The Dynamics of Trade in Central and Eastern European Countries

Imre Fertő

We describe the evolving pattern of Central European countries' trade using recently developed empirical procedures based around the classic Balassa index. Despite significant changes in Central European economies during transition to a market economy, the distribution of the indices did not change radically over the 1990s. Our results suggest that the trade pattern converged in Czech Republic, Hungary, Poland and Slovenia, while it polarised in Estonia Latvia, Lithuania and Slovakia over the period. For particular product groups, the indices display greater variation. They are stable for product groups with comparative disadvantage, but product groups with weak to strong comparative advantage show significant variation. At the product level different development can be observed in the changes of trade specialization. The comparative advantages are still based largely on primary and natural resource intensive product groups in the Baltic countries, while CEE5 countries show a successful upgrading process in technological and human capital intensive products.

Key Words: international trade, revealed comparative advantage, Central Europe
JEL *Classification:* F14, F15, E23

Introduction

Recently, there has been renewed interest for trade dynamics (Proudman and Redding 2000; Brasili et al. 2000; Redding 2002; Stehrer and Wörz 2003; Wörz 2005; Hinloopen and van Marrewijk 2004b; Zaghini 2005). The theoretical literature on growth and trade stresses that comparative advantage is dynamic and develops endogenously over time. In particular, one strand of the literature (Lucas 1988; Young 1991; Grossman and Helpman 1991) has demonstrated that the growth rate of a country may be permanently reduced by a 'wrong' specialisation. Another strand emphasises the role of factor accumulation in determining the evolution of international trade (Findlay 1970; 1995; Deardorff 1974).

Although there is a wealth of literature on the trade between Central-Eastern European countries and the EU member states, this has tended

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not to deal with evolution of trade patterns, except Zaghini (2005). The dynamics of trade pattern often reflects deep structural changes in the whole economy of a particular country. It takes usually a long time, since comparative advantages may not change in the short run. But, there may occur sudden external and internal shocks influencing production, diffusion of new technology and institutional systems. During the last decade, the economies of Central European countries have been considerably transformed, including transition from planned economy to market economy, increasing trade openness, FDI etc. Therefore, it is reasonable to assume that these changes may affect on the trade pattern over time. In other words, Central European countries represent exceptional cases, when powerful changes in the economy should have effects on the evolution of trade pattern.

In this paper we apply recently developed empirical methods to investigate the dynamics of trade patterns in Central European countries (Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia and Slovenia). The novelty of the paper is that we extend the traditional empirical trade analysis by the application of the factor abundance approach (Hinloopen and van Marrewijk 2004b) to identify the changes in the pattern of comparative advantage. The paper is organised as follows. The second section briefly reviews some of the theoretical literature concerning the dynamics of trade patterns. The third section outlines the employed methodology. Results are reported in two stages. First, in the fifth section we present results on the dynamics of trade pattern in the fourth section. Second, we show the results on the structural changes in comparative advantage based on a factor abundance approach. The summary and some conclusions are presented in the last section.

Trade Dynamics

The standard Heckscher-Ohlin model implies that the pattern of trade specialisation changes only if trading partners experience a change in their relative factor endowments. This suggests that the existence of persistent trade patterns is perfectly consistent with the model, if the relative factor endowments of countries do not change significantly with respect to their main trading partners.

The New Trade Theory emphasises the importance of increasing returns scale in explaining trade flows, which complicates the predictions of trade theory, because they depend on the specific assumptions about the nature of return to scale. One strand of this literature assumes that economies of scale are internal to the firm (e. g. Krugman 1987; Helpman and Krugman 1985). In this case, the main implications of the factor proportions theorem basically do not change.

If national external economies of scale exist, trade patterns dynamics depend on the effects of the external economies of scale on the slope of the production possibility frontier. Kemp (1969) and Markusen (1981) have proven that, if external economies of scale are negligible with respect to the factor intensity differences between two sectors, then a relative supply curve is positively sloped, and yields similar implications as in the standard Heckscher-Ohlin model.

