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Austrian border regions and eastern integration A low competitiveness - high growth paradoxon

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Abstract

Many regions on the EU Eastern borders have developed favourably after the opening up of the border and the implementation of association agreements with the CEECs. This was often seen as a positive sign for the further perspectives of these regions after EU enlargement. In this paper we take a closer look at the mechanisms involved in a case study for Austria. Based on a very disaggregated data set at a regional as well as sectoral level we find that neither sectoral preconditions nor locational advantages can explain the good performance of (rural) border regions after 1989. Using multivariate cluster analyses we group 3-digit-industries to theoretically founded typologies indicating different sector characteristics and find that (fast growing) rural border regions are dominated by industries that show disadvantageous characteristics for east-west trade. Furthermore, we identify locational factors relevant for regional growth in a traditional Barro-style growth regression and find a regional distribution of these factors in Austria, which also places rural border regions at a disadvantage. Rather than these factors or advantages from proximity to the new markets, impacts internal to the Austrian markets seem to determine regional growth patterns in the 1990s. Therefore it would be misleading to take a stable development of rural border regions after EU enlargement for granted due to past experiences.

JEL classification: F02, F15, R11, R12

Key words: Border Regions, Integration, EU Enlargement, Regional Competitiveness, Austria

1. Introduction

The enlargement of the European Union by its associated countries in Central and Eastern Europe is with no doubt a very complex integration project, challenging the capacities of economic policy management in the countries on the Eastern border of the EU. Given the large income and welfare divide within the future integration area, economic conditions will change considerably after the enlargement, especially in the regions adjacent to the present EU-border. Only in these border regions some border crossing activities like commuting, shopping abroad or the cross-border rendering of services (e.g. in construction and crafts) make any sense economically due to the short distance to the border. It is only there where the liberalisation of regionally segmented markets (like many services sectors or the labour market) will make any difference. As many of these border regions can be seen as „peripheral" not only in a geographical, but also in an economic sense – not the least an outcome of their economic disadvantages from the „dead border" for decades – concerns were raised about these region's ability to cope with the new challenges soon after the opening up of the „iron curtain". In fact, many of these regions were specialised on labour-intensive low-skill activities and served as low-wage areas in a national perspective – a functional orientation which looses any foundation after transition of the adjacent CEECs to market economies. For example, in 2001 wage differentials between the eastern border regions in Austria and the adjacent CEECs still amounted to 3:1 at PPP and 7.5:1 at exchange rates, respectively, making Austrian border regions high-wage locations in the wider integration area to come.

These facts in mind, the European Commission was concerned about the future development of the border regions in a Union of 25 or 27 members in recent years. The Commission's „Communication Strategy for Enlargement" of 2000 underlined that „the people in the regions bordering the candidate countries need to be reassured of the positive effects of enlargement" and announced an analysis of the socio-economic situation in border regions[1]. The Nice European Council called upon the Commission to „propose a programme for the frontier regions in order to strengthen their economic competitiveness". The resulting Communication of the *Commission* (2001a) stated the striking differences between border regions in terms of socio-economic development and the need for different actions to ensure a smooth transition of border regions. At the same time, however, the Communication pointed out that the gradual opening of Community borders to candidate countries during the 1990s did not have a negative impact on border regions and the action plan proposed essentially relies on still existing Community policies[2]. In fact, many regions on the EU Eastern border developed favourably after the opening of the border and the implementation of association agreements with the CEECs. This was often seen as a positive sign for the further perspectives of these

[1] Neither the second report (*Commission*, 2001) nor the first progress report (*Commission*, 2002) on economic and social cohesion analyse the problem in depth, nevertheless they were concerned with socio-economic disparities in a Union of 25 and the resulting needs for reforms in cohesion policy. Nonetheless, the higher level of GDP per head in those regions which border the candidate countries as compared to other regions with external borders to third countries were stressed explicitly.

[2] The Commission proposed an additional EUR 195 million for border regions with applicant countries in 2001-2006. Given the broad definition of border regions, comprising 23 NUTS II regions in 5 member countries, this additional funding seems negligible.

regions after EU enlargement, especially in studies at a country level (for Austria e.g. *Geldner*, 1994; *Krajasits – Delapina*, 1997).

In this paper we propose the hypothesis that such an assumption could be misleading, especially for the more peripheral, "rural" border regions. We call in question that the partly encouraging performance of these regions after the opening up of the Eastern borders has been an outcome of a sufficient structural and regional competitiveness and therefore contest the possibility to take a stable development of rural border regions after EU enlargement for granted due to the experiences in the 1990's. The paper tests this hypothesis in a case study for Austria. We will proceed in three different steps. First, we present an overview of the developments in Austria's border areas in the 1990's and test for significant structural breaks in employment dynamics after the opening up of the Eastern border (chapter 2). Then, in chapter 3 we take a closer look at the structural preconditions of these border regions with respect to Eastern integration. We group NACE-3-industries to theoretically founded typologies indicating different development potentials by multivariate cluster analysis and analyse the distribution of the resulting industry types in space. In chapter 4, we identify the location factors responsible for different patterns of regional growth in the period after the opening up of the borders to the candidate countries empirically and ask, in addition, if the pure distance to these borders was a growth enhancing factor per se in the 1990s. Chapter 5 concludes.

In contrast to most other studies on the topic, we rely on a rather disaggregated data set, which was drawn from recent censuses[3]. At a sectoral level, we operate at the three-digit level of NACE, whereby 170 out of the 222 industries distinguished at this level of disaggregation are integrated in our analysis[4]. At the regional level, we operate at the level of the 93 Austrian districts, a disaggregation level just below the NUTS-III level of EUROSTAT[5]. This allows us to free the analysis from the usual classification of administrative regions and to study the development of structural, "economic" regions (or better: regional types). Here we are able to rely on a paper of *Palme* (1995), who classified Austrian districts by their economic structures using multivariate cluster analysis. In defining the relevant "border regions", we also go beyond the very broad definition of the EU Commission[6] and define a district to be part of the border area, if its economic centre can be reached within 90 minutes travel time from a relevant economic centre in the candidate countries[7].

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[3] We would like to thank Statistics Austria for providing data in an appropriate detail.

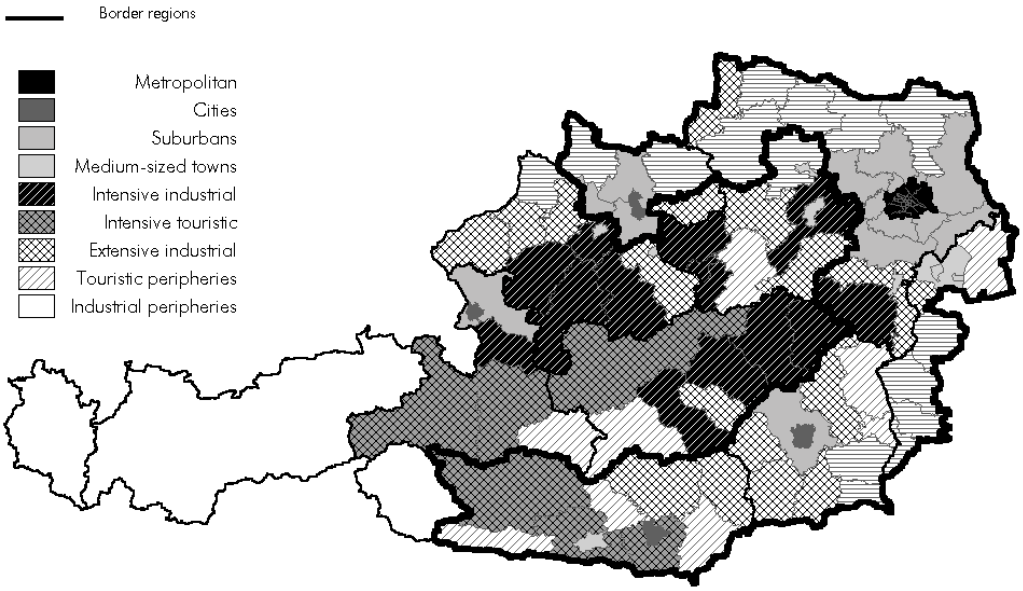
[4] All industries from manufacturing (section D, 99 industries) and market services (sections F to K, 71 industries) were included in our analysis; 52 industries from mining, energy and non-market services were not considered.

[5] The area of a district is 847 square kilometres on average, and its population is roughly 82.000.

[6] The Commission defines border regions as regions at the NUTS II level bordering (by land or sea) candidate countries currently negotiating accession which contain cross-border programmes under INTERREG III A in the period 2000-2006 (*Commission*, 2001a).

[7] This definition, which is broader than one only integrating border districts, but more restrictive than a delimitation at NUTS-II level, seems preferable in an analytical perspective, as it is based on the probable range of those "regional" markets, which will be organised in a border crossing way after enlargement: For daily commuting as well as shopping tourism or the border-crossing rendering of services an isochrone of 90 minutes seems plausible. For daily commuting, *Huber* (2001) found empirical evidence which supports this assumption.

Figure 1: ´Border regions´ and ´economic regions´ in Austria



Source: Palme (1995); Mayerhofer - Palme (2001).

As one can see in figure 1, the so defined border area comprises large parts of Northern, Eastern and Southern Austria and includes a very heterogenous set of economic regions – the largest cities (Vienna, Linz, Graz) as well as some of the most peripheral regions of the country. Overall, the population of the border regions adds up to 4.7 Mill. people, roughly 60% of the national population.

2. Austrian border regions in the 1990s: The peripheries take the lead

Eastern enlargement can build on a well-established network of agreements between the European Union and the CEECs, which has led to a major liberalisation of market transactions already in the 1990s. A free trade zone between the EU and the Candidate Countries has been virtually completed so far, and the unlimited exchange of goods is already possible. In the west, this primarily benefited those countries which had already been able to build contacts with the CEECs and accumulate the requisite market knowledge during the old regime. Next to Germany, Austria was one of these countries. During the 1990s commodity exports more than quadrupled to 10.0 billion EUR in spite of an asymmetric removal of trade barriers. The trade balance gradually achieved a surplus, which currently

stands at EUR 1,88 billion EUR. Trade in services similarly produced high and stable surpluses (+0.61 billion EUR in 2000). Overall, trade with the accession countries contributed markedly towards curbing Austria's "chronic" current account deficit: Without trade with the near CEEC5 alone, the deficit would nearly have been double in recent years.

Given these figures there is no doubt that the liberalisation of trade with the associated countries has had a mostly beneficial effect on the Austrian economy (*Stankovsky*, 1996; *Holzmann – Neck*, 1996; *Stankovsky – Palme*, 1999). *Breuss – Schebeck* (1998) quantify the effects of the stepped-up trade with the CEECs on real GDP by a total of 3,6% from 1989 to 1997, and these results were incidentally supported by several other studies (e.g. *Keuschnigg – Kohler*, 1997).

