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Dimensions of quality upgrading-
Evidence for CEEC´s

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# Dimensions of quality upgrading - Evidence for CEEC's

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**Abstract:**

The impact of trade integration of Central and Eastern European economies in European markets has been studied extensively. Often these studies observe quality upgrading of CEEC exports. In this paper we consider three dimensions of quality upgrading: upgrading across industries, upgrading across different quality segments within industries, and finally, product upgrading within quality segments inside industries. For the analysis we partition industries into distinct quality segments based on EU-15 import unit values. The results for ten CEECs (CEE-5, Baltics and Southeastern Europe) and thirteen industries suggest fundamental differences, both, across country groups and across the three different notions of quality upgrading. The CEE-5 show no evidence of entering a "low-quality trap" in all three dimensions. While there is in general catching-up across industries and inside quality segments, convergence to the EU-level is significantly slower in the high quality segments for the Baltics and Southeast Europe. Thus, the second notion of low-quality specialization may be applicable to these countries.

# 1.    Introduction

Trade specialization patterns of CEECs often show initial specialization in low tech and low skill industries: this specialisation pattern has been shown to change over time, in many cases rapidly, with CEECs shifting production towards higher tech, higher skilled industries (see Havlik, 2001; Stehrer, Landesmann and Burgstaller, 2000; Wörz, 2003). All these studies rely on a comparison of trade structures across industries and countries and trade flows in individual industries disregarding quality differentials inside industries (exceptions being Landesmann and Burgstaller, 1997, and Landesmann and Fersterer, 1998). Thus, it might be conceivable that CEECs, while catching-up in terms of their export industries, do not manage to catch-up in terms of the quality of the goods produced. This would lead to specialisation in low quality goods within industries.

Dulleck (2002) in a 2-country 2-qualities framework provides several reasons why countries may be trapped in the production of low-quality goods within an industry. The main argument rests on assumptions of economies of scale in the production of high quality goods. These together with international trade policies, external economies due to quality uncertainty (e.g. labelling, imaging) or external economies due to demand effects give rise to a disadvantage for second movers, i.e. transition economies. The first mover advantage of Western European countries results in a situation where firms from these economies serve the whole market (West and East) with high quality goods. The latter point shows (based on an idea in Murphy et al., 1989), however, that the transition countries can be successful in high quality industries if a critical number of sectors are entering the high quality sectors (segments) simultaneously; i.e. a 'Big-Push' is needed to escape the low quality trap. In the present article we study whether such developments can be observed.

There is evidence that at least some of the transition countries do quite well in upgrading their products (i.e. increasing the overall unit value of their exports; see for example Landesmann and Stehrer, 2002; Aturupane et al., 1999). Here quality is measured as unit value ratios of exports by industries. Increasing unit values in relation to those countries that define the quality benchmark indicate a movement towards producing higher quality. In general, average unit value ratios of different industries are compared. Still, this does not rule out the possibility that these countries may sell only in the lower quality segments of each industry as proposed by the model described above. In this paper, we go a step further by adding an additional dimension of quality, namely changes in unit values within quality segments of certain industries.

We examine whether there is evidence of a low quality trap in CEEC-EU trade and in particular, whether CEECs run the risk of specialising in the production and export of goods that are of a lower quality than those imported by EU-15 countries on average. We move away from the emphasis that is prevalent in the literature looking at movements across industries and examine whether a low quality trap exists within industries or even within industry segments.

The basis for our analysis is data on unit values. As Aiginger (1997) points out, unit values contain information about the quality and competitiveness of industry output. We define quality

segments of products by their unit values in EU-15 imports (i.e. import prices per kilogram). We construct three different segments for each of thirteen industries representing low-, medium-, and high-quality goods within a particular industry. The segments are constructed using the unit values of the European Union's imports as a benchmark measure of the quality of different goods. By doing so, we can observe whether the export composition of transition countries moves towards exporting goods from higher segments as well as whether the price/quality gaps within high quality segments closes faster than the gaps in low or medium quality segments. The emphasis of this study lies on segments within industries.

The paper is organised as follows. In Section 2 we discuss our hypotheses and introduce the dimensions of 'quality' used in the empirical part of the paper. Section 3 introduces the methodological issues and describes the data sources. In Section 4 we present a descriptive overview of the ongoing dynamics of trade patterns with respect to the hypothesis given in Section 2. This is done for two subsets of industries only (low and high tech industries). Section 5 then describes the results from our econometric investigation of two of the hypothesis given in Section 2. Section 6 concludes.

## 2. Dimensions of Quality Upgrading

As discussed in the introduction the notion of 'quality upgrading' or 'quality traps' may be misleading due to different concepts or measurement issues. In this section we discuss the notions of 'quality' we use in our analysis.

### 2.1. Industry specialization patterns

A factor endowments or Heckscher-Ohlin perspective on trade stimulates a view that countries may – because of their endowments – specialize in certain industries, i.e. labour rich countries specialize in labour intensive industries, the latter often found to be characterised by low unit values and hence be considered low quality industries. Quality in this view assumes that products for example classified under the industry "electrical and optical equipment" are high quality whereas products classified under "food products, beverages and tobacco" are low quality. From the assumption that CEECs are relatively scarce in skilled labour or in skills necessary for the post-communist production process and given that higher tech industries are skill-intensive, specialization in low tech industries by CEECs would follow. To explain this pattern in a Ricardian model the productivity gap (under the assumption of equalized wage rates across industries) would have to be relatively larger in the higher tech sectors which was the case at the beginning of the transition. Patterns of trade specialization in the beginning of the transition period more or less followed this pattern for most countries. However there is ample evidence that CEECs do not follow this pattern of specialization over time either because their skill-endowments are similar to those of Western European countries (e.g. most of the CEECs had high levels of technical education in the past) or because productivity gaps are closed much

faster in more technology intensive industries (see e.g. Landesmann and Stehrer, 2002, for a discussion of recent developments).

## 2.2. Specialization patterns within industries

The description above cannot capture specialization within industries. For a judgement of the quality of a country's exports within a particular industry it is important to know the specific type of the majority of products exported in this industry. For example, knowing that Romania exports "electronic and optical equipment" tells us little about the quality of the goods exported; there is a large difference in quality for example between simple radio alarms and advanced scientific equipment, both of which are a part of the electronic and optical equipment industry. Similarly, within the industry "food products, beverages and tobacco" there are likely to be large differences in quality between champagne and small processed foodstuffs. A low quality trap in exports can be considered to involve specialization in the low quality segment of industries, i.e. the production of radio alarms in electronic and optical equipment and of small processed food in "food products, beverages and tobacco". Instead of comparing export composition across industries we compare export composition across quality segments of industries. By ranking the products within each industry according to the unit value of EU-15 imports, we divide each industry into quality segments. This definition of a low-quality trap would hold then if CEECs specialized in the segment with the lowest quality (termed segment I below). This means that a country may be able to specialize in production and exports in high-tech sectors but within these sectors only in the lower quality segments. If one assumes that equal products get the same price in EU markets, this implies that our notion of a low quality trap is equivalent to a relatively higher share of exports in the low-quality segment of an industry.

