irrespective of the number of emloyees. Up to 1998, enterprises included only if having more than 20 employees (construction enterprises: more than 10). As of 1999, enterprises with more than 4 employees are considered.
FDI density	FDI	Number of enterprises with any foreign share in subscribed capital per total number of domestic enterprises (including inactive enterprises, budgetary institutions, and NGOs).
Regional specialisation index	HERF	Herfindahl index of specialisation, region i: $H_i=\Sigma_j(E_{ij}/E_i)^2$, calculated from shares of employment in branches j=1…M, E_{ij}, in total regional employment, E_i. NACE branches considered: DA, DB+DC, DD+DE, DF+DG+DH, DI, DJ, DK+DL+DM, DN.
Export orientation	S_EXPOUT	Share of exports in industrial output.
Employment share of agriculture	S_EMPLAB	Share of employees in agriculture (NACE 1-digit categories: A, B) in the total number of employees in the region.
Employment share of industry	S_EMPLCF	Share of employees in industry and construction (NACE 1-digit categories: C to F) in total number of employees in the region.

Table 2 NUTS III regions: GDP per capita 1994-2001 (1000 HUF, 1995 prices)

	1994	1995	1996	1997	1998	1999	2000	2001	avg. 94-01
Average	477	481	478	498	520	528	549	565	512
Average without capital	451	454	450	468	489	495	510	524	480
Coefficient of variation	0.28	0.29	0.31	0.33	0.34	0.37	0.40	0.37	0.34
C.o.v. without capital	0.15	0.16	0.18	0.21	0.24	0.25	0.27	0.21	0.21
Change (%)		**1994/95**	**1995/96**	**1996/97**	**1997/98**	**1998/99**	**1999/00**	**2000/01**	**avg. 1994-01**
Average		0.7	-1.1	3.9	4.1	1.0	3.3	4.0	2.3
Average without capital		0.6	-1.3	3.8	4.2	0.8	3.0	4.0	2.2
Coefficient of variation		5.66	-2.64	1.33	0.90	3.81	1.09	1.59	0.71
C.o.v. without capital		6.54	-2.25	1.40	0.92	4.99	1.14	1.65	0.72

Figure 1 NUTS III regions: log GDP growth per capita

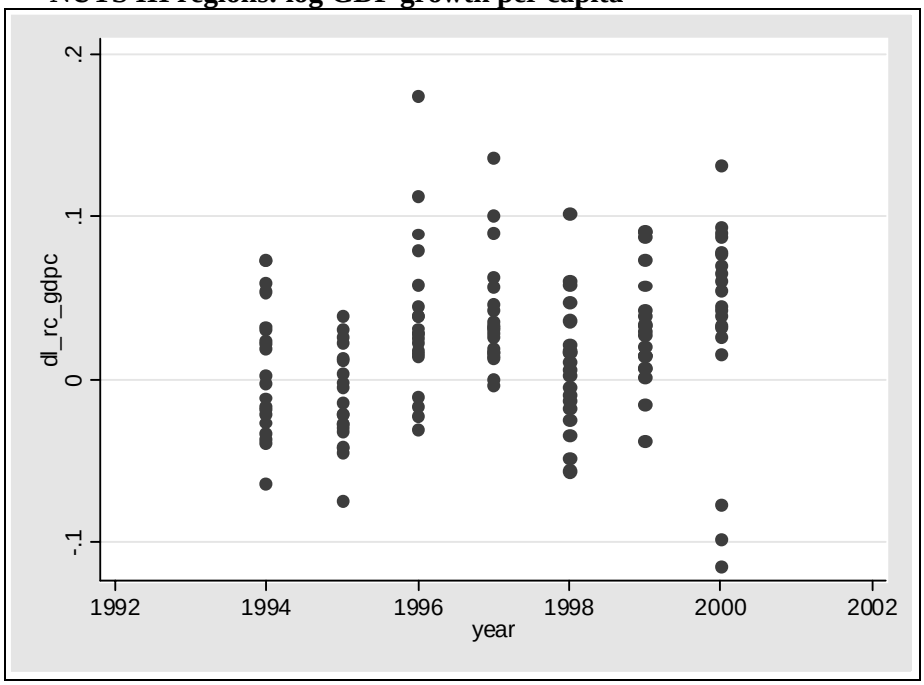

Table 3 NUTS III regions: Investment per capita 1994-2001 (1000 HUF, 1995 prices)

Region	1994	1995	1996	1997	1998	1999	2000	2001	avg. 94-01
Average	72	79	90	92	111	100	106	106	95
Average without capital	67	70	82	84	106	88	94	92	86
Coefficient of variation	0.42	0.63	0.54	0.48	0.39	0.72	0.62	0.66	0.56
C.o.v. without capital	0.33	0.43	0.43	0.32	0.34	0.55	0.43	0.40	0.40
Change (%)		**1994/95**	**1995/96**	**1996/97**	**1997/98**	**1998/99**	**1999/00**	**2000/01**	**avg. 1994-01**
Average		9.5	17.5	17.4	25.7	-14.2	11.1	1.1	9.7
Average without capital		7.2	18.6	18.3	27.6	-17.7	11.7	0.6	9.5
Coefficient of variation		4.68	1.27	3.46	1.25	-2.01	2.14	15.02	3.69
C.o.v. without capital		6.18	1.19	3.38	1.16	-1.39	2.07	27.06	5.66

Figure 2 Change in log capital stock per cap. – correlation with log GDP growth per cap.

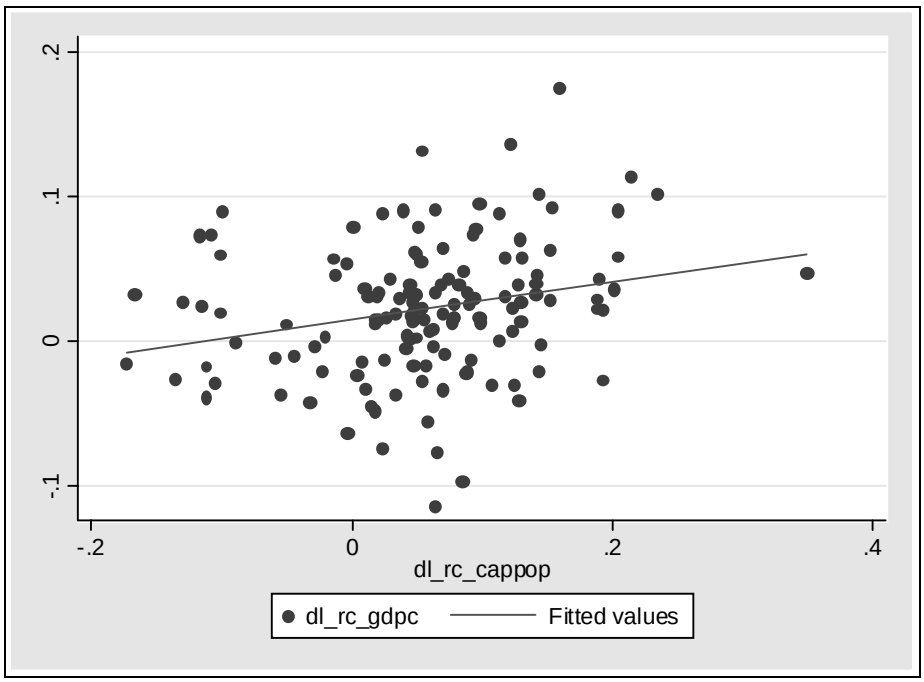

Table 4 NUTS III regions: Employment rate 1994-2001 (Employees per cap., %)

