The Dynamics of Trade in Central and Eastern European Countries*

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Abstract

We describe the evolving pattern of Central European countries' trade using recently developed empirical procedures based around the classic Balassa index and its symmetric transformation. . Despite significant changes in Central European economies during transition to a market economy, the distribution of the indices remained fairly stable over the 1990s. Our results suggest that trade pattern has converged in Estonia, Hungary, Poland and Slovenia, while it polarised in Czech Republic, 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.

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Keywords international trade, revealed comparative advantage, Central Europe

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1. Introduction

Recently, there has been renewed interest for trade dynamics (Proudman and Redding, 2000; Brasili et al. 2000; Redding 2002; Zaghini, 2003; Hinloopen and van Marrewijk 2004b). 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 not deal with evolution of trade patterns, except Zaghini (2003). The dynamics of trade pattern is often reflects deep structural changes in the whole economy of a particular country. It takes usually long time, comparative advantages may not change in short run. But, it may happen sudden external and internal shocks influencing production, diffusion of new technology and institutional systems. Last decade the economies of Central European countries have been considerable transformed, including transition from planned economy to market economy, increasing trade opennes, FDI etc. Therefore, it is reasonable assumed that these changes may affect on the trade pattern over time. In other words, Central European countries represent an 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 Central European countries' (Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia and Slovenia). The paper is organised as follows. Section 2 briefly reviews some of the theoretical literature concerning the dynamics of trade patterns. Section 3 outlines the measurement of trade specialisation, while section 4 describes the empirical models and procedures we apply. Results are reported and discussed in section 5, with a summary and some conclusions presented in section 6.

2. 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 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. On strand of this literature assume that economies of scale is 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, 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, yields similar implications as in the standard Heckscher-Ohlin model.

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

However, Either (1979, 1981) argues that increasing returns depends on the size of 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 assumption that knowledge spillovers are international in scope, have shown that the history of the production structure of a country does not affect on its long run trade pattern, which only depends on the relative factors endowments.

However, other family of models find that dynamic scale economies arising from learning by doing are country specific and suggests 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 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 pattern display persistence or mobility over time. They conclude that it is ultimately an empirical question.

3. Measuring Trade Specialisation

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

$$B = (x_{ij} / x_{rj}) / (x_{is} / x_{rs}) \qquad (1)$$

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 (e.g. Donges and Riedel, 1977; Kunimoto, 1977; Bowen, 1983; and Vollrath, 1987, 1989 and 1991). Iapadre (2001) provides a critical overview on the most commonly used measures of international specialisation. Here we focus only on the B index and its transformation.

A problem with the Balassa index is that its value is asymmetric; it varies from one to infinity for products in which a country has a revealed comparative advantage, but only from zero to one for commodities with a comparative disadvantage. This asymmetry creates at least two problems. First, if the mean of the B index is higher than its median, then the distribution of B will be skewed to the right. This means that the relative weight of sectors with B>1 will be overstated compared to sectors with B<1 (De Benedictis and Tamberi, 2001), which will have a bearing on econometric work focusing on revealed comparative advantage patterns (Dalum et al., 1998).

Second, a methodological problem arises when one applies the logarithmic transformation of the Balassa index, because a change in B from 0.01 to 0.02 has the same impact as a change from 50 to 100. (This criticism also applies to other RCA indices.) Dalum et al. (1998) propose a revealed symmetric comparative advantage (RSCA) index to alleviate the skewness problem:

$$\text{RSCA} = (B-1) / (B+1) \quad (2).$$

The RSCA ranges from minus one to plus one and avoids the problem of zero values, which arises in the logarithmic transformation. The main advantage of this approach is that changes in values of B below unity have the same weight as changes above unity. But the disadvantage is that forced symmetry does not necessary imply normality in the error terms and may hide some of the B dynamics (De Benedictis and Tamberi, 2001).

Proudman and Redding (2000) note that the arithmetic mean of the B index across sectors is not necessarily equal to one. They argue that the numerator in (1) is unweighted by the share of total exports accounted for by a particular product group, while the denominator is a weighted sum of export shares of all commodities. Hence, if a country's trade pattern is described by high export shares in a few sectors, which account for a small share of exports to the reference market, this implies high values for the numerator and low values for the denominator. This yields a mean value of B above one in a given country. Moreover, average values of B may change over time, hence a country may misleadingly display changes in its average extent of specialisation. The authors propose an alternative measure of revealed comparative advantage in which a country's export share in a given product group is divided by its mean export share in all (n) commodity groups:

$$\overline{B}_{ij} = \frac{B_{ij}}{\frac{1}{n}\sum_i B_{ij}} \quad (3)$$

The mean value of the normalised B in (3) is constant and equal to one. The interpretation of this index is that one normalises the B measure by its cross-section mean in order to abstract from changes in the average extent of specialisation. However, De Benedictis and Tamberi (2001) argue that the normalised B index loses its consistency with respect to the original B, because it may display the opposite status where the B value falls in the range between one and its mean.

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. 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:

$$1-\frac{X_{ij}}{W_i} > \frac{X_{ij}}{X_j}\left(1-\frac{X_j}{W}\right) \qquad (4),$$

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 (4) 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:

$$HI = \left(1-\frac{X_{ij}}{W_i}\right) / \frac{X_{ij}}{X_j}\left(1-\frac{X_j}{W}\right) \qquad (5)$$

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 comperhensive 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 Hillman condition should be included as a standard diagnostic test for empirical analysis of comparative advantage.