If national external economies of scale are relevant, the predictions of the model will change substantially. Wong (1995) has shown that in the presence of national external economies of scale, the world trade pattern is determined by initial comparative advantage.

However, Either (1979; 1981) argues that increasing returns depend on the size of the world market. He demonstrates that in the case of international external economies of scale, increasing returns of scale do not influence the pattern of international trade. Grossman and Helpman (1990; 1991), under the assumption that knowledge spillovers are international in scope, have shown that the history of the production structure of a country do not affect on its long-run trade pattern, which only depends on the relative factors endowments.

However, other families of models find that dynamic scale economies arising from learning by doing are country specific and suggest a lock-in effect for the pattern of specialisation. Krugman (1987) and Lucas (1988) demonstrate that in the presence of dynamic economic scale the long-run trade pattern is determined by initial comparative advantage. The main implications of these models are that international trade patterns tend to be more specialised.

Proudman and Redding (2000) built a model focusing on international trade and endogenous technical change which illustrates that a precisely specified model yields ambiguous conclusions concerning whether international trade patterns display persistence or mobility over time. They conclude that it is ultimately an empirical question.

Methodology

The most popular indicator of a country's trade specialisation is the Revealed Comparative Advantage (RCA) index first proposed by Balassa (1965):

$$B = \frac{\frac{x_{ij}}{x_{rj}}}{\frac{x_{is}}{x_{rs}}}, \tag{1}$$

where x represents exports, i is a commodity, j is a country, r is a set of commodities and s is a set of countries. B is based on observed trade patterns; it measures a country's exports of a commodity relative to its total exports and to the corresponding export performance of a set of countries. If $B > 1$, then a comparative advantage is revealed, i. e. a sector in which the country is relatively more specialised in terms of exports.

Many researchers have attempted to refine revealed comparative advantage (see Vollrath 1991). Despite many criticisms, e. g. the asymmetric value, problem with logarithmic transformation, etc. (see De Benedictis and Tamberi 2001) the B index remains the popular tool in empirical trade analysis. The main advantage of the B index against alternative measures is its theoretical foundation. Earlier, Hillman (1980) had investigated the relationship between the B index and comparative advantage as indicated by pre-trade relative prices, abstracting from considerations caused by the possibility of government intervention on exports. He showed that the B index is not appropriate for cross-commodity comparison of comparative advantage, because in this case the value of B is independent of comparative advantage in the Ricardian sense of pre-trade relative prices. Furthermore, Hillman developed a necessary and sufficient condition to obtain a correspondence between the B index and pre-trade relative prices in cross-country comparisons for a given product:

$$1 - \frac{X_{ij}}{W_i} > \frac{X_{ij}}{X_j}\left(1 - \frac{X_j}{W}\right), \tag{2}$$

where X_{ij} is exports of commodity i by country j, X_j is total exports of country j, W_i is world exports of commodity i, and W is the world's total exports. Assuming identical homothetic preferences across countries, the condition in (2) is necessary and sufficient to guarantee that changes in the B index are consistent with changes in countries' relative factor-endowments. This condition guarantees that growth in the level of a country's exports of a commodity results in an increase in the B index. For an empirical test, Marchese and Nadal de Simone (1989) transformed Hillman's condition into:

$$HI = \frac{1 - \frac{X_{ij}}{W_i}}{\frac{X_{ij}}{X_j}\left(1 - \frac{X_j}{W}\right)}. \tag{3}$$

If *HI* is larger than unity, the *B* index used in cross country comparison will be a good indicator of comparative advantage. The authors argued that Hillman's index should be calculated in any empirical research attempting to identify the long-term implications of trade liberalisation using the *B* index. However, only two studies appear to have applied Hillman's index: Marchese and Nadal de Simone (1989) show that Hillman's condition is violated in less than 10 per cent of exports of 118 developing countries in 1985; and in the data set used by Hinloopen and Van Marrewijk (2001) Hillman's condition was not valid for only 7 per cent of export value and less than 1 per cent of the number of observations. Furthermore, Hinloopen and Van Marrewijk (2004a), using a comprehensive dataset between 1970–1997, find that violations of the Hillman condition are small as a share of the number of observations, but may be considerable as a share of the value of total world exports. The authors argue that the Hillman condition should be included as a standard diagnostic test for empirical analysis of comparative advantage.

