Revealed Comparative Advantage in the Internal Market

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Abstract

This paper investigates comparative advantage and its development across selected Asian, American and European countries between 1996 and 2002. In doing so, we calculate the Balassa index of revealed comparative advantage using industry data at the HS 4-digit level. The major part of the analysis concentrates on the factor intensities of the sample countries' comparative advantage and the overlap between them in the Internal Market. The paper shows that there is clearly some convergence in terms of the factor content of comparative advantage between Asian countries, the new member states and the EU15. The EU's comparative advantage has recently moved towards intensive use of both human and physical capital.

1. Introduction

Economic integration or trade liberalisation in general has substantial effects on the location of economic activities. Differences in comparative advantage across countries determines specialisation patterns at the inter-country level, while at intra-national level the forces of new economic geography are at work. The former mechanism works even in the absence of factor mobility across nations — trade and international factor mobility are substitutes — whereas the latter works when factors of production are mobile and trade is not costless. A combination of trade costs and scale economies generates agglomeration forces that encourage geographical clustering of production and economic activities in general. This clustering may create regions with many economic activities and others with very few or almost none. On the other hand, agglomeration forces may lead to sectoral clustering: one sector clusters into one region while other sectors cluster in other regions. The geographical distribution of economic activities is then very concentrated in each sector but dispersed at the level of all sectors.

In this paper, we concentrate on comparative advantage and evaluate the specialization patterns of the EU and selected countries from Asia and the Americas in the latter half of the 1990s and early 2000s. Our investigation is based on the concept of *revealed comparative advantage (RCA)*. The basic logic behind RCA is to evaluate comparative advantage on the basis of a country's specialization in (net) exports relative to some reference group. The most general point of reference would be the world as a whole but due to the lack of data we have chosen to use data on intra-EU trade plus trade between the EU and our sample countries in this study. Recently, RCA has been used quite extensively in studying specialisation patterns in trade between the EU15 and the new member states and Russia (e.g., Neven 1995, Kaitila 2001, 2004, Kaitila and Widgrén 2003, Algieri 2004, Widgrén 2004).

RCA alone, however, only shows which goods countries tend to specialize in their trade. It does not reveal the origins of comparative advantage. According to the Heckscher-Ohlin theorem a given country's comparative advantage (or disadvantage) is determined by its factor endowments. A country has a comparative advantage in those sectors that use intensively the productive factors that are abundant in the country. Cross-country trade patterns are determined by differences in comparative advantage: a country will export goods whose production uses intensively the factors that are relatively abundant (and thus comparatively cheap) in that country before trade and import those goods whose production would require the use of relatively scarce (expensive) factors.

To carry out this investigation we divide traded goods into five categories according to the factor intensity of their production. To that end, we follow the methodology and classification proposed by Neven (1995) in his study on the eastern enlargement of the EU. Traded goods are categorized, on the one hand, according to capital intensity (high,

intermediate, low) and, on the other hand, according to skilled vs. unskilled labour intensity.

2. Evaluating specialisation patterns

2.1 The Balassa index of revealed comparative advantage

In the analysis below, we use two different ways to measure comparative advantage. The idea behind the first is that the direction of trade flows reveals countries' specialization patterns and hence their comparative advantage, though not the source of this advantage. The measure of revealed comparative advantage, the Balassa index (BI), is calculated as the ratio of the share of a given product in a country's exports to another country or region to the share of the same product in that country or region's total exports. Specifically, the BI for country i in its exports of good k to country/region j can be expressed as

$$BI(EX) = \frac{x_{ij}^{k} / X_{ij}}{x^{k} / X}$$

where x_{ij}^{k} denotes exports of product k from country i to country/region j (the term j can refer to the whole world or some reference group such as the OECD), X_{ij} is total exports from country i to the reference group, x^{k} is the reference group's exports of good k, X is the reference group's total exports and EX refers to export shares being used to compute the index. If the index is greater than one for product k, the country is said to have comparative advantage in exports of that good.

In the analysis, we employ the HS 4-digit classification for exports , which comprises 1367 goods, and Eurostat data to calculate the Balassa index for all countries and products in given years. We disregard the exports of those goods in which the countries did not have a comparative advantage, and are thus left with only the goods in which the value of the Balassa index is larger than unity. We then divide these, following Neven (1995), into categories as described in the following sub-section.

2.2 Neven's classification of manufacturing industries

The factor intensity of production in which the EU and selected countries have RCA is analysed by using Neven's (1995) classification. The author classifies manufacturing industries into five categories at the NACE CLIO 3-digit level (some at the 4-digit level) according to their relative capital and skill intensity (see Figure 1). In determining capital and skill intensities he used the following four criteria:

- the share of white-collar workers in the industry's total labour force,
- the average wage in the industry,
- the ratio of labour costs to industry value added, and
- the ratio of fixed investment to value added in the industry.

Western European data from the late 1980s are used to determine the classification of industries. Although these data are old, this is unlikely to constitute a problem here because the characteristics of different industries are relatively constant.