4. Empirical Models and Procedures

Our investigations are focused on the stability of trade indices 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 several ways. First, applying the procedure of Brasili et al. (2000) Hinloopen and Van Marrewijk (2001) we analyse the dynamics of the RSCA index via stochastic kernels. We adopt a Gaussian kernel function and a normal smoothing parameter, as suggested by Silverman (1986). Since the aim is to compare probability density function along time, we keep the bandwith of probability density function constant.

Second, after Dalum et al. (1998) we use RSCA in regression analysis:

$$RSCA_{ij}^{t2} = \alpha_i + \beta_i RSCA_{ij}^{t1} + \varepsilon_{ij} \qquad (6),$$

where superscripts t1 and t2 describe the start year and end year, respectively. The dependent variable, RSCA at time t2 for sector i in country j, is tested against the independent variable which is the value of RSCA in year t1; α and β are standard linear regression parameters and ε is a residual term. If β=1, then this suggests an unchanged pattern of RSCA between periods t1 and t2. If β>1, the existing specialisation of the country is strengthened. If 0<β<1, then commodity groups with low (negative) initial RSCA indices grow over time, while product groups with high (positive) initial RSCA indices decline. The special case where β<0 indicates a change in the sign of the index. However, Dalum et al. (1998) point out that β>1 is not a necessary condition for growth in the overall specialisation pattern. Thus, following Cantwell (1989), they argue that:

$$\sigma_i^{2t2} / \sigma_i^{2t1} = \beta_i^2 / R_i^2 \qquad (7a),$$

and hence,

$$\sigma_i^{t2} / \sigma_i^{t1} = |\beta_i| / |R_i| \qquad (7b),$$

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 β=R. If β>R the degree of specialisation has grown, while if β<R the degree of specialisation has fallen.

The third 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 the difference in structure and specialisation of a particular Central European country 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 an 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 difficult interpret. Second, they also differ from one country to another, therefore it makes 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.

$$M_1 = \frac{K - tr(P)}{K - 1} \qquad (8a),$$

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.

$$M_2 = 1 - |det(P)| \qquad (8b).$$

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

5. Empirical results

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 the 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.

5.1 Dynamics of the Distribution

The normalised B index after Proudman and Redding (2000) (see equation 3) was not employed in the empirical analysis because of the consistency problem noted by De Benedictis and Tamberi (2001). The share of product groups where B falls between one and its mean is above 10% in almost one quarter of all cases. Therefore, we use B and the RSCA transformation.

Table 1 shows a simple summary measure of dispersion for each of the two specialisation indices, B and RSCA, at the start and end of the period.[1] A general decrease in international specialisation is evident for the Hungary, Poland and Slovenia in that the standard deviation has fallen. The picture for Czech Republic Estonia and Lithuania, is less clear; the dispersion of the B index has risen, suggesting an increase in specialisation, whilst that for RSCA shows the opposite or vice versa. Latvia and Slovakia report a growth in specialisation, under both B and RSCA indices.

A more complete picture can be obtained by examining the sectoral distribution of the RSCA indices. Figure 1 shows, for each country, estimates of the kernel density function in the start and end years. The shape of these distributions is asymmetric and right skewed, except Czech Republic. Contrary to the expectation of Hinloopen and Marrewijk (2001), the distributions are not monotonically decreasing in every case. The absence of a rightward shift in the kernel distributions suggests no increase of specialisation.

[1] Due to lack of data in the case of the Lithuania, the end year is 2001.

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 RSCA indices between the start and end years, can be rejected (at a level of 5% or less) in the cases of the Estonia, Lithuania and Slovakia.

The regression results in Table 3, based on (6), reveal (relatively high β values) that trade patterns have not altered considerably between the start and end years. The β/R ratios show that the pattern of revealed comparative advantage has tended to converge for Estonia, Hungary, Poland, and Slovenia, whilst for other countries shows a diverge trend in trade specialisation. Furthermore, they suggest that the dispersion in the distribution of the RSCA indices has been relatively stable. However, contrary to the intention of the normalisation approach (Dalum et al., 1998 and Laursen, 1998), the Jarque-Bera tests report non-normality in the error terms for 2 of the 8 regressions.

The extent to which Cenral-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 4. 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 signficant fall in specialisation in Czech Republic, Poland and Slovenia.

5.2 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 5 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 is larger than those in the middle of distribution for Czech Republic, Estonia, Latvia, Lithuania and Slovakia. In other words, it is easier maintain a strong revealed comparative advantage than 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, wihlst asymmetry is confirmed for Czech Republic and Hungary, tending to a right skewed distribution.

Table 6 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. However, the two indices do not yield the same ranking.

6. 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 and its symmetric transformation. Despite significant changes in Central European economies during transition to a market economy, the distribution of the indices remained fairly stable over the 1990s. The extent of specialisation in Central European trade exhibits a mixed trend. Our results suggest that trade pattern has converged in Estonia, Hungary, Poland and Slovenia, wihlst it polarised in Czech Republic, Latvia, Lithuania and Slovakia over the period. 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.

How are these stylised measurements linked to 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, we observe both growth and fall in trade specialisation.

References

Amendola, G., Guerrieri, P. and Padoan, P.C. (1992). International Patterns of Technological Accumulation and Trade. *Journal of International and Comparative Economics* 1. (1): 173-197.

Amiti, M. (1998). New Trade Theories and Industrial Location in the EU. *Oxford Review of Economic Policy* 14 (2): 45-53.