We focus on the stability of the Balassa index over time. One can distinguish at least two types of stability (Hinloopen and Van Marrewijk 2001): (i) stability of the distribution of the indices from one period to the next; and (ii) stability of the value of the indices for particular product groups from one period to the next.

The first type of stability is investigated in two ways. First, after Dalum et al. (1998) we use the *B* index in regression analysis:

$$B_{ij}^{t_2} = \alpha_i + \beta_i B_{ij}^{t_1} + \varepsilon_{ij}, \tag{4}$$

where superscripts t_1 and t_2 describe the start year and end year, respectively. The dependent variable, *B* at time t_2 for sector i in country j, is tested against the independent variable which is the value of *B* in year t_1; α and β are standard linear regression parameters and ε is a residual term. If $\beta = 1$, then this suggests an unchanged pattern of *B* between periods t_1 and t_2, i. e. there is no change in the overall degree of specialization. If $\beta > 1$, the existing specialisation of the country is strengthened. If $0 < \beta < 1$, this indicates despecialisation, i. e. commodity groups with low initial *B* indices grow over time, while product groups with high initial *B* indices decline. The special case where $\beta < 0$ indicates a change in the sign of the index. However, Dalum et al. (1998) point out that $\beta > 1$ is not a necessary condition for growth in the overall specialisation pattern. Thus, following Cantwell (1989), they argue that:

$$\frac{\sigma_i^{2t_2}}{\sigma_i^{2t_1}} = \frac{\beta_i^2}{R_i^2} \tag{5}$$

and hence,

$$\frac{\sigma_i^{t_2}}{\sigma_i^{t_1}} = \frac{|\beta_i|}{|R_i|}, \tag{6}$$

where R is the correlation coefficient from the regression and σ^2 is variance of the dependent variable. It follows that the pattern of a given distribution is unchanged when $\beta = R$. If $\beta > R$ the degree of specialisation has grown, while if $\beta < R$ the degree of specialisation has fallen.

The second way in which the stability of the distribution of B is examined seeks to measure the extent to which Central European countries' exports have become *relatively* more or less specialised over the period. This is undertaken using the Gini coefficient as a measure of concentration (see, for example, Amiti 1998). The Gini coefficient is used as a summary measure of the difference in the structure of exports between a particular Central European country and the EU. The closer the Gini coefficient is to its upper bound of 1, the greater is the difference in structure and specialisation of a particular Central European country's exports vis-à-vis the EU.

The second type of stability, that of the value of the trade index for particular product groups, is also analysed in two ways. First, following a recent empirical method pioneered by Proudman and Redding (2000) and applied by Brasili et al. (2000) and Hinloopen and Van Marrewijk (2001), we employ transition probability matrices to identify the persistence and mobility of revealed comparative advantage as measured by the B index. There is no accepted guide in the literature for classification of B index into appropriate categories. Most studies classify data into various percentiles, like quartiles or quintiles. Hinloopen and Van Marrewijk (2001) point out that this classification has several drawbacks. First, boundaries between classes are difficult to interpret. Second, they also differ from one country to another, therefore making cross-country comparisons difficult. Consequently, following Hinloopen and Van Marrewijk (2001), we divide the B index into four classes:

Class a: $0 < B \leq 1$
Class b: $1 < B \leq 2$
Class c: $2 < B \leq 4$
Class d: $4 < B$

Class a refers to all those product groups without a comparative advantage. The other three classes, b, c, and d, describe the sectors with a comparative advantage, roughly classified into weak comparative advantage (class b), medium comparative advantage (class c) and strong comparative advantage (class d).