Figure 1 illustrates the classification. Category 1 is characterised by a high share of wages in value added, very high average wages, and a very high proportion of white-collar workers. These are typically high-tech industries where human capital is used intensively in production. Category 2 comprises production activities intensive in human capital, but low physical capital intensity. This category includes industries which have a relatively low level of investment relative to value added, high wages, and a high share of wages in value added. Manufacturers of electrical machinery and equipment serve as an example from this category. Category 3 includes production intensive in labour and which uses relatively little capital. Average wages are low, and there is a low level of investment and a high share of wages in value added. An example from this category is textiles and apparel industry. Category 4 includes industries that are intensive in labour and capital. These industries have a high level of investment, relatively low wages, a low proportion of white-collar workers, and an intermediate share of wages in value added. Automobile manufacturing, for instance, falls under this category. Category 5 is dominated by the forest and food-processing industries that are intensive in both physical and human capital. Also the paper industry belongs to this category. Table 1 summarises the characterisation of the categories.

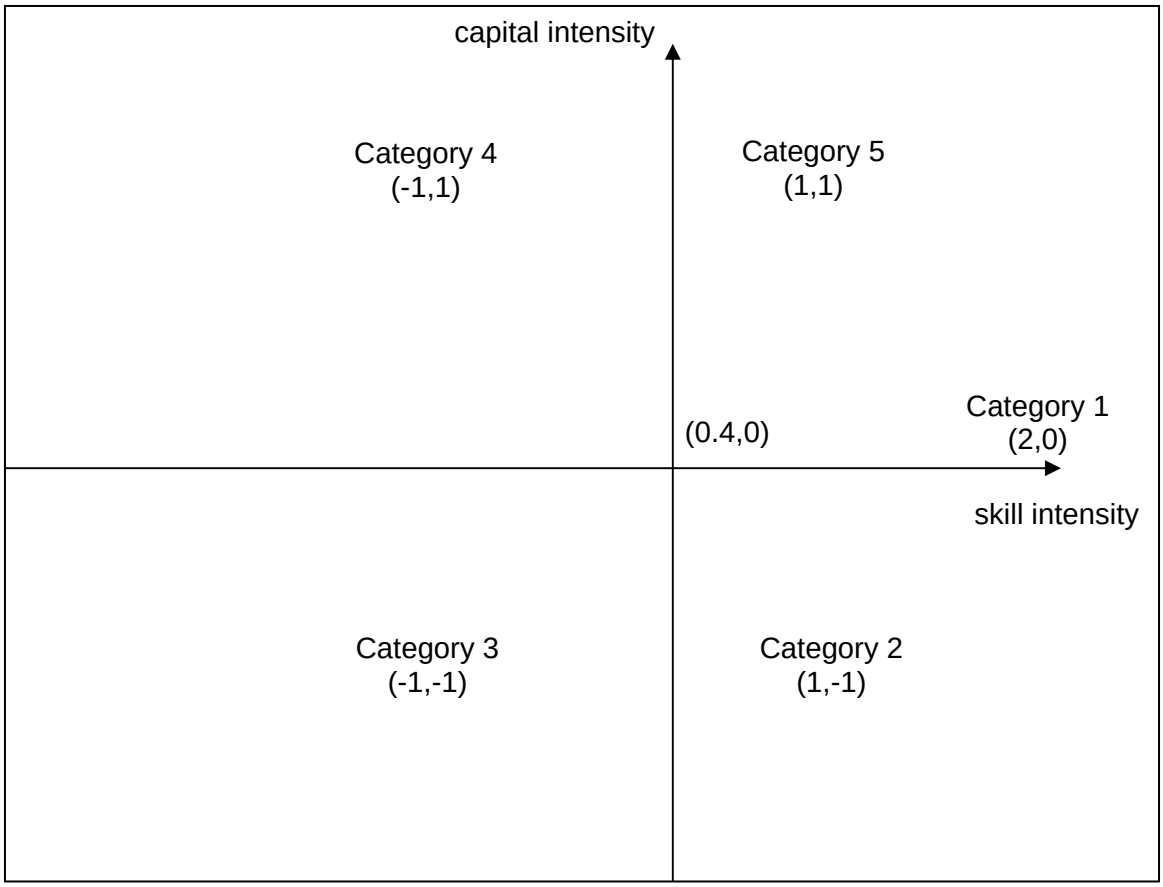
Table 1. A summary of the properties of the five industry classification categories

Intensity Cat	Human capital	Labour	Physical capital	Example
1	Very high	High	Intermediate	High tech
2	High	High	Low	Electrical equipment
3	Low	High	Low	Textiles
4	Low	Low	High	Car industry
5	High	Low	High	Paper industry

In the analysis, we have added coordinates on a two-dimensional space for each category. The x-coordinate proxies skill-intensity and the y-coordinate capital intensity. The coordinates are assumed to be (2,0) for category 1, (1,-1) for category 2, (-1,-1) for category 3, (-1,1) for category 4 and (1,1) for category 5. We use these to define a given country's average position in the capital-skill-intensity space. If a country's RCA is equally distributed across all categories, it is located at (0.4,0). Countries' that have RCA in relatively skill-intensive sectors have an x-coordinate larger than 0.4 and those having RCA in capital-intensive industries have a y-coordinate greater than 0. The coordinate

values are, of course, somewhat arbitrary but when used for analyzing changes in the factor content of countries' RCA they summarise the classification pretty well.