	1994	1995	1996	1997	1998	1999	2000	2001	avg. 94-01
Average	24.0	23.0	22.1	21.7	20.5	22.9	23.0	23.1	22.5
Average without capital	23.3	22.3	21.4	21.1	19.1	21.3	21.4	21.5	21.4
Coefficient of variation	0.18	0.20	0.20	0.20	0.34	0.34	0.35	0.35	0.27
C.o.v. without capital	0.13	0.14	0.15	0.15	0.17	0.16	0.16	0.15	0.15
Change (% points)		**1994/95**	**1995/96**	**1996/97**	**1997/98**	**1998/99**	**1999/00**	**2000/01**	**avg. 1994-01**
Average		-1.02	-0.91	-0.35	-1.27	2.40	0.17	0.08	-0.13
Average without capital		-1.05	-0.86	-0.33	-1.97	2.24	0.09	0.06	-0.26
Coefficient of variation		-0.42	-0.38	-1.37	-2.59	0.44	5.20	4.33	0.75
C.o.v. without capital		-0.39	-0.31	-1.47	-0.46	0.36	9.24	6.00	1.85

Figure 3 Change in log employment rate – correlation with log GDP growth per cap.

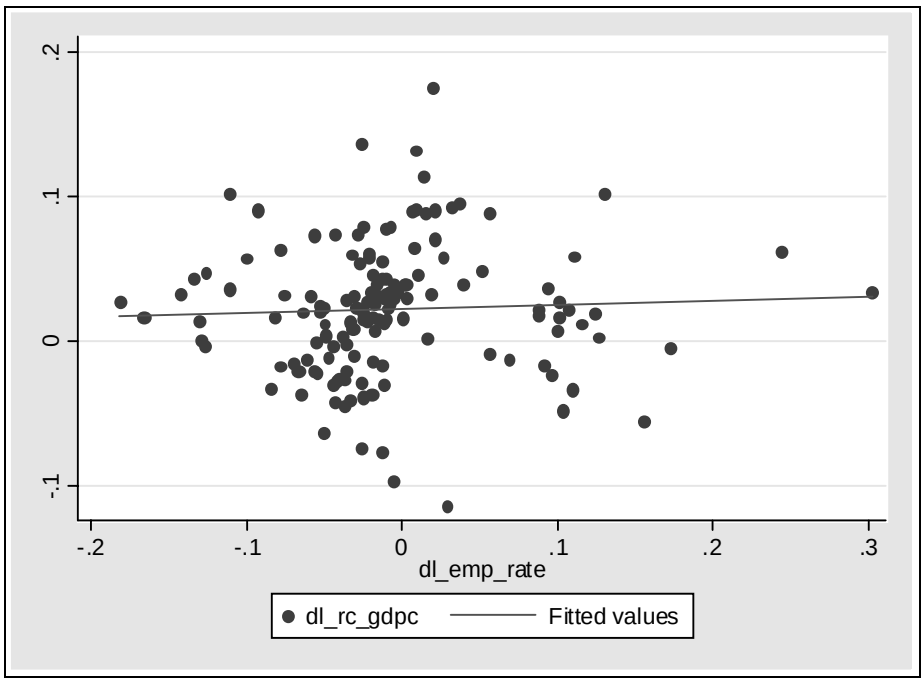

Table 5 NUTS III regions: FDI density, 1994-2001 (‰)

	1994	1995	1996	1997	1998	1999	2000	2001	avg. 94-01
Average	11.5	12.7	13.5	14.7	19.1	18.2	17.3	16.1	15.4
Average without capital	10.5	11.7	12.4	13.6	18.0	17.0	16.0	14.8	14.2
Coefficient of variation	0.55	0.55	0.55	0.54	0.48	0.51	0.51	0.53	0.53
C.o.v. without capital	0.45	0.46	0.47	0.47	0.43	0.44	0.43	0.45	0.45
Change (% points)		**1994/95**	**1995/96**	**1996/97**	**1997/98**	**1998/99**	**1999/00**	**2000/01**	**avg. 1994-01**
Average		1.19	0.77	1.28	4.37	-0.91	-0.95	-1.20	0.65
Average without capital		1.15	0.73	1.21	4.34	-1.00	-1.00	-1.13	0.61
Coefficient of variation		0.78	1.01	0.82	1.00	-1.18	-1.47	-2.30	-0.19
C.o.v. without capital		0.81	1.07	0.85	1.04	-1.01	-1.42	-2.50	-0.17

Figure 4 Log FDI density – correlation with log GDP growth per cap.

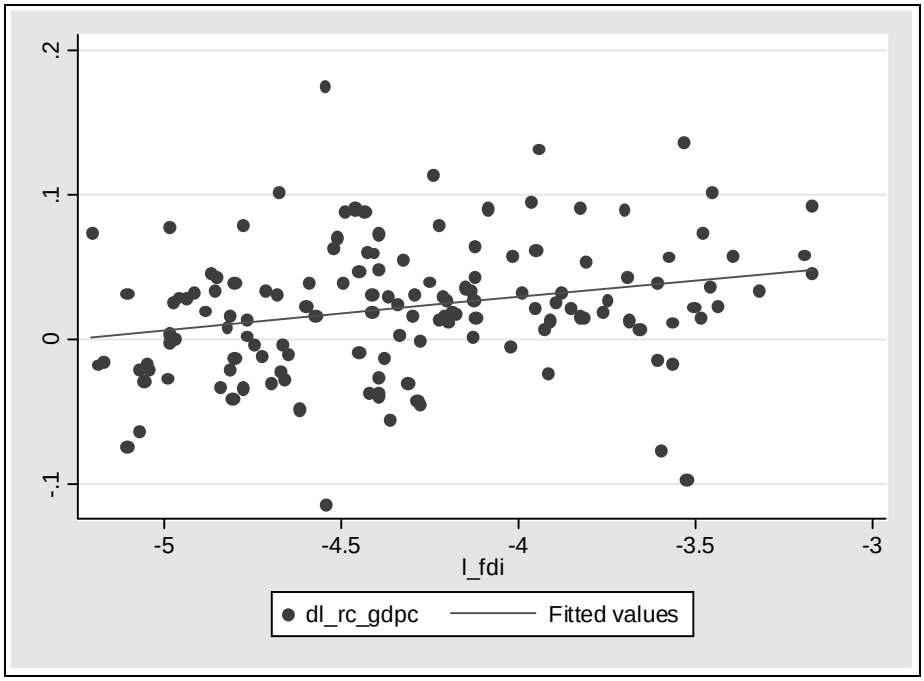

Table 6 NUTS III regions: Regional specialisation, 1994-2001 (Herfindahl index)

	1994	1995	1996	1997	1998	1999	2000	2001	avg. 94-01
Average	0.2062	0.2047	0.2078	0.2147	0.2205	0.2114	0.2195	0.2219	0.2133
Average without capital	0.2072	0.2054	0.2087	0.2156	0.2216	0.2129	0.2211	0.2237	0.2145
Coefficient of variation	0.15	0.14	0.17	0.20	0.18	0.21	0.28	0.29	0.20
C.o.v. without capital	0.15	0.14	0.17	0.21	0.18	0.21	0.28	0.29	0.20
Change (index points)		**1994/95**	**1995/96**	**1996/97**	**1997/98**	**1998/99**	**1999/00**	**2000/01**	**avg. 1994-01**
Average		-0.0016	0.0031	0.0069	0.0058	-0.0091	0.0081	0.0024	0.0022
Average without capital		-0.0018	0.0033	0.0069	0.0060	-0.0087	0.0081	0.0026	0.0024
Coefficient of variation		-7.36	3.73	1.84	3.32	-1.41	3.35	5.37	1.26
C.o.v. without capital		-6.55	3.65	1.89	3.29	-1.50	3.43	5.05	1.32

Figure 5 Change in log regional specialisation – correlation with log GDP growth per cap.