## 2.3 Quality upgrading in quality segments of industries

Finally, quality upgrading can be defined as a movement towards producing 'higher quality' products within quality segments. Under the assumption of perfect markets the unit value ratios measure quality differentials. One may ask whether quality upgrading is relatively faster at the lower or higher segments within the quality spectrum. To use the previous example again, Romanian UVRs may increase relatively faster in the radio alarm segment of the electronics industry than in the scientific equipment segment. In this dimension we do not examine shifts across quality segments, but changes within the different segments. If improvements were only to occur in the low quality segment, this may point towards a low quality trap. As far as we know, this dimension of quality has not yet been studies in the empirical literature.

## 2.4 Summary

We argued that there are at least three dimensions of quality upgrading. In Section 4 of the paper we provide some descriptive statistics using these concepts. In the econometric analysis of the paper (Section 5), we mainly refer to the second and third definition, since for the first definition

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[3] This choice is well confirmed by the data. We first estimated a two-way error component model using a LSDV estimator. Industry dummies were often highly significant, country dummies only sometimes so.

(trade patterns by industry) there already exists a large literature (for recent studies see Havlik, 2001, Landesmann and Stehrer, 2002 and Landesmann, 2003).

These three notions of upgrading are summarized in Figure 1.

**Figure 1**
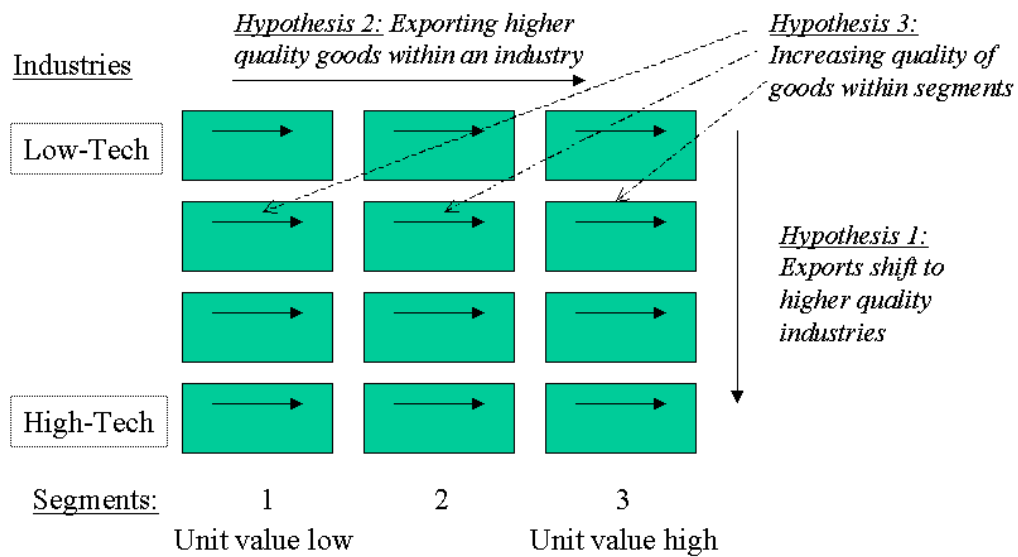


## 3. Data and methodology

In the empirical study below we use the specialization patterns of CEECs trade flows into the EU market to assess the above stated hypotheses and their specific individual relevance for CEECs. For this we use trade data at a very detailed level from which we calculate the relevant data for the respective industries and segments within these industries. In this section we provide an overview of the classifications and calculations of the relevant data.

### 3.1 Data

The database used is the COMEXT trade database which provides trade data at the 8-digit CN level for EU-15 imports and exports. The period analysed is from 1995 to 2000. Beginning in 1995 has the advantage that the Central and Eastern European countries had already started

trade integration with the EU and had already been through the transformational recession. Further, from 1995 onwards data for EU-15 are available which thus includes important trading partners for the CEECs (in particular Austria). The database consists of about 10000 products in each year. One of the problems is that the number of products and the products covered changes from year to year. To cope with this problem we include only products which are consistently in the database over the whole period. This reduced the number of products to about 8000 per year.

## 3.2 Methodology of the calculation of relative unit values

In the calculation of the relative unit values of traded products we use the COMEXT trade database at the most detailed 8-digit level. Denoting the value of exports to EU-15 of commodity i by country c in year t by $v_{it}^c$ and the quantity (measured in tons) by $x_{it}^c$, the export unit value is defined as

$$UV_{it}^c = v_{it}^c / x_{it}^c \tag{1}$$

The unit values of country c's exports to the EU-15 are then compared to the unit values of total EU-15 imports (from the world, including intra-EU trade) by calculating the logs of the unit value ratios

$$UVR_{it}^c = \ln (UV_{it}^c / UV_{it}^{EU}) \tag{2}$$

where $UV_{it}^{EU}$ denotes the unit value of total EU-15 imports for a particular commodity i in year t. Taking the logarithm of ($UV_{it}^c$ / $UV_{it}^{EU}$) ensures a symmetric aggregation across products for ratios larger and smaller than 1 (see below). In logs, the ratio is thus greater (smaller) than zero if the export unit value of country c is greater (smaller) than the unit value of total EU-15 imports.

We will not present information at the very detailed (8-digit) product level but aggregate the unit value ratios to the level of industries. Within industries we further distinguish between three quality segments. The CN 8-digit level can be classified according to the NACE rev. 1, 2-digit (DA-DN) classification which comprises fourteen industries. We used thirteen of these in the analysis, excluding the oil industry which is very unequally represented in individual CEECs. Within each of these thirteen industries we distinguish between three quality segments. These segments are calculated in the following way: first, we calculate the unit value ratios using the averages of EU-15 imports for the years 1995 - 2000 and rank them within each industry. Then we calculate the cumulated sum of the value of EU-15 imports (ranked by the unit value ratios) within industries. Finally, we classify the products of the lower third of the cumulated import value as segment I (low quality segment), the middle third as segment II (medium quality segment) and the upper third as segment III (high quality segment).

