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Structural Change in the CENTROPE Region

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1. Introduction

It is widely known that the structural characteristics of an economy belong to the most important indicators of a country''s or region's economic development. The shares of manufacturing, agriculture and services in total employment, as well as the shares of employment in different occupational and educational groups are closely correlated to aggregate indicators of wealth. It is also widely known that the economies of the former socialist Central and Eastern European Countries (CEEC) have faced substantial problems of reallocating resources from unproductive to more productive uses on their way to a closer integration into the world economy. They started their transition to market economies with an employment structure that was heavily centred on industrial (and in some countries also agricultural) employment, extremely large enterprises and an almost complete predominance of state owned firms. It thus comes as no surprise that these countries and their regions have experienced substantial structural change since the start of market oriented reforms.[2]

Structural change, however, is not only a phenomenon observed in transition economies. It also characterises most mature market economies. In this context, recent theoretical and empirical research (see *Rowthorn – Ramaswamy*, 1999; *Foellmi – Zweimüller*, 2002 and *Mesch*, 2005) identifies a number of supply and demand side factors such as technological change, international trade, differences in income elasticities, changing intermediary demand, outsourcing as well as institutional changes, which contribute to structural change and attempts to measure the relative contribution of these factors to structural change in both transition as well as market economies.

Our aim in this paper is to focus on characteristics and consequences of structural change in the CENTROPE region, a European cross-border region

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[2] See *Boeri – Terrell* (2002), *Mickiewicz* (2001) and *Mickiewicz – Zalewska* (2001) for recent studies on structural change in the CEECs.

comprising areas from Austria, Hungary, Slovakia and the Czech Republic which was set up in 2003 by institutional arrangement[3]. In detail, the paper addresses three related issues:

1. We want to determine to what extent the sectoral structures of the eastern and western[4] part of CENTROPE differ from each other as well as from the remainder of the European Union and how these structural differences shape the growth perspectives of the region.

2. We try to measure the extent and direction of structural change from a European perspective and quantify the contribution of this structural change to productivity growth.

3. We want to find out how trade patterns for manufactured products have reacted to the new situation, whether specialisation or diversification is on the advance, and how comparative advantages develop in changing environments.

The reason for this focus is twofold. First, we are interested in the positive implications of structural change in the cross-border context. While a large literature on the potential impact of integration on new and old EU Member States exists, the regional implications of this integration process – in particular when it comes to cross-border regions at the former external border of the EU – are still under-researched. CENTROPE is a particularly interesting case study of integration since it comprises some of the most advanced regions of both the new and old Member States and may thus reflect the structural effects of EU integration particularly well. We thus augment the case study literature on border regions (see *Van Houtem*, 2000 for a survey) by focusing on this region. Second, our interest is rooted in the normative aspects of regional policy. To formulate policies for the CENTROPE region a clear understanding is needed of what are the characteristic structural features of the region, how they relate to economic developments and what can be expected from the future in terms of structural change in the region.

In order to achieve our goals the remainder of the paper is organised as follows: In the next section we shortly describe the data sources used. Section 3 highlights

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[3] The constituting document of CENTROPE is the declaration of Kittsee which was signed by Vienna, Lower Austria, Burgenland, Bratislava, Trnava, Györ-Moson-Sopron, Southern Moravia, Brno, Eisenstadt, Györ, Sopron and St.Pölten. Our analysis extends on this definition by focusing on the set of NUTS 2 regions, in which these cities and NUTS 2 regions are included and by also including Southern Bohemia as is customary in the analytic literature on CENTROPE (see *Palme – Feldkircher*, 2005 *Krajasits - Neuteufl - Steiner*, 2003). We thus consider the Austrian provinces of Vienna, Lower Austria and Burgenland, Southern Moravia and Southern Bohemia in the Czech Republic, Bratislava and Western Slovakia in Slovakia as well as Western Transdanubia in Hungary.

[4] In what has become a common use of language we refer to the new Member States regions (countries) of CENTROPE as the eastern part and denote Austria as the western part, even though some regions of the new Member States are located more to the west than the Austrian regions.

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the main structural characteristics of the region. We show that CENTROPE is characterised by internal structural disparities that may be considered as typical for the enlarged EU. In particular regions of the new Member States are still more industrialised and have lower productivities than EU-15 regions. We also show that CENTROPE is in a favourable position relative to other cross-border – regions, due to its strong urban core and a lack of problems of mono-industrialisation and extremely peripheral agricultural areas. In section 4 we then focus on structural change and its contribution to productivity growth. We find that structural change at the sectoral level has been particularly pronounced in the eastern parts of CENTROPE but that this change has only modestly contributed to productivity growth. The primary sources of productivity growth in CENTROPE as well as in other EU regions were productivity changes within sectors. Section 5 analyses the foreign trade patterns of the CENTROPE countries by identifying a rapid catching up process in terms of exports and trade balances and document the rapid structural change in (particularly the eastern parts of) CENTROPE to more skill- and technology intensive activities. Section 6 documents that structural change in CENTROPE countries surpassed that in the EU-15. Trade patterns of the CENTROPE countries broadened in this process, as traditional specialisations eroded and an export structure more similar to that of the EU-15 arose. Section 7, finally, summarises the results and draws some policy conclusions.

2. The Data

The data we use stem from two sources. First, we use Eurostat data for employment and gross value added from the Regio Database at both the 2 and 3 digit level of the Nomenclature of Units for Territorial Statistics Classification (NUTS) to analyse the sectoral structure at the regional level. Apart from potential problems arising from differences in national statistical systems, these data suffer from missing data problems and a low level of sectoral disaggregation. For instance when focusing on the NUTS 3 level we have information on three sectors (agriculture, manufacturing and services) for the years 1995 to 2001. Even at this low level of disaggregation we miss data on France, the Netherlands and Cyprus for 2001 and on France, the Netherlands, Cyprus, Poland, Greece, Estonia, Slovenia and Latvia when comparing data between 1995 and 2001. At the NUTS 2 level, by contrast, information on Gross Value Added (GVA) and employment on 15 broad sectors of the economy is available, but only for 14 countries of the enlarged EU. Excluding missing data thus leaves us with a data set for regional GVA and employment in three sectors and 1078 NUTS 3 regions from 22 EU Member States in 2001, which reduces to 948 regions when comparing structural change between 1995 and 2001. Alternatively, on NUTS 2 level we have data for a slightly more detailed structural breakdown (15 sectors) for 180 regions from 14 countries of the EU-25.

We use these data to gauge regional structural change in CENTROPE. Concerns about the problems of their low sectoral disaggregation, however, lead us to also use trade data from the UN World Trade data base. While these data are only available at a national level, they comprise sectoral information at a very disaggregated (NACE 3 and NACE 4) level. This allows a much more detailed analysis of structural change in the manufacturing sector of CENTROPE, including the use of sectoral typologies to depict trends in factor intensity, use of human capital and quality orientation.

3. The Sectoral Structure of the CENTROPE Region: Evidence from Regional Data

Focusing first on NUTS 3 regions, data suggest that the CENTROPE region is not only characterised by significant disparities in terms of economic development (see *Palme – Feldkircher*, 2005), but also in terms of sectoral specialisation. The eastern part of CENTROPE is characterised by a substantially higher share of manufacturing in both employment and GVA, while service sectors tend to be underrepresented (table 1). Compared to the EU-25 as well as the old and new Member States some interesting characteristics of the CENTROPE region arise. In particular the share of agriculture is substantially lower in the new member state regions of CENTROPE than in other new member state regions, while the service sector share is higher. In the Austrian part of CENTROPE, too, the service sector share is higher relative to the average old member state, while the manufacturing share is lower.

Table 1: Economic Structure in CENTROPE and the EU (NUTS 3, 2001)

	EU	CENTROPE	Old Member States		New Member States	
			Total	CENTROPE	Total	CENTROPE
Employment						
Agriculture	6.23	5.13	4.07	3.95	17.56	5.80
Manufacturing	26.99	31.86	26.31	21.25	30.56	37.98
Services	66.79	63.02	69.62	74.80	51.88	56.22
GVA						
Agriculture	2.10	2.81	1.99	1.95	4.03	5.08
Manufacturing	28.02	28.23	27.77	24.31	32.34	38.66
Services	69.87	68.96	70.23	73.74	63.63	56.26

Note: The table reports average employment and GVA shares of 1078 NUTS 3 regions in % for 2001. Data on France, the Netherlands and Cyprus are not included.

Source: Eurostat, Austrian Institute of Economic Research.

Table 2: Economic Structure in the CENTROPE Region (NUTS 2, 2001)

	Employment			GVA		
	Total	of this old Member States	of this new Member States	Total	of this old Member States	of this new Member States
Agriculture	4.9	4.0	5.8	2.5	2.4	2.8
Mining and quarrying	0.3	0.2	0.5	0.3	0.6	0.5
Manufacturing	21.0	13.3	28.4	17.2	16.2	18.9
Electricity, gas and water supply	1.3	0.9	1.7	2.8	2.8	2.6
Construction	7.1	6.8	7.3	6.6	6.7	6.2
Trade	15.4	16.2	14.6	14.7	15.8	13.5
Hotels and restaurants	4.0	4.4	3.6	2.6	2.5	2.9
Transport	7.3	8.0	6.8	8.6	8.3	8.2
Financial intermediation	2.6	3.6	1.6	5.8	5.4	5.0
Real estate, renting & business activities	10.7	13.7	7.8	17.5	17.5	13.4
Public administration and defence	7.1	8.0	6.3	6.8	6.9	6.6
Education	6.0	5.5	6.5	4.9	5.1	4.9
Health and social work	7.5	9.5	5.6	5.1	5.0	5.3
Other community, social, personal service activities	4.5	5.6	3.5	4.5	4.6	4.0
Activities of households	0.1	0.2	0.0	0.2	0.2	0.4

Note: The table reports employment and GVA shares in % for NUTS 2 regions in 2001.