Regional dynamics in these years of structural change and geo-political transformation by no way support the fears arising soon after the beginning of the transition process in 1989: Neither an erosion of the Eastern border regions due to stiffer competition from adjacent low-wage countries took place, nor a widening of the core-periphery divide, which would be consistent with the neo-classical paradigma (due to the specialisation of rural areas) and the New Economic Geography (due to the u-curve story) alike (table 1). On the contrary, in rural regions, employment growth, at 1.5 percent p.a., was significantly above the Austrian average in 1989–2000, while human capital intensive regions (the centres), at 0.7 percent p.a., recorded less than half that rate. In Eastern border regions, employment growth was slightly below the Austrian average, but this was an effect of the low performance of urbanised border regions, while rural border regions grew, at 1.6 percent p.a., even faster than in non-border areas. The growth pattern of GVA per capita does not show such striking regional differentials due to higher productivity growth in urbanised areas. However, also here there is no evidence for a regional polarisation between core and periphery or a drop back of rural border regions in the new integration regime.

Of course, only an analysis of the longer run dynamics makes it possible to distinguish long run trends in spatial structural change from extraordinary developments in the 1990s. Only in this way, for example, we are able to determine whether the high growth of (rural) border regions after the opening up of the border is a new trend in a changing environment or just a further step in a long run convergence process in Austria. For this reason, following *Bade – Niebuhr* (1999) for Germany, we performed stability tests for the different region's relative employment dynamics since 1983[8], interpreting a structural break at the time of the border opening (1990) as a necessary, but not sufficient indication for integration-driven changes in regional development conditions[9]. We

[8] Our research is based on data of the Association of Austrian Social Security Institutions, which publishes yearly figures about dependent employees at a district level in a comparable form since 1983.

[9] Of course, a structural break in employment series in 1990 may be caused by factors other than eastern integration. However, only in the case of such a break a hypothesis stating effects of integration on spatial structural change makes any sense.

Table 1: Regional dynamics in Austria in the 1990s

	Number of districts in the region	Population 2001	Employment growth 1989-2000 % p. a.	GVA per capita growth 1988-1995 % p. a.
Nuts-I-regions				
Eastern Austria	29	3,390,916	0.7	6.2
Southern Austria	27	1,747,025	0.9	6.1
Western Austria	37	2,927,225	1.1	5.6
Aggregated economic regions				
Human capital intensive (1)	28	4,288,346	0.7	6.0
Physical capital intensive (2)	25	1,816,693	0.8	5.7
Rural (3)	40	1,960,127	1.5	5.9
Economic regions				
Metropolitan (1)	1	1,562,676	0.2	6.1
Cities (1)	5	761,619	0.7	5.3
Suburban (1)	13	1,257,972	2.0	6.7
Medium-sized towns (1)	9	706,079	0.9	6.2
Intensive industrial (2)	15	1,181,523	0.7	5.8
Intensive touristic (2)	10	635,170	0.9	5.6
Extensive industrial (3)	16	940,373	1.4	6.0
Touristic peripheries (3)	10	381,873	1.3	6.0
Industrial peripheries (3)	14	637,881	1.7	5.9
Border regions				
All	49	4,829,883	0.7	6.0
Urbanised	22	3,541,985	0.6	6.0
Rural	27	1,287,898	1.6	6.1
Non-border	44	3,235,283	1.0	5.9
Border districts	25	1,235,005	1.5	5.4
AUSTRIA	93	8,065,166	0.9	6.0

Source: Institute for Regional Studies and Spatial Planning, Federation of Austrian Social Security Institutions, Statistics Austria, own calculations.

detect such a break if the development of the cumulated growth differential of a region to the Austrian average systematically deviates from a linear trend[10].

Methodologically we relied on stability tests proposed by *Chow* (1960). The Analysis of Variance Test is based on a comparison of the sum of squared residuals obtained by fitting a single equation to the entire sample period with the sum of squared residuals obtained when separate equations are fit to each sub-period (in our case 1983–1990 and 1990–2000 respectively). The Predictive Test for Stability estimates a model for a sub-sample comprised of the first T_1 observations. This model is then used to predict the values of the dependent variable in the remaining T_2 observations. The test examines the hypothesis that the prediction errors have mean zero. While the latter test has been suggested only for $T_2 < (k+1)$ with k = the number of parameters, that is, for the case when the Analysis of Variance Test cannot be used, *Wilson* (1978) showed that the test has desirable power properties when there are some unknown specification errors. Hence we used both tests in our

[10] In this form the tests ask for first order stability: The share of a region in total employment may change, all that is necessary is the stability of that change in time.

analysis. As the two tests may yield conflicting results, we only accepted the notion of a structural break if the null hypothesis of no structural change was rejected by both tests at a 5 % level.

As the tests proposed are only reliable if the errors are independent and identically distributed normal random variables, we performed appropriate residual (pre-)tests. Normality tests based on the Jarque-Bera statistic could not reject the hypothesis of normally distributed errors in any case. As, in addition, both the Analysis of Variance Test and the Predictive Test would be inaccurate if the error variances in the two samples are unequal (*Toyoda*, 1976), we also tested for heteroskedasticity, but were not able to reject the hypothesis of equal variances in the sub-samples at a 25% level[11]. However, we found significant (positive) autocorrelation in the residuals in most of our estimates, which is not surprising if regressing a linear trend on employment growth, a variable highly dependent on the business cycle. We used a first-order autoregressive model in our tests in these cases.

While the results of the stability tests (table 2) indicate some significant shifts in regional development trends in Austria between the 1980s and the 1990s, there is no evidence that advantages from geography have changed fundamentally between these periods. Overall it seems as if it were the economic characteristics of the regions and not so much their location which determined the long run development paths and their changes after the opening up of the Eastern border. Thus, we find a significant change in the long-term employment dynamics in human capital-intensive as well as in rural regions in Austria. While the latter developed rapidly in the 1990s after finding their employment dynamics stagnate in the 1980s, regions with rich human capital resources (the centres), after gaining shares in the 1980s, lost much of their ground in the 1990s. Within these human capital intensive regions, suburban regions saw a continuation of an already positive development, while the performance of the cities worsened significantly in the 1990s, with the metropolitan area of Vienna continuing a negative trend.

On the other hand, our tests do not indicate any significant structural break in the employment dynamics of Austria's NUTS-I regions, which means that the traditional West-(south-)East-divide in Austria did not come to an end due to the integration processes of the 1990s. This finding is further strengthened by the fact that, according to our definition of a structural break[12], neither the broader Eastern border regions nor the immediate border districts experienced a significant change in employment dynamics after the opening up of the Eastern border. Within the broader border region, however, we can find significant structural breaks in the regional employment series alongside the just mentioned lines: Rural border regions managed a turn-around to a markedly better employment growth in the 1990s, while urbanised border regions lost ground significantly, compared to the employment trend in the 1980s.

[11] We use this level of significance here, because the F-test for equality of variances is a pre-test, that is, it is a test preliminary to the test for stability. *Maddala* (2001) recommends to use a higher significance level than the usual 5% for pre-tests.

[12] If we take a less rigorous definition and identify a structural break if only one of the Chow tests indicate parameter instability, we can detect a worsening of the development of the broader border region at a 5% level.

Table 2: Stability of employment dynamics in Austrian regions, 1983–2000

Chow-Tests for structural break in 1990

	Trend 1983-2000	ANOVA Test (F-statistic)	Predictive Test (F-statistic)	Direction of change in dynamics
Nuts-I-regions				
Eastern Austria	– 0.0021***	2.243	4.368	→
Southern Austria	– 0.0023***	2.174	0.783	→
Western Austria	+ 0.0032***	0.991	2.661	→
Aggregated economic regions				
Human capital intensive	– 0.0003	4.188**	9.630*	↓
Physical capital intensive	– 0.0023***	5.188***	4.224	→
Rural	+ 0.0047***	3.423*	67.249**	↑
Border regions				
Eastern border regions	– 0.0009***	2.253	28.373**	→
Urbanised	– 0.0017***	3.529*	48.481**	↓
Rural	+ 0.0052***	3.871**	100.404***	↑
All non-border	+ 0.0015***	2.253	28.373**	→
Urbanised	+ 0.0011***	1.913	25.931**	→
Rural	+ 0.0042***	0.818	30.507**	→
Eastern Border districts	+ 0.0046***	0.545	1.167	→
Non-border districts	– 0.0004***	0.545	1.167	→

Source: Federation of Austrian Social Security Institutions, own calculations. - ↓ Structural break in 1990, followed by a more negative development, → no structural break in 1990, ↑ structural break in 1990, followed by a more positive development. *** significant at a level of 1 percent, ** significant at al level of 5 percent, * significant at a level of 10 percent.

To sum up, employment dynamics in Austrian regions in the 1990s do not support fears about an erosion of the border regions or a surge in regional polarisation due to stiffer competition from neighbouring low-wage countries after the opening up of the eastern borders. Border regions, in general, and immediate border districts, in particular, managed a stable development in the 1990s, with rural border regions (as the traditional location of labour-intensive productions) experiencing a significant improvement of employment dynamics. However, does this encouraging development really indicate that (rural) border regions were able to cope with the challenges of Eastern integration due to a sufficient competitiveness? Is this development connected with border opening at all, or does it reflect other factors which coincide with Eastern integration only by chance[13]? We will have a closer look at these questions in the following chapters.

[13] It is a major disadvantage of our (disaggregated and thus necessarily non model-based) approach that it does not allow to isolate integration effects without ambiguity. However, we think that our work can yield additional information, which complements the (still rare) findings from regional model simulations (for Austria, e.g. *Mayerhofer*, 1992; *Fischer – Schneider*, 2000; *Bröcker – Schneider*, 2002).

3. Sectoral pre-conditions for Eastern integration: A bad hand for rural border regions

In order to determine the structural preconditions of Austrian (border) regions we first distinguished, at a disaggregated level of 170 NACE 3-digit industries, between industries facing potential advantages and disadvantages with respect to (eastern) integration. For this we deduced those industry characteristics from integration theory which can theoretically be expected to cause different development paths at a sectoral level following integration, and represented these characteristics by one or more discriminating variables. Using multivariate cluster analyses, we then allocated industries to groups which are homogenous in terms of these characteristics and which therefore should achieve similar development potentials with respect to Eastern integration. In principle, three theories prooved relevant for our problem, yielding six theoretically founded typologies of industries (table 3)[14)].

[14] We only give a short overview of the theoretical underpinnings and the methodological implementation of the typologies here. For a comprehensive discussion see the technical annex in *Mayerhofer – Palme* (2001).