Figure 1. A quantification of Neven's categories



Source: Neven (1995) and author's assumptions.

3. Specialisation patterns in EU internal and external trade

3.1 Some recent findings

Specialisation patterns in intra-EU15 trade as well as the impact of eastern enlargement and the enlarged EU's external trade relations have recently been studied quite extensively. In terms of methodology used, the closest to ours is Kaitila (2004), which studies the factor content of EU15 and CEE8 countries' comparative advantage[1] using a somewhat modified version of Neven's (1995) methodology described above. In contrast to Neven's study, Kaitila (2004) uses the standard Balassa index in evaluating RCA and,

[1] See also Kaitila (2001) for an earlier study on the same topic.

more importantly, attempts to place the countries' revealed comparative advantage in a two-dimensional space as is our intension here too.[2]

The study finds, as might be expected, that in 2002 specialization patterns and hence comparative advantage in EU15 exports were generally based more on skill intensity than the exports of CEE countries. In Figure 1 above, EU15 exports are, on average, positioned further to the right than those of the CEE8 countries. In terms of how much the skill-intensive sectors (Category 1) account for a given country's comparative advantage, Kaitila (2004) shows that the most skill-intensive EU15 countries are Ireland and the UK, the Netherlands, Finland and Belgium. Among the new member states they are quite closely followed by Hungary and Estonia. The CEE countries with the highest skill intensity in areas of specialization all follow the same pattern: the share of sectors with intensive use of low-skilled labour has diminished by approximately as much as the share of sectors which use high-skilled labour intensively has increased. The specialisation of the EU15 countries is on average based only slightly more on intensive use of physical capital compared to the CEE countries, Romania being the biggest exception. In this respect, the change occurring during the latter half of the 1990s and early 2000s in the new member states is also rather unclear.

Widgrén (2004) applies a similar methodology to a small sample of old (Finland and Sweden) and new EU countries (Hungary, Poland and the Czech Republic) and Asian countries (China, Korea and Japan). He uses the above mentioned coordinate values when classifying countries on a two-dimensional skill-capital intensity scale. The study applied OECD data on total exports at the HS 4-digit level, which was then reclassified into the NACE CLIO 3-digit level as in Kaitila (2001, 2004).

The reference group in computing the Balassa indices was the OECD. The indices in the five categories of the skill-capital intensity dimension are presented in Table 2. Standard Balassa indices have been computed but at the aggregate category level, hence as the ratio of a category in a country's exports to that category's share in OECD exports. Values exceeding one suggest RCA and are highlighted in the table.

Table 2. The Balassa indices for the five skill-capital intensity categories in selected countries in 2001.

	China	Korea	Japan	Poland	Hungary	Czech Rep.	Sweden	Finland
5	0.45	0.22	0.14	**1.49**	0.88	0.84	**2.28**	**3.18**
4	0.83	0.96	**1.15**	**1.11**	0.99	**1.27**	1.04	**1.08**
3	**3.37**	**1.04**	0.40	**2.05**	**1.20**	**1.24**	0.78	0.78
2	0.80	0.70	**1.27**	0.92	0.96	**1.20**	1.00	0.71
1	0.88	**1.22**	0.94	0.52	**1.22**	0.59	0.95	**1.16**

Source: Widgrén (2004).

[2] Kaitila (2004) uses different coordinate values. They are (4, 2) for Category 1, (2, 1) for Category 2, (–2, 1) for Category 3, (–2, 3) for Category 4, and (2, 3) for Category 5.

As a more general conclusion, Widgrén (2004) finds some convergence towards more skill-intensive RCA, with Sweden and Japan situated on the far right in this dimension (see Figure 1 above), Finland and Korea clearly converging and the remaining countries displaying the same direction but lagging behind. The biggest individual shift in skill-intensity dimension is observed for China. The analysis covered developments between 1996 and 2001.

In this study we extend the analysis to cover more extra-EU trade by contrasting a sample of 12 Asian and American countries to the EU15 and the new member states in their specialisation patterns. Turkey is interesting as it is negotiating for EU membership, while free trade talks with the EU also make Russia an interesting case.

3.2 Specialisation patterns in trade between the EU15 and selected countries

In the following, we evaluate the differences and similarities of RCA in trade between the EU15 and 12 important non-EU15[3] trading partners excluding the new member states. As mentioned above, Turkey and Russia are interesting in this respect[4]. The other countries in the sample are selected subjectively based on their general importance in world trade. They include countries in Asia, and North and South America. With respect to the CEE10 countries, we rely on the results presented earlier in Kaitila (2004). We, however, modify his findings to make them comparable to ours.

Our focus is on RCA in the Internal Market. The use of Eurostat data, which includes trade between EU countries and countries in the rest of the world, has some implications for the Balassa indices computed. Since our dataset contains EU countries' exports to all other countries and imports from all other countries we are not exactly able to compute the Balassa index presented above in Section 2.1. This is because we do not have data on bilateral trade flows between the countries that do not belong to the EU. Therefore, the reference share of each commodity in trade does not contain all bilateral trade flows within our sample of countries as it should. Since these trade flows cover the majority of world trade, we believe the error is, however, not significant.