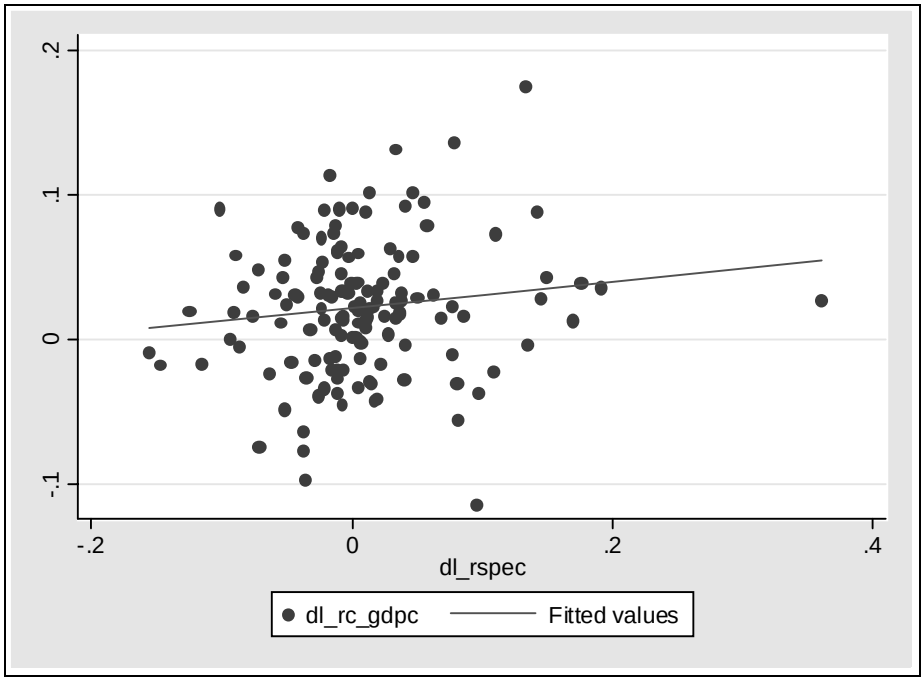

Table 7 NUTS III regions: Export in industrial output, 1994-2001 (%)

	1994	1995	1996	1997	1998	1999	2000	2001	avg. 94-01
Average	27.6	32.9	35.7	40.8	44.3	46.2	48.9	50.1	40.8
Average without capital	27.6	33.1	35.9	41.1	44.8	46.8	49.5	50.6	41.2
Coefficient of variation	0.34	0.37	0.38	0.37	0.38	0.42	0.36	0.37	0.37
C.o.v. without capital	0.35	0.38	0.38	0.37	0.38	0.43	0.36	0.38	0.38
Change (% points)		**1994/95**	**1995/96**	**1996/97**	**1997/98**	**1998/99**	**1999/00**	**2000/01**	**avg. 1994-01**
Average		5.32	2.78	5.17	3.42	1.98	2.67	1.21	3.22
Average without capital		5.46	2.79	5.27	3.62	2.04	2.72	1.10	3.29
Coefficient of variation		0.96	1.65	0.82	1.14	2.73	4.00	6.04	2.48
C.o.v. without capital		0.96	1.69	0.82	1.08	2.72	4.04	6.79	2.58

Figure 6 Change in log exports in industry output – correlation with log GDP growth p. c.

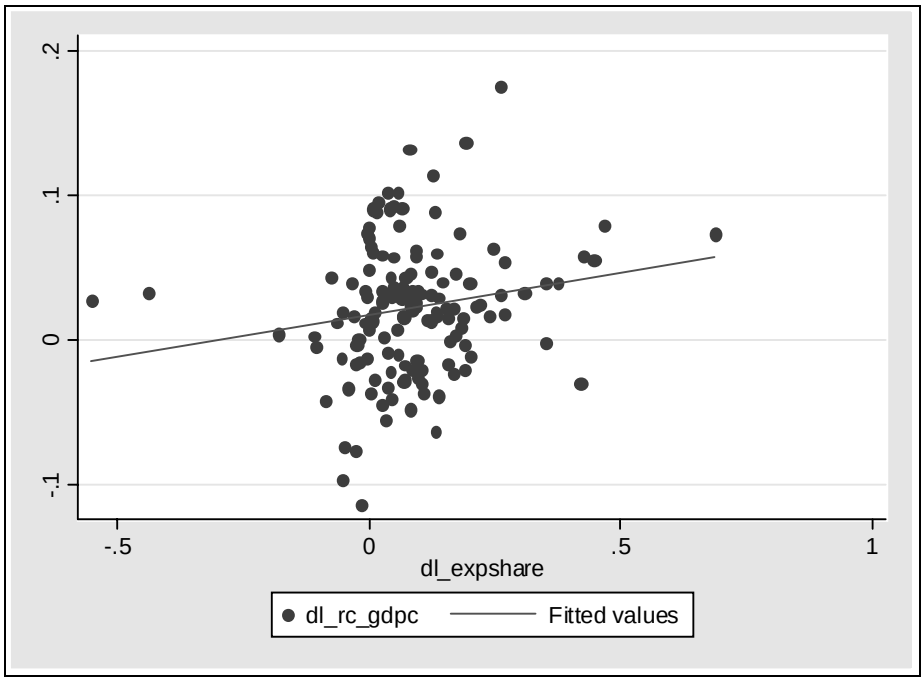

Table 8 NUTS III regions: Employees in agriculture 1994-2001 (%)

	1994	1995	1996	1997	1998	1999	2000	2001	avg. 94-01
Average	9.6	9.1	8.9	8.6	9.2	8.0	7.2	6.5	8.4
Average without capital	10.0	9.6	9.3	9.1	9.6	8.5	7.6	6.9	8.8
Coefficient of variation	0.37	0.35	0.37	0.38	0.40	0.40	0.38	0.39	0.38
C.o.v. without capital	0.29	0.27	0.29	0.31	0.32	0.32	0.30	0.31	0.30
Change (% points)		**1994/95**	**1995/96**	**1996/97**	**1997/98**	**1998/99**	**1999/00**	**2000/01**	**avg. 1994-01**
Average		-0.46	-0.27	-0.22	0.53	-1.12	-0.83	-0.69	-0.44
Average without capital		-0.48	-0.28	-0.23	0.57	-1.18	-0.88	-0.72	-0.46
Coefficient of variation		-1.42	-1.60	-2.81	1.57	-0.51	-0.78	-0.65	-0.89
C.o.v. without capital		-1.39	-1.57	-2.75	1.45	-0.44	-0.72	-0.59	-0.86