Balassa, B. (1965). Trade Liberalization and Revealed Comparative Advantage. *The Manchester School of Economic and Social Studies* 33: 99-123.

Balassa, B. (1977). Revealed Comparative Advantage Revisited: An Analysis of Relative Export Shares of the Industrial Countries, 1953-71. *The Manchester School of Economic and Social Studies* 45: 327-344.

Bowen, H.P. (1983). On the Theoretical Interpretation of Indices of Trade Intensity and Revealed Comparative Advantage. *Weltwirtschaftliches Archiv* 119 (3): 464-472.

Brasili, A., Epifani, P. and Helg, R. (2000). On the Dynamics of Trade Patterns. *De Economist* 148 (2): 233-257.

Cantwell, J. (1989). *Technological Innovation and Multinational Corporations*. Oxford: Blackwell.

Dalum, B., Laursen, K. and Villumsen, G. (1998). Structural Change in OECD Export Specialisation Patterns: De-Specialisation and 'Stickiness'. *International Review of Applied Economics* 12 (2): 423-443.

Deardorff, A. (1974). Factor Proportions and Comparative Advantage in the Long Run: Comment. *Journal of Political Economy* 82: 829-833

De Benedictis, L. and Tamberi, M. (2001). A note on the Balassa Index of Revealed Comparative Advantage. Quaderni di ricerca n. 158. Department of Economics, University of Ancona

Dimelis, S. and K. Gatsios (1995), 'Trade with Central and Eastern Europe: The Case of Greece', in R. Faini and R. Portes (eds.), *EU Trade with Eastern Europe: Adjustment and Opportunities* (London: CEPR).

Either, W.J. (1979). Internationally Decresing Costs and World Trade. *Journal of International Economics*, 9 1-24.

Either, W.J. (1982). National and International Return to Scale in the Modern Theory of International World Trade. *American Economic Review* 72: 389-405.

Fertő, I and Hubbard, L.J. (2003). Revealed Comparative Advantage and Competitiveness in Hungarian Agri-Food Sectors. *World Economy* 26 (2): 247-259.

Findlay, R. (1970). Factor Proportions and Comparative Advantage in the Long Run: Comment. *Journal of Political Economy*, 78: 27-34

Findlay, R. (1995). *Factor Proportions, Trade and Growth*. Cambridge: MIT Press

Geweke, J., Marshall, R., and Zarkin, G. (1986). Mobility indices in continuous time Markov chains. *Econometrica* 54 (6): 1407-1423.

Grossman, G. and Helpman, E. (1990). Comparative Advantage and Long-run Growth. *American Economic Review* 80: 796-815.

Grossman, G. and Helpman, E. (1991). *Innovation and Growth in the Global Economy*. Cambridge: MIT Press

Gual, J. and C. Martin (1995), 'Trade and Foreign Direct Investment with Central and Eastern Europe: Its Impacts on Spain', in. R. Faini and R. Portes (eds.), *EU Trade with Eastern Europe: Adjustment and Opportunities* (London: CEPR).

Helpman, E. and Krugman, P. (1985). *Market Structure and Foreign Trade*. Cambridge: MIT Press.

Helpman, E. (1981). International Trade in the Presence of Product Differentation, Economies of Scale and Imperfect Competition: A Chamberlain-Heckscher-Ohlin Approach. *Journal of International Economics* 11: 305-340.

Hillman, A.L. (1980). Observation on the Relation between 'Revealed Comparative Advantage' and Comparative Advantage as Indicated by Pre-Trade Relative Prices. *Weltwirtschaftliches Archiv* 116 (2): 315-321. o.

Hinloopen, J. and van Marrewijk, C. (2001). On the Emprical Distribution of the Balassa Index. *Weltwirtschaftliches Archiv* 137 (1): 1-35.

Hinloopen, J. and van Marrewijk, C. (2004a). Empirical relevance of the Hillman condition and the comparative advantage. Tinbergen Institute Working Paper, 2004-019/2, Amsterdam

Hinloopen, J. and van Marrewijk, C. (2004b). Dynamics of Chinese Comparative Advantage. Tinbergen Institute Working Paper, 2004-034/2, Amsterdam

Iaparde, L.P. (2001). Measuring of International Specialization. *International Applied Economic Review* 7 (1): 173-183.

Kemp, M. (1969). *The Pure Theory of International Trade and Investment*. Englewood Cliffs, N.J.: Prentice-Hall

Krugman, P. (1987). The Narrow Moving Band, the Dutch Disease, and the Competitive Consequences of Mrs. Thatcher: Notes on Trade in the Presence of Dynamic Scale Economies. *Journal of Development Economics*, 27 (1): 41-54.

Kunimoto, K. (1977): Typology of Trade Intensity Indices. *Hitotsubashi Journal of Economics* 11 (1): 15-32.

Laursen, K. (1998). Revealed Comparative Advantage and the Alternatives as Measures of International Specialisation. DRUID Working Paper No. 98-30, Aalborg University

Laursen, K. (2000). *Trade Specialisation, Technology and Economic Growth*. Cheltenham: Edward Elgar

Lucas, R. (1988). On the Mechanics of Economic Development. *Journal of Monetary Economics*, 22 (1): 3-22.

Marchese, S. and De Simone, F.N. (1989). Monotonicity of Indices of Revealed Comparative Advantage: Empirical Evidence on Hillman's Condition. *Weltwirtschaftliches Archiv* 125 (1): 158-167.