In our case, the numerator of the Balassa index should be interpreted as the share of a commodity in a country's exports to the Internal Market. This ignores the shares of different commodities in trade with other regions. One should be cautious when making conclusions about general comparative advantage as our computations presume that the export structure of India, say, is similar in her exports to the EU and the rest of the world.

Table 3 reports the shares of the above-described categories in 2002 and their change from 1996 to 2002. The results suggest that the intensive use of low-skilled labour forms

[3] We have used Eurostat trade statistics which, unfortunately, do not contain 1996 data for the new member states. That is why we concentrate on the EU15 in what follows.
[4] For an evaluation of general economic effects see Sulamaa and Widgrén (2004).

the major base in revealed comparative advantage in Asian countries other than Japan and in Russia. Among the Asian countries examined, Korea and Thailand are, however, exceptions as the total percentage of categories 3 and 4 in the these countries is roughly the same as in the EU15. In the NAFTA countries, RCA stems clearly less from intensive use of low-skilled labour than in other countries or regions.

Table 3. *The share of RCA sectors in skill-capital-intensity classes in 2002 and the change in shares from 1996 to 2002 in selected countries and the EU15*

	1	*2*	*3*	*4*	*5*	*3+4*	*1+2+5*
EU15	30.6	20.6	6.8	38.0	4.0	44.8	55.2
Brazil	3.0	24.9	5.0	39.9	27.1	44.9	55.1
China	23.0	13.3	24.7	38.4	0.6	63.0	37.0
India	7.7	8.0	37.4	42.2	4.7	79.6	20.4
Korea	43.1	9.8	17.7	29.3	0.0	47.1	52.9
Mexico	39.5	25.0	1.7	25.5	8.3	27.2	72.8
Russia	6.8	5.0	0.1	83.7	4.4	83.8	16.2
Thailand	26.9	14.9	16.8	35.6	5.8	52.4	47.6
Turkey	1.0	8.9	46.5	34.5	9.2	81.0	19.0
U.S.	51.7	33.7	1.6	9.4	3.6	11.1	88.9
Canada	26.3	20.9	3.3	26.9	22.6	30.2	69.8
Indonesia	15.2	16.1	36.5	25.4	6.8	61.9	38.1
Japan	31.5	22.1	2.4	44.0	0.0	46.4	53.6

	1	*2*	*3*	*4*	*5*	*3+4*	*1+2+5*
EU15	10.6	-8.1	-2.1	-0.4	0.0	-2.6	2.6
Brazil	0.3	-1.7	-1.1	5.2	-2.7	4.1	-4.1
China	15.5	2.1	-9.1	-8.2	-0.4	-17.3	17.3
India	3.2	-4.0	0.5	2.4	-2.2	2.9	-2.9
Korea	2.6	-0.6	1.7	-3.6	0.0	-1.9	1.9
Mexico	18.3	9.6	-1.0	-25.4	-1.5	-26.4	26.4
Russia	-0.6	0.8	-0.4	-0.3	0.4	-0.6	0.6
Thailand	0.0	-2.3	-0.1	7.3	-4.9	7.2	-7.2
Turkey	-5.2	1.0	-3.9	12.5	-4.4	8.5	-8.5
U.S.	2.5	5.7	-0.9	-4.9	-2.5	-5.8	5.8
Canada	5.1	7.2	1.2	-4.5	-8.9	-3.4	3.4
Indonesia	10.0	-0.6	-1.7	-7.0	-0.7	-8.7	8.7
Japan	-3.0	1.3	0.1	1.7	0.0	1.8	-1.8

Source: Author's calculations.

Among Asian countries other than Japan, Korea and Thailand as well as China have relatively high shares of category 1 exports. Korea has the highest share after the U.S. Other countries/regions where RCA is based on intensive use of high-skilled labour are the EU15, Canada and Japan. When we add categories with intermediate use of skilled

labour, the NAFTA countries are the highest ranked whereas Russia, India and Turkey have the lowest shares.

As a general conclusion, the upper panel of Table 3 suggests that intensive use of skilled labour forms the base of RCA in the U.S. and Korea and to a lesser extent in the EU, other NAFTA countries, Thailand and China. The basis of RCA in intensive use of capital is the highest in Brazil, India and Russia. Perhaps more interesting than the levels are the changes in RCA patterns between 1996 and 2002 shown in the lower panel of the table. Here, one can immediately see a clear shift from low-skilled labour to intensive use of high-skilled labour as the base of RCA in China, Mexico and Indonesia.

Note that the same development from intensive use of low-skilled to high-skilled labour occurs also in the U.S. and Korea, which have the highest shares in intensive use of skilled labour as the base of RCA (see the upper panel of Table 3). In the U.S., Canada and Korea, this development takes place also at the cost of capital intensity. With respect to the U.S. and Korea, the development suggests that export specialization occurred in industries characterised by intensive use of skilled labour already in 1996. The other countries are now gradually catching up.