Source: Eurostat.

When moving to NUTS 2 level data (table 2) we find that the lower orientation of the new Member States regions of CENTROPE on services applies to almost all service sectors[5], but is most pronounced in real estate and business services. This points to particular structural deficits in these activities. Finally, NUTS 2 level data suggest that one of the CENTROPE region's main characteristics is its sectoral diversity (chart 1). At the level of 15 broad sectors the CENTROPE region is less specialised than the average EU-15 region, and is characterised by a relatively diversified structure.[6]

These results are indicative of the overall situation of the CENTROPE. On the one hand the CENTROPE region is characterised by substantial internal regional disparities, which reflect the typical (historically determined) differences between

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[5] The only exceptions are education with respect to employment and health and social services with respect to GVA. Both sectors, however, belong to the non-market services, where employment shares are heavily influenced by national institutions. These exceptions may therefore in part reflect institutional rather than economic differences between countries.

[6] This diverse structure is a result of the substantial structural differences within the region and is also documented at a more detailed level by *Krajasits – Neuteufl – Steiner* (2003), who consider this as one of the region's main attractions as a location for production.

old and new Member States. On the other hand compared to the latter CENTROPE is comprised of a set of more "modern" (i.e. more service oriented and less agricultural) regions, which is especially true for Vienna and Bratislava as well as fast growing regions in Western Hungary.

Chart 1: Specialisation in CENTROPE and the EU-25
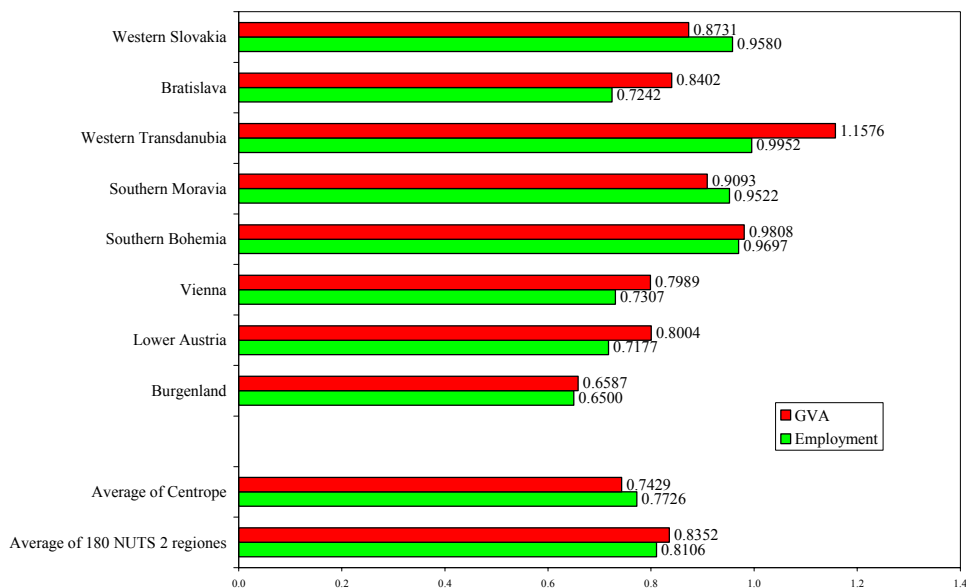
Note: The table reports Herfindahl Indices for employment and GVA in 15 NACE groups in 2001.

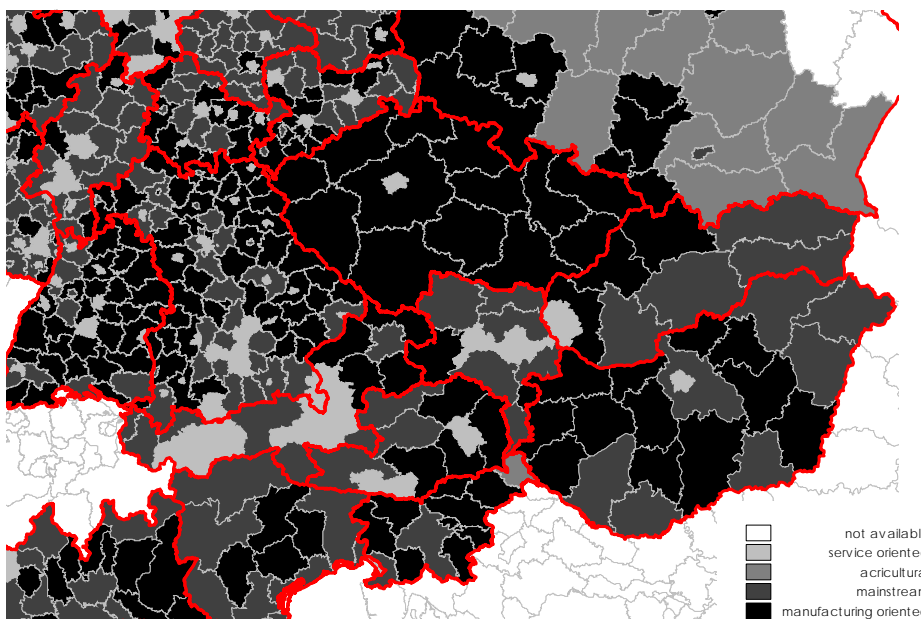*Source: Eurostat, Austrian Institute of Economic Research..*

3.1. Regional Types in CENTROPE

"These general findings should, however, not mask the substantial heterogeneity among the regions of CENTROPE. Performing a cluster analysis on regional employment shares at the NUTS 3 level of the EU in total we find that the regions of CENTROPE can be grouped into three out of four EU clusters (see table 3 and chart 2).

- "Industrial regions": The majority of the new member state regions belong to a cluster, which is characterised by high shares of manufacturing employment and GVA as well as a rather low productivity level. Apart from the bulk of the regions in the new Member States this industrial cluster also covers some smaller NUTS 3 regions, in particular in Eastern Germany. In the Austrian part of CENTROPE two regions (Mittelburgenland and Mostviertel-Eisenwurzen) belong to this cluster.

- "Mainstream regions": Most of the Austrian CENTROPE regions belong to a cluster of regions sharing an intermediate importance of industrial production. The cluster encompasses the largest part of the European NUTS 3 regions (in total 428), especially a large set of regions in Italy, Germany and Spain. It therefore may be referred to as "mainstream". Aside from the lower share of industrial employment the cluster is also characterised by a higher labour productivity than the first one.

Chart 2: Regional Types in the CENTROPE Countries

Note: Results of a Cluster analysis conducted on 1.078 EU NUTS 3 regions.

Source: Eurostat, Austrian Institute of Economic Research.

- "Service oriented regions": The capital cities of Bratislava and Vienna and a large part of their surroundings are grouped into a cluster of "service oriented regions". In the wider European context the cluster comprises 325 mostly urban and suburban regions.[7] Apart from a high share of service employment this cluster also has the highest average productivity among all regional types.

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[7] For instance in Austria most capital cities of the 9 provinces as well as their surrounding NUTS 3 regions fall into this category.

- "Agricultural regions": Last but not least, a total of 86 EU regions share an outstanding role of agriculture in their economic base, which goes along with a small services sector and low productivities. While regions from the eastern and southern EU periphery cluster here, none of the regions of CENTROPE fall in this rather problematic category.

Table 3: Descriptive Statistics on Clusters Identified at the EU Level

	Agricultural Regions	Service Regions	Mainstream Regions	Industrial Regions
Number of regions from ...				
Old member States	51	322	397	188
of this in CENTROPE	0	3	6	2
New Member States	35	3	31	44
of this in CENTROPE	0	1	1	9
Total	86	325	428	232
Average employment share in ...				
Agriculture	34.9	2.7	6.3	6.1
Manufacturing	21.2	20.1	29.7	41.3
Services	43.9	77.2	64.0	52.7
Average GVA Share in ...				
Agriculture	11.9	1.8	3.9	3.3
Manufacturing	24.6	23.0	30.7	41.4
Services	63.5	75.3	65.4	55.3
Average Productivity[1]) in...				
Agriculture	7,809	24,142	25,572	21,148
Manufacturing	22,143	52,404	43,475	39,432
Services	28,448	44,748	42,254	40,407

Note: The table reports cluster means for 1.078 NUTS 3 regions. Data on French, Dutch and Cyprus regions are not included.
[1]) Productivity = GVA/Employee.

Source: Eurostat, Austrian Institute of Economic Research.

Overall, these results reconfirm the earlier findings suggesting that CENTROPE may be characterised as a region with substantial structural disparities, which parallel those found in the enlarged EU in general. There are, however, a number of structural features which may lead one to expect better conditions for growth and catching up in productivity than in other cross-border regions at the former external border of the EU. In particular the region can claim a strong urban core, consisting of the "twin cities" of Vienna and Bratislava and their surroundings. Furthermore, the CENTROPE – in contrast to many of the southern European as well as east Polish regions – has no lagging regions with a high share of

agricultural employment. In addition the results suggest that in addition to the East-West dichotonomy a second albeit less pronounced divide exists within the region, distinguishing urban regions and a number of (from a European perspective) industrial regions.