Proudman, J. and Redding, S. (2000). Evolving Patterns of International Trade. *Review of International Economics* 8 (3): 373-396.

Redding, S. (1999). Dynamic Comparative Advantage and the Welfare Effects of Trade. *Oxford Economic Papers* 51 (1): 15-39.

Redding, S. (2002). Specialization Dynamics. *Journal of International Economics* 58 (2): 299-334.

Silverman, B.W. (1986). *Density Estimation for Statistics and Data Analysis*. London: Chapman Hall

Shorrocks, A. (1978). The measurement of mobility. *Econometrica*, 46 (5): 1013-1024.

Vollrath, T.L. (1991). A Theoretical Evaluation of Alternative Trade Intensity Measures of Revealed Comparative Advantage. *Weltwirtschaftliches Archiv* 130 (2): 265-279

Wong, K. (1995). *International Trade in Goods and Factor Mobility*. MIT Press, Cambridge

Yeats, A.J. (1985). On the Appropriate Interpretation of the Revealed Comparative Advantage Index: Implication of a Methodology Based on Industry Sector Analysis. *Weltwirtschaftliches Archiv,* 121 (1): 61-73.

Young, A. (1991). Learning-by-doing and Dynamic Effects of International Trade. *Quarterly Journal of Economics*, 106 (2): 396-406.

Zaghini, A. (2003). Trade Advantages and Specialisation Dynamics in Acceding countries. European Central Bank, Working Paper No. 249., Frankfurt am Main.

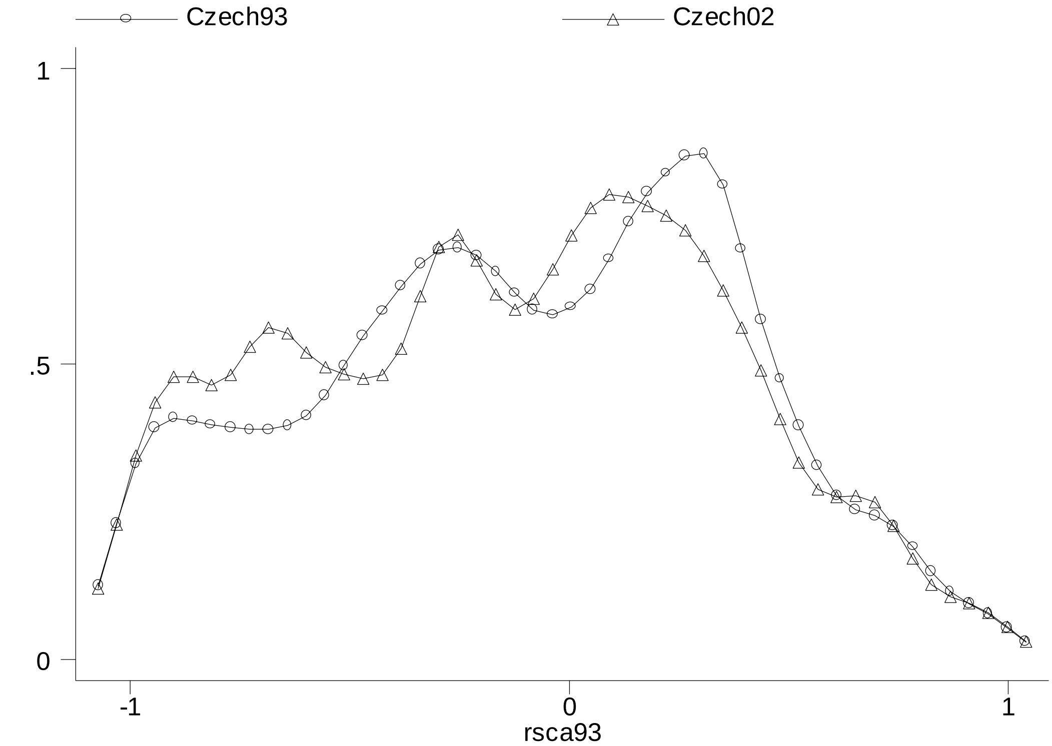
Table 1: Standard Deviation of B and RSCA

Country	Year	Standard deviation	
		B	RSCA
Czech Republic	1993	4.80	0.48
	2002	3.92	0.48
Estonia	1993	6.38	0.56
	2002	12.93	0.56
Hungary	1993	4.70	0.53
	2002	3.24	0.51
Latvia	1993	5.78	0.57
	2002	22.28	0.58
Lithuania	1993	10.98	0.54
	2001	2.89	0.56
Poland	1993	10.95	0.55
	2002	10.43	0.52
Slovakia	1993	1.82	0.50
	2002	2.57	0.53
Slovenia	1993	2.01	0.53
	2002	1.62	0.52

Table 2: Significance of changes in the distribution of RSCA index between 1993 and 2002

Country	p values
Czech Republic	0.0467
Estonia	0.3111
Hungary	0.0020
Latvia	0.0004
Lithuania	0.3201
Poland	0.0047
Slovakia	0.1654
Slovenia	0.0141