Further, we construct a weighted sum of the unit value ratios $r_{it}^c$ across the products belonging to a particular industry and quality segment $j_q$ where j denotes the industry and q = 1,2,3 the segment, denoting the set of products in a particular industry and quality segment by $I(j_q)$. The

weight used for a particular commodity i in $I(j_q)$ is the share of its export value in the industry's and segment's exports of country c. Denoting the set of commodities i belonging to an aggregate j by $i \in I(j_q)$ the weights are calculated as

$$w_{it}^c = v_{it}^c / \sum_{i \in I(jq)} v_{it}^c \qquad (3)$$

The unit value ratio for a particular aggregate j is then

$$UVR_{j(q)t}^c = \sum_{i \in I(jq)} UVR_{it}^c w_{it}^c \qquad (4)$$

This measure can be interpreted analogously to the unit value ratios for a particular commodity as mentioned above. Similarly we use in the descriptive part the unit value of exports defined by

$$UV_{j(q)t}^c = \sum_{i \in I(jq)} UV_{it}^c w_{it}^c \qquad (5)$$

# 4. Descriptive analysis

For a descriptive overview we present the two variables: market share in EU markets and unit value ratios for individual country groups in selected low and high tech industries. This is done according to the three hypotheses stated above. In this section, we present the data for a subset of typically low-tech industries: food products, beverages and tobacco (DA), textiles and textile products (DB), and leather and leather products (DC), as well as a subset of typically high-tech industries: machinery and equipment (DK), electrical and optical equipment (DL), and transport equipment (DM). Data are presented for three country groups, CEE-5 (Czech Republic, Hungary, Poland, Slovakia, and Slovenia), EE-2 (Bulgaria and Romania) and BAL (Estonia, Latvia, and Lithuania), and for two years, 1995 and 2000.

## 4.1 Specialization patterns

We first discuss specialization patterns across the two types of industries. Table 4.1.a gives data for the export structure of the three groups of CEEC's (defined as the share of the industry group's exports relative to total exports for a particular group of countries), the market shares in total EU-15 imports, the unit value of exports and the unit value ratio discussed above. Table 4.1.b presents the growth of the respective variables between 1995 and 2000.

Let us discuss these in turn. First one can see that the group CEE-5 in 1995 exported about one quarter of their total exports in either the low-tech or the high-tech industries. But this has changed dramatically over time. In 2000 the low-tech industries only had a share of about 16 per cent whereas the high-tech industries had increased to more than 37 per cent. Thus, this group of countries has clearly specialized in the high-tech industries. A similar but less pronounced pattern can be found for the Baltic states which started with more than 40 per cent in the low-tech sectors and only about 8 per cent in the high-tech sectors. Similar to the CEE-5 group, the share

for low-tech industries decreased between 1995 and 2000, while increasing for high-tech industries.

Table 4.1.a

## Specialization patterns

### Export structure of CEEC's

| | CEEC-5 | | EEC-2 | | BAL | |
|---|---|---|---|---|---|---|
| | **1995** | **2000** | **1995** | **2000** | **1995** | **2000** |
| **Low-tech** | 24.59 | 15.98 | 43.11 | 47.83 | 43.51 | 37.08 |
| **High-tech** | 27.13 | 37.32 | 8.18 | 10.61 | 4.92 | 10.14 |

### Shares in EU-15 imports

| | CEEC-5 | | EEC-2 | | BAL | |
|---|---|---|---|---|---|---|
| | **1995** | **2000** | **1995** | **2000** | **1995** | **2000** |
| **Low-tech** | 3.27 | 3.45 | 0.81 | 1.49 | 0.28 | 0.50 |
| **High-tech** | 1.96 | 3.12 | 0.08 | 0.13 | 0.02 | 0.05 |
| **Total** | 2.73 | 3.66 | 0.39 | 0.53 | 0.13 | 0.23 |

### Unit value

| | CEEC-5 | | EEC-2 | | BAL | |
|---|---|---|---|---|---|---|
| | **1995** | **2000** | **1995** | **2000** | **1995** | **2000** |
| **Low-tech** | 19.38 | 18.10 | 15.53 | 18.34 | 13.64 | 17.29 |
| **High-tech** | 12.05 | 18.83 | 11.54 | 12.02 | 10.81 | 16.45 |

### Unit value ratios

| | CEEC-5 | | EEC-2 | | BAL | |
|---|---|---|---|---|---|---|
| | **1995** | **2000** | **1995** | **2000** | **1995** | **2000** |
| **Low-tech** | -0.03 | 0.05 | -0.29 | -0.15 | -0.23 | -0.02 |
| **High-tech** | -0.35 | -0.17 | -0.74 | -0.35 | -0.38 | -0.19 |

Table 4.1.b

## Changes in specialization patterns[1]

### Total value of EU-15 imports from CEEC

| | CEEC-5 | EEC-2 | BAL |
|---|---|---|---|
| | **1995-2000** | **1995-2000** | **1995-2000** |
| **Low-tech** | -0.07 | 0.02 | -0.03 |
| **High-tech** | 0.08 | 0.06 | 0.10 |

### Shares in EU-15 imports

| | CEEC-5 | EEC-2 | BAL |
|---|---|---|---|
| | **1995-2000** | **1995-2000** | **1995-2000** |
| **Low-tech** | 0.01 | 0.17 | 0.09 |
| **High-tech** | 0.12 | 0.11 | 0.13 |
| **Total** | 0.07 | 0.07 | 0.08 |

### Unit value

| | CEEC-5 | EEC-2 | BAL |
|---|---|---|---|
| | **1995-2000** | **1995-2000** | **1995-2000** |
| **Low-tech** | -0.01 | 0.04 | 0.04 |
| **High-tech** | 0.11 | 0.01 | 0.07 |

### Unit value ratios[2]

| | CEEC-5 | EEC-2 | BAL |
|---|---|---|---|
| | **1995-2000** | **1995-2000** | **1995-2000** |
| **Low-tech** | 0.08 | 0.14 | 0.21 |
| **High-tech** | 0.18 | 0.38 | 0.18 |

*Notes*: 1) Annual growth rates are approximated by dividing the total period growth by the number of years.
2) Difference between 1995 and 2000

Although there is restructuring towards high-tech industries, these countries remain specialized in low-tech industries. This is also the case for EE-2 which shows specialization towards low-tech goods although the export shares are also increasing in the high-tech industries (as the shares of the other industries - mainly resource intensive ones - are decreasing).

These patterns are also reflected in the market shares in total EU-15 imports. Additionally one can see that all country groups have increased their market shares in all industry groups with higher growth rates in the higher tech industries (with the exception of the EE-2). Further one can see that the bulk of CEEC exports are from the group CEE-5.

In terms of unit values there has been major upgrading especially in high-tech sectors for CEE-5 and BAL. There is a remarkable similarity for this measure in 2000 across country groups, the only exception being the group EE-2 in the high-tech industries. Similar patterns can be found in the unit value ratios where similar patterns and movements over time can be observed.