Second, the degree of mobility in patterns of specialisation can be summarised using indices of mobility. These formally evaluate the degree of mobility throughout the entire distribution of B indices and facilitate direct cross-country comparisons. The first of these indices (M_1, following Shorrocks 1978) evaluates the trace (tr) of the transition probability matrix. This index thus directly captures the relative magnitude of diagonal and off-diagonal terms, and can be shown to equal the inverse of the harmonic mean of the expected duration of remaining in a given cell.

$$M_1 = \frac{K - tr(P)}{K - 1}, \tag{7}$$

where K is the number of cells, and P is the transition probability matrix.

The second index (M_2, after Shorrocks 1978 and Geweke et al. 1986) evaluates the determinant (det) of the transition probability matrix.

$$M_2 = 1 - |det(P)|. \tag{8}$$

In both indices, a higher value indicates greater mobility, with a value of zero indicating perfect immobility.

Furthermore, to test the equality of different Markov transition probabilities we apply Anderson and Goodman's (1957) test statistics, which under null hypothesis $p_{ij} = \overline{p_{ij}}$, for each state i has an asymptotic distribution:

$$\sum_j n_i^* \frac{(p_{ij} - \overline{p_{ij}})^2}{p_{ij}} \sim \chi^2(m-1) \cdot n_t^* = \sum_{t=0}^{T-1} n_t(t),$$

where m is the member of states, p_{ij} are the estimated, $\overline{p_{ij}}$ are the probabilities under null, and $n_t(t)$ describes the number of sectors in cell i at time t.

Empirical Results

The revealed comparative advantage can be measured at the global level (e. g. Vollrath 1991), at a regional or sub-global level (as in Balassa's original specification) or restricted to the analysis of bilateral trade between just two countries or trading partners (e. g. Dimelis and Gatsios 1995; Gual and Martin 1995). Given that we are interested in the dynamics of

Central European countries' trade vis-à-vis the EU, calculation of the indices is restricted to an EU context, using total merchandise exports as the denominator (respectively, *s* and *r* in (1)). We focus on the period 1993–2002, with data supplied by UNCTAD at the three-digit level of the SITC for 232 product groups. Following Marchese and Nadal de Simone (1989), the indices calculated from our data set are found to be fully consistent with Hillman's condition.

DYNAMICS OF THE DISTRIBUTION

Table 1 shows some simple summary measures of dispersion for *B* index at the start and end of the period (due to lack of data in the case of the Lithuania, the end year is 2001). A general decrease in international specialisation is evident for the Czech Republic, Hungary and Poland, in that the all the measures have fallen. The numbers also suggest that these countries lost their comparative advantage for some product groups. Interestingly, the mean of *B* index has decreased in Lithuania and Slovenia, while the median of *B* index has grown. The other group of countries (Estonia, Latvia and Slovakia), however report a growth in specialisation. Furthermore, Estonia and Latvia have relatively high mean values with the lowest median values, indicating a narrow band of high specialisation.

To evaluate the statistical significance of these changes, a two-tailed Wilcoxon signed rank test was applied because of the non-normality in the distributions. The null hypothesis, of no difference in the *B* indices between the start and end years, can be rejected (at a level of 5% or less) in the cases of Latvia, Lithuania, Poland, Slovakia and Slovenia.

The regression results in table 2, based on (4) show a more complete picture. The coefficient on initial specialization is always significantly different from zero and one, except Slovakia. The estimations suggest that there is no reverse change in trade pattern in Central European countries. The coefficients are less than one for six countries (Czech Republic, Estonia, Hungary, Lithuania, Poland, and Slovenia) This implies that in these countries the international specialisation has increased for products in which the countries were initially relatively less specialised and has decreased for those in which they were initially highly specialised. Nevertheless, there are remarkable differences among countries: the value of β is relatively small for Estonia and Lithuania (below 50 per cent), thus pointing at large changes within the distribution, it is much higher for Czech Republic and Slovenia, then indicating a relative stability of