Figure 7 Employees in agriculture (%) – correlation with log GDP growth per capita

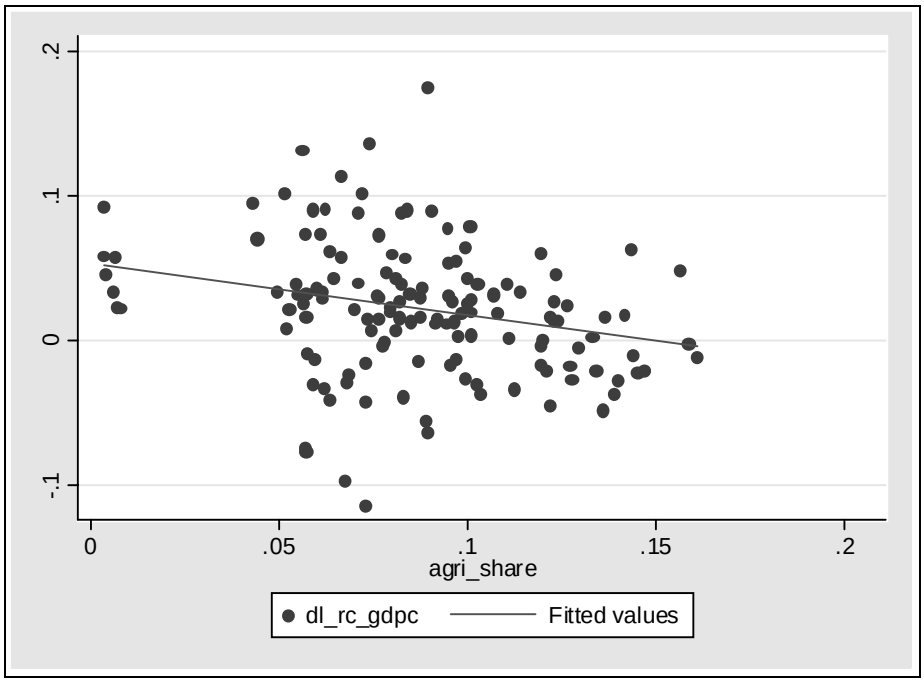

Table 9 NUTS III regions: Employees in industry 1994-2001 (%)

Region	1994	1995	1996	1997	1998	1999	2000	2001	avg. 94-01
Average	38.2	37.5	38.3	39.0	41.2	41.0	41.5	41.2	39.7
Average without capital	39.0	38.3	39.3	40.0	42.2	42.0	42.5	42.2	40.7
Coefficient of variation	0.16	0.20	0.18	0.19	0.19	0.18	0.18	0.19	0.18
C.o.v. without capital	0.12	0.17	0.14	0.15	0.16	0.14	0.15	0.15	0.15
Change (% points)		**1994/95**	**1995/96**	**1996/97**	**1997/98**	**1998/99**	**1999/00**	**2000/01**	**avg. 1994-01**
Average		-0.72	0.87	0.64	2.23	-0.19	0.46	-0.32	0.42
Average without capital		-0.69	0.95	0.71	2.23	-0.21	0.47	-0.30	0.45
Coefficient of variation		-6.65	5.18	1.75	1.43	-6.99	2.78	-2.85	-0.77
C.o.v. without capital		-7.20	4.86	1.55	1.46	-6.33	2.81	-3.06	-0.84

Figure 8 Employees in industry (%) – correlation with log GDP growth per capita

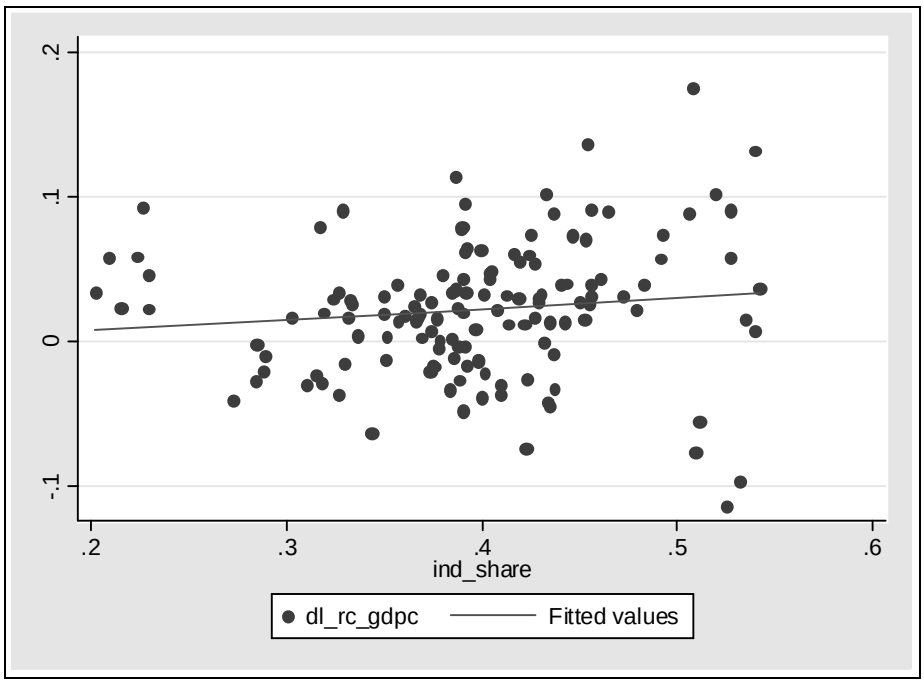

Table 10 Correlations between the variables

	GDP per capita	Investment per capita	Employ-ment rate	FDI density	Exports in industrial output	Regional speciali-zation	empl. share: agriculture
Investment per cap.	**0.89*** **	1.00					
Employment rate	**0.90*** **	**0.78*** **	1.00				
FDI density	**0.77*** **	**0.71*** **	**0.65*** **	1.00			
Exports in ind. output	**0.26*** **	**0.29*** **	0.11	**0.33*** **	1.00		
Reg. specialization	**0.15***	0.11	0.06	-0.11	0.40	1.00	
Empl. share: Agriculture	**-0.48*** **	**-0.51*** **	**-0.40*** **	**-0.50*** **	**-0.16****	**0.29*** **	1.00
Empl. share: Industry	-0.14*	-0.11	**-0.23*** **	-0.06	**0.51*** **	**0.33*** **	0.05

Note: *, **, *** indicate significance at 10%-, 5%-, 1% respectively.

Table 11 Correlations between the transformed variables

	D_log (GDP per capita)	D_log (capital per capita)	D_log (employ-ment rate)	log (FDI density)	D_log (exports in ind. output)	D_log (reg.spec.)	log (empl.share: agriculture)
D_log (capital p.c.)	**0.25*** **	1.00					
D_log (empl. rate)	0.04	0.05	1.00				
log (FDI density)	**0.25*** **	**0.15***	**0.36*** **	1.00			
D_log (ex-port share)	**0.18****	-0.06	**-0.19****	-0.06	1.00		
D_log (reg.spec.)	0.13	0.09	-0.10	-0.04	-0.05	1.00	
log (empl. share: agric.)	**-0.25*** **	**-0.24****	-0.13	**-0.42*** **	0.03	0.02	1.00
log (empl. share: ind.)	0.12	-0.06	0.03	0.05	0.03	0.04	0.06

Note: *, **, *** indicate significance at 10%-, 5%-, 1% respectively.