## 4.2 Quality specialization within industries

Now we consider the constructed quality segments within industries, which were discussed above. Table 4.2.a presents the same variables as in table 4.1.a but with industries divided into the three quality segments.

With respect to the export structure, the share of the low quality segment (segment 1) is much higher in the high-tech industries (about 70 per cent) as compared to this share in the low-tech industries (between 15 and 33 per cent) for all three country groups. In the latter set of industries, the majority of exports is from segment 3 (high-quality) with shares ranging from 40 to 60 per cent. Although there have been some changes over time the general structure remains stable. But there is a remarkable difference between the three country groups. The group of CEE-5 lost shares in the high-quality segment of the lower tech industries, but gained shares in the medium- and high-quality segments in the higher tech sectors. This pattern is reversed for the two other groups.

On the other hand, all country groups gained considerably greater market shares in EU-15 total imports in the low and medium quality segments in both types of industries. The exceptions here are Bulgaria and Romania which gained a relatively greater market share in the higher quality segments of the low-tech industries.

The unit value of exports increased in most cases. Exceptions are decreases in the low-tech industries for CEE-5 (in quality segments 1 and 3) and in the high-tech industries for EE-2 (segment 1) and BAL (segment 2). The increases in the high quality segment of the high-tech sectors for CEE-5 and BAL are remarkable. In relation to the EU-15, the overall quality of exported goods has increased, notably so in the high quality segment of the high tech industries for CEE-5 and BAL. Still, the unit value of exports from the Baltic countries are still far below those of exports from CEE-5, reaching the latter's 1995-level in 2001. Exports from EE-2 in this segment have shown a decline in UVRs, while the quality in the low quality segment has risen for

these countries. This points towards the existence of a low-quality trap according to our second definition for EE-2, whereas no such development is suggested for all other CEECs.

Table 4.2.a

## Specialization in quality segments within industry groups

### Export structure

| | | CEEC-5 | | EEC-2 | | BAL | |
|---|---|---|---|---|---|---|---|
| | | 1995 | 2000 | 1995 | 2000 | 1995 | 2000 |
| Low-tech | | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |
| | 1 | 28.63 | 33.28 | 15.32 | 11.61 | 26.84 | 25.35 |
| | 2 | 26.85 | 27.40 | 31.33 | 29.91 | 29.53 | 30.07 |
| | 3 | 44.52 | 39.32 | 53.35 | 58.48 | 43.63 | 44.59 |
| High-tech | | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |
| | 1 | 70.51 | 67.59 | 62.39 | 67.32 | 71.23 | 75.09 |
| | 2 | 18.97 | 20.66 | 26.30 | 23.92 | 20.36 | 16.90 |
| | 3 | 10.51 | 11.75 | 11.32 | 8.76 | 8.41 | 8.01 |

### Shares in EU-15 imports

| | | CEEC-5 | | EEC-2 | | BAL | |
|---|---|---|---|---|---|---|---|
| | | 1995 | 2000 | 1995 | 2000 | 1995 | 2000 |
| Low-tech | | 3.27 | 3.45 | 0.81 | 1.49 | 0.28 | 0.50 |
| | 1 | 2.74 | 3.57 | 0.36 | 0.54 | 0.82 | 1.54 |
| | 2 | 2.78 | 2.87 | 0.81 | 1.35 | 0.24 | 0.38 |
| | 3 | 4.25 | 3.89 | 1.27 | 2.50 | 0.24 | 0.43 |
| High-tech | | 1.96 | 3.12 | 0.08 | 0.13 | 0.02 | 0.05 |
| | 1 | 3.96 | 6.57 | 0.15 | 0.27 | 0.05 | 0.16 |
| | 2 | 1.44 | 2.63 | 0.09 | 0.13 | 0.05 | 0.16 |
| | 3 | 0.52 | 0.84 | 0.02 | 0.03 | 0.01 | 0.02 |

### Unit value

| | | CEEC-5 | | EEC-2 | | BAL | |
|---|---|---|---|---|---|---|---|
| | | 1995 | 2000 | 1995 | 2000 | 1995 | 2000 |
| Low-tech | | 19.38 | 18.10 | 15.53 | 18.34 | 13.64 | 17.29 |
| | 1 | 8.31 | 7.41 | 6.32 | 8.34 | 5.62 | 7.72 |
| | 2 | 15.13 | 17.15 | 12.16 | 15.52 | 12.74 | 18.59 |
| | 3 | 29.05 | 27.81 | 20.16 | 21.78 | 19.18 | 21.85 |
| High-tech | | 12.05 | 18.83 | 11.54 | 12.02 | 10.81 | 16.45 |
| | 1 | 5.57 | 8.36 | 6.20 | 5.74 | 3.58 | 11.05 |
| | 2 | 15.55 | 20.63 | 9.34 | 16.38 | 35.65 | 24.89 |
| | 3 | 49.22 | 75.92 | 46.08 | 48.34 | 11.91 | 49.27 |

### Unit value ratios

| | | CEEC-5 | | EEC-2 | | BAL | |
|---|---|---|---|---|---|---|---|
| | | 1995 | 2000 | 1995 | 2000 | 1995 | 2000 |
| Low-tech | | | | | | | |
| | 1 | -0.06 | -0.04 | -0.27 | -0.11 | -0.21 | 0.06 |
| | 2 | 0.02 | 0.14 | -0.20 | 0.00 | -0.14 | 0.13 |
| | 3 | -0.03 | 0.06 | -0.37 | -0.24 | -0.30 | -0.16 |
| High-tech | | | | | | | |
| | 1 | -0.36 | -0.21 | -0.62 | -0.29 | -0.58 | -0.07 |
| | 2 | -0.48 | -0.33 | -0.94 | -0.79 | -0.63 | -0.69 |
| | 3 | -0.55 | -0.32 | -0.81 | -0.94 | -0.86 | -0.44 |