Table 3: Typologies of industries relevant for integration

Theoretical foundations and their implementation in cluster analysis

Typology	Theoretical foundation	Determining factors of trade	Discriminating variables	Industry types	Theoretical competitive position in the West (Austria)
1. Factor intensity	Neo-classical Trade Theory (*Ohlin*, 1933; *Samuelson*, 1948, 1949)	Factor endowments	Wages as a percentage of gross output Gross investment as a percentage of GDP Expenditure on research and development as a percentage of gross output (manufacturing only) Advertising expenditure as a percentage of gross output (manufacturing only) Software expenditure as a percentage of gross output (services only)	Labour-intensive, low qualifications	–
				Labour-intensive, high qualifications	+
				Capital-intensive	0
				Technology-intensive (software-intensive)	+
				Marketing-intensive (manufacturing only)	+
				Mainstream	0
2. Skill intensity	Neo-classical Trade Theory (*Ricardo*, 1817; *Vernon*, 1966)	Technology differences	Share of unskilled workers Share of workers of secondary occupational school level Share of workers of tertiary occupational school level Share of workers of university graduate level	Low qualifications	–
				Medium qualifications, blue-collar workers	0
				Medium qualifications, white-collar workers	0
				High qualifications	+
3. Price versus quality competition	Trade Theory (*Falvey*, 1981; *Falvey – Kierzkowsky*, 1985)	Comparative advantages	"Revealed Quality Elasticity" (Aiginger, 1997)	Low quality competition	–
				Medium quality competition	0
				High quality competition	+
4. Internal economies of scale	New Trade Theory (Krugman, 1980; Helpman - Krugman, 1985)	Home market effects	Technical economies of scale in production (ordinal)	Low internal returns to scale	0
				Medium internal returns to scale	0
				High internal returns to scale	+
5. External economies of scale	New Economic Geography (*Marshall*, 1890; *Krugman*, 1991)	Economies of scale, self-reinforcing effects	Ellison-Glaeser index at the district level	Localised, higher qualifications	+
				Localised, lower qualifications	0
				Geographically not localised	0
6. Forward-backward linkages	New Economic Geography (*Krugman – Venables*, 1995; *Venables*, 1996)	Economies of scale, self-reinforcing effects	Net output Share of intermediary demand Herfindahl index at NUTS-I level	High forward-backward linkages, concentrated	+
				High forward-backward linkages, non-concentrated	0
				Low forward-backward linkages	0
7. Tradability			Localised Gini coefficient at district level	Tradable services Non-tradable services	. .

Source: Own compilation. + ... potentially advantaged, – ... potentially disadvantaged, 0 . . . neutral.

Accordingly, factors endowments (*typology 1*) will provide one characteristic that determines industry expectations with regard to enlargement: countries will specialise in goods (industries) the production of which allows increased use of abundant production factors (*Ohlin*, 1933; *Samuelson*, 1948, 1949). In view of the current factor endowments, capital-intensive producers will find comparative advantages in the West, with capital being defined widely[15] to include both human capital and

[15] Capital in the narrow sense, however, is not assumed to cause advantages, considering the high mobility of capital in the European internal market.

knowledge factors according to newer extensions of the traditional model (generalised factor proportions model). Based on 5 distinct discriminating variables, by means of cluster analysis we found a differentiation by altogether six industry groups; of these, technology-/software-intensive, marketing-intensive and labour-intensive industries that pose high qualification requirements may, at least in theory, enjoy advantages in the West (and Austria), whereas low-qualified labour-intensive industries will be disadvantaged.

Ricardian models within the neo-classical paradigm (*Ricardo*, 1817; *Posner*, 1961; *Krugman*, 1979) stress the role of differences in production technologies for comparative advantages, indicating advantages for industries which embrace innovation or which focus their portfolio on products in an early stage of their life-cycle. As data on innovation at a disaggregated industry level are not available, we approximated by the skill content of production (*typology 2*), using the shares of different qualification groups in industry employment as discriminating variables. Out of the resulting four industry groups, we theoretically expect advantages for industries that use high-quality human resources. Industries that require a low level of qualifications for production, on the other hand, should be exposed to greater pressure to adjust.

New Trade Theory adds imperfect markets and increasing returns to scale to the model and thereby opens up to an analysis of product differentiation and intra-industry trade. Location criteria are exogenously determined once again, with a single but decisive exception: market size. According to the theory, industries with increasing (internal) returns to scale and horizontally differentiated products will find advantages, due to positive pecuniary externalities, if they locate in the larger market ("Home market effect"; e.g. *Krugman*, 1980; *Krugman – Venables*, 1990; *Helpman – Krugman*, 1985). As the well integrated EU15 provide without doubt the larger market compared to the associated countries, we assume higher development potentials for industries in the EU15 that manufacture at increasing returns and can thus utilise (internal) scale economies (*typology 4*). We hereby drew on *Pratten* (1988) to quantify technological economies of scale in production at a 3-digit-industry level and distinguished three industry types, of which only one was assumed to have any relevance for development differentials after integration.

In the case of vertical product differentiation[16], producers in the economically higher developed countries will specialise in product variants of higher quality, while suppliers in the Candidate countries should have advantages in variants at a lower quality standard (*Falvey*, 1981; *Falvey - Kierzkowsky*, 1985). Thus, in the West there will be advantages for industries operating in markets characterised by quality rather than price competition. The corresponding *typology 3* is based on the "Revealed Quality Elasticity"-approach of *Aiginger* (1997), discriminating between industries with price and quality competition by means of relative unit values and trade balances between Austria and its 30 most important trading partners at a 3-digit industry level.

Typologies 5 and 6 draw on the results of *New Economic Geography* (*Krugman*, 1991; *Fujita – Krugman – Venables*, 1999) and indicate industries with rather persistent location patterns, which therefore can be expected to be less affected by a stiffer location competition after Enlargement. In

[16] This form of IIT still prevails between the Candidate countries and the EU, as can be expected given the still high development differentials between the country groups (*Hoekman – Djankov*, 1997).

NEG, location patterns are determined endogenously, and factor as well as firm mobility trigger self-reinforcing effects. Typically, an interaction of centrifugal and centripetal forces in locational choice is modelled, which often generates a non-linear relationship between industrial concentration and economic integration (inverted u-curve). Agglomeration effects are further accelerated by factor migration in integration, thus reinforcing external economies by cumulative (cyclical) processes. Consequently, industries which are able to use external economies of scale should be less vulnerable to new competition from adjacent low-wage countries. (*typology 5*). We used the *Ellison-Glaeser* (1997) - index to discriminate industries in this respect[17], but deviated from the threshold values proposed in that paper (which are somewhat arbitrary) by determining the demarcation between industry groups by means of a cluster analysis[18])[19]).

Additionally, recent approaches of NEG (*Krugman – Venables*, 1995; *Venables*, 1996) also model self-reinforcing effects from input-output linkages. Therefore, a rather stable location pattern can also be expected for industries which are characterised by close forward- and backward linkages at a supra-regional level (*typology 6*). We used data from Austrian input-output tables as well as the recent (1995) census to catch these linkages at an industry level, whereby we only assume an advantage in stiffer cross border competition if the enterprises linked are clustered in space. As no (local) spill-over-effects, but (wider) pecuniary effects are involved here, we measured this spatial concentration by an Herfindahl-index at the NUTS-I level.

Finally, an indication of whether or not an industry is affected by integration at all can be obtained from a typology representing a (supra-regional) tradability aspect (typology 7). While manufacturing products, being material in character, can without exception be traded even across greater distances, services frequently require geographical proximity between the supplier and the buyer in order to be rendered. These services consequently can be traded only within a (geographically restricted) regional market. Eastern integration is thus likely to impact these industries only within a distance from the border that can be economically surmounted by the customer travelling to the producer or the producer travelling to the customer (the "border region"). In contrast to previous approaches (such as *Bhagwati*, 1984; *Sapir*, 1993; *Mayerhofer*, 1998) which essentially make an ad-hoc differentiation between tradable and non-tradable services, we have chosen an empirical (indicator) approach here: considering that services which cannot be traded across distance will be forced to follow the

[17] As opposed to other indices of relative concentration, the Ellison-Glaeser index is well founded theoretically and controls for spatial differences in firm size. It takes on a value of zero not if employment is uniformly spread across space, but instead if employment is only as concentrated as it would be expected had the plants in the industry chosen locations randomly ("dartboard approach").

[18] The use of cluster analysis seems preferable to an exogenous determination of the threshold values also in the case of only one discriminating variable, as problems from a classification of similar industries to different industry groups at the fringes of the groups can be minimised in this way.

[19] As the Ellison-Glaeser-index controls for internal economies of scale, but not for other elements driving spatial concentration, e.g. national resources or historic trajectories (*Maurel – Sedillot*, 1999), we classified industries with external economies according to their skill-intensity in a second step. Only EOS-industries using qualifications beyond a certain threshold value were classified as potentially advantaged.

distribution of population in their location patterns more or less, we used a (relative) measure of concentration as a discriminating variable[20].

As all typologies but the last one were created for manufacturing and services separately, we set up 11 typologies in total[21], whereby for manufacturing, typologies 1–3 were already available from studies by *Peneder* (1999) and *Aiginger* (2000). Data were taken from the 1995 census (typologies 1, 5–7), Austrian IO-tables (typology 6), the Austrian micro-census (typology 2) and foreign trade statistics (typology 3) and entered hierarchical cluster analysis in a standardised form. We tested for different distance and similarity measures and found the cosine of the variable vectors best performing given the structure of the data involved[22].

The resulting typologies, which are listed in an overview in the appendix (tables A1 and A2) and described in a greater detail in *Mayerhofer – Palme* (2001), show that manufacturing as well as services sector are dominated by industries which are potential winners or at least no direct losers from integration in Austria[23]. However, these typologies – which after all draw on theoretical expectations with regard to integration – will be suitable for further investigation only if such expectations can be confirmed empirically. While for the tertiary sector we were only able to show that relative employment growth after the opening up of the Eastern border was in line with the theoretical expectations modelled in the typologies, in manufacturing a better testing was possible, due to the extensive database available and the fact that trade barriers were mostly eliminated here, making the development in the 1990s an excellent "market test" for the typologies.

Based on trade flows between Austria, Germany and Italy on the one hand and the adjacent CEEC5 on the other, we obtained clear evidence for the empirical relevance of the typologies proposed. An F-test for a number of years (1988, 1993, 1995, 1999) based on RCA values showed that the typologies differentiate between industry groups with a different competitiveness in East-west trade successfully. A more stringent test checking whether the typologies were able to correctly identify the direction of trade advantages was successful too.

As we can see in table 4, industry types in Austria, Germany and Italy which are theoretically expected to enjoy trade advantages have (at times considerable) positive RCA values[24] in trade with the CEEC5 for all years analysed, with one single exception. Likewise, industry groups identified as "disadvantaged" have also developed as expected; the RCA values have the correct negative sign in 11

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[20] In terms of fact we used Gini-coefficients for 170 3-digit-industries and the district level as discriminating variable.