3.2. Structural Preconditions for Employment Growth

This raises the question to what degree the sectoral structure of the region is conducive for growth and what share of the healthy growth performance of the region – and in particular of its eastern parts – is due to a favourable sectoral structure. To address this issue we perform a shift share analysis of regional GVA and employment growth for all EU NUTS 2 regions for which data were available.[8] The starting point of this analysis is that for any given economic indicator (e.g. GVA and employment) the difference in growth rates between the regional (x_i) and the EU level (x_{EU}) can be written as

$$(1) \qquad x_i - x_{EU} = \sum_j (s_{ij} x_{jEU} - s_{jEU} x_{jEU}) - \sum_j (s_{ij} x_{jEU} - s_{ij} x_{ij})$$

where s_{ij} and s_{jEU} denote the shares of sector j in region i and in the EU and x_{ij} and x_{jEU} are the sectoral growth rates of sector j in region i and in the EU, respectively. The right hand side of equation (1) thus decomposes growth into two components:

- The first term ($\sum_j (s_{ij} - s_{jEU}) x_{jEU}$) measures the growth differential between region i and the EU that would have resulted if all sectors had grown with the EU-wide sectoral growth rate. Thus, if a region has (relative to the EU) a large share of sectors with high EU-wide growth rates, this factor would be positive. By contrast, if there is a disproportionately large regional share of (at the EU level) slow-performing sectors, this factor will be negative. Thus, the term denotes a structural effect on regional growth.

- The second term on the other hand denotes a regional effect to growth. If it is positive (negative), this indicates that the average sector in a region is growing faster (slower) than in the EU. This fact could be traced to differences in regional development potentials (e.g. in geographical location, infrastructure or economic policy), but (in our case) also to a general catching up process of lagging regions, which encompasses all sectors.

This work horse method of regional economics has been frequently used in the literature on regional development. For transition economies *Traistaru – Wolf* (2003) in their analysis for Bulgaria, Hungary, Poland, Romania, Slovakia and Slovenia showed that in 1990 to 2000 regional effects were the dominant drivers of regional employment growth, explaining over 90% of the variation in regional growth rates. For Austria *Mayerhofer – Palme (2001)* and *Mayerhofer – Huber*

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[8] We use NUTS 2 digit data in this decomposition on account of its greater sectoral breakdown.

(2005) performed a Shift-Share-Analysis at the provincial level. According to their results the Austrian part of CENTROPE is characterised by relatively inhomogeneous developments. For Vienna they identified a positive structural effect, accompanied by a negative regional effect. By contrast, for Burgenland they depicted structural disadvantages combined with a highly positive regional effect. However, all these studies focus on regional developments relative to the national average. Hence, we extend this evidence by focusing on regional growth relative to the EU-wide benchmark.

Chart 3: Structural and Regional Effects on GVA and Employment Growth of the Old and New EU Member States
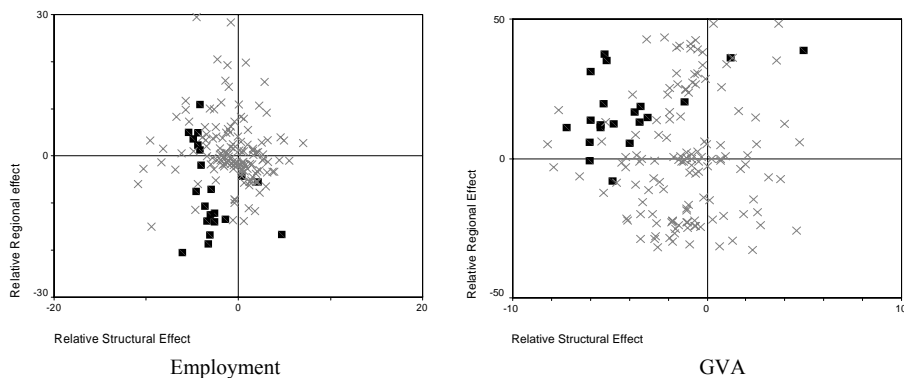
Employment   GVA

Note: The table reports results of a shift share analysis for employment and GVA of the NUTS 2 regions in 14 EU Member States, 1995–2001
X-Regions of old Member States;
■ – Regions of new Member States.

Source: Eurostat, Austrian Institute of Economic Research.

Chart 3 presents results for all regions in our data set. As can be seen, the regions of the new Member States of the EU show negative structural effects, thus suggesting that these regions entered the observation period with an employment and GVA structure that was not conducive to growth. The only regions in the new Member States that profited from a high concentration of sectors with a high EU-wide employment growth were the capital cities of Budapest, Prague und Bratislava. In terms of GVA growth only Budapest und Prague profited from a favourable sectoral structure.

By contrast, the regional effect is mostly positive for GVA growth but mostly negative for employment growth in the new Member States' regions. The only regions which have a negative regional effect with respect to GVA growth in the new Member States are Northern and Central Moravia, while for employment growth positive regional effects are found in only 6 Hungarian NUTS 2 regions.

Thus the majority of the new member state regions achieved more rapid GVA growth within sectors in 1995 – 2001. The rapid productivity catch up that occurred in these countries, however, precluded a positive regional effect with respect to employment growth.

Table 4: Structural and Regional Effects on Growth in the CENTROPE Region

	Employment Growth			GVA Growth		
	Growth-differential	Structural effect	Regional effect	Growth-differential	Structural effect	Regional effect
Burgenland	+ 1.2	–3.4	+ 4.6	– 4.1	–3.4	– 0.7
Lower Austria	– 3.2	–2.3	– 0.9	– 5.7	–2.7	– 3.1
Vienna	– 3.5	+3.0	– 6.5	– 8.9	+2.4	–11.3
Southern Bohemia	–14.7	–2.6	–12.1	+ 5.6	–5.5	+11.1
Southern Moravia	–14.9	–1.4	–13.5	+ 9.5	–3.5	+13.0
Western Transdanubia	– 2.9	–4.2	+ 1.3	+29.9	–5.2	+35.1
Bratislava	– 3.4	+2.1	– 5.5	+19.1	–1.2	+20.2
Western Slovakia	–12.1	–4.6	– 7.5	+ 3.9	–7.2	+11.1

Note: The table reports results of a shift share analysis for employment and GVA on EU NUTS 2 regions, 15 sectors, 1995–2001 in percentage points.

Source: Eurostat, Austrian Institute of Economic Research.

Considering the results of this analysis for the NUTS 2 regions of CENTROPE in detail (table 4) we find some striking similarities between the Austrian and new member state regions of CENTROPE. All of the regions in the new Member States (with exception of Bratislava) are characterised by a negative structural effect in both GVA and employment growth, while the regional effect is positive for GVA growth but negative (with the exception of Western Transdanubia) for employment growth. Somewhat more surprisingly, similar results apply to the majority of the Austrian regions in CENTROPE. In particular both employment and GVA growth in the Austrian regions (with the exception of Vienna) is burdened by a sectoral structure not conducive to regional growth. Furthermore, the regional effect is positive for employment growth in Burgenland only.[9]

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[9] The Burgenland is somewhat of an outlier in Austrian regional development with exceptionally high employment and GVA growth throughout the 1990's. This may be attributed to a combination of eligibility for structural funds, relocation of economic activity from Vienna, opening of Eastern Europe and a general catch-up process of this least developed region of Austria (see *Huber*, 2005 for details).

4. Structural Change and Productivity Growth

4.1 The Extent and Direction of Structural Change

In 1995 thus most of the regions of CENTROPE (except its urban areas) were characterised by sectoral structures which did not encourage growth. The high growth in the new member state regions of CENTROPE primarily resulted from productivity catch up. This in turn implies that growth in the region was in general not very employment intensive.

Table 5: Extent and Direction of Structural Change in CENTROPE and the EU (1995 – 2001)

	EU	CENTROPE	Old Member states		New Member States	
			Total	CENTROPE	Total	CENTROPE
Change in employment shares in percentage points (NUTS 3 level, 3 sectors)						
Agriculture	−1.09	−2.16	−0.87	−1.13	−2.84	−2.66
Manufacturing	−2.25	−2.16	−2.35	−4.50	−0.38	−0.47
Services	+3.34	+4.31	+3.23	+5.63	+3.22	+3.13
Change in GVA shares in percentage points (NUTS 3 level. 3 sectors)						
Agriculture	−0.49	−0.57	−0.48	−0.46	−1.70	−1.80
Manufacturing	−2.70	−1.25	−2.74	−0.74	−2.33	−2.24
Services	+3.20	+1.82	+3.22	+1.20	+4.02	+4.03
Turbulence Index (NUTS 3 level. 3 sectors)						
Employment	0.043	0.044	0.042	0.044	0.056	0.046
GVA	0.042	0.044	0.042	0.021	0.052	0.058
Turbulence Index (NUTS 2 level. 15 sectors)						
Employment	0.062	0.061	0.063	0.063	0.072	0.067
GVA	0.064	0.062	0.060	0.052	0.069	0.073

Note: Data on France, the Netherlands Cyprus, Estonia, Poland, Lithuania, Slovenia and Greece are excluded due to missing data problems. The turbulence indicator is calculated as $1/2\Sigma_i|s_{it} - s_{it-1}|$ with s_{it} (s_{it-1}) the sectoral employment (GVA) share of a region at time t (t-1).

Source: Eurostat, Austrian Institute of Economic Research.