The EU is an interesting exception. Its specialisation is increasingly based on industries that use high-skilled labour intensively, though this takes place at the cost of intensive use of intermediate-skilled labour (Category 2) rather than low-skilled labour. The EU's most important export goods in Category 1 at the HS 4-digit level are wadding, gauze, bandages and like articles (3304); parts of aircraft and space-aircraft (8802); nucleic acids (2933); sulphonamides (2934); electric machinery and apparatus having special function (8542) and office machines (8471). These all have at least a one per cent share in EU exports. Note that transmission apparatus for radio-telephony, etc. (8524) which include, for instance, mobile phones have only a 0.25 per cent share. This is, however, the second largest share after the U.S. amongst all the countries examined. For purposes of comparison, this product group accounted for a 10.9 per cent share of Finland's exports (see Widgrén 2004). The most notable shift towards specialisation that is based on intensive use of capital can be seen in Brazil, Turkey and Thailand.

Table 4 gives the respective figures for the CEE10 countries with the difference being that the reference year is 1993 instead of 1996. Compared to our sample countries, specialisation in the CEE10 countries is based more on intensive use of low-skilled labour. With the exception of Hungary, the Czech Republic and Estonia, the new member states are in this respect comparable to India, Russia and Turkey. Specialisation in the new member states also seems to be based more on intensive use of capital.

Table 4. The shares of CEE10 countries' RCA sectors in skill-capital-intensity classes in 2002 and the change in shares from 1993 to 2002

	1	*2*	*3*	*4*	*5*	*3+4*
Bulgaria	4.4	6.7	48.8	35.8	4.2	84.6
Czech Rep.	12.9	23.8	10.7	51.3	1.3	62.0
Estonia	26.0	10.6	21.3	39.4	2.7	60.7
Hungary	25.8	17.8	11.3	44.3	0.8	55.6
Latvia	2.1	2.6	24.5	69.8	1.0	94.3
Lithuania	12.9	8.5	42.4	31.2	4.9	73.6
Poland	4.6	14.0	23.5	53.7	4.3	77.1
Romania	1.5	10.6	68.5	18.5	1.0	87.0
Slovakia	7.4	13.5	17.6	59.6	1.9	77.2
Slovenia	3.8	25.5	15.1	55.4	0.2	70.5

	1	*2*	*3*	*4*	*5*	*3+4*
Bulgaria	-4.0	-1.0	13.2	1.4	-9.5	14.5
Czech Rep.	5.5	11.9	-16.2	3.4	-4.6	-12.9
Estonia	20.6	3.4	-4.4	-18.6	-1.0	-23.0
Hungary	16.3	5.3	-27.6	10.5	-4.5	-17.1
Latvia	-3.2	1.1	8.4	-3.8	-2.5	4.6
Lithuania	-4.2	6.7	22.3	-15.9	-8.9	6.4
Poland	-1.0	7.8	-18.3	15.8	-4.3	-2.5
Romania	-1.4	7.3	-1.1	-3.3	-1.7	-4.3
Slovakia	-0.1	6.4	-16.0	16.4	-6.7	0.4
Slovenia	1.9	6.2	-19.9	12.9	-1.1	-7.0

Source: Kaitila (2004)

In terms of specialising in activities which use high-skilled labour intensively (Category 1), Hungary and Estonia differ from other CEE10 countries. The percentage of Category 1 RCA sectors in these countries is comparable to the EU15, Canada, Thailand and China. They have also experienced changes in patterns of RCA similar to China, Mexico and Indonesia: from intensive use of low-skilled to high-skilled labour as the determinant of RCA.

The results in Tables 3 and 4 are in line with the so-called *Leontief paradox,* i.e., that the U.S. is a net exporter of goods that are labour intensive and a net importer of goods that are capital intensive. Table 5 illustrates this and the overall determinants of RCA in the sample countries. The figures in the table are computed as the ratio of a category's share in a country's exports to the category's share in the reference group's exports. Thus, the numbers can be interpreted as average Balassa indices within the groups. If the number in Category 1, say, exceeds one, we can conclude that a country has RCA in industries that use skilled labour intensively.

Table 5. Sample countries' RCA in different categories

	1	*2*	*3*	*4*	*5*
EU15	1.07	1.08	0.75	0.98	0.84
Brazil	0.11	1.31	0.55	1.03	5.72
China	0.81	0.70	2.73	0.99	0.13
India	0.27	0.42	4.14	1.09	1.00
Korea	1.51	0.51	1.96	0.76	0.00
Mexico	1.38	1.31	0.18	0.66	1.76
Russia	0.24	0.26	0.01	2.17	0.94
Thailand	0.94	0.78	1.86	0.92	1.22
Turkey	0.03	0.47	5.14	0.89	1.93
U.S.	1.81	1.77	0.18	0.24	0.75
Canada	0.92	1.09	0.37	0.70	4.78
Indonesia	0.53	0.84	4.04	0.66	1.43
Japan	1.10	1.16	0.27	1.14	0.00

Source: Author's calculations

Table 5 shows that the U.S., the EU and Japan have RCA in both categories characterized by intensive use of high-skilled labour (Categories 1 and 2). The U.S. and the EU do not have RCA in either category representing intensive use of capital. Moreover, Brazil and India have RCA in both capital intensity categories. It thus seems that human capital explains the exports of the U.S., the EU and Japan better than intensive use of physical capital. Note that Mexico also has RCA in categories representing intensive use of human capital and not in categories characterized by intensive use of physical capital. One possible explanation for this is the fact that the HS 4-digit classification often treats intermediates and final goods as variants of the same commodity. The similarity in RCA between the U.S. and Mexico might thus indicate that parts of the production processes of human capital intensive goods that are exported from the U.S. have shifted to Mexico. This is not, however, in contrast to the argument that RCA has substantial effects on the location of economic activities but rather supports it.