TABLE 1 Descriptive statistics of B index

Country	Year	Mean	Median	Std. dev.	Maxium
Czech Republic	1993	1.81	0.88	4.80	60.92
	2002	1.62	0.81	3.92	45.7
Estonia	1993	2.47	0.38	6.38	77.48
	2002	3.22	0.48	12.93	117.35
Hungary	1993	1.63	0.57	4.70	60.17
	2002	1.28	0.56	3.24	30.5
Latvia	1993	2.16	0.18	5.78	78.89
	2002	4.16	0.33	22.28	257.92
Lithuania	1993	1.66	0.38	10.98	52.01
	2001	1.45	0.40	2.89	26.55
Poland	1993	2.81	0.57	10.95	146.50
	2002	2.40	0.56	10.43	116.09
Slovakia	1993	1.18	0.59	1.82	16.40
	2002	1.35	0.52	2.57	26.85
Slovenia	1993	1.08	0.60	2.01	15.10
	2002	1.07	0.83	1.62	12.64

TABLE 2 Stability of B between 1993 and 2002

	α	β	R	β/R	(1)	(2)
Czech Republic	0.23	0.77	0.942	0.82	0.000	0.000
Estonia	1.59	0.47	0.222	2.09	0.000	0.000
Hungary	0.34	0.60	0.828	0.72	0.000	0.000
Latvia	–0.62	2.20	0.804	2.73	0.000	0.000
Lithuania*	1.01	0.33	0.289	1.14	0.000	0.000
Poland	0.95	0.53	0.623	0.86	0.000	0.000
Slovakia	0.06	1.11	0.774	1.43	0.000	0.121
Slovenia	0.23	0.84	0.854	0.98	0.000	0.000

NOTES *2001. Column headings are as follows: (1) Sign. of F (H_0:$\beta = 0$); (2) Sign. of F (H_0:$\beta = 1$).

the specialisation pattern, and somehow intermediate for Hungary and Poland. However, Latvia displayed a strong specialisation. The F test confirms that trade specialisation has not changed in Slovakia. However, the β/R ratios show that the pattern of revealed comparative advantage has tended to converge for only Czech Republic, Hungary, Poland, and

TABLE 3 Gini indices of *B* between 1993 and 2002

Year	Czech R.	Estonia	Hungary	Latvia	Lithuania	Poland	Slovakia	Slovenia
1993	0.642	0.7752	0.7256	0.8409	0.8257	0.8016	0.6045	0.6663
1994	0.6621	0.7737	0.691	0.8444	0.7128	0.7846	0.6154	0.6543
1995	0.6246	0.7719	0.6867	0.8995	0.718	0.7686	0.6456	0.6529
1996	0.6386	0.7775	0.6907	0.9154	0.6985	0.7443	0.6636	0.6518
1997	0.6188	0.7946	0.6822	0.9387	0.6763	0.7469	0.6257	0.6498
1998	0.6065	0.8053	0.6782	0.9561	0.7116	0.7302	0.6176	0.6353
1999	0.6082	0.8166	0.6854	0.9375	0.7451	0.7166	0.6435	0.6458
2000	0.6021	0.8259	0.6954	0.9054	0.7345	0.7029	0.6544	0.6381
2001	0.5966	0.8167	0.6739	0.8913	0.7227	0.7057	0.662	0.6306
2002	0.6418	0.849	0.6984	0.9073	n. a.	0.7561	0.662	0.621
β	−0.006	0.010	−0.002	0.007	−0.005	−0.011	0.007	−0.006
t	−2.010	8.460	−1.360	1.690	−0.790	−3.420	2.660	−7.540
R^2	0.339	0.899	0.189	0.263	0.083	0.594	0.470	0.877

Slovenia. Although Estonia and Lithuania also show 'β-despecialization,' their the degree of specialization has actually increased. Similarly, Slovakia also experienced a growing specialisation in trade pattern.

The extent to which Central-European exports have become relatively more or less specialised over the period, vis-à-vis the EU, is shown by the Gini coefficients in table 3. Regressing the log of the Gini coefficients on a simple time trend (see, for example, Amiti 1998), there is a significant increase in specialisation in Estonia and Slovakia; no significant change in Hungary, Latvia and Lithuania; and a significant fall in specialisation in Czech Republic, Poland and Slovenia.