[21] Due to a lack of data, typologies 3 and 4 were computed only for the manufacturing sector.

[22] As a method for combining clusters we used between-groups linkages in all typologies; this method is superior to other methods for spherical clusters with equal variances and sample sizes a priori.

[23] In manufacturing, 47 of the 99 industries show mainly advantageous characteristics with respect to Eastern integration, while 35 industries seem potentially disadvantaged and 17 industries are in a neutral position. In the tertiary sector (overall 70 industries), the respective relationship is 35:18:17.

[24] Following *Balassa* (1965), RCA-values were defined as $RCA_i = \ln\left(\frac{X_{ij}/M_{ij}}{X_j/M_j}\right)$, whereby i = industry (type) and j = country (group).

of the 12 cases reviewed. Interestingly, there is a clear tendency of trade structures to converge over time, with potentially disadvantaged industries performing better as time goes by, and potentially advantaged industries loosing ground[25]. According to a detailed analysis of this stylised fact for Austria (*Mayerhofer – Palme*, 2001), the better performance of potentially disadvantaged industries stems from higher exports in recent years, indicating that these industries are increasingly able to manage the new challenges successfully. On the other hand, the shrinking RCA values of potentially advantaged industries typically stem from higher imports from the CEECs and are accompanied by rising exports to the West. This may indicate the growing importance of cross-border producer networks, where a purchase of (cheap) inputs and components from subcontractors in adjacent CEECs serves to strengthen price advantages on Western markets[26].

Table 4: Relevance of typologies in explaining trade advantages and disadvantages with respect to CEE-countries

		1988[1]	1993[2]	1995[3]	1999[3]
		RCA values			
Industry types potentially advantaged with respect to integration					
Typology 1	Labour-intensive, high qualifications	+1.540	+0.530	+0.100	–0.100
Typology 1	Technology-intensive	+1.813	+1.250	+0.949	+0.732
Typology 1	Marketing-intensive	+0.163	+0.480	+0.483	+0.552
Typology 2	High qualifications	+1.322	+0.733	+0.672	+0.680
Typology 3	High quality competition	+1.201	+0.919	+0.794	+0.911
Typology 4	High internal returns to scale	+0.648	+0.204	+0.047	+0.143
Typology 5	Localised, higher qualifications	+1.057	+0.561	+0.409	+0.325
Typology 6	High forward-backward linkages, concentrated	+0.257	+0.107	+0.108	+0.112
Industry types potentially disadvantaged with respect to integration					
Typology 1	Labour-intensive, low qualifications	−1.208	–1.106	−0.907	–0.631
Typology 2	Low qualifications	−0.274	–0.102	−0.004	+0.242
Typology 3	Low quality competition	−0.666	–0.675	−0.663	–0.385

Source: Eurostat, own calculations. RCA values for manufacturing goods from Germany, Austria and Italy trading with the CEECs, unweighted average of industries. – [1] Germany, Italy with Czechoslovakia, Hungary, Poland. – [2] Germany, Italy with the Czech and Slovak Republic, Slovenia, Hungary, Poland. – [3] Germany, Italy, Austria with the Czech and Slovak Republics, Slovenia, Hungary, Poland.

Coming back to a regional analysis, we first can see some striking differences in the spatial concentration of the industry types proposed (table 5).

[25] This stylised fact is consistent with empirical evidence showing a rising share of intra-industry trade between EU-countries and the CEECs (*Landesmann*, 1995; *Hoekman – Djankar*, 1997; *Aturupane – Djankar – Hoekman*, 1999).

[26] No change in their competitive position has so far been experienced by industries characterised by high marketing orientation and brisk competition for quality. Here, advantages arise from a steady improvement of products and long-term investment in brand advertising. Therefore, established companies in these industries seem to have advantages over new competitors even in the long run.

Due to our analysis based on the Herfindahl-index for employment at a district level[27], industries potentially advantaged with respect to integration are clearly more concentrated in space than industries with negative development expectations. In an economic policy view, this finding, which holds for manufacturing and services alike[28], is encouraging: The more dispersed pattern of potentially disadvantaged industry types[29] may reduce the probability of locally concentrated (and thus deeper) problems of structural change in integration. The spatial concentration of potentially advantaged industries, on the other hand, may be a good starting point for active structural policy measures in the line of a cluster concept.

Table 5: Regional concentration of industry types in Austria

Herfindahl-Index at a (93) district level, 1995

		Manufacturing	Services		
			Total	Tradables	Non-tradables
Industry types potentially advantaged in integration		0.237	0.288	0.324	0.166
Typology 1	Labour-intensive, high skill	0.084	0.272	0.325	0.112
Typology 1	Technology-intensive	0.298	0.205	0.233	0.149
Typology 1	Marketing-intensive	0.198	.	.	.
Typology 2	High qualifications	0.158	0.355	0.422	0.155
Typology 3	High quality competition	0.205	.	.	.
Typology 4	High internal returns to scale	0.327	.	.	.
Typology 5	Localised, higher qualifications	0.390	0.360	0.380	0.225
Typology 6	High forward-backward linkages, concentrated	0.288	0.337	0.351	0.180
Industry types potentially disadvantaged in integration		0.171	0.143	0.229	0.106
Typology 1	Labour-intensive, low skill	0.094	0.102	0.110	0.064
Typology 2	Low qualifications	0.156	0.149	0.248	0.105
Typology 3	Low quality competition	0.205	.	.	.

Source: ST.AT, own calculations.

However, the regional distribution of the different industry types across Austria does not indicate that much of the necessary adjustments will take place in the form of an (less problematic) intra-regional

[27] The Herfindahl index is defined as $H_i = \sum_{j=1}^{93} (s_{ij})^2$, whereby *i* = industry (type), *j* = district and *s* = employment share.

[28] Concentration values for manufacturing and services are not strictly comparable due to the different number of industries in these sectors. Within the services sector, however, we are able to detect the expected differences between industries with regional and international markets.

[29] We recalculated our findings using a measure for relative concentration as well and found comparable results.

structural change: As one can see by means of location quotients for Austrian employment (table 6)[30], industries potentially advantaged with respect to integration seldom cluster in the same districts than potentially disadvantaged industries; problems of regional mismatch may arise therefore.

A striking feature of the results is regional polarisation between core and periphery with respect to the structural pre-conditions for integration; and this pattern is reproduced within the Eastern border region, which seems more exposed to effects from integration overall due to higher shares of potentially advantaged as well as disadvantaged industries alike. Human capital intensive regions (especially Vienna and the other large cities) benefit from above-average employment shares in potentially advantaged manufacturing as well as services industries; on the other hand, they are less affected by low competitive industries, although the employment share of potentially disadvantaged industries is only slightly below average here, due to a high relevance of disadvantaged services with a regional market also in cities adjacent to the border. Physical capital intensive regions show lower shares in potentially advantaged as well as disadvantaged industries, because they are in general distant from the Eastern borders, so that their suppliers of non-tradable services are hardly affected by integration at all. Finally, in the rural regions, potentially advantaged industries are of similarly low importance as in physical capital intensive regions; but rural regions comprise a higher share of industries which are likely to be losers from integration. This problem is compounded in the rural border regions, where, in addition to a labour-intensive manufacturing, non-tradable services will have to adjust to the break-up of their markets which have so far been (nationally) segmented by the border. The share of employees in potentially disadvantaged industries is almost 50% higher compared to the Austrian average here.

[30] The location quotient is defined as $LQ_{ij} = E_{ij} \Big/ \sum_{j=1}^{m} E_{ij} : \sum_{i=1}^{n} E_{ij} \Big/ \sum_{j=1}^{m} \sum_{i=1}^{n} E_{ij}$, whereby i = industry type, j = regional type and E = employment.

Table 6: Structural advantages and disadvantages in Austrian regions

Location quotient for employment, 1995

	Potentially advantaged sectors			Potentially disadvantaged sectors		
	Total	Manufacturing	Services	Total	Manufacturing	Services
Aggregated Economic regions						
Human capital-intensive (1)	115.4	117.8	119.6	97.7	88.4	106.7
Physical capital-intensive (2)	79.4	83.1	69.0	90.2	111.8	64.3
Rural (3)	74.9	78.8	61.2	120.3	112.7	120.2
Economic regions						
Metropolitan (1)	137.9	156.0	143.5	101.5	69.4	123.3
Cities (1)	106.7	117.4	107.8	91.6	96.3	93.4
Suburbans (1)	103.0	88.8	113.7	111.7	100.5	118.8
Medium-sized towns (1)	88.4	100.1	71.3	74.6	91.1	57.3
Intensive industrial (2)	82.9	84.9	64.3	86.0	109.0	45.8
Intensive touristic (2)	71.8	75.7	76.2	99.2	123.3	92.8
Extensive industrial regions (3)	78.2	80.8	58.5	110.7	109.2	99.2
Touristic peripheries (3)	68.2	70.4	64.5	117.6	113.7	119.3
Industrial peripheries (3)	72.9	79.1	63.3	139.7	120.4	153.5
Border Regions						
All	113.2	111.1	118.4	119.4	94.9	138.7
Urbanised	121.7	121.5	128.5	112.9	88.6	132.0
Rural	77.0	79.5	66.4	147.3	114.3	173.6
Non-border region	80.9	86.6	70.6	71.9	106.1	38.2
Austria	100.0	100.0	100.0	100.0	100.0	100.0

Source: ST. AT, own calculations.

Without doubt, these results are in sharp contrast to the regional developments in Austria in the 1990s, as portrayed in the previous chapter. Indeed, those regions with the worst structural pre-conditions for integration – the rural (border) regions – are those with the highest employment dynamics after the opening up of the Eastern border; while those regions which should have done better in this first stage of Eastern integration from a structural perspective – the human capital intensive regions and the urbanised border regions – fell behind considerably in the 1990s.

As a matter of fact, it is a well known result in empirical literature that differences in regional growth are not determined by the region's sectoral composition in the first line[31]. In fact, we found a negative correlation between the industry-mix component and the residual (regional) component in a traditional shift-share analysis for employment growth[32] in Austrian economic regions as well as districts in

[31] See *Müller – Schmutzler* (1997) for EU countries or *Esteban* (2000) for EU regions for recent results in this line. *Bade* (1991) finds for Germany, that a forecast of regional employment dynamics by means of the industry-mix component (alone) is inferior to a forecast based on the assumption of identical regional growth rates.

[32] In a traditional 2-factor-decomposition we found positive signs for the industry-mix components, but also high negative values for the residual (regional) components in (all sub-types of) human capital intensive regions. In rural regions, negative industry-mix components usually combine with high positive regional components. *Molle* (1997), who obtained similar results for EU regions, explains this by a higher (cost) pressure on urbanised regions to adjust their economic base constantly. To cope with interactions between industry and region, following *Esteban* (2000) we further decomposed the residual component in a regional component (in a narrow sense) and an allocation component and found the latter only positive in the Metropolis and the (larger) cities. All findings are stable between the periods analysed.