Unfavourable structural preconditions, however, do not last forever: The CENTROPE region experienced substantial structural change in the last decade. In table 5 we show changes in sectoral GVA and employment shares and the turbulence index as an indicator of the speed of structural change[10] for our NUTS 3 and NUTS 2 level data. While according to these results CENTROPE in total hardly differs from the average of the EU in terms of the speed of structural

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[10] This indicator is defined as $\frac{1}{2}\Sigma_i|s_{it} - s_{it-1}|$ where s_{it} (s_{it-1}) are the shares of sector i in total employment (GVA) of a region in period t (t-1). The indicator takes on a maximum of 1 (for total structural change) and a minimum of 0 (no structural change).

change, there are some important differences between its' western and eastern parts. Structural change in terms of GVA was particularly pronounced in the eastern part of CENTROPE. By contrast, the change of the employment structure in the new member state regions was somewhat slower in the second half of the 1990s than in the regions of other new Member States. By contrast, the Austrian parts of CENTROPE differed from overall EU regions by a substantially slower structural change in GVA.

Furthermore in the CENTROPE region – as well as in the rest of the EU – the predominant tendency was tertiarisation and deindustrialisation. This tertiarisation was somewhat stronger in terms of the GVA in the new member state regions of CENTROPE but somewhat weaker (than at least in the Austrian CENTROPE regions) in terms of employment. In addition, the eastern parts of CENTROPE as well as the new member state regions in total were marked by a substantially more pronounced de-agrarisation in employment and GVA than the regions in the old Member States (due to a higher share of agricultural employment in 1995). However, a more detailed analysis at the level of individual NUTS 3 regions (see *Huber – Mayerhofer*, 2006) suggests that the share of agriculture in employment and GVA declined in all new Member States' regions of CENTROPE. This is important because recent research (*Mickiewicz – Zalewska*, 2001) has shown that in a number of countries and regions transition was associated with a tendency of re-agrarisation – an indicator of unsuccessful reforms as it was associated with declining income levels and a predominance of subsistence farming. Against this background, the direction of industrial change in the eastern part of CENTROPE can be taken as another indication of a successful transition of the region, which is without doubt more developed than many other (agricultural) regions in the new Member States. In the Austrian regions of CENTROPE by contrast the employment share in manufacturing declined more rapidly than in the eastern parts of CENTROPE, but GVA shares reduced less rapidly. This indicates a substantial relative productivity growth in manufacturing in the western part of CENTROPE.

4.2 The Contribution of Structural Change to Productivity Growth

While this evidence indicates substantial changes in relative productivities, it does not give an answer to the question of how structural change contributed to productivity growth in CENTROPE. To address this issue we shift our analysis from the NUTS 3 to the NUTS 2 level data base – which provides more detailed sectoral information – and once more perform a shift share decomposition of growth in the CENTROPE region. We follow *Fagerberg* (2000), *Timmer – Szirmai* (2000) *Peneder* (2003) and *Havlik* (2005) by taking into consideration that the change in total productivity (P_{it}) in a region i at time t can be described as a weighted average of changes of sectoral productivities, whereby the weights are the

employment shares (S_{ijt}) of sector j in region i in year t. More formally total productivity in region i can thus be written as:

(2)
$$\Delta P_{iT} = \sum_j P_{ij2001}S_{ij2001} - \sum_j P_{ij1995}S_{ij1995}$$

with Δ the difference operator. As shown in the cited literature, this can be rearranged to the following expression for total productivity growth:

(3)
$$\Delta P_{i1995/2003} = \{\sum_j P_{ij1995}(S_{ij2001} - S_{ij1995})\}$$
$$+ \{\sum_j (P_{ij2001} - P_{ij1995})(S_{ij2001} - S_{ij1995})\}$$
$$- \{\sum_j (P_{ij2001} - P_{ij1995})S_{ij1995}\}$$

The three terms on the right hand side of equation 3 have economically interesting interpretations:

- The first term ($\sum_j P_{ij1995}(S_{ij2001} - S_{ij1995})$)) measures the so called 'static structural change effect'. It is positive (negative), if sectoral employment shares in a region increase in sectors with a high (low) average productivity level. It thus provides information on the relevance of the so called "structural bonus hypothesis" (see *Fagerberg*, 2000), which states that in the course of economic development sectors with high productivities also increase their employment shares.

- The second term ($\sum_j (P_{ij2001} - P_{ij1995})(S_{ij2001} - S_{ij1995})$)) is referred to as the 'dynamic structural change effect'. It is positive, if sectors with above average productivity growth also expand their employment shares disproportionately but negative, if – as often claimed in the literature (e.g. by *Baumol*, 1967, who refers to this as the "structural burden hypothesis") – sectors with high productivity growth have lower than average employment growth.

- The third term ($\sum_k (P_{ik2001} - P_{ik1995})S_{ik1995}$), finally, represents an '(intra-) sectoral growth effect': It measures the hypothetical productivity increase in a region that would have resulted if the sectoral employment structure had remained unchanged in the observation period.

In table 6 we show the results of this decomposition. As can be seen the sectoral growth effect contributes around 90% to total labour productivity growth. Thus, even if the sectoral employment structure among the 15 sectors in our NUTS 2 data base had remained unchanged in 1995 – 2001, productivity growth would have been only 10% lower in the regions than actually observed. Obviously, the overwhelming part of productivity growth resulted from increased productivity *within* sectors rather than from higher employment growth in sectors performing particularly well in terms of productivity growth.

While this result is in line with recent findings at a national level (*Fagerberg,* 2000; *Timmer – Szirmai,* 2000; *Peneder,* 2003 or *Havlik,* 2005), this is not the case for our result that the dynamic structural change effect is negative for all regions. This finding is, however, consistent with *Baumol*'s (1967) conjecture that sectors with higher productivity growth expand employment less rapidly than sectors with lower productivity growth (the 'structural burden hypothesis'). The static structural change effect, however, is positive and larger than the negative dynamic structural change effect. Therefore, sectors characterised by a higher productivity in 1995 also showed higher employment growth and thus contributed to a productivity catch up in the CENTROPE region.

Table 6: Contribution of Shift Share Components to Productivity Growth

	EU	CENTROPE	Old Member States		New Member States	
			Total	CENTROPE	Total	CENTROPE
			Static Structural Change			
Total	+ 7.95	+22.20	+ 7.88	+ 49.36	+ 8.99	+ 6.42
Agriculture	− 2.71	− 6.36	− 2.71	− 11.61	− 2.67	− 3.31
Manufacturing	− 5.22	−16.56	− 5.43	− 40.92	− 2.17	− 2.41
Services	+15.88	+45.13	+16.02	+101.89	+13.83	+12.14
			Dynamic Structural Change			
Total	− 3.40	−15.65	−3.34	−39.93	− 4.23	− 1.54
Agriculture	− 0.89	− 2.23	−0.83	− 2.13	− 1.83	− 2.28
Manufacturing	− 3.01	− 5.60	−3.02	−12.61	− 2.93	− 1.52
Services	+ 0.51	− 7.82	+0.51	−25.18	+ 0.53	+ 2.26
			(Intra-)Sectoral Growth			
Total	+95.44	+93.45	+95.45	+90.56	+95.24	+95.12
Agriculture	+ 3.57	+ 7.35	+ 3.42	+ 7.66	+ 5.84	+ 7.17
Manufacturing	+30.49	+52.64	+29.98	+78.26	+38.06	+37.75
Services	+61.38	+33.45	+62.06	+ 4.64	+51.34	+50.20
			Total Structural Change			
Total	+ 4.55	+ 6.55	+ 4.54	+ 9.43	+ 4.76	+ 4.88
Agriculture	− 3.60	− 8.59	− 3.54	− 13.74	− 4.50	− 5.59
Manufacturing	− 8.23	−22.16	− 8.45	− 53.53	− 5.10	− 3.93
Services	+16.39	+37.31	+16.53	+ 76.71	+14.36	+14.40

Note: The table reports shares of total productivity growth 1995–2001 in %, unweighted means of NUTS 2 regions in 14 EU Member States. Productivity is measured as GVA (in euro at current exchange rates) per employee.

Source: Eurostat, Austrian Institute of Economic Research.

In terms of the regional variation of the individual effects (table 7) we see that the primary difference between Austrian and new Member States' regions of CENTROPE is that the dynamic structural change effect is particularly negative – both relative to the new as well as the old Member States – in the former. A closer analysis makes clear that this phenomenon is primarily due to employment and

productivity shifts in the service sector. Obviously, service sectors with a high productivity growth showed a lower employment growth. This particularity in Austrian regions may be a consequence of a number of important liberalisation measures which occurred in particular in (highly productive) service sectors in recent years (e.g. liberalisation of the telecommunication sector, mergers and acquisitions in financial services).