Table 4.2.b

# Changes in specialization in quality segments within industry groups

| | | Export structure | | |
|---|---|---|---|---|
| | | **CEEC-5** | **EEC-2** | **BAL** |
| | | **1995-2000** | **1995-2000** | **1995-2000** |
| **Low-tech** | | | | |
| | **1** | 0.03 | -0.05 | -0.01 |
| | **2** | 0.00 | -0.01 | 0.00 |
| | **3** | -0.02 | 0.02 | 0.00 |
| **High-tech** | | | | |
| | **1** | -0.01 | 0.02 | 0.01 |
| | **2** | 0.02 | -0.02 | -0.03 |
| | **3** | 0.02 | -0.05 | -0.01 |

| | | Shares in EU-15 imports | | |
|---|---|---|---|---|
| | | **CEEC-5** | **EEC-2** | **BAL** |
| | | **1995-2000** | **1995-2000** | **1995-2000** |
| **Low-tech** | | 0.01 | 0.17 | 0.16 |
| | **1** | 0.06 | 0.10 | 0.18 |
| | **2** | 0.01 | 0.14 | 0.12 |
| | **3** | -0.02 | 0.19 | 0.16 |
| **High-tech** | | 0.12 | 0.11 | 0.41 |
| | **1** | 0.13 | 0.16 | 0.47 |
| | **2** | 0.17 | 0.09 | 0.48 |
| | **3** | 0.12 | 0.01 | 0.26 |

| | | Unit value | | |
|---|---|---|---|---|
| | | **CEEC-5** | **EEC-2** | **BAL** |
| | | **1995-2000** | **1995-2000** | **1995-2000** |
| **Low-tech** | | -0.01 | 0.04 | 0.05 |
| | **1** | -0.02 | 0.06 | 0.08 |
| | **2** | 0.03 | 0.06 | 0.09 |
| | **3** | -0.01 | 0.02 | 0.03 |
| **High-tech** | | 0.11 | 0.01 | 0.10 |
| | **1** | 0.10 | -0.01 | 0.42 |
| | **2** | 0.07 | 0.15 | -0.06 |
| | **3** | 0.11 | 0.01 | 0.63 |

| | | Unit value ratios[1] | | |
|---|---|---|---|---|
| | | **CEEC-5** | **EEC-2** | **BAL** |
| | | **1995-2000** | **1995-2000** | **1995-2000** |
| **Low-tech** | | | | |
| | **1** | 0.02 | 0.16 | 0.27 |
| | **2** | 0.12 | 0.20 | 0.28 |
| | **3** | 0.09 | 0.13 | 0.14 |
| **High-tech** | | | | |
| | **1** | 0.15 | 0.33 | 0.51 |
| | **2** | 0.15 | 0.15 | -0.05 |
| | **3** | 0.23 | -0.12 | 0.41 |

*Notes*: 1) Difference between 1995 and 2000

## 4.3 Quality specialization within segments

One may ask if these changes in unit values and unit value ratios within the segments are due to changes in the composition (which corresponds to hypothesis 3 above) or to changes in selling prices. Table 4.3 presents the data for unit values and unit value ratios using the weights for 1995. One can see that the values are more constant over time than in Table 4.2. This is also true for the high quality segment in the high-tech industries in which the groups CEE-5 and BAL showed large increases in their unit values. This suggests that although price increases in this segment have played a role, the shifts towards higher quality within the segments (i.e. the composition) have been of greater significance.

Table 4.3.a

**Unit values and UVR using weights of 1995**

| | | Unit value (1995 weights) | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| | | CEEC-5 | | EEC-2 | | BAL | |
| | | 1995 | 2000 | 1995 | 2000 | 1995 | 2000 |
| **Low-tech** | | | | | | | |
| | 1 | 8.31 | 8.13 | 6.32 | 7.15 | 5.62 | 6.45 |
| | 2 | 15.13 | 16.44 | 12.16 | 11.94 | 12.74 | 15.14 |
| | 3 | 29.05 | 29.60 | 20.16 | 21.74 | 19.18 | 21.29 |
| **High-tech** | | | | | | | |
| | 1 | 5.57 | 6.40 | 6.20 | 4.29 | 3.58 | 4.40 |
| | 2 | 15.55 | 16.29 | 9.34 | 8.32 | 35.65 | 13.12 |
| | 3 | 49.22 | 58.69 | 46.08 | 45.41 | 11.91 | 14.81 |

| | | Unit value ratios (1995 weights) | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| | | CEEC-5 | | EEC-2 | | BAL | |
| | | 1995 | 2000 | 1995 | 2000 | 1995 | 2000 |
| **Low-tech** | | | | | | | |
| | 1 | -0.06 | -0.03 | -0.27 | -0.10 | -0.21 | 0.06 |
| | 2 | 0.02 | 0.10 | -0.20 | -0.08 | -0.14 | 0.07 |
| | 3 | -0.03 | 0.06 | -0.37 | -0.23 | -0.30 | -0.14 |
| **High-tech** | | | | | | | |
| | 1 | -0.36 | -0.23 | -0.62 | -0.43 | -0.58 | -0.32 |
| | 2 | -0.48 | -0.38 | -0.94 | -0.82 | -0.63 | -0.54 |
| | 3 | -0.55 | -0.41 | -0.81 | -0.76 | -0.86 | -0.49 |

Table 4.3.b

**Changes in unit values and UVR's using weights from 1995**

| | | Unit value (1995 weights) | | |
|---|---|---|---|---|
| | | **CEEC-5** | **EEC-2** | **BAL** |
| | | **1995-2000** | **1995-2000** | **1995-2000** |
| **Low-tech** | | | | |
| | **1** | 0.00 | 0.03 | 0.03 |
| | **2** | 0.02 | 0.00 | 0.04 |
| | **3** | 0.00 | 0.02 | 0.02 |
| **High-tech** | | | | |
| | **1** | 0.03 | -0.06 | 0.05 |
| | **2** | 0.01 | -0.02 | -0.13 |
| | **3** | 0.04 | 0.00 | 0.05 |
| | | **Unit value ratios (1995 weights)[1]** | | |
| | | **CEEC-5** | **EEC-2** | **BAL** |
| | | **1995-2000** | **1995-2000** | **1995-2000** |
| **Low-tech** | | | | |
| | **1** | 0.04 | 0.17 | 0.27 |
| | **2** | 0.07 | 0.12 | 0.21 |
| | **3** | 0.10 | 0.13 | 0.17 |
| **High-tech** | | | | |
| | **1** | 0.12 | 0.19 | 0.26 |
| | **2** | 0.10 | 0.12 | 0.10 |
| | **3** | 0.14 | 0.05 | 0.37 |

*Notes:* 1) Difference between 1995 and 2000

# 5. Econometric analysis

## 5.1 Quality upgrading within industries

The first question we want to answer is whether countries have shifted exports to the EU-15 towards higher quality segments within an industry. Finding evidence that the share of exports out of total industry exports have increased in the higher quality segments allows us to argue that the respective country has increased its quality of exports within that industry. Alternatively, if the share of exports has increased in the low quality segment, it would appear that the country has shifted production towards the low end of the market and specialized in low quality goods. This refers to our second dimension of quality upgrading as outlined earlier.

To test this hypothesis we regress the change in each segment's export share (in total exports of an industry, between 1995 and 2000) on its initial value and on segment dummies for the second and third segments. The initial segment share is included as a catch-up term; a negative coefficient implies that segments with initially relatively low shares are increasing their shares and vice versa. A positive and significant coefficient on the export share of segment 3 dummy would imply that the share of exports of this segment have increased over time at the expense of one or both of the other segments. Such a positive and significant coefficient on segment 3 implies that there has been a shift towards production in the high quality segments of the industries, and as

such no evidence of a low quality trap. We also include the change in the unit value ratio in the regression in order to test whether improvements in quality within segments (i.e. compositional changes within segments) during the period have been important in explaining the performance of the different segments.