Figure 1 Kernel Distributions of RSCA indices



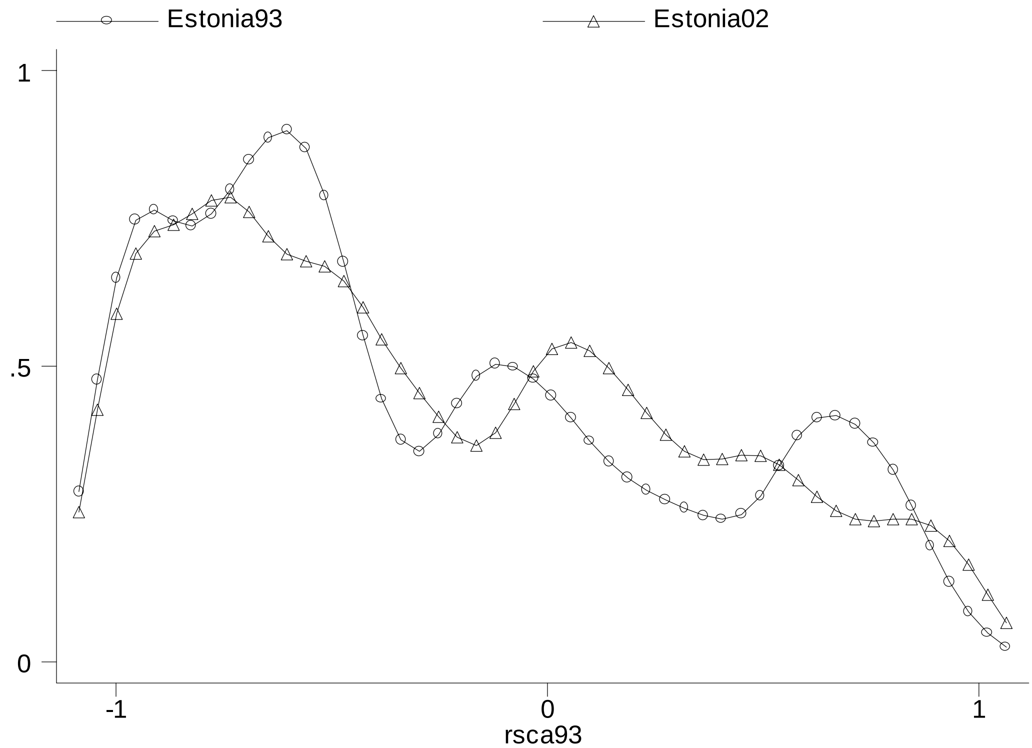
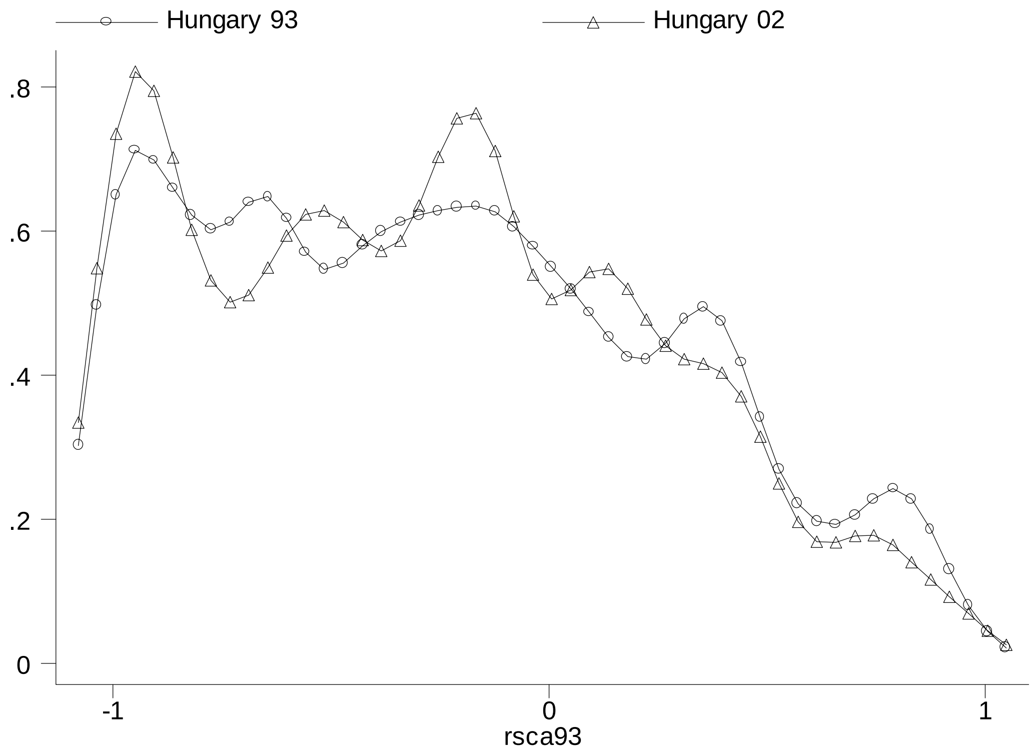


Figure 1 cont.