Table 7: Contribution of Shift Share Components to Productivity Growth

	Burgen-land	Lower Austria	Vienna	Southern Bohemia	Southern Moravia	West-Trans-danubia	Bratis-lava	Western Slovakia
	Static Structural Change							
Total	+ 80.69	+ 35.18	+ 33.37	− 1.06	− 2.26	+14.83	+13.96	+ 4.27
Agriculture	− 22.85	− 13.32	− 0.50	− 3.92	− 2.13	− 4.22	− 1.51	− 5.47
Manufacturing	− 24.55	− 59.41	− 40.53	− 0.75	− 1.64	− 1.13	− 3.21	− 6.00
Services	+128.09	+107.92	+ 74.39	+ 3.61	+ 1.51	+20.18	+18.68	+15.73
	Dynamic Structural Change							
Total	− 57.97	− 32.73	− 29.95	+ 0.53	− 1.68	− 7.39	+ 1.85	− 0.84
Agriculture	− 5.07	− 1.51	− 0.08	− 2.48	− 1.43	− 1.15	− 1.04	− 6.49
Manufacturing	− 8.76	− 17.48	− 12.12	+ 2.15	− 0.49	− 4.98	− 2.27	− 1.52
Services	− 44.14	− 13.74	− 17.75	+ 0.86	+ 0.24	− 1.26	+ 5.16	+ 7.17
	(Intra-)Sectoral Growth							
Total	+77.28	+ 97.55	+96.58	+100.54	+103.95	+ 92.56	+ 84.20	+96.57
Agriculture	+16.51	+ 7.02	+ 0.49	+ 9.24	+ 7.28	+ 3.44	+ 2.10	+16.99
Manufacturing	+70.53	+120.71	+51.45	+ 46.05	+ 40.97	+ 54.12	+15.81	+33.13
Services	− 9.77	− 30.18	+44.64	+ 45.25	+ 55.70	+ 34.99	+66.28	+46.46
	Structural Change							
Total	+22.72	+ 2.45	+ 3.42	− 0.53	− 3.94	+ 7.44	+15.81	+ 3.43
Agriculture	− 27.92	− 14.83	− 0.58	− 6.40	− 3.56	− 5.37	− 2.55	− 11.96
Manufacturing	− 33.31	− 76.89	−52.65	+ 1.40	− 2.13	− 6.11	− 5.48	− 7.52
Services	+83.95	+ 94.18	+56.64	+ 4.47	+ 1.75	+18.92	+23.84	+22.90

Note: The table reports shares of total productivity growth 1995–2001 in %, unweighted means of NUTS 2 regions in 14 EU Member States Productivity = GVA (in Euro at current exchange rates) per employee.

Source: Eurostat, Austrian Institute of Economic Research.

Furthermore table 7 shows that among the Austrian CENTROPE regions Burgenland is somewhat of a special case. Here the contribution of the static structural change effect to total productivity growth was the largest among all regions. Thus in Burgenland, which combines a low development level relative to the Austrian average and a rapid catching up process, the employment structure is clearly moving towards more productive sectors. At the other extreme, in the Czech Regions (Southern Moravia and Southern Bohemia) the static structural change effect is slightly negative. This indicates that in these regions employment increased primarily in sectors with a low productivity in 1995. In addition, in

Southern Moravia the dynamic structural change effect is also negative, while in Southern Bohemia it is positive but very small. The Czech regions of CENTROPE would thus have shown a (by between 0.5% and 4%) higher productivity growth, if no structural change had occurred at all. In Bratislava and Western Transdanubia, by contrast, sectors which had a high productivity already in 1995 also expanded their employment disproportionately (positive static structural change effect), thus contributing to productivity catch-up. In addition, Bratislava also belongs to one of the few regions in CENTROPE where the dynamic structural change effect is positive, due to a high employment growth in service sectors with high productivity growth.

In consequence the contribution of structural change in employment to productivity growth (which was particularly high in the new Member States regions in the late 1990's) was rather modest. In most regions structural change (both dynamic and static) contributed less than 10% to total productivity growth, and there are only a few significant differences between new and old member state regions in this respect. We find, however, that the contribution of structural change to productivity growth was particularly high in Bratislava and Burgenland, while in the Czech Regions productivity increases were hampered by a structural change to sectors with low initial productivity levels.

5. Competitiveness and Structural Change in CENTROPE's Manufacturing Sector: Evidence from Foreign Trade Statistics

To sum up, our results indicate that the CENTROPE region is a typical border region at the economic divide between old and new EU Member States, with marked differences between its sub-regions. The region is advantaged in its development perspectives compared to other areas in the new integration space due to its strong urban core and a lack of peripheral and rural areas. On the other hand, structural preconditions were not conducive to growth and structural change contributed only little to productivity growth to date. All these results however, stem from a rather aggregated data base (15 sectors), putting the analysis to the risk of misleading conclusions due to a substantial heterogeneity of individual industries within sectors.

To overcome this weakness at least partially we in the following focus on a rather disaggregated database on world trade set up by the UN. By analysing the evolutions of trade patterns of the CENTROPE countries at a national level, we are able to gain deeper insights into specialisation and structural change in the region's manufacturing sector. We identify the comparative advantages of CENTROPE's goods producing sector, analyse changes in trade and (as a consequence) production patterns, identify recent trends in terms of specialisation and diversity

and ask if the integration of very unequal trade partners is reflected in the speed of change.

First of all, UN world trade data provide ample evidence that integration of the CENTROPE countries into world trade proceeded rapidly in recent years (chart 4). Exports of manufactured goods from the CENTROPE Countries to the rest of the world more than doubled between 1995 and 2003. Austrian exports increased by 80%, but exports of the eastern CENTROPE countries tripled. The new EU Member States of CENTROPE succeeded especially at the European internal market, where they achieved impressive gains in market shares. Overall, the share of the CENTROPE countries in total EU-25 imports increased from 3.9% in 1995 to 5.4% in 2003, with Hungary (from 0,4% to 1,2%) and the Czech Republic (from 0,9% to 1,4%) achieving the largest improvements. As a consequence the openness of the new Member States of CENTROPE with respect to the EU is now larger than that of the average EU country: In 2003 Hungary exported 73% of its exports to the old EU Member States, while the Czech Republic stood at 69.8% and Slovakia at 60.8%.

Chart 4: Foreign Trade of CENTROPE Countries (in billion euro)
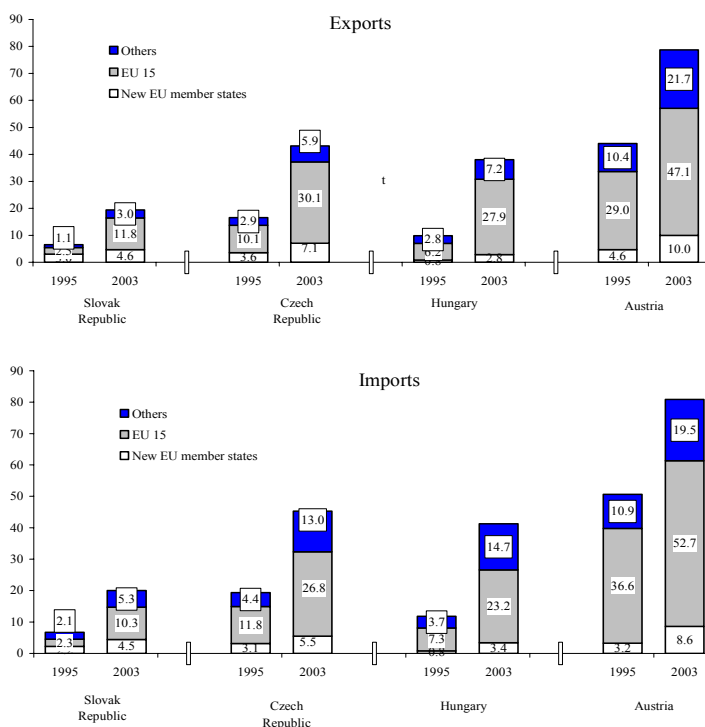
Source: UN-World Trade Data Base, Austrian Institute of Economic Research.

While this rise in exports indicates that the CENTROPE countries' strive for competitiveness was rather successful, this is even more true when looking at exports and imports of these countries simultaneously. The trade balance improved from EUR –7.64 billion to + 6.73 billion vis-à-vis the EU-25 and from EUR –6.00 billion to +1.67 billion vis-à-vis the rest of the world between 1995 and 2003. While improvements can be seen in all countries, Hungary and the Czech Republic clearly stand out vis-à-vis the EU-25, while Austria was especially successful vis-à-vis the rest of the world.

Looking at a broad sectoral dimension, these impressive results were realized on the basis of rather different trade patterns. In general, the export portfolio of the CENTROPE differs considerably from that of the old EU Member States: Arising strengths in electrical and optical equipment and transport equipment complement more traditional (but shrinking) specialisations in basic and fabricated metal products, wood and wood products as well as pulp, paper and paper products in recent years. On the other hand export shares in chemicals and plastic products, refined petroleum products and (recently) food products were comparatively small. Within CENTROPE different supply patterns coexist, whereby specialisations are more complementary than rival and not always in line with theoretical expectations: For instance trade increases in the last decade were strongly focused on electronics and optics in Hungary and the Czech Republic and on transport vehicles in Slovakia, Hungary and the Czech Republic. This implies that by 2003 the eastern CENTROPE countries were more specialised on these core areas of the technology sector than Austria. By contrast, this most developed country of CENTROPE holds strong (and stable) specialisations in wood products, paper and textiles. Thus, in contrast to economic theory which would predict that low labour costs will lead to a predominance of labour intensive industries in the new Member States of CENTROPE, actual trade patterns suggest a more technology oriented trade structure in these countries than in Austria.

When moving to a sectorally more disaggregated level of individual industries and analysing these trade data by using a series of typologies of industries developed in Peneder (2001, 2002) and Aiginger (1997) (see table 8), however, a somewhat more differentiated picture emerges. Grouping industries according to their factor intensity[11], we find that all CENTROPE countries are somewhat more specialised in labour intensive industries and (with the exception of Hungary) in

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[11] This typology (taken from *Pender*, 2002) groups NACE 3-digit industries into, capital, marketing, technology and labour intensive industries according to their factor inputs. A fifth group comprising industries without a dominant factor input is denoted as traditional industries.