1980/89, 1989/95 and 1995/98)[33], and a simple regression analysis for a cross section of the Austrian districts shows that the bulk of growth differentials between the regions can be "explained" by the regional component (*Mayerhofer – Palme*, 2001a). This does by no means indicate that the industry-mix is irrelevant for regional employment dynamics[34]. However, the findings do indicate that the structural pre-conditions of a region do not fully determine its development perspectives with respect to Eastern integration. In addition, these findings draw attention to questions related to those determinants of regional growth which are represented by the regional component in a shift-share analysis. What about the role of (man-made) location factors here? Was the geographical location of a region alone a relevant factor for growth in the first stage of Eastern integration? We will have a closer look at these questions in the following section.

4. Regional location factors: The picture does not change

In this chapter we try to identify those determinants of regional growth that were responsible for regional growth differentials in Austria in the 1990s, and analyse differences in the provision of that location factors in space, again with a special emphasis on Eastern (rural) border regions. The (simple) assumption is that factors being essential determinants for development in the first stage of integration will also influence the region's ability to cope with the new situation after enlargement.

For this we tried to identify the correlation between regional dynamics and a bulk of possibly relevant location factors at the district level by means of traditional econometric growth regressions in the tradition of *Barro* (1991)[35]. We used per-capita GDP growth in the 93 Austrian districts as dependent variable. Due to a lack of data[36], our analysis is restricted to the period 1988–1995, the early stage of Eastern integration. For the same reason we were not able to use a panel-econometric approach in estimating the parameters, hence the well-known problems of a pure cross section (*Quah*, 1993) apply[37]. Independent variables were taken from various sources, especially the latest Austrian censuses (1988, 1991, 1995), see table A3 in the appendix for details. We tested various choice and

[33] Similar results were found by Br*oecker* (1989) for German regions, while *Kampmann* (1991) for German cities or *Müller – Schmutzler* (1997) for EU countries could not find any correlation between these components.

[34] *Broecker* (1997) attributes the low explanation value of the industry-mix to the fact that industries in crisis do not shrink evenly across regions, that their impact is compensated by heterogeneous industries, and that the industry-mix component does not catch indirect effects, working out through forward- and backward linkages.

[35] *Barro – Sala-i-Martin* (1991) for the US, *de la Fuente* (1996) for Spain, *Alecke – Untiedt* (2000) for Germany and *Pompili* (1994), *Fagerberg – Verspagen – Caniels* (1997), *Cambridge Econometrics* (1998) and *Tondl* (1999) for EU regions are recent examples for similar studies at a regional level.

[36] Calculations for regional GVA in Austrian districts for the 1970s and 1980s are not comparable with later data; data from 1995 onwards are still in operation at Statistics Austria and will be published at a NUTS-III level only.

[37] We tried to cope with the problem of stability in dynamics by performing stability tests in time and got satisfying results. Marginal changes in the estimation period (1989-95; 1988-94) didn't cause relevant changes in the estimation results, and we were not able to reject the hypothesis of parameter stability at a 5% level in any case.

environmental variables proposed by growth theories as well as regional economics (table 7)[38], but ignored variables relevant only at a country level[39].

Table 7: Determinants for (regional) growth in economic theory

	Neoclassical growth theory	New growth theory	Regional economics	New Economic Geography
Model of reference	Solow (1956); Swan (1956)	Romer (1986,1990); Grossman-Helpman (1991)	Marshall (1890); Perroux (1955)	Krugman (1991); Krugman-Venables (1995)
Driving forces	Capital accumulation	Technological Externalities of investment in real and human capital, infrastructure and R&D	Localisation- and urbanisation economies	Pecuniary externalities from an interaction of internal economies of scale and transport costs
Determinants for growth	Initial level of per-capita-income investment	Human capital R&D Infrastructure	Agglomeration Factor costs Industry structure	Accessibility Market potential

Source: Own compilation.

Our starting point for estimation is the neo-classical growth model, which emphasises the role of capital accumulation, i.e., the propensity to invest (which is identical with the propensity to save in a closed model) for growth. With marginal productivity of capital decreasing by assumption, the model produces a convergence expectancy: The lower the starting level of an economy (measured by GDP per capita or employee), the higher the growth rate ceteris paribus. If regions were intrinsically the same except for their starting capital intensities, then convergence would apply in an absolute sense; poor places would tend to grow faster per capita than rich ones. However, if regions differ in various respects, then convergence applies only in a conditional sense: growth rate tends to be high if initial per capita GDP is low in relation to its steady-state level[40].

[38] See *Mayerhofer – Palme* (2001a) for a comprehensive theoretical underpinning of the variables used.

[39] For example, many studies (e.g. *Barro*, 1991, 1997; *Sachs – Warner*, 1997) emphasise differences in tax systems as well as socio-economic, institutional and cultural factors as highly relevant in explaining growth differentials at a country level. At the regional level, however, differences in these variables are negligible, at least in the case of Austria. On the other hand, the role of foreign trade for growth is evident from theoretical (*Grossman – Helpman*, 1991) as well as empirical (*Levine – Renelt*, 1992) studies, but could not be considered here due to a lack of data.

[40] Formally, the model can be represented as $Dy = f(y, y^*)$, where Dy is the growth rate of per capita output, y is the current level of per capita output, and y^* is the steady-state level. Dy is diminishing in y for given y^* and rising in y^* for given y, whereby y^* depends on an array of choice and environmental variables. For a given initial level of per capita output, y, an increase in the steady-state level, y^*, raises the per capita growth rate over a transition interval. For a given value of y^*, a higher starting level of per capita output, y, implies a lower per capita growth rate (*Barro*, 1997).

A first estimate of this neo-classical model[41], using initial per capita GDP and investment per employee (in manufacturing) as regressors, suffered from not normally distributed residuals according to a Jarque-Bera test. After eliminating 4 districts, whose growth figures could be prooved as distorted due to statistical reasons[42], from our sample, we were not able to reject the null hypothesis of normally distributed errors at a 5% level. Additionally, we were not able to reject the null hypothesis of homoskedastic errors by means of a White-test. Finally, we were concerned that investment per employee is endogenously determined by per capita GDP growth through an "acceleration" mechanism (*Samuelson*, 1939). However, we were not able to reject the hypothesis of consistent OLS estimates by means of Hausman-tests for endogeneity in the version proposed by *Davidson – MacKinnon* (1993), using different sets of exogenous variables[43].

The resulting model 1 (table 8) confirms the importance of convergence forces in Austria in the early stage of Eastern integration with surprising clarity – surprising especially when considering the ambivalent background of previous studies[44]. The coefficients for initial per capita GDP and for private investment per employee show the expected signs and are highly significant[45]. Nevertheless, this model fails to provide a satisfactory explanation for a substantial part of the variation in growth rates between the Austrian districts, as indicated by the low adjusted R^2. This is at least partly due to the fact that investment per employee in manufacturing is a rather week proxy for capital accumulation in the whole economy and therefore is not able to catch all the effects from different steady-state levels. As a consequence, we added further choice and environmental variables proposed by theory (table 7). From New Growth theory we took the idea of endowment with human capital, research activities and infrastructure as key determinants for growth[46], and tested a broad range of different variables in this context. As these theories essentially deal with "point economies" and therefore neglect spatial mechanisms with relevant growth effects at a regional level, we further

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[41] We estimated the regression equation $g = \alpha + \beta \ln(y_{it-T}) + \mathrm{X}_{it-T}\gamma + u$ with $g = \frac{1}{T}\ln\left(\frac{y_{it}}{y_{it-T}}\right)$, whereby y_{it} denotes GDP per capita in region i at time t, T denotes the time from the initial year to the last year, u is the regression residual and $\boldsymbol{X}$ is a vector of other relevant variables.

[42] This applies to Bruck an der Leitha and Gänserndorf due to problems concerning the booking of regional taxes, and to Villach-Land and Voitsberg, where big firm closures in mining took place in the period analysed.

[43] Nevertheless, we estimated our model by means of TSLS also, but found no relevant deviations of the parameter estimates from the OLS estimates.

[44] *Hofer – Wörgötter* (1997) found only weak evidence for convergence in a study for Austrian NUTS-II regions (1961-1989) and districts (1961-86). For the 1980s they were not able to detect convergence at all. In general, convergence seems a stable trend more at a country than at a regional level; methodically, cross sectional analysis seems to be more in favour of convergence results as compared to studies based on time series analysis (*Carlino – Mills*, 1996).

[45] In addition, the respective parameter values are remarkably stable in the following extensions of the model.

[46] Models like *Romer* (1986) or *Lucas* (1988) allow for a wider definition of capital and include human-capital variables, thus ensuring that the returns to capital (in a wider sense) not necessarily diminish even in the long run due to knowledge-spillovers and external effects of human capital. *Romer* (1990) or *Grossman – Helpman* (1991) model technological change explicitly, innovation develops endogenously by targeted research carried out to exploit (temporary) monopolistic gains. Long run (endogenous) growth effects from infrastructure were modelled by *Barro* (1990) or *Barro – Sala-i-Martin* (1992): investments in infrastructure cause higher productivity and private investment here, which, through higher output and therefore tax returns, again causes higher investments in infrastructure.

augmented our analyses by determinants taken from Regional Economics and New Economic Geography, in particular factor costs, agglomeration economies, characteristics of the industrial structure and the accessibility to promising markets.

Table 8: Regressions for per capita GDP growth, 1988–1995
Cross-section for Austrian districts; OLS-estimator

	Model 1	Model 2	Model 3	Model 4
Constant	+0.1199***	+0.0528	+0.0532	+0.0620
Per Capita GDP 1988	– 0.0162***	– 0.0233***	– 0.0231***	– 0.0253***
Investment per employee	+0.0203***	+0.0201***	+0.0201***	+0.0210***
Academics in population	–	+0.0093*	+0.0092*	+0.0081
Employment share in tradable services	–	+0.0094**	+0.0095**	+0.0100***
Population density	–	+0.0186**	+0.0189**	+0.0177**
Population density (squared)	–	– 0.0017**	– 0.0018**	– 0.0017**
Overall demand potential	–	+0.0056*	–	
National demand potential	–	–	+0.0053*	+0.0055*
Employment share in pot. advantaged industries	–	–	–	+0.0043
Employment share in pot. disadvantaged industries	–	–	–	– 0.0010
$\bar{R}^2$	0.138	0.311	0.312	0.299
F-value	8.069***	6.667***	6.689***	5.179***
White (F)–test for Heteroskedasticity	1.697	0.694	0.679	0.739
Jarque–Bera Normality Test	0.242	1.771	1.829	1.718
Akaike–Criterion	– 6.171	– 6.341	– 6.343	– 6.305

Source: Own calculations. – *** significant at a level of 1 percent, ** significant at al level of 5 percent, * significant at a level of 10 percent.