The model is estimated using a fixed effects model for each country group. Rather than having a time-series and a cross-country element to the data, we have an industry and a country dimension. We define industries as individuals and estimate a one-way error component model, splitting the error term into an industry specific part and a purely random term. This seemed appropriate given that we already grouped countries into relatively homogeneous groups. Thus, fixed effects are more likely to arrive from individual industry characteristics rather than from country characteristics.[3] The results are presented in the first three columns of Table 5.1.[4]

Table 5.1

## Specialization within industries

| dsegshaval | Values | | | Tons | | |
| --- | --- | --- | --- | --- | --- | --- |
| | CEEC-5 | EEC-2 | BAL | CEEC-5 | EEC-2 | BAL |
| segshaval95 | -0.2372 *** | -0.1190 *** | -0.4991 *** | -0.1534 * | -0.0441 | -0.5709 *** |
| | 0.000 | 0.000 | 0.000 | 0.061 | 0.415 | 0.000 |
| duvr | 0.0916 ** | 0.0046 | 0.0170 | -0.0271 | -0.0169 | -0.0594 * |
| | 0.012 | 0.303 | 0.633 | 0.904 | 0.538 | 0.063 |
| DSeg2 | 0.5794 *** | 0.0553 * | -0.0887 | -0.0311 | 0.0255 | -0.3551 *** |
| | 0.000 | 0.096 | 0.108 | 0.116 | 0.466 | 0.000 |
| DSeg3 | 0.0364 ** | 0.0826 *** | -0.0782 | -0.0590 ** | 0.0254 | -0.3761 *** |
| | 0.036 | 0.006 | 0.154 | 0.030 | 0.518 | 0.000 |
| const. | 0.0391 ** | -0.0069 *** | 0.2179 *** | 0.0837 | -0.0002 | 0.4483 *** |
| | 0.048 | 0.000 | 0.000 | 0.860 | 0.996 | 0.000 |
| R2-within | 0.36 | 0.22 | 0.31 | 0.21 | 0.11 | 0.27 |
| R2-overall | 0.36 | 0.22 | 0.31 | 0.21 | 0.11 | 0.27 |
| obs. | 195 | 78 | 117 | 195 | 78 | 117 |
| groups | 13 | 13 | 13 | 13 | 13 | 13 |

From these results, we can see that the catch up term is significant for all country groups. The dummies for segment 2 and 3 are positive and significant for the group CEE-5 and EE-2 which means that these countries are exporting successfully also in the higher quality segments. According to the coefficients the CEE-5 have shown a particularly large improvement in export performance, while the change has been less pronounced for the EE-2. In segment 3 the performances appear similar in both country groups. The segment dummies are not significant for the Baltic countries, so there has been no significant difference in export performance across segments. This also explains the higher catch-up term for this group. The change in the unit value ratio is only significantly positive for CEE-5, which means that the change in quality within segments is an important determinant of segment performance for this group only.

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[4] Results from the random effects estimator are qualitatively similar.

One potential criticism of these results is that the change in the value share of segment 3 may be due to the impact of changing prices. If prices of the goods produced in segment 3 have risen faster than in other segments, then we would expect that the value of exports in segment 3 would have increased relative to the other segments. To cope with this criticism, we repeat the results using the export share of the segments in quantity terms (tons) rather than the segment shares in terms of values. This is once again regressed on the initial segment share relative to the EU-15 share (in terms of tons), segment dummies and the change in the unit value ratio. Interestingly enough, the results are quite different when using tons instead of values and the estimations have less explanatory power. Given the descriptive evidence from section four, the negative catch-up term still indicates above average increases in high-quality segments. However, it is significant only for CEE-5 and BAL, while not for EE-2. Further, for the group of CEE-5, exports in the high-quality segment rose significantly slower than in both other segments. While in value terms, catching up was significantly faster in both, the high and medium quality segments, this finding points towards the possibility that price increases are caused by other factors than purely technical improvements. For instance, there may have been an initial adverse labelling effect (of low quality associated with 'made in Eastern Europe' regardless of the physical quality) that has successfully been removed for this group of most advanced CEECs. Whereas a car manufactured in the Czech Republic in 1995 may already have been of a certain quality level, this was perceived less so than in 2000, therefore lowering its market value. Thus, Czech cars are now able to attain higher prices on the EU market than five years ago because of an improved image. Consequently, changes in unit values (and unit value ratios) reflect a notion of quality that is defined by consumer tastes as well as physical characteristics. In that sense, the quality of CEE-5 exports has increased greatly inside different industries. Quality improvements have also been observed for the group of EE-2, yet no such indication is given for the Baltic states.

The negative dummy for the third segment in the Baltic states on the other hand indicates relatively weaker increases in higher quality exports compared to low quality export shares. For this group of countries, the signs on the dummy variables for quality segments are consistent between the two specifications. We conclude that specialisation inside industries has increasingly been towards the low quality segment. Together with the negative and significant coefficient on the change in unit value ratio, we take this as evidence for the second definition of a low quality trap for Baltic countries.

Although our definition of a low-quality trap does not distinguish between producing low quality in different industries, it might seem appropriate to discuss developments in certain groups of industries separately. In the following, we repeat our calculations for different types of industries separately. As in the previous section, we split industries into low-tech and medium- to high-tech intensive. In the regressions we use the same explanatory variables as above. EE-2 and BAL have been treated as one group due to the small number of observations. Thus, we present the results for two different groups: the more advanced CEE-5 countries and all others.