Table 12 Correlations between the transformed variables: Capital region excluded

	D_log (GDP per capita)	D_log (capital per capita)	D_log (employ-ment rate)	log (FDI density)	D_log (exports in ind. output)	D_log (reg.spec.)	log (empl.share: agriculture)
D_log (capital p.c.)	**0.22*** **	1.00					
D_log (empl. rate)	0.02	0.02	1.00				
log (FDI density)	**0.21****	0.04	**0.33*** **	1.00			
D_log (ex-port share)	**0.19****	-0.05	**-0.18****	-0.05	1.00		
D_log (reg.spec.)	0.14	0.11	-0.09	-0.03	-0.05	1.00	
log (empl. share: agric.)	**-0.22*** **	-0.12	-0.03	**-0.23*** **	0.01	0.01	1.00
log (empl. share: ind.)	**0.23*** **	-0.09	**0.18****	**0.42*** **	0.004	0.03	**-0.38*** **

Note: *, **, *** indicate significance at 10%-, 5%-, 1% respectively.

Table 13 OLS estimation results

Dep. variable: Δln(GDP/POP)	(1)	(2)	(3)	(4)	(5)	(6)
Δln(CAP/POP)	**0.1087*** (0.0412)**	0.0641 (0.0451)	**0.1029*** (0.0382)**	0.0526 (0.0438)	**0.0867** (0.0370)**	**0.0830** (0.0381)**
Δln(EMP/POP)	0.0007 (0.0379)	0.1202 (0.0908)	0.0031 (0.0475)	0.0924 (0.0866)	-0.0206 (0.0483)	-0.0211 (0.0481)
ln(FDI)			**0.0149* (0.0090)**	0.0118 (0.0088)	0.0135 (0.0086)	**0.0144* (0.0086)**
Δln(S_EXPOUT)			**0.0690*** (0.0244)**	**0.0721*** (0.0210)**	**0.0657*** (0.0223)**	**0.0665*** (0.0219)**
Δln(HERF)			**0.0893* (0.0525)**	0.0423 (0.0564)	**0.0929* (0.0515)**	**0.0961* (0.0525)**
S_AGRI	**-0.2989*** (0.0980)**	**-0.2401*** (0.0891)**	**-0.2171** (0.1092)**	**-0.1762* (0.0990)**	**-0.2208** (0.1007)**	**-0.2088** (0.0985)**
S_IND	0.0929 (0.0656)	0.0857 (0.0680)	0.0759 (0.0634)	0.0633 (0.0659)	0.0578 (0.0620)	
year dummies	N	Y	N	Y	1995	1995
constant	Y	Y	Y	Y	Y	Y
R^2	0.12	0.24	0.20	0.29	0.25	0.25
adj. R^2	0.15	0.29	0.24	0.36	0.30	0.28
N	140	140	140	140	140	140
year dummies F	n/a	F(6,129) = 4.64***	n/a	F(6,126)= 5.05***	F(1,131) = 21.16***	F(1,132)= 20.71***

Note: *, **, *** indicate significance at 10%-, 5%-, 1% respectively. Robust standard errors in parentheses.

Table 14 OLS estimation results: Capital region excluded

Dep. variable: Δln(GDP/POP)	(1)	(2)	(3)	(4)	(5)	(6)
Δln(CAP/POP)	**0.1047*** (0.0407)**	0.0431 (0.0448)	**0.1033*** (0.0387)**	0.0359 (0.0471)	**0.0872** (0.0372)**	**0.0882** (0.0386)**
Δln(EMP/POP)	-0.0120 (0.0450)	**0.2886*** (0.1075)**	-0.0002 (0.0533)	**0.2747*** (0.1055)**	-0.0220 (0.0541)	-0.0182 (0.0539)
ln(FDI)			0.0148 (0.0108)	0.0078 (0.0110)	0.0131 (0.0105)	**0.0158* (0.0094)**
Δln(S_EXPOUT)			**0.0693*** (0.0247)**	**0.0721*** (0.0204)**	**0.0661*** (0.0226)**	**0.0672*** (0.0220)**
Δln(HERF)			**0.0885* (0.0533)**	0.0113 (0.0528)	**0.0927* (0.0522)**	**0.0956* (0.0539)**
S_AGRI	**-0.2225* (0.1353)**	-0.1615 (0.1261)	**-0.2215* (0.1318)**	-0.1480 (0.1218)	**-0.2188* (0.1222)**	**-0.2574** (0.1197)**
S_IND	0.1303 (0.0919)	0.1144 (0.0875)	0.0741 (0.0995)	0.0800 (0.0936)	0.0600 (0.0955)	
year dummies	N	Y	N	Y	1995	1995
constant	Y	Y	Y	Y	Y	Y
R^2	0.11	0.26	0.19	0.31	0.24	0.24
adj. R^2	0.14	0.31	0.23	0.38	0.29	0.28
N	133	133	133	133	133	133
year dummies F	n/a	F(6,122)= 5.70***	n/a	F(6,119)= 5.50***	F(1,124)= 19.48***	F(1,125)= 18.23***

Note: *, **, *** indicate significance at 10%-, 5%-, 1% respectively. Robust standard errors in parentheses.

Table 15 PCSE estimation results

Dep. variable: Δln(GDP/POP)	(1)	(2)	(3)	(4)	(5)	(6)
Δln(CAP/POP)	**0.1087*** (0.0414)**	**0.0641** (0.0317**	**0.1029*** (0.0404)**	0.0528 (0.0369)	**0.0867*** (0.0296)**	**0.0569* (0.0293)**
Δln(EMP/POP)	0.0007 (0.0672)	0.1202 (0.0812)	0.0031 (0.0643)	0.0924 (0.0719)	-0.0206 (0.0447)	0.0328 (0.0467)
ln(FDI)			0.0149 (0.0105)	0.0118 (0.0106)	0.0135 (0.1037)	0.0726 (0.0557)
Δln(S_EXPOUT)			**0.0690*** (0.0218)**	**0.0721*** (0.0223)**	**0.0657*** (0.0195)**	**0.0725*** (0.0206)**
Δln(HERF)			0.0893 (0.0583)	0.0423 (0.0622)	**0.0929* (0.0561)**	0.0130 (0.0102)
S_AGRI	**-0.2989*** (0.0766)**	**-0.2401*** (0.0718)**	**-0.2171*** (0.0790)**	**-0.1762** (0.0753)**	**-0.2208** (0.0727)**	**-0.2016*** (0.0702)**
S_IND	0.0929 (0.0792)	0.0857 (0.0868)	0.0759 (0.0685)	0.0633 (0.0777)	0.0578 (0.0686)	0.0590 (0.0707)
year dummies	N	Y	N	Y	1995	some
constant	Y	Y	Y	Y	Y	Y
R^2	0.12	0.24	0.20	0.30	0.25	0.28
adj. R^2						
N	140	140	140	140	140	140
year dummies X^2		$X^2(4)$= 2852.37***		X^2 (6) = 1805.52***	X^2 (1)= 14.36***	$X^2(4)$ = 48.56***

Note: *, **, *** indicate significance at 10%-, 5%-, 1% respectively. Robust standard errors in parentheses.