We are not able to elaborate on the results of this extensive analysis in detail here, but present the variables tested and their performance when added to the base model (model 1) separately in table A3[47]. In sum, we were able to confirm the relevance of human capital endowments for regional growth without doubt, but yielded only mixed results for a broad set of synthetic indicators approximating (transport) infrastructure endowments[48] and research density. Additionally, we were not able to detect any significant effect of cost factors on regional dynamics[49], but found a significant correlation

[47] In some cases, we were able to reject the null hypothesis of homoskedastic errors by means of a White-test. In these cases we used the heteroskedasticity consistent covariance matrix estimator proposed by *White* (1980) to correct standard errors.

[48] *Barro – Sala-i-Martin* (1995) explain the often achieved result of a lacking significance of road infrastructure in growth regressions for developed countries by a near optimal investment quota in road infrastructure in all of these countries.

[49] Indeed, a dominant role of cost factors for industry location can only be expected in a world with perfect markets and full information. However, the complete lack of correlation between regional growth and factor costs may also indicate an endogeneity problem: dynamic regions offer higher factor payments due to factor shortage – the well known "*Kaldor* (1978)-paradox". However, the results of a Hausman-test for endogeneity do not support this conjecture.

between growth and proxies for agglomeration economies and market access, as well as some characteristics of industrial structure.

By integrating some of the variables that had proven significant in these tests[50] in the pure neo-classical model (model 1), we derived to an expanded model (model 2, table 8), whose explanatory power more that doubled compared to the basic model[51]. In addition to the share of academics in population and the share of tradeable services in employment, which do not need further explanation, population density entered the equation as a proxy for agglomeration economies[52], and the accessibility of promising markets was represented by an overall demand potential in the form of the distance-weighted GDP's in Austrian districts (national demand potential) and the (10) largest cities in Central Europe (international demand potential) respectively[53]. By using national demand potential instead of overall demand potential, however, we were able to enhance explanatory power even further (model 3)[54].

We applied the standard program of residual tests on this model and were not able to find any problems. This is also true for stability tests with changing samples of districts[55]. Hence, we may view a greater accumulation of capital, good regional endowments with human capital and infrastructure, agglomeration economies, a high share of tradable services and the access to promising markets as statistically proven determinants of regional growth in Austria in 1988–95, accompanied by a striking tendency to (conditional) convergence in this early stage of Eastern integration: The magnitude of the

[50] Due to multicollinearity we were not able to integrate all explanatory variables that had proven significant in the partial regressions to the enhanced model. As market access variables (demand potential) were correlated to initial per capita GDP when counting own GDP also, we used variables representing only access to markets other than the home district (demand potential 1) in our analysis.

[51] Overall, an explanatory power of one third in the enhanced models seem satisfactory for a cross-section analysis at a disaggregated regional level, that intends to explain growth rates by levels. This is the more true as we didn't use a method of outlier adjustment that "optically" improves results: If outliers were modelled by dummy variables instead (as can be seen in the literature quite often), the adjusted R^2 would have been 0.24 in model 1 and 0.40 in model 3.

[52] As in New Economic Geography models centripetal forces are usually accompanied by (centrifugal) agglomeration costs, arising e.g. from immobile workers (*Krugman*, 1991), immobile consumers (*Krugman – Venables*, 1995) or air pollution, traffic jam and crime (*Ricci*, 1999), it seems appropriate to model density variables dependent on size to represent positive, but shrinking agglomeration effects.

[53] To construct this and other "potential" variables, we used the well known assumption that an impact shrinks with squared distance: $P_i = \sum_j Z_j \Big/ d_{ij}^{\,n}$, whereby j = point of destination, i = point of origin and d_{ij} = travel time between i and j in minutes. Travel times were identified by means of a traffic model for Central Europe (MOBIDYN), for n we tested different specifications.

[54] This may represent a problem in modelling international demand potential, however. The GDP of the 10 largest cities in Central Europe represents neither total international demand potential, nor those parts decisive for manufacturing as the main actor in international trade. Additionally, the change of international market potential (and not it's level) may be the relevant determinant for growth in Eastern integration. Unfortunately, we were not able to test this hypothesis due to a lack of data.

[55] We performed these stability tests by skipping the first ten districts from our sample, then the second ten districts and so forth. We were not able to reject the null hypothesis of parameter stability in 8 of the nine tests performed.

estimated coefficient of initial GDP (β = -0,0231) implies that the rate of convergence[56], which denotes the speed at which a region approaches its steady state income level, is 2.52% per year in 1988–95. As model 4 indicates, higher employment shares of industries potentially advantaged or disadvantaged with respect to Eastern integration (although showing the expected coefficient signs) did not affect regional growth significantly. A Redundant Variables Test was not able to reject the hypothesis that the coefficients on the two variables are jointly zero (F = 0.298; ρ = 0.743), thus confirming the results from chapter 3.

In view of the distribution of these determinants of regional growth across Austria's regions, we essentially arrive at the same conclusions as in the previous analysis of the structural pre-conditions with respect to integration. We again find advantages for the core and disadvantages for the periphery, especially the rural border regions to the CEECs. As table 9 shows, human capital intensive regions not only have a beneficial industrial structure with respect to Eastern integration, but also are better endowed with location factors found to support regional growth in the analysis above. Essentially, they are relatively better off in all growth determinants identified but initial per capita GDP, with particular advantages at population density and tradable services. Rural regions, on the other hand, are placed at a disadvantage with respect to all of these factors, while physical capital-intensive regions take an intermediate position. In rural border regions, we not only find the expected disadvantages concerning density variables and demand potential, but also concerning all location factors of importance in a knowledge-based economy: The share of academics is about half that of the Austrian average, and investment intensity as well as expenditures in R&D lag behind seriously, too.

Table 9: Determinants of regional growth in Austrian regions

	Per-capita GDP	Invest-ment per employee	Academics in population	Tradable services	Industries with external EOS, high skilled	Population density	Demand potential		R&D expendi-tures in turnover	Speciali-sation of manufac-turing
							Total	Without own market		
	1988	1995	1991	1995	1995	1991	1995	1995	1996	1995
	In €	1,000 €	In %	Share in employment		Population per square km	Austria=100		In %	Herfin-dahl-index
Aggregated economic regions										
Human capital intensive (1)	18,013	11.0	6.3	17.2	12.0	2.185	216	142	2.4	0.031
Physical capital intensive (2)	12,501	8.0	2.7	5.3	5.5	68	71	93	1.1	0.048
Rural (3)	8,466	7.1	2.4	5.6	4.6	68	36	75	0.9	0.039
Economic regions										
Metropolitan (1)	20,778	12.5	7.0	19.2	15.5	3.695	2.612	92	3.7	0.027
Cities (1)	21,797	11.4	7.5	17.4	9.4	1.726	270	103	0.9	0.030
Suburbans (1)	13,352	7.8	4.3	15.6	11.3	163	100	183	0.8	0.034
Medium-sized towns (1)	14,277	8.7	3.6	11.5	6.6	578	89	110	2.2	0.044
Intensive industrial (2)	12,724	7.9	2.8	6.4	6.8	83	80	100	1.1	0.036

[56] As $\beta = -\left(\frac{1-e^{bT}}{T}\right)$, the rate of convergence (b) can be estimated directly from OLS estimates of β (*Barro – Sala-I-Martin*, 1995)

Intensive touristic (2)	12,066	8.2	2.6	2.9	2.6	36	58	82	1.3	0.073
Extensive industrial (3)	9,033	7.2	2.4	5.9	5.7	80	45	82	1.0	0.036
Touristic peripheries (3)	8,622	7.2	2.5	4.2	3.2	45	29	73	0.4	0.045
Industrial peripheries (3)	7,574	6.7	2.3	6.2	3.6	64	31	69	0.4	0.040
Border regions										
All	15,142	10.3	5.6	14.4	10.5	1.808	121	104	2.5	0.034
Urbanised	17,880	11.1	6.4	16.9	12.6	2.419	228	143	2.6	0.030
Rural	7,900	7.0	2.3	5.4	4.5	67	34	72	0.9	0.039
Non-border	13,243	8.9	3.9	10.1	6.7	473	76	96	1.2	0.042
Austria	14,401	9.5	4.3	7.6	5.8	93	100.0	100.0	2.0	0.043

Source: ST.AT, WIFO, Federation of Austrian Social Security Institutions, own calculations.

Essentially, the encouraging performance of the rural border regions in employment and (to a lesser extent) GDP growth in the 1990s, as shown in table 1 above, can only be "explained" by the (unexplained) convergence trend detected in our analysis. This is the more true, as we were not able to find any growth advantages from the pure geographical location at the border to the emerging Eastern markets in additional regression analysis (table 10).

Table 10: Regressions for per capita GDP growth, 1988–1995
Cross section for Austrian districts; OLS-estimator

	Model 3	Model 5	Model 6	Model 7	Model 8	Model 9
Constant	+0,0532	+0,0590	+0,0801	+0,0681	+0,0830	+0.0735
Per capita GDP 1988	– 0.0231***	– 0.0242***	– 0.0262***	– 0.0248***	– 0.0277***	– 0.0288***
Investment per employee	+0.0201***	+0.0203***	+0.0207***	+0.0205***	+0.0193**	+0.0204***
Academics in population	+0.0092*	+0.0094*	+0.0098*	+0.0089	+0.0131	+0.0117**
Employment share in tradable services	+0.0095**	+0.0097**	+0.0096**	+0.0096**	+0.0118**	+0.0126***
Population density	+0.0189**	+0.0187**	+0.0183**	+0.0185**	+0.0124	+0.0152*
Population density squared	– 0.0018**	– 0.0017**	– 0.0017**	– 0.0017**	– 0.0013	– 0.0015*
National demand potential	+0.0053*	+0.0056*	+0.0053*	+0.0053	+0.0080	+0.0086**
Border region	–	– 0.0010	–	–	– 0.0584	–
Border district	–	–	– 0.0029	–	–	+0.1542
Urbanised border region	–	–	–	– 0.0015	–	–
Rural border region	–	–	–	– 0.0003	–	–
Proximity to border x per capita GDP	–	–	–	–	+0.0073	+0.0133
Proximity to border x investment per employee	–	–	–	–	– 0.0017	– 0.0024
Proximity to border x academics in population	–	–	–	–	– 0.0052	– 0.0167
Proximity to border x share in tradable services	–	–	–	–	– 0.0074	– 0.0008
Proximity to border x population density	–	–	–	–	+0.0261	– 0.0113
Proximity to border x population density squared	–	–	–	–	– 0.0020	+0.0026
Proximity to border x national demand potential	–	–	–	–	–	– 0.0232**
$\bar{R}^2$	+0.312	+0.304	+0.311	+0.296	+0.292	+0.344
F-value	+6.689***	+5.810***	+5.973***	+5.114***	+3.423***	+4.076***
White (F)-test for Heteroskedasticity	+0.679	+0.779	+0.696	+0.585	+0,640	+0.667
Jarque-Bera Normality Test	+1.829	+1.830	+1.875	+1.862	+2,987	+1.992
Akaike-Criterion	– 6.343	– 6.322	– 6.332	– 6.301	– 6.239	– 6.315

Source: Own calculations. – *** significant at a level of 1 percent, ** significant at al level of 5 percent, * significant at a level of 10 percent. ‚Proximity to border': in model 8 ‚border region', in model 9 ‚border district'.