INTRA-DISTRIBUTION DYNAMICS

Further information on the dynamics of the trade index can be obtained by analysis of Markovian transition matrices, showing the probability of passing from one state to another between the starting year (1993) and the end year (2002). The transition matrices in table 4 suggest that values of the *B* index are fairly persistent from 1993 to 2002 for observations with a comparative disadvantage (class a) for all countries. The diagonal elements for this class are 0.82 or above for all countries, indicating a high probability that a product with a comparative disadvantage at the start of the period will have that same status at the end of the period.

The persistence is relatively strong at the other ends of distribution (d, d), the value of cells is larger than 40 per cent. This suggests that once obtaining a large comparative advantage they will likely maintain it over time. Note that the values relative to the ends of the distribution on the main diagonal are larger than those in the middle of distribution for the Czech Republic, Estonia, Latvia, Lithuania and Slovakia. In other words, it is easier maintain a strong revealed comparative advantage than a weak or medium one. However, indices in classes b, c and d display considerable variation in their pattern. The probability of a loss of comparative advantage for those observations starting with a weak comparative advantage (class b) are high (above 50 per cent), for Hungary, Latvia and Lithuania. There is a small chance of moving from class c (medium comparative advantage) to class d (high comparative advantage) in the cases of the Czech Republic, Hungary and Slovenia.

In summary, these results suggest that the probability of an observation moving to a lower value cell (a weakening of comparative advantage) is much higher than the reverse case. The limit distributions show a more polarised distribution for Estonia, Poland, and Slovenia, whilst asymmetry is confirmed for the Czech Republic and Hungary, tending to a right skewed distribution.

Table 5 reports the mobility indices, M_1 and M_2, for each of the countries. Both indices indicate that mobility is highest in Lithuania and lowest in Slovenia. Furthermore, Estonia, Hungary and Slovenia show the most persistent pattern of specialisation, while Poland, Latvia and Lithuania are the most dynamic economies. Similarly to other papers (Brasili et al. 2000; Proudman and Redding 2000; Hinloopen and van Marrewijk 2001; 2004b; Zaghini 2005) the two indices do not yield the perfectly same ranking. But the Spearman rank correlation coefficient remains high (0.95).

Finally, Anderson and Goodman's test rejects the equality of all transition matrices relative to the estimated benchmark (table 5, columns 2–3). In other words, changes across different comparative advantage classes were significant for all countries.

Structural Changes in Trade Specialisation

This section analyses some details of the structural change in Central European countries' comparative advantage. After Hinloopen and van Marrewijk (2004b) we classify most sectors at the 3-digit level according to factor intensity on the basis of the International Trade Center's clas-

TABLE 4 Transition matrices of *B* Index

B	a	b	c	d	a	b	c	d
	Czech Republic				*Estonia*			
a	0.77	0.16	0.05	0.02	0.84	0.11	0.04	0.01
b	0.40	0.42	0.15	0.03	0.20	0.48	0.20	0.12
c	0.29	0.35	0.26	0.10	0.26	0.32	0.26	0.16
d	0.25	0.06	0.13	0.56	0.11	0.11	0.22	0.56
Initial distribution	0.53	0.27	0.13	0.07	0.69	0.11	0.08	0.12
Final distribution	0.57	0.25	0.11	0.07	0.64	0.16	0.09	0.10
Limit distribution	0.61	0.24	0.10	0.06	0.55	0.21	0.12	0.12
	Hungary				*Latvia*			
a	0.85	0.08	0.03	0.03	0.80	0.11	0.05	0.04
b	0.51	0.46	0.03	0.00	0.56	0.22	0.11	0.11
c	0.33	0.33	0.29	0.04	0.35	0.09	0.26	0.30
d	0.06	0.12	0.41	0.41	0.36	0.07	0.14	0.43
Initial distribution	0.67	0.15	0.10	0.07	0.76	0.08	0.10	0.06
Final distribution	0.69	0.17	0.09	0.06	0.71	0.11	0.08	0.09
Limit distribution	0.73	0.16	0.07	0.04	0.68	0.11	0.09	0.12

Continued on the next page

sification, the joint UNCTAD/WTO organization. According to five broad factor intensity categories as follows:

A. *Primary products* (83 sectors); e. g. meat, dairy, cereals, fruit, coffee, sand, minerals, oil, natural gas, iron ore, and copper ore.