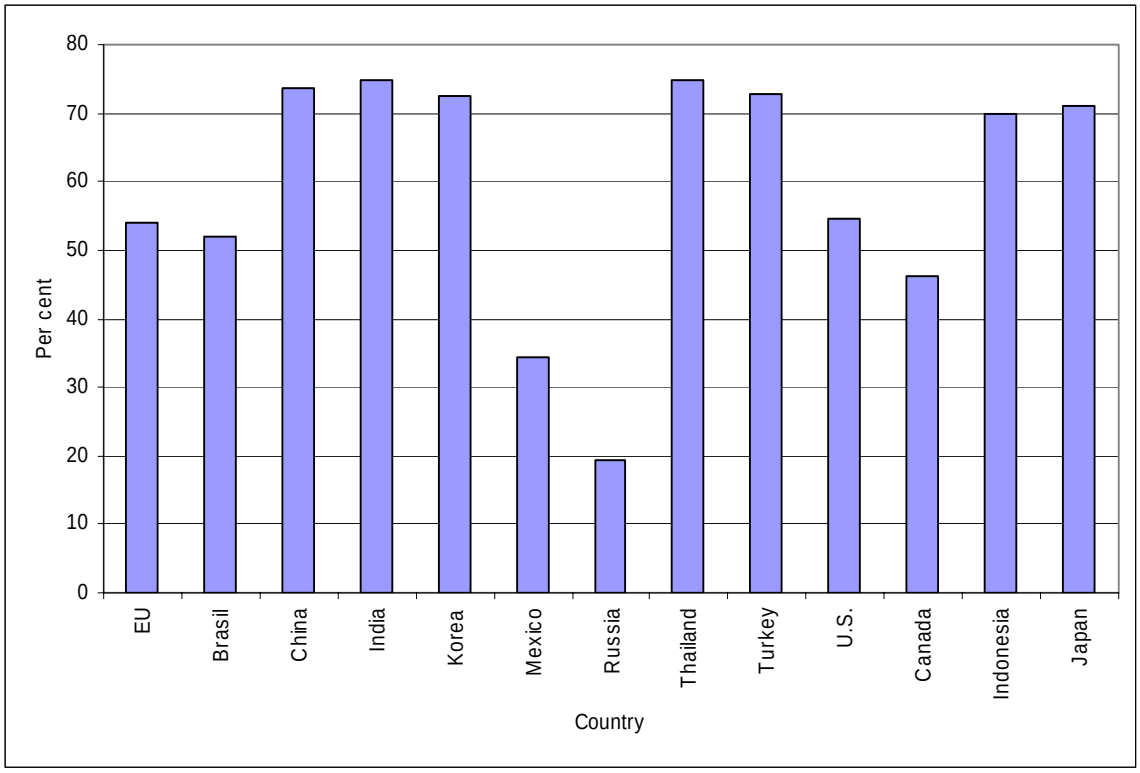
Table 6. CEE10 countries' RCA in different categories

	1	*2*	*3*	*4*	*5*
Bulgaria	0.19	0.44	6.68	1.15	1.10
Czech Rep.	0.53	1.46	1.39	1.56	0.32
Estonia	1.22	0.75	3.16	1.37	0.76
Hungary	1.06	1.09	1.46	1.34	0.20
Latvia	0.12	0.21	4.25	2.84	0.33
Lithuania	0.62	0.62	6.46	1.11	1.43
Poland	0.20	0.90	3.18	1.70	1.11
Romania	0.06	0.62	8.37	0.53	0.23
Slovakia	0.29	0.79	2.18	1.73	0.45
Slovenia	0.15	1.54	1.92	1.65	0.05

Source: Kaitila (2004) and author's calculations

Table 6 gives the respective figures for the CEE10 countries. Generally, there is not much overlap with the EU15 with the exception of the Czech Republic, Estonia, Hungary and Slovenia all having RCA in at least one category with intensive use of skilled labour. There is a notable similarity between the CEE10 countries as they all have RCA in Category 3 with intensive use of low-skilled labour and low capital intensity and with the exception of Romania in Category 4 characterised by intensive use of low-skilled labour and high capital intensity. Hence, considerable overlap exists in RCA between the CEE10 countries.