Table 16 PCSE estimation results: Capital region excluded

Dep. variable: Δln(GDP/POP)	(1)	(2)	(3)	(4)	(5)	(6)
Δln(CAP/POP)	**0.1047** (0.0437)**	0.0431 (0.0308)	**0.1033** (0.0425)**	0.0359 (0.0356)	**0.0872*** (0.0306)**	0.0398 (0.0304)
Δln(EMP/POP)	-0.0120 (0.0791)	**0.2886*** (0.1151)**	-0.0002 (0.0751)	**0.2747** (0.1178)**	-0.0220 (0.0504)	**0.2802*** (0.1108)**
ln(FDI)			0.0148 (0.0096)	0.0078 (0.0088)	0.0131 (0.0093)	0.0082 (0.0081)
Δln(S_EXPOUT)			**0.0693*** (0.0219)**	**0.0721*** (0.0224)**	**0.0661*** (0.0196)**	**0.0712*** (0.0209)**
Δln(HERF)			0.0885 (0.0588)	0.0113 (0.0652)	**0.0927* (0.0569)**	0.0110 (0.0651)
S_AGRI	**-0.2225*** (0.0895)**	**-0.1615** (0.0792)**	**-0.2215** (0.0932)**	**-0.1480* (0.0904)**	**-0.2188*** (0.0848)**	**-0.1493* (0.0917)**
S_IND	0.1303 (0.1224)	0.1144 (0.1159)	0.0741 (0.1035)	0.0800 (0.0999)	0.0600 (0.1052)	0.0797 (0.1004)
year dummies	N	Y	N	Y	1995	some
constant	Y	Y	Y	Y	Y	Y
R^2	0.11	0.26	0.19	0.31	0.24	0.31
adj. R^2						
N	133	133	133	133	133	
year dummies X^2		467.31***		1847.86***		461.90***

Note: *, **, *** indicate significance at 10%-, 5%-, 1% respectively. Robust standard errors in parentheses.

A Note on Export Openness and Regional Wage Disparity in Central and Eastern Europe

Peter Egger,[†,‡] Peter Huber[‡] and Michael Pfaffermayr[†,‡] *

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Abstract

This paper extends the empirical literature on the effects of trade liberalization on regional disparities within a country. Studying the case of the Central and Eastern European Countries, we find significant convergence of real wages in Poland and Bulgaria, only. Furthermore, countries with a faster growing export openness in the period 1991 - 1998 experienced larger increases in their regional disparities. Especially, intermediate goods trade seems to have been a main driving force. Our estimates suggest that the long run impact of rising intermediate goods export openness in the last decade was a 23% increase in the average economy's variance of real wages.

Keywords: Real wage rates; Regional convergence; Outsourcing
JEL: R23, F15, J31

* University of Innsbruck, Department of Economics, Universitätsstr. 15, A-6020 Innsbruck, Austria. ‡ Austrian Institute of Economic Research, P.O.-Box 91, A-1103 Vienna, Austria. We are grateful to two anonymous referees for their helpful suggestions.

1 Introduction

The tendencies to liberalize trade in the last decades have led to a re-emergence of interest in the potential effects of trade on regional disparities within a country. "New economic geography" models (Krugman, 1991) have drawn attention to the fact that in the presence of (internal and external) increasing returns and labor migration, forward and backward linkages between upstream and downstream industries (Venables, 1996), or simply factor accumulation in the presence of externalities (Baldwin, 1999), trade liberalization may lead to increased disparities *across countries*. Recently, Crozet and Koenig-Soubeyran (2002), Fujita et al. (Chapter 18, 1999), Haaparanta (1998), Krugman and Livas (1996), Monfort and Nicolini (2002), Paluzie (1999), and Villar (2001) shifted the focus to regional disparities *within countries*. In these regional models, trade liberalization potentially affects regional disparities within countries as producers either move closer to the border to secure market access to foreign countries or to the centre to benefit from a larger market.

The economic geography models differ starkly, however, concerning their predictions. First, as pointed out by Venables (1996) even within the prototype geography and trade model a u-shaped relationship between equilibrium regional disparities and transport costs arises due to two opposing forces. On the one hand, low trade costs encourage firms to locate in the centre, because more distant markets are cheaper to serve. On the other hand, low trade costs, in particular of intermediates, allow upstream and downstream firms to locate far apart from each other. In models where the internal distribution of economic activity depends on external (cross-border) transport costs, this relationship becomes even more complicated as the possible equilibria depend on the relative weight of internal and external transport cost (see Monfort and Nicolini, 2002, for a characterization of the possible equilibria).

Second, predictions of these models are highly dependent on the type of centripetal and centrifugal forces included. In Krugman and Livas (1996), economizing on transport costs to foreign markets and taking advantage of cheap land prices in the periphery, motivate producers to move towards (low-wage) border regions after trade liberalization. In typical models, the centripetal forces, originate from external economies of scale, which do not depend on trade liberalization. Accordingly, trade liberalization works to reduce existing income disparities within countries. In Monfort and Nicolini (2002) and Paluzie (2001), by contrast, an additional centripetal force is in-

troduced, which creates incentives for producers to move away from border regions to avoid competition from abroad. Therefore, Paluzie (2001, p. 81) concludes that in most simulations "it is the opening of an economy that brings further regional polarization".

Given these differing predictions concerning the relationship between trade liberalization and regional wage disparities, it seems likely that integration may have different impacts on regional disparities depending on the actual context in which it takes place. This context comprises relative internal and external transport costs, the potential for competition from abroad and the strength of internal and external economies of scale. In accordance with this hypothesis recent empirical work on the relationship between regional disparities and trade liberalization leads to contradictory results. Hanson (1998) focusing on the US-Mexican case of trade liberalization finds that Mexican industry has located closer to the border of the US and wages in border regions have risen more strongly in Mexican border regions. Evidence provided for other countries (see Crozet and Koenig-Souberayn, 2002, Pons et al., 2002, Sjöberg and Sjöholm,2002) does not corroborate these results, however. Sjöberg and Sjöholm (2002) present descriptive evidence that spatial concentration of manufacturing in Indonesia has changed little in a time period, when Indonesia liberalized trade substantially. Crozet and Koenig-Souberayn (2002) find that urbanisation in Romania has increased most strongly in regions, which have improved their market access most. They take this as evidence for the agglomerative effects induced by trade liberalization. Finally, Pons et al. (2002), analyzing trade liberalization in Spain in the second half of the 19th century, find that industrial agglomeration came along with trade liberalization.

This note extends the empirical literature by analyzing another case of rapid and dramatic trade liberalization. We focus on the link between regional disparities in terms of wages and export behavior in Central and Eastern European countries (CEEC). These countries have undergone particularly rapid trade liberalization in the 1990's. In eight CEEC in 1992 foreign trade openness measured as the ratio of exports plus imports to GDP accounted for 64.7% on average. This figure increased in five out of eight CEEC countries. By 1999 the average ratio amounted to 106.9%.[1] Our primary aim is to establish whether trade liberalization has fostered regional

[1]In 1999 data for only four CEEC are available. The average trade openness measure in 1998 covering eight CEEC was 102.8%.

convergence or divergence in these countries.