B. *Natural-resource intensive products* (21 sectors); e. g. leather, cork, wood, lime, precious stones, pig iron, copper, aluminium, and lead.

C. *Unskilled-labor intensive products* (26 sectors); e. g. pipes, various textiles, clothing, glass, pottery, ships, furniture, footwear, and office supplies.

D. *Technology intensive products* (62 sectors); e. g. various chemicals, medicaments, plastics, engines, generators, machines, tools, pumps, telecommunications and photo equipment, optical equipment, and aircraft.

E. *Human-capital intensive products* (43 sectors); synthetic colours, pigments, perfumes, cosmetics, rubber and tires, tubes, pipes, vari-

Continued from the previous page

	Lithuania				*Poland*			
a	0.87	0.06	0.04	0.03	0.75	0.20	0.05	0.01
b	0.53	0.11	0.21	0.16	0.24	0.50	0.21	0.06
c	0.21	0.16	0.21	0.42	0.19	0.35	0.27	0.19
d	0.19	0.25	0.13	0.44	0.05	0.14	0.33	0.48
Initial distribution	0.69	0.16	0.08	0.07	0.65	0.15	0.11	0.09
Final distribution	0.71	0.09	0.09	0.11	0.55	0.25	0.12	0.08
Limit distribution	0.70	0.10	0.08	0.12	0.43	0.31	0.16	0.10
	Slovakia				*Slovenia*			
a	0.86	0.08	0.06	0.01	0.85	0.13	0.02	0.00
b	0.40	0.40	0.17	0.04	0.13	0.70	0.17	0.00
c	0.14	0.36	0.25	0.25	0.15	0.26	0.48	0.11
d	0.00	0.00	0.50	0.50	0.17	0.17	0.25	0.42
Initial distribution	0.62	0.21	0.12	0.05	0.70	0.13	0.12	0.05
Final distribution	0.63	0.17	0.13	0.07	0.64	0.22	0.10	0.03
Limit distribution	0.60	0.16	0.14	0.10	0.49	0.35	0.14	0.03

TABLE 5 Mobility indices and test statistics for equality of Markov transition matrice

	M_1	M_2	χ^2	p value
Czech Republic	0.663	0.983	107.702	0.000
Estonia	0.619	0.979	144.287	0.000
Hungary	0.662	0.967	131.361	0.000
Latvia	0.762	0.993	56.595	0.000
Lithuania	0.793	0.996	90.328	0.000
Poland	0.669	0.994	123.504	0.000
Slovakia	0.664	0.984	140.906	0.000
Slovenia	0.516	0.916	190.213	0.000

ous types of steel and iron, cutlery, televisions, radios, cars, watches, and jewellery.

This leaves five 3-digit sectors not classified according to intensity which will be ignored in the remainder of this section. The complete classification can be found at following website: www.few.eur.nl/few/people/vanmarrewijk/eta.

TABLE 6 Share of product groups in exports $B > 1$ according to factor intensity

	1993					2002				
	A	B	C	D	E	A	B	C	D	E
Czech Republic	0.22	0.07	0.21	0.17	0.33	0.07	0.04	0.16	0.33	0.41
Estonia	0.43	0.10	0.26	0.16	0.05	0.31	0.08	0.22	0.25	0.13
Hungary	0.38	0.06	0.23	0.24	0.09	0.11	0.03	0.13	0.57	0.15
Latvia	0.29	0.22	0.21	0.08	0.20	0.45	0.18	0.24	0.02	0.11
Lithuania	0.54	0.04	0.09	0.11	0.22	0.52	0.05	0.10	0.03	0.30
Poland	0.32	0.15	0.33	0.06	0.14	0.16	0.08	0.28	0.18	0.30
Slovakia	0.17	0.10	0.17	0.21	0.35	0.12	0.07	0.16	0.16	0.49
Slovenia	0.10	0.12	0.33	0.22	0.22	0.04	0.10	0.19	0.34	0.32