Neither a dummy variable for the (broader) border region (model 5) nor a dummy variable for the direct border districts (model 6) adds any explanatory power to the enhanced model 3 as measured by the adjusted R^2, the F-value of the regression or the Akaike Information Criterion. When controlling for the location factors mentioned in the previous analysis, a location adjacent to the opened border therefore seems not beneficial for regional growth per se. This result was further confirmed when considering urbanised as well as rural border regions separately (model 7). The coefficients of both dummy variables are far from significant, and a Redundant Variable Test is not able to reject the null hypothesis that both coefficients are jointly zero ($F = 0.116$; $\rho = 0.891$). Finally, we were also unable to find large regional differences in the causal relationships between location factors and regional growth identified in model 3 with respect to a location near the Eastern border. For testing this, we introduced interaction terms for border regions (model 8) and border districts (model 9) respectively, which allow the growth effects of location factors identified deviate for these regional types. For the (broader) border region, we were not able to find relevant deviations from the causal relationships as documented in model 3 at a 5% level. For the border districts, however, we found a significantly lower influence of national demand potential on regional growth, which may be explained by the peripheral location of that regions in a national context. However, even here we were not able to reject the null hypothesis that the interaction terms are jointly zero by means of a Redundant Variable Test ($F = 1.501$; $\rho = 0.172$), and the Akaike Information Criterion did not prefer model 9 to the enhanced model without regional dummies (model 3).

To sum up, we were able to show that regional growth pattern in Austria were determined by the (theoretically founded) location factors mentioned in table 7 to a considerable extent in the first stage of Eastern integration, and that these factors, like the structural pre-conditions analysed before, place rural border regions in Austria at a disadvantage. In addition, the pure geographical location at the border to the Candidate countries proved not to be an essential determinant for regional growth in itself, even in the years immediately after the opening up of the Eastern borders. Therefore, the encouraging development of the rural (border) regions in the first stage of Eastern integration must not be seen as an indication of a high competitiveness of these regions in an integrated Central Europe. It would be misleading, therefore, to take a stable development of rural border regions after EU enlargement for granted due to past experience.

5. Conclusions

Regional dynamics in Austria in the 1990's in no way support the fears arising soon after the opening up of the borders to the adjacent CEE countries in 1989: Neither an erosion of the Eastern border regions took place due to a stiffer competition from neighbouring low-wage countries, nor a widening of the core-periphery divide within these very heterogeneous border regions, as would be fair to assume due to the specialisation of rural border regions on labour-intensive low-skilled activities. On the contrary, employment in rural border regions grew nearly double the rate of urbanised border regions and managed a turn-around to markedly better employment dynamics in the 1990's. This was often seen as a positive sign for the future perspectives of these regions after EU enlargement.

However, our empirical work based on a rather disaggregated data set shows that neither the sectoral pre-conditions of rural border regions nor their endowment with growth-enhancing location factors

justify such a conclusion. What concerns industry-mix, we grouped NACE-3 industries to theoretically founded typologies indicating different sector characteristics by means of multivariate cluster analyses and found that (fast growing) rural border regions are characterised by industries that show disadvantageous characteristics for east-west trade to a far higher extent. The share of employees in potentially disadvantaged industries is almost 50% higher than the Austrian average here, due to a labour-intensive manufacturing, but also due to a lot of (non-tradable) services industries which will have to cope with an opening-up of their markets, so far segmented by the border. What concerns regional location factors, we first tried to determine the relevant growth determinants by means of Barro-type econometric growth regressions at a district level. By analysing the spatial distribution of factors which proved relevant for regional growth in these regressions, we found that the rural border regions are at a disadvantage also in this respect. This is true for the accumulation of capital, agglomeration economies, the access to promising markets and the endowment with human capital, infrastructure and R&D alike. Moreover, we could not find any advantage from a location at the border to the emerging transition countries in itself, even in the years immediately after the opening up of the Eastern borders.

In fact, as we were not able to trace the encouraging development of rural border regions after the opening up of the Eastern border back to detectable advantages of these regions with respect to integration, it is fair to suspect other mechanisms than the border opening in itself as (at least partially) decisive for this development. Further research is needed here, but some recent results may give a first clue. First of all, there is some evidence that the ongoing decentralisation of economic activity from the city cores to their suburbs increases in (geographical) range over time, so that a lot of previously peripheral (rural) border regions meanwhile can be seen as parts of the wider surroundings of these cities, due to an improved transport and communication infrastructure[57]. Secondly, there is evidence for a (broader) de-concentration process in Austria's services sector, driven by a catching up of more peripheral regions in business related services (*Mayerhofer*, 1999): While up to the 1980's higher-ranked business related services were offered in a few central places only, these services are increasingly supplied also in smaller towns and (therefore) in rural districts in recent years. Thirdly, there is first evidence (*Mayerhofer – Palme*, 2001a) that services firms located in the periphery, due to a better transport network, increasingly manage to render services to customers in the Austrian cities also, thereby increasing their market range and opening additional growth potentials to the periphery.

If these guesses can be verified empirically, it might be appropriate to focus regional policy measures designed to prepare border regions for Eastern enlargement on those rural border regions which are located far away from larger cities and therefore are unable to profit from these trickling-down effects mentioned above[58]. In any case, such preparatory measures will be good policy on principle, due to the pre-conditions of rural border regions with respect to industry mix and growth-relevant location

[57] For example, *Mayerhofer* (2000) estimated spatio-temporal distance functions as proposed by *Kellerman – Krakover* (1986) for the Vienna region and found the peak of the spatial distribution of (employment) growth rates in manufacturing as well as parts of the services sector moving away from the city centre steadily since the 1970's.

[58] A closer look at employment dynamics within the rural border regions shows that those districts which locate really peripheral to the large cities of the country (e.g. the northern parts of Lower Austria or parts of southern Carinthia) did not have any growth advantage in the 1990's (*Mayerhofer – Palme*, 2001a).

factors alike. As it would be misleading, due to our findings, to take a stable development of rural border regions after EU enlargement for granted due to past experience, regional policy measures should be pinpointed to an up-grading of these regions, in order to ensure such a development.

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Table A1: Industry characteristics in Austrian 3-digit manufacturing industries

		Factor intensity	Skill intensity	Price versus quality competition	Internal economies of scale	External economies of scale	Forward-backward linkages
Industries with the most favourable characteristics with respect to integration							
244	Manufacture of pharmaceuticals, medicinal chemicals and botanical products	+	+	+	+	0	+
353	Manufacture of aircraft and spacecraft	+	+	+	+	+	0
322	Manufacture of TV and radio transmitters and apparatus for line telephony	+	0	+	0	+	0
341	Manufacture of motor vehicles	+	0	+	+	0	0
293	Manufacture of agricultural and forestry machinery	0	+	+	0	+	0
294	Manufacture of machine tools	+	+	+	0	0	0
245	Manufacture of soap, detergents and perfumes; toilet, cleaning and polishing preparations	+	0	0	+	0	+
334	Manufacture of optical instruments and photographic equipment	+	0	+	0	+	0
246	Manufacture of other chemical products	+	0	+	+	0	0
365	Manufacture of games and toys	+	0	+	0	0	+
295	Manufacture of other special purpose machinery	0	+	+	0	0	0
292	Manufacture of other general purpose machinery	0	+	+	0	0	0
343	Manufacture of parts and accessories for motor vehicles and their engines	0	0	+	+	0	0
312	Manufacture of electricity distribution and control apparatus	+	0	+	0	0	0
321	Manufacture of electronic valves and tubes and other electronic components	+	0	0	0	+	0
316	Manufacture of electrical equipment n.e.c.	+	0	0	0	0	+
331	Manufacture of medical and surgical equipment and orthopaedic appliances	+	0	+	0	0	0
323	Manufacture of TV and radio receivers, sound or video recording or apparatus	+	0	–	0	+	+
332	Manufacture of instruments and appliances for measuring, checking, testing	+	0	+	0	0	0
352	Manufacture of railway and tramway locomotives and rolling stock	–	0	+	+	0	+
Industries with the most unfavourable characteristics with respect to integration							
267	Cutting, shaping and finishing of stone	–	–	–	0	0	0
174	Manufacture of made-up textile articles, except apparel	–	–	–	0	0	0
264	Manufacture of bricks, tiles and construction products, in baked clay	–	–	–	0	0	0
266	Manufacture of concrete products for construction purposes	0	–	–	0	0	0
201	Sawmilling and planing of wood, impregnation of wood	–	0	–	0	0	0
261	Manufacture of glass and glass products	0	–	–	0	0	0
262	Manufacture of non-refractory ceramic goods other than for construction	–	–	0	0	0	0
251	Manufacture of rubber products	0	–	–	0	0	0
284	Forging, pressing, stamping and roll forming of metal; powder metallurgy	–	0	–	0	0	0
202	Manufacture of veneer sheets and of plywood and other panels and boards	–	0	–	0	0	0
268	Manufacture of other non-metallic mineral products	0	–	–	0	0	0
204	Manufacture of wooden containers	–	0	–	0	0	0
361	Manufacture of furniture	–	0	0	0	0	0
281	Manufacture of structural metal products	–	0	0	0	0	0
203	Manufacture of builders' carpentry and joinery	–	0	0	0	0	0
252	Manufacture of plastic products	0	–	0	0	0	0
182	Manufacture of other wearing apparel and accessories	–	–	+	0	0	0
287	Manufacture of other fabricated metal products	0	0	–	0	0	0
177	Manufacture of knitted and crocheted articles	0	–	0	0	0	0
205	Manufacture of other products of wood, of cork, straw and plaiting materials	–	0	–	0	0	+

Source: Own calculations. +...potentially advantageous in integration, –...potentially disadvantageous in integration, 0...neutral.