Furthermore, we disentangle the impact of final goods versus intermediate goods export openness on regional disparities. This may potentially affect regional disparities differently, since the latter is closely related to the activity of multinational enterprises (see Slaughter, 2000) and the CEEC have also experienced substantial FDI inflows (see Brenton, DiMauro and Lücke, 1999). The theory of vertically organized multinational firms underpins the importance of cost differences among countries as motivation to fragment production (and services) across borders (Helpman, 1984). Since vertical multinationals by definition engage in intermediate goods trade, we use intermediate goods exports as a proxy for the effect of vertical FDI on regional disparities.

2 Data and σ-Convergence Estimation

Our data comprise real wages of eight Central and Eastern European countries[2] at the regional level, where consumer price indices have been used to convert nominal into real data (the base year is 1995). The length of the series varies between countries, but on average, we cover the time span of 1991-1999. This time period is particularly suited for our purpose, because it was characterized by rapid trade liberalization, substantial foreign direct investments flows and low internal migration rates[3] in the CEEC. The literature on economies in transition, however, stresses a number of further important factors influencing economic development. These are usually grouped under the headings of differences in starting conditions, economic policy and speed of institutional reforms (Fisher, Sahay and Vegh, 1996). Since many of these determinants are hard to measure but by and large time invariant, our specification in first differences eliminates these influences.

We look at regional convergence at the country level and, thereby, focus on the role of both intermediate and final goods export openness as determinants of real wage convergence. Data on intermediate and final goods exports of the CEEC are reported at the detailed Standard International

[2]Bulgaria, Czech Republic, Estonia, Hungary, Poland, Romania, Slovakia, and Slovenia.

[3]High migration rates contribute to wage convergence. A substantial literature on migration within the CEEC, however, shows very low internal migration rates (see Fidrmuc, 2003, Cseres-Gergely and Zsombor, 2002, Hazans, 2003, and Kallai, 2003).

Trade Classification 5-digit level in UNO's Broad Economic Categories. We aggregate the data appropriately to obtain aggregate intermediate and final goods exports, which vary over CEECs and time. The two trade figures are measured in percent of GDP.

- Table 1 -

First, we follow Carree and Klomp (1997) and test for regional σ-convergence of real wages within the CEEC countries. For each country (i), we compute the standard deviation of real wages over its regions in the initial $(\sigma(w)_{i0})$ and the last year $(\sigma(w)_{iT})$, and use Carree and Klomp's likelihood ratio T_2-statistic to decide, whether the observed change is significant. We find significant regional wage convergence only in Bulgaria and Poland, for Romania wage convergence is insignificant, and in all other countries evidence suggests divergence. This is by and large consistent with previous results concerning income convergence in the candidate countries (Petrakos, 1999; Gorzelak, 1996). Furthermore, Table 1 suggests that a high increase in both intermediate and final goods exports is accompanied either by divergence or at least no convergence. This can be seen when comparing the bold figures for Czech Republic, Estonia, Hungary, Romania, and Slovak Republic. This is consistent with models of both New Trade Theory and Economic Geography. These models suggest that trade activity is especially strong, where internal economies of scale are relevant, so that it pays to concentrate production in a single location. A large rise in export openness may point to a change in favor of production concentration. The latter emphasizes external economies and implies that agglomeration forces accentuate this pattern. The likelihood of spillovers, and forward and backward linkages also favor concentration of production in centers, where wages are relatively high. Then, we would expect that a high export openness widens the gap in wages between the center and the periphery (see Fujita et al., 1999).

This interpretation is also highly consistent with the literature on regional development in the CEEC (see Smith, 1998; Traistaru, Nijkamp and Longhi, 2002), which emphasizes the role of large (capital) cities and border regions in shaping the process of wage divergence within the CEEC. These regions are also known for their high export openness. Border regions received a disproportionately large share in FDI, which has been mainly trade creating (see Fazekas, 2000).

Since the power of the T_2-statistic presented in Table 1 is low in small samples (see Carree and Klomp, 1997, p. 685, Table 2), we extend the

analysis by running dynamic panel data regressions and apply the Blundell and Bond (1998) estimator, which is especially suited for short panels. We estimate the following specification:

$$\begin{aligned}\Delta\sigma\left(w\right)_{it} &= \lambda\Delta\sigma\left(w\right)_{it-1}+\beta_0+\beta_1\Delta X_{it}^{intermediate}+\beta_2\Delta X_{it}^{final} \\ &\quad +\beta_3\Delta X_{it}^{intermediate}\times\Delta\sigma\left(w\right)_{it-1}+\beta_4\Delta X_{it}^{final}\times\Delta\sigma\left(w\right)_{it-1}+\varepsilon_{it}\end{aligned} \tag{1}$$

where $t = 1, ..., T$, Δ is the first difference operator and $\varepsilon_{it} \sim N(0, \sigma_\varepsilon^2)$. $X_{it}^{intermediate}$ denotes intermediate exports openness defined as exports of intermediates in % of GDP, and ΔX_{it}^{final} represents final goods export openness (likewise in % of GDP). Since the sample size is small, we pool over countries and concentrate on the impact of intermediate and final goods export openness on regional wage convergence in the "average" economy. Baltagi and Griffin (1997) show that in small panels the efficiency gain from pooling is usually considerable without inducing much bias. The regression framework allows us to guard against the simultaneous influence of changes in intermediate and final goods trade on the steady-state distribution of wages. Additionally, with a consistent parameter estimate of the lagged variance of wages at hand, we are able to answer the question of how fast wages converge and whether the speed of adjustment is influenced by the change in export openness. Table 2 reports the results of three specifications. In any specification, the model characteristics support the choice of our instruments, which shows up in insignificant Sargan overidentification test statistics and in insignificant second-order autocorrelation of the residuals.

- Table 2 -

We estimate several specifications, to check for the robustness of the estimation results, specifically with respect to multicolinearity due to the interaction terms. Model 1 restricts $\beta_3 = \beta_4 = 0$ and accounts for the impact of a change in both the intermediate and the final goods openness on regional convergence, without considering any impact of these determinants on the speed of adjustment. We obtain a similar picture as in Table 1. Final goods openness seems to have a diverting impact on regional wages. We cannot identify any additional significant impact of intermediate goods export openness, when conditioning on the two trade variables simultaneously.

Model 2 restricts the steady-state impact of both intermediate and final goods exports to be zero ($\beta_1 = \beta_2 = 0$). However, it allows an impact on

the speed of adjustment. As compared to Model 1, the parameters prove to be relatively stable. Final goods exports openness significantly increases the persistence of regional wage differentials for the typical CEEC.

Since intermediate goods trade and final goods trade may have similar trade costs, they are possibly correlated. Hence, in Models 3 and 4 we introduce total export openness as a single indicator. We find that total export openness exerts no significant impact on the steady state standard deviation in real wages. In contrast, it reduces the speed of wage adjustment. Mixing the effects of intermediate and final goods export openness thus masks their differential impact found in Models 1 and 2. This seems particularly severe in the case of the steady state effects.