Table 8: Export Structure of CENTROPE Countries (Share of Total Exports with the Rest of the World in %)

	Slovakia		Czech Republic		Hungary		Austria		CENTROPE Countries		EU-15	
	1995	2003	1995	2003	1995	2003	1995	2003	1995	2003	1995	2003
Factor intensity												
Traditional industries	25.6	21.2	30.2	30.2	22.0	20.1	30.7	28.0	29.2	26.1	23.5	21.7
Capital intensive	39.6	26.5	24.6	19.5	20.1	13.2	21.5	17.9	23.5	18.2	20.9	19.5
Marketing intensiv	9.5	7.5	12.1	9.2	21.8	8.5	10.9	13.1	12.3	10.6	14.5	12.8
Technology intensive	10.4	29.3	16.9	30.0	19.1	50.1	24.4	29.5	21.0	34.0	32.1	38.0
Labour intensive	14.9	15.4	16.2	11.1	17.1	8.1	12.4	11.5	14.0	11.1	9.1	7.9
Skill intensity												
Low qualification	44.8	26.5	38.4	23.7	46.3	18.7	27.6	24.4	33.5	23.2	27.8	23.2
Medium qualification/ blue collar	18.1	40.2	24.2	30.5	14.4	24.5	25.4	28.0	23.3	29.2	21.1	22.3
Medium qualification/ white collar	27.4	24.3	24.1	25.7	29.4	41.0	28.4	26.7	27.5	29.2	29.8	30.8
High qualification	9.8	9.1	13.2	20.2	9.9	15.8	18.6	20.9	15.7	18.3	21.2	23.6
Quality in competition												
low	48.2	29.1	38.0	27.7	36.2	26.0	29.9	25.3	33.8	26.4	24.8	22.3
medium	26.4	27.8	26.5	33.2	29.4	29.3	30.8	29.2	29.4	30.1	30.0	28.3
high	25.5	43.1	35.5	39.1	34.3	44.7	39.4	45.5	36.8	43.5	45.2	49.4

Source: UN – World Trade Data base, Austrian Institute of Economic Research. Highlighted values denote export shares that exceed those of the EU-15.

traditional industries than the EU-15. In addition, the Czech Republic and Slovakia still hold a specialisation in capital intensive industries. Similarly, concerning human capital intensity[1], high export shares in industries with low and medium skilled blue collar qualifications are rather ubiquitous and dominate export structures in all countries but Hungary even in 2003. Finally, an analysis of the trade patterns by the role quality plays in product market competition[2] completes this evidence: Again we find that both the new Member States of CENTROPE as well as Austria are specialised in sectors, where quality competition plays a minor or at best intermediate role for market success.

Table 8, however, also documents a striking up-grading of the supply structures in the eastern CENTROPE countries in general and in Hungary in particular: Export shares in labour and capital intensive industries declined in part dramatically in 1995–2003, this as a rule in favour of technology intensive industries, whose export shares rapidly approached to western standards in Slovakia and the Czech Republic and already exceed this benchmark in Hungary. Similar trends can be seen in human capital intensity and product quality: Export shares in low-skill industries more than halved in Hungary and declined by 40% in Slovakia and the Czech Republic within only eight years. In 2003, about 40% to 45% of eastern CENTROPE's exports to the world were in a segment with high quality competition.

While the new Member States of CENTROPE thus experienced a rapid change of exports to more "modern", technology and skill intensive activities, trade patterns of Austria only partially reflect the comparative advantages of a highly developed industrial country. Also here structural change to technology and (foremost) marketing intensive activities is under way, but the speed of this change is considerably lower. As a result, Austria's export portfolio was not more sophisticated than that of the eastern countries of CENTROPE in 2003, although income and therefore wage levels were incomparably higher.

Chart 5 underlines these deficits in Austria's structural competitiveness by plotting export shares in the most sophisticated industry groups against the economic development levels of the countries observed. We see a steep development of technology intensive and skill intensive activities in the new EU Member States of CENTROPE, which in the end leads to remarkably high export shares in the respective industries – at least if one takes the comparably low levels of economic development in these countries into account. On the other hand, there is no significant catching up of Austria in a sectoral dimension: Evolutions here more or less follow the flatter development patterns of the EU-25, albeit export

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[1] This typology from *Peneder* (2001) groups industries into four groups (low skill, medium skill blue collar, medium skill white collar and high skill) according to the qualification of workers employed in these industries.

[2] This typology due to *Aiginger* (1997) considers price differentials within industries to determine the role of quality (and alternatively price) in product market competition.

shares in sophisticated (especially technology intensive) industries are comparably low in Austria given the high GDP per Capita of this western part of CENTROPE.

Chart 5: Evolutions in the Export Shares of the Most Sophisticated Industry Groups (Exports to the Rest of the World and GDP per Capita (PPP), 1995 and 2003)
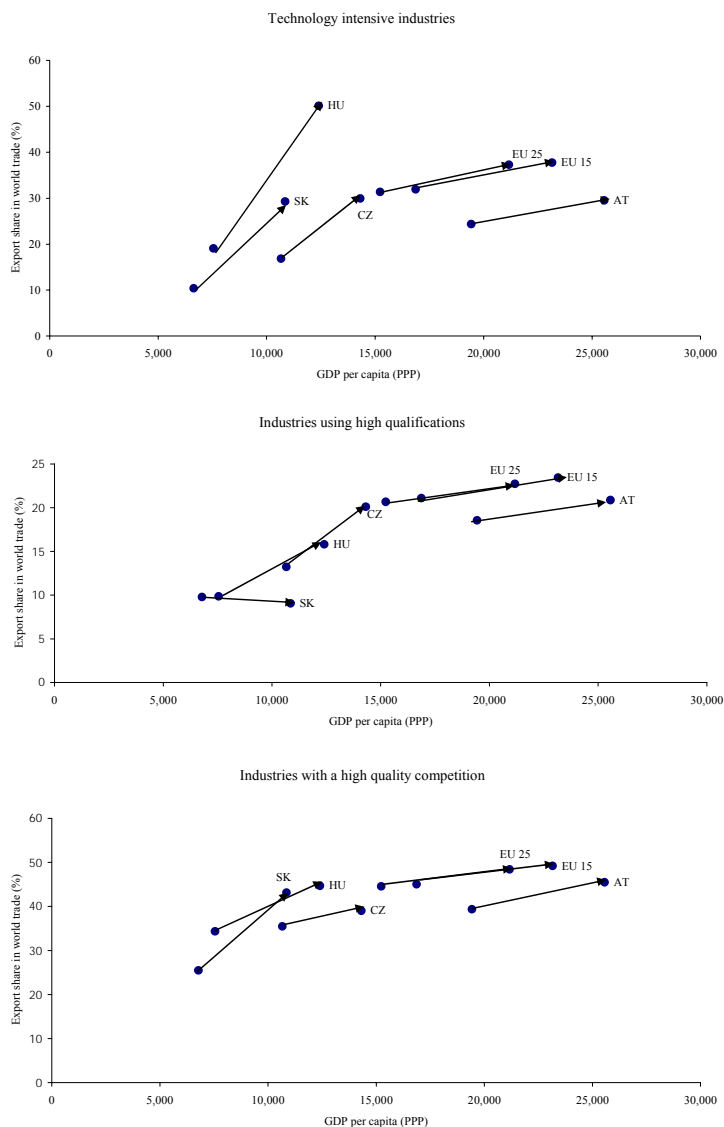
Source: UN – World Trade Database, Eurostat, Austrian Institute of Economic Research.

Table 9: Export-Unit-Values by Industry Types (Price (EUR) per kg in Trade with the Rest of the World)

	Slovakia		Czech Republic		Hungary		Austria		CENTROPE Countries		EU-15		EU 25	
	1995	2003	1995	2003	1995	2003	1995	2003	1995	2003	1995	2003	1995	2003
Factor intensity														
Traditional industries	0.95	1.98	1.30	2.24	2.15	3.58	3.34	3.76	2.13	2.94	3.79	4.01	3.55	3.78
Capital intensive	0.28	0.40	0.31	0.59	0.40	0.65	0.82	0.80	0.47	0.62	0.56	0.65	0.53	0.63
Marketing intensive	0.75	1.20	1.03	0.66	1.33	1.90	4.66	4.04	1.20	1.15	1.44	1.57	1.39	1.50
Technology intensive	3.07	8.70	4.70	10.53	5.69	19.18	12.86	17.34	8.50	14.43	12.09	13.94	11.77	13.67
Labour intensive	0.65	1.41	0.73	1.19	2.00	1.96	1.01	0.96	0.94	1.16	2.01	2.05	1.77	1.78
Skill intensity														
Low qualification	0.34	0.54	0.48	0.58	0.86	1.12	1.31	1.22	0.73	0.85	1.10	1.14	1.03	1.09
Medium qualification/ blue collar	0.71	2.86	1.18	2.52	2.26	5.07	3.20	3.31	1.43	2.52	3.71	4.25	3.24	3.71
Medium qualification/ white collar	0.59	0.72	0.65	1.31	0.98	2.55	1.52	1.72	1.05	1.57	1.06	1.26	1.03	1.24
High qualification	3.17	5.45	3.44	8.80	4.33	11.93	10.44	15.00	6.84	11.35	14.43	15.82	13.63	15.04
Competition in quality														
Low	0.30	0.45	0.36	0.66	0.59	1.08	1.22	1.15	0.54	0.73	0.66	0.76	0.62	0.73
Medium	0.88	1.63	1.31	2.48	1.94	3.68	2.40	2.55	1.63	2.37	2.28	2.35	2.19	2.30
High	1.52	4.93	2.16	2.10	3.10	9.36	6.61	6.90	3.76	4.53	5.48	6.47	5.21	6.12

Source: UN-World Trade data base, Austrian Institute of Economic Research.