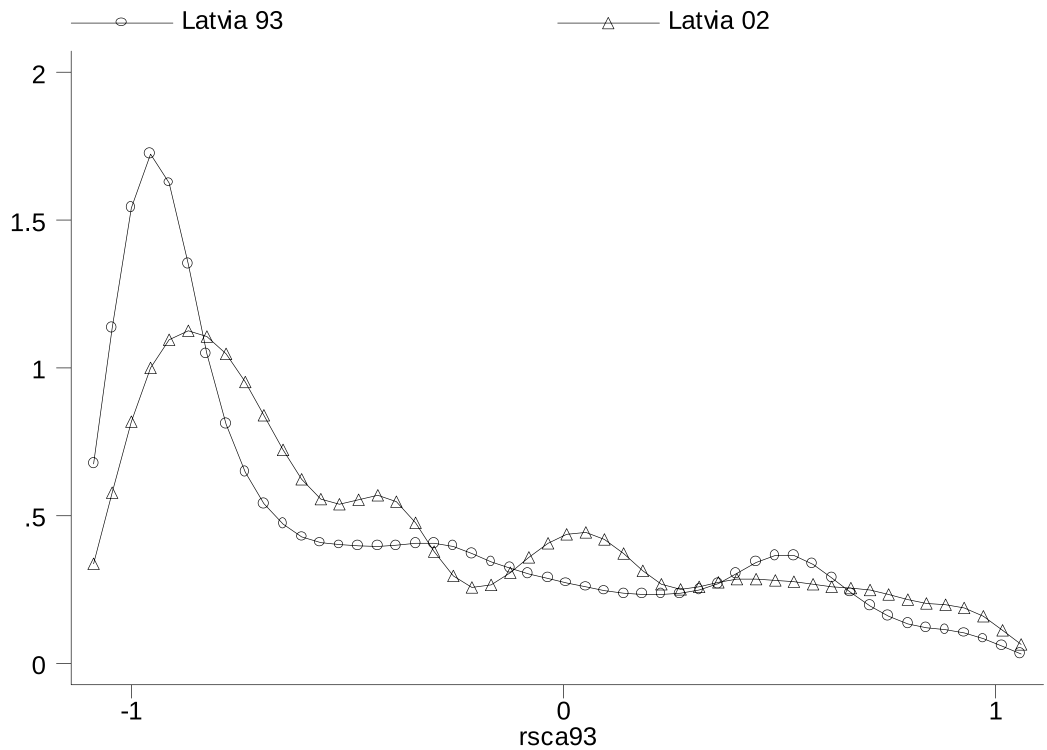
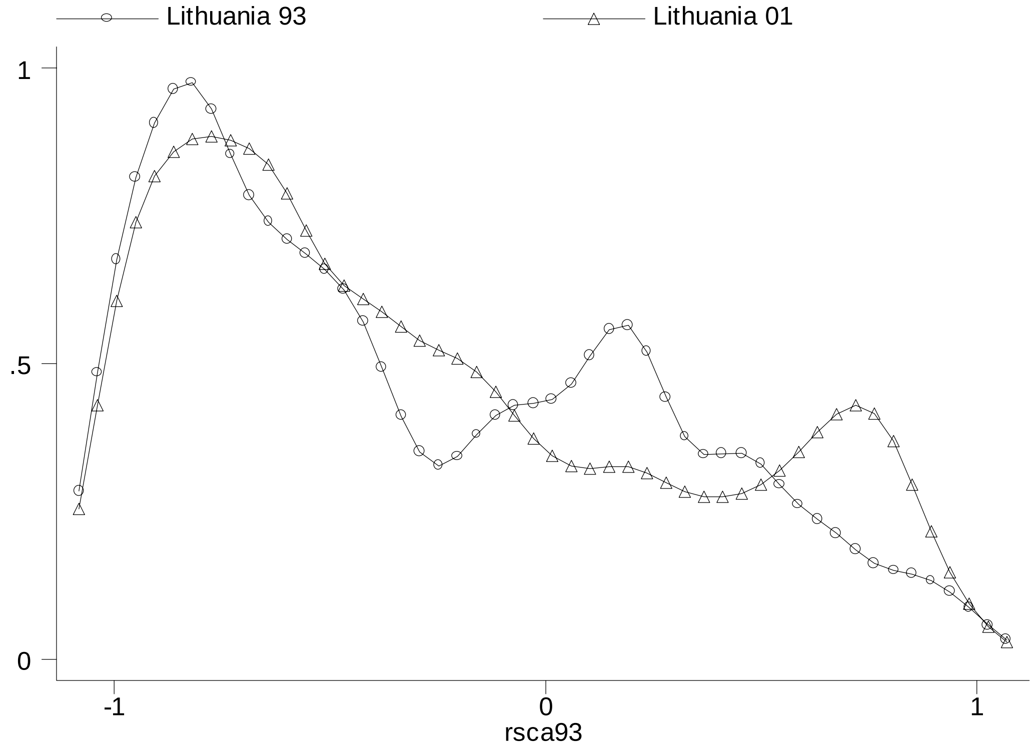


Figure 1 cont.