Figure 2. The percentage of exports classified in Neven's five categories



Source: Author's calculations

It is worth noting that Neven's five categories do not cover the whole HS 4-digit classification. That may cause some bias in the results above. In our sample, division into the five categories covers roughly 50 per cent of the sample countries' exports. Figure 2 shows the country-by-country percentages of exports that can be divided into the five categories. The higher the share, the more reliable the results presented above are. The lowest shares are in Russia and Mexico. Only one fifth of Russia's exports and one third of Mexico's exports fall into the five categories. That can be explained by the fact that the biggest commodity groups that are left outside the categorisation are petroleum oils and coal and briquettes. The highest shares of commodity groups that can be divided into the five categories are in exports of the Asian countries in the sample.

Low shares of commodity groups that can be divided into the five categories change the conclusions concerning Mexico's RCA. This is illustrated in Table A1.1 in Appendix 1. The share of Mexican exports that fall into Category 1 (intensive use of human capital) is only 13.6 per cent while the normalised share in Table 2 above was nearly 40 per cent. The non-normalised percentage of Category 1 in the reference trade flows is 21 per cent indicating that Mexico does not have RCA in Category 1.

Table 7 shows the category-wise RCAs using non-normalised export shares. The conclusion concerning the U.S., Japan, China, India, Korea, Russia, Thailand, Turkey and Indonesia is robust but most notably the EU loses its RCA in all categories when non-normalised export shares are used. The same holds for Russia and Mexico as well. It is difficult to say which approach is better as they both represent very extreme assumptions. When normalised export shares are used it is assumed that the undividable part of exports have the same distribution over the categories as the dividable share. This is not necessarily true, however. If non-normalised export shares are used only a part of a country's exports is considered. Clearly, the countries in which only a small share of exports can be divided into the categories are treated very differently in these approaches.

Table 7. Sample countries' RCA in different categories using non-normalised export shares

	1	*2*	*3*	*4*	*5*
EU15	0.75	0.76	0.53	0.69	0.59
Brazil	0.07	0.88	0.37	0.70	3.86
China	0.77	0.67	2.61	0.95	0.13
India	0.26	0.41	4.02	1.06	0.97
Korea	1.42	0.48	1.85	0.72	0.00
Mexico	0.62	0.59	0.08	0.29	0.78
Russia	0.06	0.07	0.00	0.55	0.24
Thailand	0.92	0.76	1.80	0.90	1.18
Turkey	0.03	0.44	4.86	0.85	1.83
U.S.	1.29	1.26	0.13	0.17	0.54
Canada	0.55	0.66	0.22	0.42	2.87
Indonesia	0.49	0.77	3.67	0.60	1.30
Japan	1.02	1.07	0.24	1.05	0.00