Interestingly, hence, Austria's high performance in export values and trade balances vis a vis the EU and the world alike goes hand in hand with marked deficits in it's economic structure. This constitutes a "structure – performance – paradox" (*Peneder*, 2003a), which may however be explained by intra-sectoral improvements in skills, technology and quality. Indeed, our analysis so far only considered structural change at an inter-sectoral level by studying changes to other (more or less technology-, skill- and quality intensive) industries. However, structural change may also be intra-sectoral in nature in the sense that firms move to higher quality and price segments within a specific industry.

A comparison of the export prices obtained by the CENTROPE countries in world trade (table 9) indicates that this may indeed explain at least parts of the Austrian performance puzzle. According to UN trade data unit values of Austrian exports (EUR 2.0 per kilogram on average) exceeded the CENTROPE average (EUR 1.7) as well as the average of the EU 25 (EUR 1.8) in 2003. As one can see, Austrian export prices were higher than those of the CENTROPE in almost all industry types, with advantages particularly pronounced in marketing- and technology intensive industries. Unit values of the eastern CENTROPE countries, by contrast, also improved substantially (and especially in the industries mentioned), but remained well below both the EU-25 and the CENTROPE average. Once again an important exception is Hungarian exports. Here unit values in 2003 exceeded the EU average in a number of particularly technology intensive products after a marked catching up in the second half of the 1990's and the beginning of the new century.

To sum up, our results reveal a remarkable sectoral catching up process in eastern CENTROPE countries' manufacturing, albeit starting from a specialisation in medium and low tech sectors. Austria's economic structure, on the other hand, proceeds only slowly to more sophisticated industries, but Austrian firms were able to occupy higher positions at the quality ladder within industries. Market share losses to the eastern CENTROPE countries therefore could be avoided – in spite of an unfavourable specialisation on mid-tech and mid-skill industries – by an orientation to more quality (and therefore price) intensive segments within these industries. If such a specialisation is sustainable, however, is an open question. As table 9 reveals, Austria's price advantages in less sophisticated industries are eroding rapidly – obviously it's particularly hard to keep up quality advantages in technology and skill extensive industries over time.

6. Persistence and Change: On the Evolutions of CENTROPE's Trade Patterns

While these results indicate a remarkable up-grading of (at least eastern) CENTROPE's economic structure from an unfavourable (low-tech, low-skill) position in the mid 1990s and a slower structural change in Austria, where the

favourable competitive position is rooted primarily in higher quality products, they so far only rely on an analysis of some telling but broad typologies of industries. In the following, we extend on these results on the speed and direction of structural change by analysing the evolutions of the whole distribution of the set of (120) NACE 3 digit industries observable in our data base. In this way, we are also able to elaborate on the question, whether the increased integration into international trade led to more specialisation or (by an erosion of "old" comparative advantages) to a somewhat more diversified industrial structure.

As a first step, in table 10 we display both the so called index of compositional structural change[1] as a measure of the speed of change in CENTROPE countries world trade patterns, and the index of specialisation, which indicates the deviation of the trade structure in the individual countries from a benchmark structure (here the EU-25). By this we first of all are able to confirm our previous results on the speed of change. Indeed, foreign trade structures of the new Member States of CENTROPE changed more rapidly than those of Austria, while the latter in turn changed its trade orientation much more rapidly than the "old" EU Member States in our observation period. In fact, integration put some pressure on the border countries to restructure and modernise, and this led to a comparably strong adjustment in industrial structures. As the index of specialisation indicates, these adjustments resulted in a convergence of CENTROPE's export structure to that of the EU-25 – export orientations in nearly all CENTROPE countries (except the Czech Republic) moved to industries, which also determine the trade patterns of the other EU Member States.

Table 10: Indicators of Structural Change and Trade Orientation in the CENTROPE Countries

	Index of Compositional Structural Change			Index of Specialisation	
	1995–1999	1999–2003	1995–2003	1995	2003
Hungary	0.360	0.195	0.411	0.363	0.317
Slovakia	0.294	0.149	0.378	0.367	0.367
Czech Republic	0.194	0.148	0.280	0.285	0.298
Austria	0.094	0.072	0.138	0.222	0.214
CENTROPE	0.151	0.082	0.197	0.206	0.190
EU-15	0.060	0.053	0.081	0.012	0.017

Source: UN – World Trade data base, Austrian Institute of Economic Research.

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[1] This indicator is defined as $\frac{1}{T} \sum_j \left| s_{ijt+T} - s_{ijt} \right|$ with s_{ijt} the share of an industry j in country i in total exports at time t. Without structural change the indicator takes on a value of zero, higher structural change is indicated by higher values.

In principle, this process of structural change can be understood as a result of counteracting forces of persistence and change. On the one hand the comparative advantages of the CENTROPE countries have changed due to improved access to technologies, learning processes and foreign direct investments, characterizing the transition process and the broader process of globalisation alike. This fosters the development of new specialisations in integration, be they complementary or totally independent from former ones (*Fagerberg*, 1988; *Verspagen*, 1993). On the other hand specialisation – in particular in the face of increasing returns to scale – is self re-enforcing in nature, as industry-specific knowledge cannot easily be transferred between regions. This persistence in 'technological trajectories' (*Dosi et al.*, 1990) may lead to "sticky" trade structures. Furthermore, the strength of these forces may differ in different phases of development. While for most developed countries with well established innovation systems persistence should be dominant, in the context of the substantial change in technologies which is incorporated in transition substantial changes in economic structures may occur.

To test this hypothesis somewhat more formally we follow *Amendola – Guerrieri – Padoan* (1991), *Dalum – Villumsen* (1996) and *Guerrieri – Iammarino* (2003) and estimate for each country a Galtonian regression of the form

(4) $$\mathrm{B}_{ij}^{t} = \alpha + \beta * B_{ij}^{t-1} + \varepsilon_{ij}^{t}$$

with B a vector of Balassa-indices for the individual NACE 3 digit industries[2] (j) in country (i), and $t, t\text{-}1$ the years 1995 and 2003. We thus estimate the correlation between the specialisation patterns in the initial and the final year of our observation period[3]. In consequence the extimated regression coefficient ($\hat{\beta}$) is a measure of the persistence in trade structure, whereby four potential outcomes are possible:

- If $\hat{\beta}$ =1, tendencies of persistence dominate tendencies of change and the trade patterns remain unchanged.
- If $\hat{\beta}$ >1, the country under consideration increasingly specialises on industries which already dominate it's trade structure, while industries where trade has

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[2] The Balassa-Index for a (NACE 3 digit) industry j in country i is $B_{ij} = s_{ij} \big/ s_i^{EU25}$ with s for export shares. A value > 1 denotes a relative specialisation in the industry, while values < 1 apply for industries with a smaller export activity compared to the EU-25.

[3] A problem in implementing the model was that it requires a bivariate normal distribution while the Balassa Index – which can take on values from 0 to ∞ and has a (weighted) mean of 1 – is non-normal by construction. Preliminary tests indicated that the distribution of our dependent variable was skewed and leptokurtic for all countries, and the null of normally distributed values had to be rejected on the basis of a Jarque-Bera-test. We thus transformed the original indicator to a symmetric Balassa index of the form $SB_{ij} = \big(B_{ij} - 1 \big/ B_{ij} + 1 \big)$ which fulfils the normality assumption underlying our method.

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been weak previously reduce their export shares further. In this case, therefore, existing specialisations strengthen along the lines of the cumulative change argument ("*ß-specialisation*"; *Dahlum – Villumsen*, 1996).

- If $\hat{\beta}$ <1, industries with an initially weak export performance (on average) improve their position in foreign trade in the course of the period observed, while strong export industries loose ground. This would thus indicate a „regression towards the mean" (*Galton*, 1889). In this case specialisations loose in importance and give way to a more broad based, diversified export structure ("*ß-de-specialisation*"; *Dahlum – Villumsen*, 1996).

- If finally $\hat{\beta}$ <0, specialisation patterns reverse completely and initially strong export industries turn into weak ones and vice versa. Here forces of persistence play no essential role and trade patterns revaluate totally.

Table 11: Evolutions in Trade Specialisation in CENTROPE Countries

	$\hat{\alpha}$	$\hat{\beta}$	$t_{\beta>O}$	Wald-F-Test $(H_o:\beta=1)$
Total trade				
Slovakia	−0.121	+0.715	12.45***	24.68***
Czech Republic	−0.071	+0.729	11.65***	18.84***
Hungary	−0.193	+0.666	11.25***	31.86***
Austria	−0.010	+0.808	16.89***	16.07***
CENTROPE Countries	−0.047	+0.785	17.07***	21.81***
CEEC	−0.046	+0.732	13.64***	24.90***
EU-15	+0.001	+1.006	28.18***	0.03
Manufacturing trade				
Slovakia	−0.097	+0.751	11.12***	13.57***
Czech Republic	−0.056	+0.702	10.19***	18.69***
Hungary	−0.182	+0.568	7.56***	33.05***
Austria	+0.019	+0.700	13.10***	31.56***
CENTROPE Countries	−0.026	+0.742	15.03***	27.44***
CEEC	−0.024	+0.713	11.75***	22.29***
EU-15	−0.001	+1.055	17.24***	0.80

Note: The table reports the results of a Galtonian regression analysis on Balassa-indices, NACE 3 digit level, 1995–2003.

Source: UN – World trade data base, Austrian Institute of Economic Research.

The results of estimating equation 4 for the CENTROPE countries and the EU-15 are displayed in table 11. According to these results the hypothesis of a complete reversal of the sectoral structure of trade can be rejected at conventional levels of significance. All $\hat{\beta}$ -coefficients are larger than 0 at the 1% confidence interval. Furthermore, results from a Wald test indicate that for the EU-15 the hypothesis $\hat{\beta}$ =1 cannot be rejected, while for all countries of CENTROPE this is the case.