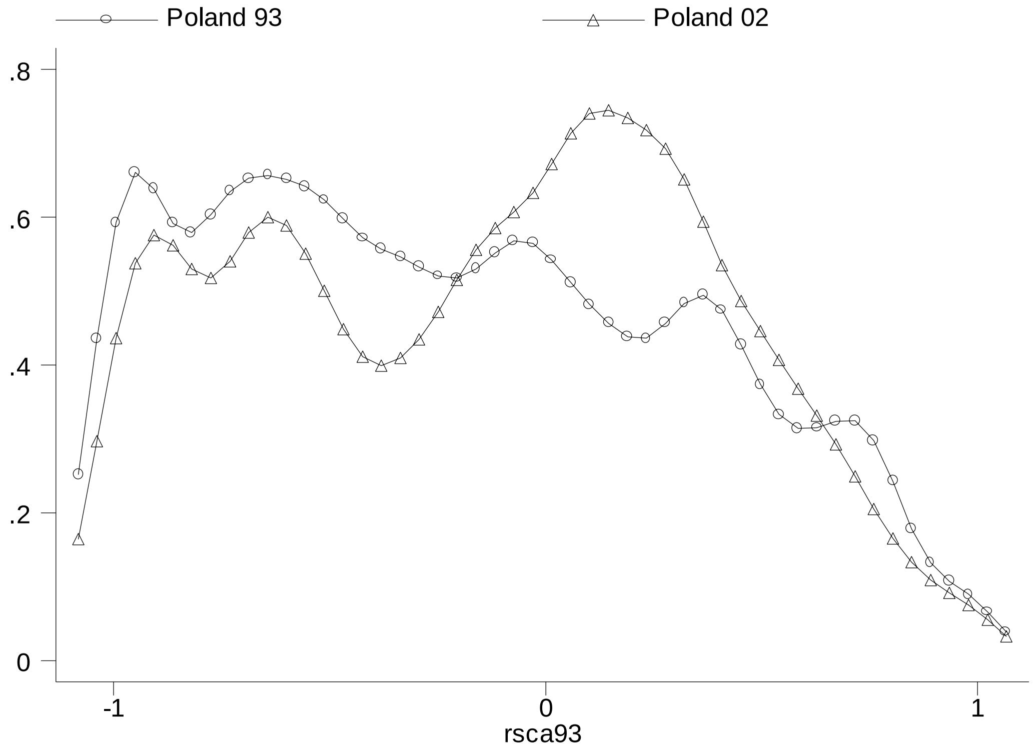
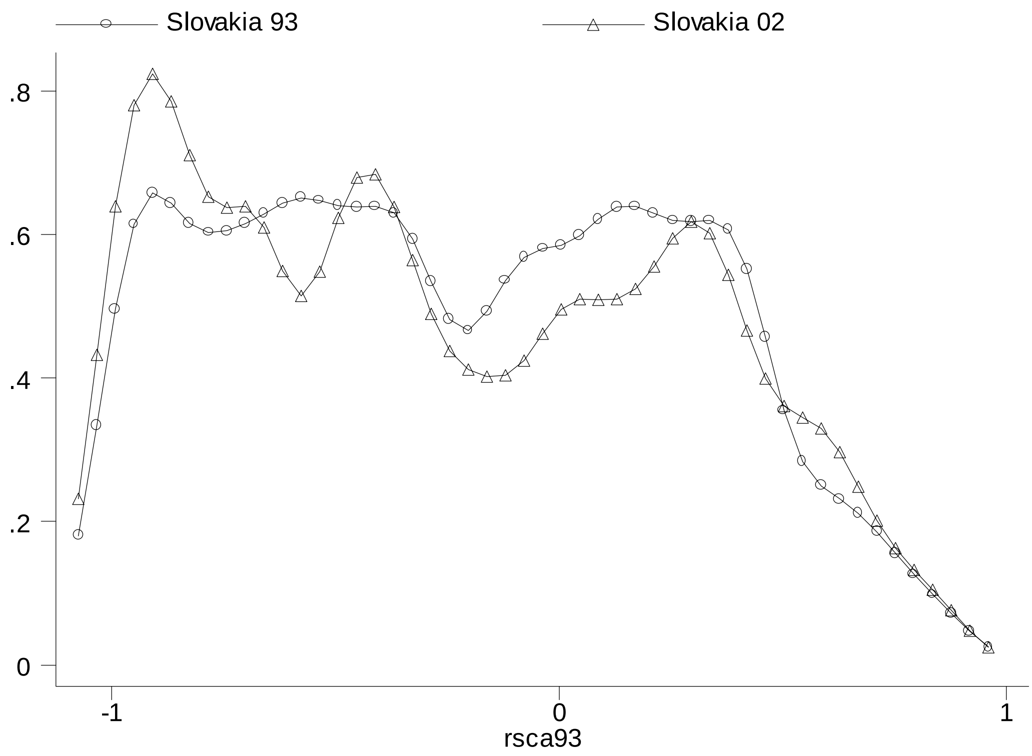


Figure 1 cont.