Table A2 : Industry characteristics in Austrian 3-digit services industries

		Market radius	Factor intensity	Skill intensity	External economies of scale	Forward-backward linkages
Industries with favourable characteristics with respect to integration						
723	Data processing	International	+	+	+	+
722	Software consultancy and supply	International	+	+	+	+
671	Activities auxiliary to financial intermediation, excluding insurance and pension	International	+	+	+	+
622	Non-scheduled air transport	International	+	+	+	+
724	Data base activities	International	+	+	+	+
514	Wholesale of household goods	International	+	+	+	0
516	Wholesale of machinery, equipment and supplies	International	+	+	+	0
731	Research and experimental development on natural sciences and engineering	International	+	+	+	0
726	Other computer related activities	International	+	+	+	0
621	Scheduled air transport	International	0	+	+	+
651	Monetary intermediation	International	+	+	0	0
741	Legal, accounting and auditing activities; consultancy; market res.; holdings	Regional	+	+	0	0
660	Insurance and pension funding, except compulsory social security	Regional	+	+	0	0
742	Architectural and engineering activities and related technical consultancy	International	+	+	0	0
501	Sale of motor vehicles	Regional	+	+	0	0
634	Activities of other transport agencies	International	+	+	0	0
633	Activities of travel agencies and tour operators; tourist assistance activities	Regional	+	+	0	0
743	Technical testing and analysis	Regional	+	+	0	0
672	Activities auxiliary to insurance and pension funding	Regional	+	+	0	0
744	Advertising	Regional	0	+	+	0
Industries with unfavourable characteristics with respect to integration						
553	Restaurants	Regional	–	–	0	0
747	Industrial cleaning	Regional	–	–	0	0
513	Wholesale of food, beverages and tobacco	International	–	–	0	0
523	Retail sale of pharmaceutical and medical goods, cosmetics and toilet articles	Regional	–	–	0	0
602	Other land transport	Regional	0	–	0	0
703	Real estate activities on a fee or contract basis	Regional	0	–	0	0
524	Other retail sale of new goods in specialised stores	Regional	–	0	0	0
452	Building of complete constructions or parts thereof; civil engineering	Regional	–	0	0	0
521	Retail sale in non-specialised stores	Regional	–	0	0	0
453	Building installation	Regional	–	0	0	0
454	Building completion	Regional	–	0	0	0
502	Maintenance and repair of motor vehicles	Regional	–	0	0	0
512	Wholesale of agricultural raw materials and live animals	International	–	0	0	0
745	Labour recruitment and provision of personnel	International	–	0	0	0
505	Retail sale of automotive fuel	Regional	–	0	0	0
746	Investigation and security activities	Regional	–	0	0	0
527	Repair of personal and household goods	Regional	–	0	0	0
725	Maintenance and repair of office, accounting and computing machinery	Regional	–	0	0	0

Source: Own calculations. +...potentially advantageous in integration, –...potentially disadvantageous in integration, 0...neutral.

Table A3: Choice and environmental variables relevant for economic growth

Results of partial regression models on the basis of model 1, OLS- or White-HC-estimators

	Definition	Coefficient	$\overline{R}^2$	F-value	Akaike Criterion
Human Capital					
Young people in labour force	People aged 15-35 in % of working population, 1991	– 0.044***	0.195	8.09	– 6.227
Women in employment	Share of women in dependent employment; Ø 1989-95	– 0.007	0.135	5.57	– 6.156
Foreign workers in employment	Share of workers without Austrian citizenship in employment, Ø 1991-95	+ 0.000	0.129	5.33	– 6.149
Academics in population	Share of population with an ISCED-4 qualification or higher, 1991	+ 0.013***	0.223	9.40	– 6.263
Graduates of universities in population	Share of population with an ISCED-6 qualification, 1991	+ 0.010***	0.213	8.93	– 6.250
Secondary education in population	Share of population with an ISCED-3 qualification 1991	+ 0.009**	0.185	7.67	– 6.216
Applied secondary education in population	Share of population with an ISCED-3 qualification in professional schools, 1991	+ 0.013***	0.213	8.95	– 6.251
Technical college in population	Share of population with a technical college qualification, 1991	+ 0008	0.138	5.71	– 6.160
Vocational training in population	Share of population with a vocational apprenticeship, 1991	+ 0.006	0.131	5.43	– 6.152
Lower educated in population	Share of population with an ISCED-2 qualification, 1991	– 0.032***	0.208	8.69	– 6.244
Infrastructure					
Accessibility of universities	Students of universities, distance-weighted, pure distance, Ø 1988-95	+ 0.002	0.148	6.09	– 6.171
Accessibility of airports/persons	Arrivals and departures at airports, distance-weighted, pure distance, Ø 1988-95	+ 0.003**	0.190	7.88	– 6.222
Accessibility of airports/freight	Loaded and unloaded freight at airports, distance-weighted, squared distance, Ø 1988-95	– 0.001**	0.199	7.87	–6.221
National accessibility	Sum of travel times to all other district centres, fastest connection	– 0.003	0.134	5.52	– 6.154
International accessibility	Sum of travel times to the 10 most important centres in Central Europe, fastest connection	+ 0.003	0.129	5.34	– 6.153
Overall accessibility	Sum of travel times to Austrian district centres and the 10 most important centres in Central Europe, fastest connection	+ 0.003	0.132	5.47	– 6.153
Cost factors					
Wage levels	Monthly gross wages, median in ATS, Ø 1988-95	+ 0.033*	0.156	6.43	– 6.181
Wage growth	Monthly gross wages, growth in % p.a. 1988-1995	– 0.003	0.129	5.34	– 6.149
Costs of residence	Monthly expenditures for dwellings per square-meter, in ATS, 1999	+ 0.014*	0.166	6.86	– 6.193
Industry structure					
Firm size	Employees per firm, 1991	+ 0.007	0.141	5.83	– 6.163
Self-employed	Self-employed in % of employment, 1991	– 0.007	0.153	6.31	– 6.177
Primary sector	Share of employment in farming and forestry in %, 1991	– 0.001	0.131	5.44	– 6.152

Secondary sector	Share of employment in manufacturing in %, 1991	–	0.001	0.128	5.32	– 6.148
Tertiary sector	Share of employment in services in %, 1991	–	0.004	0.130	5.40	– 6.151
Labour-intensive industries	Share of employment in NACE-III-industries of that industry-type in %, 1995	+	0.001	0.128	5.32	– 6.148
Technology-intensive industries	Share of employment in NACE-III-industries of that industry-type in %, 1995	+	0.000	0.128	5.32	– 6.148
Low qualifications	Share of employment in NACE-III-industries of that industry-type in %, 1995	–	0.007	0.153	6.32	– 6.177
Medium qualification, blue collar	Share of employment in NACE-III-industries of that industry-type in %, 1995	–	0.010	0.141	5.80	– 6.163
Medium qualification, white collar	Share of employment in NACE-III-industries of that industry-type in %, 1995	+	0.007**	0.186	7.69	– 6.216
High qualification	Share of employment in NACE-III-industries of that industry-type in %, 1995	+	0.003*	0.154	6.36	– 6.179
High internal returns to scale	Share of employment in NACE-III-industries of that industry-type in %, 1995	+	0.000	0.126	5.15	– 6.128
Tradable services	Share of employment in NACE-III-industries of that industry-type in %, 1995	+	0.006***	0.248	10.57	– 6.284
Non-tradable services	Share of employment in NACE-III-industries of that industry-type in %, 1995	–	0.004	0.131	5.44	– 6.152
Forward and backward linkages	Share of employment in NACE-III-industries of that industry-type in %, 1995	–	0.002	0.142	5.85	– 6.164
External economies of scale, skilled	Share of employment in NACE-III-industries of that industry-type in %, 1995	+	0.004***	0.204	8.53	– 6.239
External EOS, total	Share of employment in NACE-III-industries of that industry-type in %, 1995	+	0.001	0.129	5.34	–6.149
Specialisation and Agglomeration effects						
Absolute specialisation, manufacturing	Herfindahl index on employment, 99 manufacturing industries, 1995	–	0.010***	0.230	9.76	– 6.272
Absolute specialisation, services	Herfindahl index on employment, 70 services industries, 1995	–	0.006*	0.157	6.47	– 6.182
Absolute specialisation, total	Herfindahl-Index on employment, all NACE-III industries, 1995	–	0.007**	0.176	7.26	– 6.204
Relative specialisation, manufacturing	Coefficient of specialisation on employment, 99 manufacturing industries, 1995	–	0.023***	0.197	8.18	– 6.230
Relative specialisation, services	Coefficient of specialisation on employment , 70 services industries, 1995	–	0.001	0.129	5.33	– 6.149
Relative specialisation, total	Coefficient of specialisation on employment, all NACE-III industries, 1995	–	0.012	0.150	6.19	– 6.174
Concentration 3, manufacturing	Share of employment in the 3 largest manufacturing industries, 1995	–	0.015***	0.228	9.67	– 6.270
Concentration 3, services	Share of employment in the 3 largest servicesindustries, 1995	–	0.006	0.141	5.82	– 6.163
Concentration 3, total	Share of employment in the 3 largest NACE-III industries, 1995	–	0.008*	0.161	6.63	– 6.186
Concentration 10, manufacturing	Share of employment in the 10 largest manufacturing industries, 1995	–	0.025***	0.198	8.23	– 6.231
Concentration 10, services	Share of employment in the 10 largest services industries, 1995	–	0.026**	0.171	7.07	– 6.199
Concentration 10, total	Share of employment in the 10 largest NACE-III industries, 1995	–	0.020***	0.194	8.06	– 6.227

Population density	Population per square kilometer, 1991	+	0.002*	0.157	6.45	– 6.181
Population density		+	0.019	0.192	6.23	– 6.214
Population density squared		–	0.002**			
Market access						
National demand potential	Distance-weighted GDP in Austrian Districts, pure distance, in Mill. ATS, 1988	+	0.006**	0.173	7.14	– 6.201
National demand potential(Ø)	Distance-weighted GDP in Austrian Districts, pure distance, in Mill. ATS, average 1988-95	+	0.006**	0.182	7.55	– 6.212
National demand potential 1	Distance-weighted GDP in Austrian districts without own district, squared distance, in Mill. ATS, 1988	+	0.004***	0.226	9.56	– 6.267
National demand potential(Ø) 1	Distance-weighted GDP in Austrian districts without own district, squared distance, in Mill. ATS, average 1988-95	+	0.004***	0.225	9.52	– 6.266
International demand potential	Distance-weighted GDP in the 10 largest international cities in Central Europe, squared distance, in Mill. ATS, 1995	–	0.004	0.148	6.11	– 6.172
Demand potential overall	Sum of national demand potential (1) and international demand potential, in Mill. ATS, 1988	+	0.004***	0.226	9.58	– 6.267
Demand potential overall(Ø)	Sum of national demand potential (1) and international demand potential, in Mill. ATS, average 1988-95	+	0.004***	0.225	9.54	– 6.266

Source: own calculations. At distance-weighted variables we experimented with different distance functions , this table only shows the best performing variants.