Hence, while in the old EU-15 Member States persistence in trade patterns dominated in 1995–2003, all CENTROPE countries experienced substantial change in export structures. In particular, in line with our previous analysis, Hungarian exports changed impressively and exceeded the speed of structural change of export structure in the CEECs in total. By contrast, in the Czech Republic and Slovakia changes in export structures were comparable to the CEECs, while in Austria structural change was substantially slower in total trade, but only slightly slower in trade in manufactures. A $\hat{\beta} < 1$ for all CENTROPE countries furthermore suggests that trade patterns in the CENTROPE countries are moving in the direction of (β-)de-specialisation: Initially dominant export sectors loose in importance, while smaller sectors are gaining.

A statistically significant result of $\beta < 1$ (and therefore "β – despecialisaton" in the sense of a regression of the Balassa-index to the mean), however, is only a necessary, but not a sufficient condition that also "σ – despecialisation" (in the sense of a shrinking variance in the distribution of the Balassa -indices) occured. As shown by *Hart* (1976) the relationship between β- und σ – specialisation can be represented by the equation $\sigma_t^2 / \sigma_{t-1}^2 = \beta^2 / \rho^2$ where σ_t^2 is the variance of the a-Indices at time t and ρ is the correlation between the Ballassa-Indices for two different points in time. For values of $\hat{\beta}$ between 0 and 1 as in the case of the CENTROPE countries, β may be larger than ρ. This would imply that the changes in the relative position of individual industries dominate the tendency of a regression to the mean, so that the variance of the Balassa-index actually increases. In this case, therefore, decreasing β – specialisation would go hand in hand with increasing σ – specialisation.

To test for this possibility, table 12 together with a measure for the change in the variance of the Balassa-indices reports further indicators to detail the evolutions in the Balassa-indices' distribution. The Pearson correlation coefficient ρ measures the mobility of the individual industries within the whole distribution, whereby a high value indicates little change in the importance of individual industries in the trade structure and vice versa. Hence (1- ρ) measures a 'mobility effect' in the sense of changes in the distribution of Balassa values. This effect must not be confused with the 'regression effect' (1-β), which tests if (initially) strong export industries loose or gain in importance over time.

The results suggest that in 1995–2003 a decline in CENTROPE countries β – specialisation was indeed associated by a decline in σ – specialisation ($\sigma_t/\sigma_{t-1} < 1$). Moreover, the results reconfirm our previous findings concerning the speed of change: The Pearson correlation coefficient, which measures the stability of individual industries within the whole distribution, is clearly lower in CENTROPE countries compared to the EU-15, which confirms a higher structural turbulence of these countries in integration. Concerning the mobility effect, we see that changes in the role of individual industries were particularly large in Hungarian

manufacturing, followed by the Czech and Slovak republics. In Austria changes in the ranking of export industries were less pronounced, but clearly higher than in the "old" EU Member States. Finally, the regression of the industries to the mean (the 'regression effect') is uniformly larger in CENTROPE than changes in the ranking of industries in exports (the 'mobility effect'). This causes the variance of the Balassa indices to shrink in all countries. The comparatively strong structural change in these countries therefore led to a weakening of initial trade specialisations and a more diversified export structure in the CENTROPE countries due to both statistical concepts.

Table 12: Evolutions in the CENTROPE Countries Trade Structures

	$\hat{\rho}$	'regression effect' $(1-\beta)$	'mobility effect' $(1-p)$	σ_t / σ_{t-1}
Total trade				
Slovakia	0.755	0.285	0.245	0.947
Czech Republic	0.733	0.271	0.267	0.994
Hungary	0.721	0.334	0.279	0.924
Austria	0.842	0.192	0.158	0.960
CENTROPE Countries	0.845	0.215	0.155	0.923
CEEC	0.784	0.268	0.216	0.934
EU-15	0.934	–0.006	0.066	1.078
Manufacturing trade				
Slovakia	0.755	0.249	0.245	0.994
Czech Republic	0.726	0.298	0.274	0.967
Hungary	0.617	0.432	0.383	0.921
Austria	0.805	0.300	0.195	0.869
CENTROPE Countries	0.842	0.258	0.158	0.881
CEEC	0.773	0.287	0.227	0.923
EU-15	0.873	0.055	0.127	1.208

Note: The table reports the results of a Galtonian regression analysis on Balassa-indices, NACE 3 digit level, 1995–2003.

Source: UN – World Trade data base, Austrian Institute of Economic Research.

Eastern CENTROPE countries are thus rapidly developing in the direction of more human capital and technology intensive exports which, however, are still traded at relatively low price. In this process, strong traditional specialisations are lost, so that in general a decrease in export specialisation can be seen in all countries. This structural change was not limited to the new Member States of the CENTROPE, however. Austria's trade patterns were also subject to substantial structural change, but economic structure remained more centred on medium-tech and medium-skill

products in which the competitiveness of the Austrian suppliers is primarily based on intra-industry advantages in quality (and therefore higher export prices). Here too, the export base broadened substantially in the last decade, with traditional specialisations eroding substantially, being replaced by a more diversified export structure.

7. Conclusions

This paper elaborates on the industrial structure of the CENTROPE region and its evolution in recent years. Based on regional data for GVA and employment as well as national data on foreign trade we find that:

1. CENTROPE is a region with substantial structural disparities, which parallel those found in the enlarged EU in general. There are, however, a number of structural features of the region implying better conditions for growth and catching up in productivity than in other cross-border regions located at the former external border of the EU. In particular the region can claim a strong urban core, comprising the "twin cities" of Vienna and Bratislava as well as their surroundings. Furthermore, the region – in contrast to many other areas at the southern and eastern periphery of the EU – lacks problems of mono-industrialisation and extremely peripheral rural areas.

2. Despite these advantages a shift share analysis indicates that the regions of CENTROPE in the mid 1990s were characterised by a sectoral structure which encourages neither GVA nor employment growth. The high GVA growth in the eastern regions of CENTROPE mostly emerged within sectors and was due to productivity catch up. Hence growth in the region was in general not very employment intensive – a fact that also applies to Vienna as the most developed region within CENTROPE.

3. The CENTROPE region – in particular its eastern parts – has undergone substantial structural change in the last decade, with deindustrialisation and tertiarisation as the predominant tendency. The shares of agriculture in employment and GVA declined in all eastern regions of CENTROPE. In the light of recent findings, which associate rising shares of agricultural employment in transition economies with a failure of political reforms, this indicates a successful transition in the new Member States regions of CENTROPE. Indeed, these regions are more developed than many other regions in the new EU Member States.

4. Structural change in employment played only a minor role in productivity growth – which was particularly high in the new Member States regions in the late 1990's. In most regions of CENTROPE (both dynamic and static) structural change contributed less than 10% to total productivity growth, which is comparable to the rest of the EU. However, this contribution was higher in Bratislava and Burgenland, while in the Czech regions productivity increases

were even hampered by structural change, as employment in sectors with low initial productivity levels grew more rapidly.

5. Export data provide evidence of a rapid catching up process of the new Member States in CENTROPE. In all of these countries export shares to the EU increased dramatically, the balance of trade improved and the structure of trade moved rapidly to more 'modern', technology- and skill – intensive activities in the last decade. Relative to these spectacular improvements, Austria's export portfolio, while also showing some up-grading, proceeded only slowly to more sophisticated industries. As a result, in 2003 Austria's trade structure was not more sophisticated than that of the eastern countries of CENTROPE, while income and therefore wage levels were incomparably higher.

6. Despite the substantial improvements in competitiveness in the CENTROPE in general and the eastern parts of CENTROPE in particular, export statistics still indicate that CENTROPE tends to be specialised in mid-tech and mid-skill industries. The only outlier is Hungary where technology intensive industries play an important role, while Austria's trade patterns, on the other hand, only partially reflect the comparative advantages of a highly developed industrial country. However, Austrian firms were able to occupy higher positions on the quality ladder within industries. Market share losses therefore could be avoided – in spite of an unfavourable specialisation on mid-tech industries – by an orientation towards more quality (and therefore price) intensive segments within industries.

7. In comparison to the "old" EU member countries all CENTROPE countries experienced a strong adjustment of their industrial structures in the last decade, which points to a substantial pressure to rationalise and modernise in the integration process. During these adjustments CENTROPE's export structure converged gradually to that of the EU-25. Furthermore, we find ample evidence that integration did not lead to further specialisation, but to a substantial broadening of the export base. Traditional specialisations eroded substantially as comparative advantages changed in the course of the transition process, giving way to a more diversified export structure.

From the point of view of regional policy, our results indicate that the CENTROPE region is characterised by a very heterogeneous economic structure, arising from different specialities and comparative advantages in its sub-regions. Structural change is considerable and uniformly oriented towards more skill- and technology-intensive industries throughout CENTROPE. As a consequence, it is not a specialisation in one or a few "leading" sectors that will be the formula to success in the CENTROPE region, but a clever combination of the different but complementary comparative advantages existing there. This does not preclude opportunities for Cluster initiatives along strengths in sub-regions and –sectors, e.g. financial and business services in the urban core or electronics, transport equipment

and (in the north) wood products in its surroundings. However, specific advantages in the region do not arise from sectoral, but functional specialisation: The diversity of locational advantages and the huge differentials in wage costs within short distance make the region especially attractive for strategies of vertical working division in the form of border crossing producer networks. Economic policy should therefore concentrate on attempts to optimize the framework conditions for inter-firm and inter-governmental cooperation in the new cross-border setting.

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