Model 5 is the full model including both the steady state impact and the interaction terms of intermediate goods exports and final goods exports openness. This specification accounts for a simultaneous effect of intermediate and final goods exports on both the steady-state distribution of wages within economies and the corresponding speed of adjustment. In contrast to Models 1 and 2, we find that only intermediate goods export openness is relevant for the distribution of regional wages. This might be due to the fact that final goods exports erroneously pick up the impact of intermediate goods exports in the underspecified Models 1 and 2, due to an omitted variables bias and correlation between the two types of exports variables. Anyway, Models 1 and 2 are rejected at the 1% level in terms of Wald tests of 107.61 (Model 1) and 127.90 (Model 2) with two degrees of freedom each. Intermediate goods trade is to a large extent trade within multinational firms (see Hanson et al., 2002, for a similar argument). For the latter, forward and backward linkages may be especially important (Caves, 1996).

- Table 3 -

One might argue, that this phenomenon is mainly driven by the impact of these countries' capitals on the distribution of real wages within economies. To assess the sensitivity of our results with respect to the inclusion of capitals, we skip the corresponding region in any country, where the capital forms a separate region in the data (Bratislava, Bucharest, Budapest, Prague, and Warsaw). Table 3 presents the results for the same models as in Table 2, but the mentioned capitals are skipped and do not affect the countries' standard deviation of real wages. Obviously, the marginal impact of the export openness on the regional distribution of wages within the CEEC is not influenced

by the inclusion of the countries' capitals. In the long-run, the observed average annual change in the openness to intermediate goods exports has significantly reduced the long-run multiplier. In sum, this change accounts for an increase in the variance of the steady-state distribution of wages within the CEEC by about 25.6%, when including capitals, and by about 23.1%, when excluding capitals. The estimated half-lives of shocks are relatively small and amount to less than a year, irrespective of whether capitals are included or not, and the half-lives have even been reduced by about 0.3% due to the observed change in intermediate goods exports.

3 Conclusions

This paper provides evidence about the impact of export openness and regional wage disparities within eight Central and Eastern European countries. Based on the arguments put forward by New Trade Theory and Economic Geography, we allow for a different impact of final and intermediate goods export openness on wage disparities. In sum, our results support the view of Monfort and Nicolini (2002) and of Paluzie (2001), namely that trade liberalization tends to foster regional divergence rather than convergence. The findings are also in line with the evidence for Spain in the second half of the 19th century as reported in Pons et al. (2002). Especially intermediate goods trade seems to form a main driving force of regional divergence. Our results support new economic geography models and would be difficult to explain by traditional trade theory. Besides sheer factor cost motives of multinational production, the vertical organization of the production process seems sensitive to linkage effects and agglomeration forces based on external economies of scale in the low-wage economies. Thereby, it fosters regional divergence in terms of wages within the CEEC.

According to our evidence, the observed rise in their intermediate goods exports openness in the last decade has increased the regional disparity in wages of the average CEEC. The associated long-run impact of this development is a 23% increase in the average economy's variance of regional real wages.

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Table 1 - Carree and Klomp (1997) T_2 tests on σ-convergence by country

	Decrease of standard deviation of regional wages	Average change in intermediate products export openess	Average change in final products export openess	T_2 significant at 5%	T_2 significant at 10%
Bulgaria	-1.00	-0.95	0.01	yes	yes
Czech Republic	0.58	**1.87**	0.94		
Estonia	0.90	**2.28**	**2.00**		
Hungary	0.30	**2.07**	**1.75**		
Poland	-0.85	0.18	0.44	yes	yes
Romania	-0.01	**0.32**	**0.95**	no	no
Slovakia	0.64	-3.59	**0.98**		
Slovenia	0.49	-0.38	-1.05		
Total	0.13	0.22	0.75		

Note: Bold values indicate countries with a high openess.

Table 2 - Blundell and Bond (1998) Dynamic Panel Data Regressions

Dependent Variable is the Change in Country-Specific Standard Deviation of Regional Wages: $\Delta\sigma(w)_t$	Model 1	Model 2	Model 3	Model 4	Model 5
Lagged dependent variable: $\Delta\sigma(w)_{t-1}$	0.538 ***	0.588 ***	0.673 ***	0.345 ***	0.350 ***
	(0.059)	*(0.056)*	*(0.130)*	*(0.131)*	*(0.033)*
Intermediate goods exports interaction term: $\Delta X^{intermed}_t$ x $\Delta\sigma(w)_{t-1}$	-	-0.001	-	-	0.028 ***
	-	*(0.005)*	-	-	*(0.006)*
Final goods exports interaction term: ΔX^{final}_t x $\Delta\sigma(w)_{t-1}$	-	0.008 ***	-	-	-0.001
	-	*(0.003)*	-	-	*(0.006)*
Total goods exports interaction term: ΔX^{total}_t x $\Delta\sigma(w)_{t-1}$	-	-	-	0.005 ***	-
	-	-	-	*(0.001)*	-
Intermediate goods exports: $\Delta X^{intermed}_t$	-0.001	-	-	-	-0.003 ***
	(0.001)	-	-	-	*(0.001)*
Final goods exports: ΔX^{final}_t	0.002 **	-	-	-	0.000
	(0.001)	-	-	-	*(0.001)*
Total goods exports: ΔX^{total}_t	-	-	0.000	-	-
	-	-	*(0.000)*	-	-
Constant	0.032 **	0.031 *	0.017	0.048 ***	0.072 ***
	(0.014)	*(0.006)*		*(0.012)*	*(0.008)*
Observations	42	42	42	42	42
Countries	8	8	8	8	8
R^2	0.847	0.935	0.856	0.859	0.982
Sargan test	3.415	3.415	3.88	7.46	1.883
Degrees of freedom	27	8	18	18	26
Second order serial correlation	0.181	-1.181	-1.91 *	-0.83	0.296

*** significant at 1%; ** significant at 5%; * significant at 10%.

Table 3 - Blundell and Bond (1998) Dynamic Panel Data Regressions (Excluding Capitals)

Dependent Variable is the Change in Country-Specific Standard Deviation of Regional Wages: $\Delta\sigma(w)_t$	Model 1a	Model 2a	Model 3a
Lagged dependent variable: $\Delta\sigma(w)_{t-1}$	0.592 ***	0.589 ***	0.413 ***
	0.040	0.043	0.043
Intermediate goods exports interaction term: $\Delta X^{intermed}_t$ x $\Delta\sigma(w)_{t-1}$	-	0.002	0.027 ***
	-	0.005	0.007
Final goods exports interaction term: ΔX^{final}_t x $\Delta\sigma(w)_{t-1}$	-	0.008 **	-0.002
	-	0.003	0.006
Intermediate goods exports: $\Delta X^{intermed}_t$	-0.001	-	-0.002 ***
	0.001	-	0.001
Final goods exports: ΔX^{final}_t	0.002	-	0.000
	0.002	-	0.001
Constant	0.021	0.024 ***	0.057 ***
	0.013	0.004	0.011
Observations	42	42	42
Countries	8	8	8
R^2	0.865	0.947	0.978
Sargan test	3.025	3.176	2.187
Degrees of freedom	8	27	26
Second order serial correlation	-0.425	-0.299	-0.616

*** significant at 1%; ** significant at 5%; * significant at 10%.

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