Table 5.2

## Specialization within selected low and high tech industries

| | Low Tech | | | | High Tech | | | |
| | Values | | Tons | | Values | | Tons | |
| dsegshaval | CEEC-5 | Other | CEEC-5 | Other | CEEC-5 | Other | CEEC-5 | Other |
|---|---|---|---|---|---|---|---|---|
| segshaval95 | -0.1502 ** | -0.3913 *** | -0.2047 *** | -0.3448 ** | -0.3615 *** | -0.6637 *** | -0.0725 | -0.5068 *** |
| | *0.047* | *0.000* | *0.008* | *0.022* | *0.001* | *0.000* | *0.497* | *0.000* |
| duvr | 0.0074 | -0.0557 | -0.1758 ** | -0.0393 | 0.1106 | 0.0256 | 0.0219 | -0.0160 |
| | *0.906* | *0.504* | *0.016* | *0.749* | *0.133* | *0.428* | *0.609* | *0.431* |
| DSeg2 | -0.0008 | 0.0923 ** | -0.0999 ** | -0.0987 | -0.0183 | -0.2429 *** | 0.0418 | -0.3341 *** |
| | *0.972* | *0.026* | *0.021* | *0.187* | *0.772* | *0.002* | *0.600* | *0.000* |
| DSeg3 | -0.0215 | 0.0853 ** | -0.1196 *** | -0.0956 | -0.0490 | -0.2697 *** | 0.0334 | -0.3979 *** |
| | *0.379* | *0.045* | *0.009* | *0.246* | *0.455* | *0.001* | *0.694* | *0.000* |
| const. | 0.0571 ** | 0.0780 * | 0.1516 *** | 0.1845 * | 0.1205 * | 0.3874 *** | -0.0036 | 0.4159 *** |
| | *0.049* | *0.083* | *0.004* | *0.056* | *0.098* | *0.000* | *0.969* | *0.000* |
| R2-within | 0.15 | 0.35 | 0.36 | 0.14 | 0.45 | 0.53 | 0.35 | 0.45 |
| R2-overall | 0.15 | 0.35 | 0.34 | 0.14 | 0.45 | 0.53 | 0.35 | 0.45 |
| obs. | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 |
| groups | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |

We find again convergence in the sense that initially relatively high shares are decreasing and vice versa. From Table 4.2 this implies decreasing shares in the high quality segment of low-tech industries and increasing shares in the high quality segment of high tech industries. Convergence tends to be faster in the high-tech industries as suggested by the greater coefficients. The dummies for the different quality segments are pronouncedly different between low- and high-tech industries and for both country groups. For low-tech industries the change in the export performance for the CEE-5 in segments 2 and 3 is poorer than in segment 1. For the other group of countries this tendency is not observed, with segments 2 and 3 doing comparatively well at least when using the value data. For high-tech industries we observe the opposite, namely that within CEE-5 there is little difference in the change in export performance among segments, whereas for the group of other countries segment 2 and 3 have performed comparatively poorly when compared with segment 1, both when data on values and tons is used.

Thus, for the more advanced CEE-5, the difference between values and tons suggests above average price increases in the high quality segments of low tech industries. The insignificant segment dummies in the high tech industries reveal equally fast convergence in all three quality segments and consequently no indication of a low quality trap is given for this group of countries. In contrast, a different situation emerges for the Baltics and EE-2. In the low tech industries, they show faster convergence in higher quality segments and as such quality upgrading. However, in the high tech industries, the negative segment dummies give evidence of a low quality trap in for this latter group of countries according to our second definition.

## 5.2 Quality upgrading within segments

The third dimension of quality upgrading that we examine, is whether there has been a movement towards the lower or the higher end within the different segments. It is possible that although countries have moved their production (or exports to the EU-15) towards the higher quality segments, they remain specialized in the lower quality goods within these segments. This can also be thought of as a low quality trap and would not become apparent by our previous analysis. In this section we examine whether this has taken place in our sample of countries.

To test this hypothesis we regress the change in the UVR (our measure of quality) between 1995 and 2000 for each segment on the initial UVR. This is analogous to the empirical growth literature on the catch-up hypothesis. A negative coefficient on the initial UVR indicates that the (average) quality of the segments has increased more in the segments that were initially further behind. In this sense, we can argue that there has been a movement from a low level to a higher level of quality over time, and as such there is no evidence of a low quality trap within the segments. To account for differences across segments in catching-up, we interacted the initial UVR with segment dummies for the second and third segments.

Once again, the model is estimated using panel data techniques and assuming fixed, industry-specific effects. The results are reported in Table 5.3 for all three country groups.

Table 5.3

### Specialization within quality segments

| duvr | CEEC-5 | EEC-2 | BAL |
|---|---|---|---|
| **uvr95** | -0.4408 *** | -0.4197 * | -0.4520 ** |
| | *0.000* | *0.074* | *0.028* |
| **Dmshaval** | 6.2921 ** | 3.4274 | 9.1911 |
| | *0.022* | *0.742* | *0.420* |
| **int2** | 0.1216 | -0.7057 ** | -0.6624 ** |
| | *0.332* | *0.016* | *0.011* |
| **int3** | 0.0350 | -0.1158 | -0.5296 ** |
| | *0.766* | *0.667* | *0.031* |
| **DSeg2** | 0.0318 | -0.4014 *** | -0.2485 * |
| | *0.383* | *0.007* | *0.058* |
| **DSeg3** | 0.0030 | -0.1831 | -0.2053 * |
| | *0.936* | *0.224* | *0.078* |
| **cons** | -0.0214 | -0.0111 | 0.0501 |
| | *0.448* | *0.912* | *0.557* |
| | | | |
| **R2-within** | 0.29 | 0.40 | 0.49 |
| **R2-overall** | 0.26 | 0.37 | 0.45 |
| **obs** | 195 | 78 | 116 |
| **groups** | 13 | 13 | 13 |

The negative and significant coefficient that appears on the initial unit value ratio suggests that there has in general been catching-up within the segments. Those segments that initially had the lowest unit values relative to the EU-15 have increased their unit value ratios faster than

segments by country groups that were closer to the EU-15 in terms of their initial unit value ratios. The coefficients on the change in the import share into the EU-15 is only positive and significant for CEE-5. This shows that increased trade integration with the EU-15, by creating learning effects and knowledge spillovers, has helped to improve the quality of exports into the EU-15 for this country group.

Segment dummies are negative and significant for EE-2 in segment 2 and BAL in segments 2 and 3. For the interaction terms between segment dummies and the initial unit value ratios we find again a negative significant coefficient for EE-2 in segment 2 and for BAL in segments 2 and 3. This implies that catching-up has been faster in these segments for the respective country groups. In other words, there is no indication of a low-quality trap for these countries, now referring to our third definition. While CEE-5 show catching-up at roughly equal pace in all quality segments inside industries, the remaining CEECs also show catching-up in higher quality segments but at lower rates as indicated by the negative segment dummies. These are at the same time those product segments where the initial quality gap to the EU-15 has been highest and considerably higher than in CEEC-5. Thus, UVRs in 2000 remain below those of CEEC-5. Despite convergence inside segments, differences across segments persist.

Once again, we can consider developments in qualitatively different industries in addition. The results, again for two equally large country groups are reported below in Table 5.4.