Table 6 (columns 4–5) displays the breakdown of the export share by resource intensity in 1993 and 2002, where the *B* index is larger than one. The CEE countries show a different pattern of revealed comparative in terms of resource intensity. In 1993, the Czech Republic and Slovakia have high shares (above 50 percent) of the two 'highest' categories: technology- and human capital-intensive products during the analysed period. Corresponding figures for Estonia, Latvia and Poland have not exceeded the 30 percent. Between 1993 and 2002, Czech Republic, Hungary, Poland and Slovenia improved their share of categories E and F by more than 20 percentage points. Estonia and Slovakia also experienced significant growth in these categories. However, Latvia lost its share by 15 per cent, whilst Lithuania's proportion remained the same in category E and F.

It is interesting to compare the dynamics that we can observe in this table and in table 5. As we already noticed above, mobility indices are the highest in Poland, Latvia and Lithuania. However, for Latvia and Lithuania, the mobility does not mean an 'upward' movement on the resource-intensity scale. On the other pole, Hungary and Slovenia – although showing a highly persistent pattern in specialization remain able to increase exports' share in technology intensive and human capital intensive products.

Summary and Conclusions

In this paper we have investigated the changing pattern of Central European exports to the EU. As a measure of trade specialisation we have employed the classic Balassa index. Despite significant changes in Central

European economies during transition to a market economy, the distribution of the indices has not changed radically over the 1990s. The extent of specialisation in Central European trade exhibits a mixed trend. The distribution of Balassa index differs markedly from one country to the other. Our results suggest that the trade pattern has converged in the Czech Republic, Hungary, Poland and Slovenia, whilst it polarised in Estonia, Latvia, Lithuania and Slovakia over the period. Estimations based on Gini indices reinforces the conclusion that there is a significant increase in specialisation in Estonia and Slovakia; no significant change in Hungary, Latvia and Lithuania; and a significant fall in specialisation in the Czech Republic, Poland and Slovenia vis-à-vis the EU.

The stability of the indices for particular product groups displays more variation. Results suggest that the indices are stable for observations with comparative disadvantage, in all cases. But product groups with weak, medium or strong comparative advantage show significant variation, with a tendency to weakening comparative advantage. In other words, the Markov matrices show a relatively high mobility for all countries, even though changes are particularly frequent in the middle of the distribution.

How are these stylised measurements linked to the findings of other empirical studies? An overall picture emerging from empirical studies (Balassa 1977; Amendola et al. 1992; Laursen 2000; Proudman and Redding 2000; and Brasili et al. 2000) is that one can observe a general decrease in specialisation, with a few exceptions. However, our study of Central European trade only partly reinforces this result, since we observe both growth and fall in trade specialisation.

At the sector level the pattern of comparative advantage also differs by countries. The main explanation may be that the CEE countries have different backgrounds. They liberalised and reformed their economies to a varying degree; consequently, the differences in their earlier manufacturing bases, political stability, administrative reforms and geographical locations, have resulted in different developments in comparative advantages across-countries. Recent studies have shown that the specialization pattern of many CEECs has changed over time, in many cases rapidly, with the CEE countries shifting production towards higher-tech and higher-skill industries (see Havlik 2001; Landesmann and Stehrer 2002; Wörz 2003; Zaghini 2005). Consistently with these results we found that the comparative advantages in Baltic countries are still largely based on natural resources; whilst the Czech Republic, Hungary, Slovakia and

Slovenia are the most oriented towards human-capital and technology intensive products, with Poland following closely. The latter countries display a rather fast catching-up in high skill and high-technological intensive products, in spite of the significant technological gap they inherited from the planned economy period. However, the increasing trade specialisation in the Baltic countries focuses mainly on primary and natural resources intensive products. Our results complement those of Dulleck et al. (2005), who identify two different ways in quality upgrading for CEE countries. The first group (Czech Republic, Hungary, Poland Slovakia and Slovenia) can be characterised by successful upgrading of their export structure, whilst the results for the second group (the Baltic countries) was less unambiguous. In short, the Baltic states seem to be less successful in the catch up process to the European Union.

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