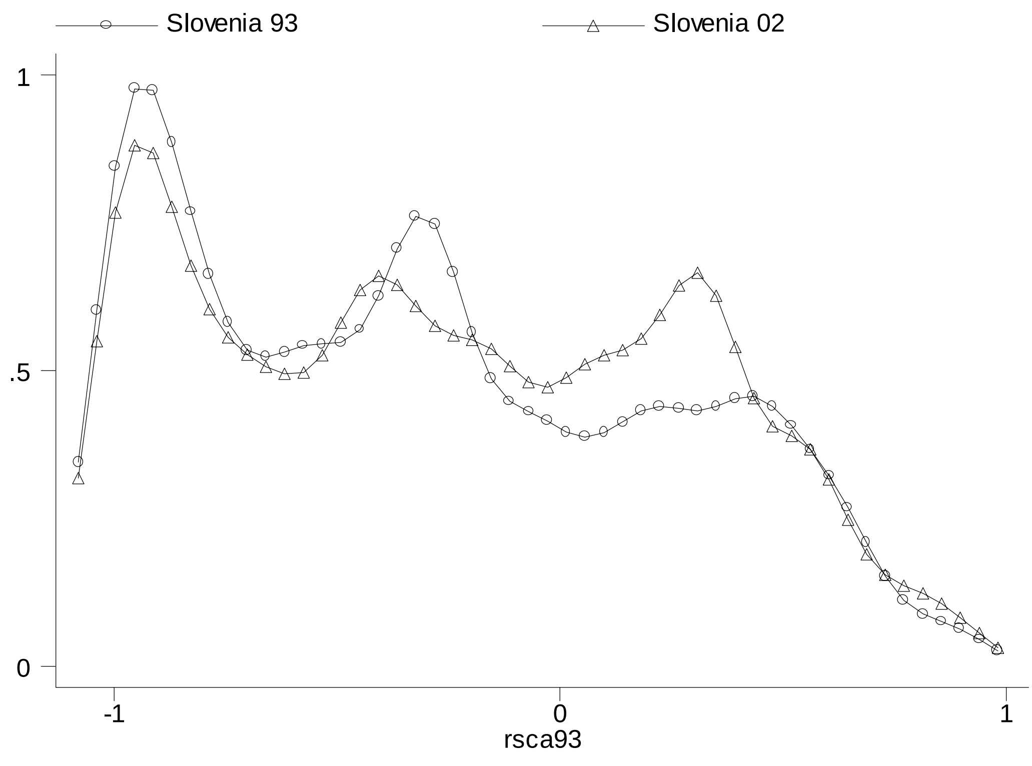


Table 3: Stability of RSCA between 2002 and 1993

	α	β	R	β/R	J-B†
Czech Republic	-0.078	0.598	0.596	1.004	10.59
Estonia	-0.045	0.704	0.706	0.998	9.83
Hungary	-0.115	0.687	0.713	0.963	193.39
Latvia	-0.114	0.491	0.486	1.011	16.78
Lithuania*	-0.100	0.614	0.597	1.029	13.25
Poland	0.003	0.684	0.718	0.953	2.62
Slovakia	-0.065	0.766	0.714	1.073	4.69
Slovenia	-0.028	0.795	0.812	0.979	74.21

Note: † Jarque-Bera test: $\chi^2_{2,5\%} = 5.99$.

*2001

Table 4: Gini indices of B between 1993 and 2002

year	Czech	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

Table 5: Transition Matrices of B Index

Czech Republic

B	a	b	c	d
a	0.77	0.16	0.05	0.02
b	0.40	0.42	0.15	0.03
c	0.29	0.35	0.26	0.10
d	0.25	0.06	0.13	0.56
initial distribution	0.53	0.27	0.13	0.07
final distribution	0.57	0.25	0.11	0.07
limit distribution	0.61	0.24	0.10	0.06

Estonia

B	a	b	c	d
a	0.84	0.11	0.04	0.01
b	0.20	0.48	0.20	0.12
c	0.26	0.32	0.26	0.16
d	0.11	0.11	0.22	0.56
initial distribution	0.69	0.11	0.08	0.12
final distribution	0.64	0.16	0.09	0.10
limit distribution	0.55	0.21	0.12	0.12

Hungary

B	a	b	c	d
a	0.85	0.08	0.03	0.03
b	0.51	0.46	0.03	0.00
c	0.33	0.33	0.29	0.04
d	0.06	0.12	0.41	0.41
initial distribution	0.67	0.15	0.10	0.07
final distribution	0.69	0.17	0.09	0.06
limit distribution	0.73	0.16	0.07	0.04

Latvia

B	a	b	c	d
a	0.80	0.11	0.05	0.04
b	0.56	0.22	0.11	0.11
c	0.35	0.09	0.26	0.30
d	0.36	0.07	0.14	0.43
initial distribution	0.76	0.08	0.10	0.06
final distribution	0.71	0.11	0.08	0.09
limit distribution	0.68	0.11	0.09	0.12

Lithuania

B	a	b	c	d
a	0.87	0.06	0.04	0.03
b	0.53	0.11	0.21	0.16
c	0.21	0.16	0.21	0.42
d	0.19	0.25	0.13	0.44
initial distribution	0.69	0.16	0.08	0.07
final distribution	0.71	0.09	0.09	0.11
limit distribution	0.70	0.10	0.08	0.12

Poland

B	a	b	c	d
a	0.75	0.20	0.05	0.01
b	0.24	0.50	0.21	0.06
c	0.19	0.35	0.27	0.19
d	0.05	0.14	0.33	0.48
initial distribution	0.65	0.15	0.11	0.09
final distribution	0.55	0.25	0.12	0.08
limit distribution	0.43	0.31	0.16	0.10

Slovakia

B	a	b	c	d
a	0.86	0.08	0.06	0.01
b	0.40	0.40	0.17	0.04
c	0.14	0.36	0.25	0.25
d	0.00	0.00	0.50	0.50
initial distribution	0.62	0.21	0.12	0.05
final distribution	0.63	0.17	0.13	0.07
limit distribution	0.60	0.16	0.14	0.10

Slovenia

B	a	b	c	d
a	0.85	0.13	0.02	0.00
b	0.13	0.70	0.17	0.00
c	0.15	0.26	0.48	0.11
d	0.17	0.17	0.25	0.42
initial distribution	0.70	0.13	0.12	0.05
final distribution	0.64	0.22	0.10	0.03
limit distribution	0.49	0.35	0.14	0.03

Table 6: Mobility Indices

	M_1	M_2
Czech Republic	0.663	0.983
Estonia	0.619	0.979
Hungary	0.662	0.967
Latvia	0.762	0.993
Lithuania	0.793	0.996
Poland	0.669	0.994
Slovakia	0.664	0.984
Slovenia	0.516	0.916