Table 5.4

## Specialization within quality segments in low and high tech industries

| duvr | Low Tech | | High Tech | |
| --- | --- | --- | --- | --- |
| | CEEC-5 | Other | CEEC-5 | Other |
| uvr95 | -0.3740 | -0.3013 | -0.4543 ** | -0.2842 |
| | 0.130 | 0.196 | 0.048 | 0.443 |
| Dmshaval | 11.7140 | -5.6460 | 15.4439 ** | 15.0864 |
| | 0.177 | 0.286 | 0.019 | 0.912 |
| int2 | 0.1825 | -0.2378 | -0.2483 | -1.4576 *** |
| | 0.600 | 0.562 | 0.350 | 0.004 |
| int3 | 0.1608 | -0.5151 * | -0.0124 | -0.7214 |
| | 0.647 | 0.079 | 0.959 | 0.106 |
| DSeg2 | 0.1440 ** | -0.0594 | -0.1686 | -0.9642 *** |
| | 0.016 | 0.526 | 0.134 | 0.009 |
| DSeg3 | 0.1325 ** | -0.2293 *** | -0.0006 | -0.5478 * |
| | 0.035 | 0.007 | 0.996 | 0.097 |
| cons | -0.0386 | 0.1246 ** | -0.0786 | 0.0820 |
| | 0.343 | 0.017 | 0.442 | 0.763 |
| R2-within | 0.29 | 0.41 | 0.61 | 0.60 |
| R2-overall | 0.18 | 0.42 | 0.56 | 0.57 |
| obs | 45 | 45 | 45 | 44 |
| groups | 3 | 3 | 3 | 3 |

For CEEC-5, we find catching-up in the high-tech industries which is equally strong in all three quality segments. The positive coefficient for the change in EU-15 import shares suggests that

positive learning effects are present. Although catching-up cannot be seen in the low tech industries, relative export unit values increase faster in the upper quality segments, rejecting the idea of a low quality trap. For the remaining CEECs, some catching-up in the high quality segment of labour intensive, less technology intensive industries is observed. However, the negative segment dummy also reveals that this convergence inside the high quality segment is at the same time accompanied by a low level of growth (in terms of quality improvements) in this segment for the low tech industries. Likewise, CEE-2 and BAL are catching up inside the medium quality segment of high tech industries, again at a depressed level of growth in UVRs compared to other segments. Thus, some indication of a low-quality trap according to our second definition exists in these countries.

## 6. Conclusions

This paper addressed the question of whether CEECs are locked in exporting low quality to the EU market which would correspond to their communist and early post-communist image. We presented empirical evidence on whether they were successfully upgrading their exports in terms of quality in the second half of the nineties or not. We referred to the lock-in scenario as a low quality trap and used various refinements of this term. The first dimension quality referred to shifts in export structure. A country is said to successfully escape a low quality trap by shifting exports from low to high tech industries. The second notion identified shifts inside industries from low to high quality segments as upgrading and therefore no evidence of such a trap. Finally, we added a third dimension of quality that to our knowledge has not been dealt with before. Rather than concentrating on shifts across distinct segments, we looked at quality improvements inside quality segments within industries. We presented descriptive evidence on all three notions of quality improvements/low quality traps. This was followed by econometric tests for the latter two definitions. We used changes in unit values and unit value ratios as an indication of quality upgrading.

As a first result, an important distinction between CEE-5 (Czech Republic, Slovakia, Hungary, Poland and Slovenia) and the five other countries (Bulgaria, Romania and the Baltic States) was observed. Whereas the former group appeared to be successful in substantial quality upgrading of their export structure according to all three definitions, the latter group did so only in terms of the first and third definition. The notion of a low quality trap defined as low-end specialization within industries could not be ruled out for these countries.

Second, the descriptive results were strongly in favour of substantial quality upgrading for CEE-5 and a low-quality trap for the remaining countries. However, the econometric results revealed a modified pattern. While the indication of low-quality within industry exports from Bulgaria, Romania and the Baltic states was more or less confirmed - i.e. quality improvement in the high quality segments were significantly lower than in low quality segments - significant quality upgrading (though at a low level) could be discerned inside the upper quality segments.

A significant faster quality upgrading across and within segments was observed for CEEC-5. Together with the descriptive evidence on those five countries we conclude that quality upgrading has taken place in this subgroup. Thus, we can clearly reject any kind of low quality trap for these countries.

It has to be mentioned that the use of unit values as a measure of quality imply a concept of quality which comprises physical and technical properties as well as consumer tastes and thus incorporates image and labelling effects as quality improvements. Comparing our results based on values to those based on quantities (i.e. tons) we find another distinction between the group of Baltic and South Eastern European countries on the one hand and CEE-5 on the other hand. Whereas the former experienced corresponding shifts in values and quantities, the latter showed increases in value terms that were often not accompanied by increases in exported quantities (or even in contrast to those). These results suggest that CEE-5 faced quality improvements associated with other factors than simply improvements in technical properties, i.e. positive labelling effects, changes in their image. This kind of improvements in quality as perceived by Western European consumers have been experienced neither by the Eastern European countries nor by the Baltic states.

Already by 1995, CEEC-5 exports were of considerably higher quality than those of other Eastern European countries. Given further quality upgrading in this group of countries, as confirmed by the findings in this paper, lack of quality will not pose an obstacle to CEEC-5 exports into the EU-15. This implies positive long-term prospects for CEEC-5 trade flows with the EU-15. However, quality seems to be a concern in the case of Bulgaria, Romania and the Baltic states. These countries show some evidence of entering a low-quality trap according to our second definition, especially so in high tech industries. Despite showing convergence (in terms of exported quality) inside high quality segments, increases in relative unit values are significantly slower in those segments. Together with their initial huge quality gaps in these segments, this implies some restructuring towards lower quality inside industries.

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# Appendix

Table A1

## List of industries

| NACE code | Description | Group |
|---|---|---|
| DA | Food products; beverages and tobacco | Low tech |
| DB | Textiles and textile products | Low tech |
| DC | Leather and leather products | Low tech |
| DD | Wood and wood products | |
| DE | Pulp, paper & paper products; publishing & printing | |
| DF | Coke, refined petroleum products & nuclear fuel | |
| DG | Chemicals, chemical products and man-made fibres | |
| DH | Rubber and plastic products | |
| DI | Other non-metallic mineral products | |
| DJ | Basic metals and fabricated metal products | |
| DK | Machinery and equipment n.e.c. | High tech |
| DL | Electrical and optical equipment | High tech |
| DM | Transport equipment | High tech |
| DN | Manufacturing n.e.c. | |

Table A2

## List of countries

| Code | Country Name | Group |
|---|---|---|
| 61 | Czech Republic | CEEC-5 |
| 64 | Hungary | CEEC-5 |
| 60 | Poland | CEEC-5 |
| 63 | Slovak Republic | CEEC-5 |
| 91 | Slovenia | CEEC-5 |
| 66 | Romania | EEC-2 |
| 68 | Bulgaria | EEC-2 |
| 53 | Estland | BAL |
| 54 | Latvia | BAL |
| 55 | Lithuania | BAL |