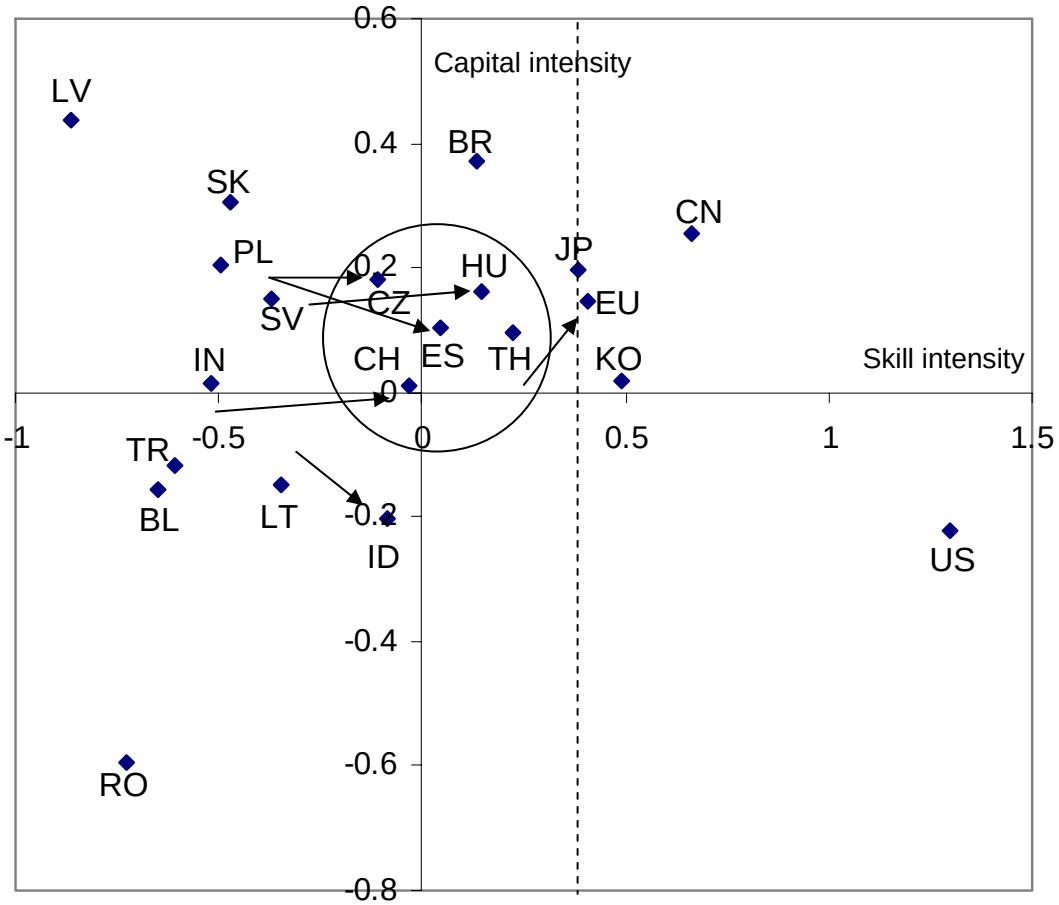
Source: Author's calculations

3.3 Weighted average RCA in the two-dimensional space

In the following, we make an attempt to summarise our sample countries' RCA in the five above-described categories. We do that by computing a weighted average of countries' category-wise RCA shown in Tables 5 and 6 using the distribution of their exports in RCA sectors over the categories shown in Tables 3 and 4 as the weight. Each category is given a two-dimensional vector value as described in Section 2.2 above. It is worth noting that the coordinate values that describe different categories are rather

arbitrary (see Figure 1 above).[5] For instance if one country's weighted average on the horizontal skill-intensity dimension is 1 and another country's is 0.5, this does not mean that the former country has RCA in production using skill-intensive labour twice the amount as in the latter country.

Figure 3. *Weighted average RCA in a sample of countries in 2002 and the most significant shifts from 1996 (shown by arrows, 1996 position at the starting point)*



Source: Own calculations, CEE10 countries are adjusted to our scale using the data on the relative shares of the five categories in Kaitila (2004, table 1).

The weighted average RCAs are plotted in Figure 3. If a country has 20 per cent of its RCA exports in each category, the weighted average RCA (WARCA) would be at point (0.4,0.0). This serves as a good reference point. If a country's WARCA is in the North-East quadrant relative to (0.4,0.0), it has a comparative advantage in sectors that

[5] For an alternative choice, see Kaitila (2004).

intensively use both physical and human capital. In our sample, Canada, the EU, Japan and Korea are such countries.[6] A country that differs from all the others is the U.S., which has comparative advantage in sectors that intensively use human but not physical capital.

Among the other countries, we have excluded Mexico and Russia from the analysis since only a minor part of their exports can be divided into Neven's categories. Russia would be located very close to Latvia, while Mexico would fall close to Hungary. Comparing the new member states to Asian countries, Figure 3 reveals that Estonia, Hungary, the Czech Republic, Thailand and China have similar WARCA values: they are slightly below the origin at the skill-intensive dimension and slightly above the capital intensity origin. The common feature for these countries with the exception of Thailand is that they have moved towards the right considerably in the skill-intensity dimension. In graphical terms, these countries have moved from outside the circle to the circle where Thailand already was in 1996. The circle is plotted just to illustrate the region where most of the countries with big shifts in the factor content of WARCA end up in. To summarize, there seems to be some convergence in WARCA and some of the Asian countries share the development with some of the new member states.

The countries whose location has remained very stable on the skill-intensive part are the U.S., Canada, Japan and Korea and the CEE10 countries excluding Hungary, the Czech Republic, Estonia, Turkey, India and Brazil. Indonesia has shifted slightly away from capital-intensive production and has moved considerably towards skill-intensive production. With regard to the latter it is at the same level as China and the other countries within the circle. The EU has shifted in a North-East direction, meaning that its WARCA is based more on intensive use of physical and human capital. It has reached Japan and Korea during the latter half of 1990s and early 2000s.

In sum, Figure 3 and the analysis in the previous sub-section demonstrate that there is some convergence in terms of WARCA between the countries whose comparative advantage has already earlier been based on intensive use of skilled labour. In our sample there are examples of these both from Asia and among the new member states. On the other hand, most of the examples are such that their WARCA has been very stable during the past years. In this group we also find examples from Asia and new member states. All countries that had relatively skill-intensive exports in 1996 (x-coordinate greater than 0.4) are such cases. The EU has managed to move to this group between 1996 and 2002.

4. Conclusions

In this paper, we have investigated comparative advantage and its development between 1996 and 2002 in a sample of Asian, American and European countries. The evaluation of comparative advantage is based on the Balassa index of revealed comparative advantage and the analysis is carried out using data at the HS 4-digit level. The major

[6] Note, however, that RCA of Canada and the EU was not robust when non-normalised weights were used (see table 7).

part of the analysis concentrates on the factor intensities of the sample countries' comparative advantage and the overlap between them in the Internal Market.

The analysis demonstrates that, among our sample of countries, the U.S. is an exception. Its comparative advantage is based on intensive use of highly skilled labour and not on physical capital. Asian countries and the new member states have considerable overlap in their comparative advantage. These countries can be divided into three groups: 1) those who converge towards the countries whose RCA is based on intensive use of human capital and not so much physical capital (Estonia, Hungary, the Czech Republic and China), 2) those who do not converge and their RCA is based on intensive use of unskilled labour and not physical capital (Romania, Lithuania, Turkey and India) and 3) those who do not converge and their RCA is based on intensive use of unskilled labour and physical capital (Latvia, Slovakia, Poland and Slovenia). Globalisation is likely to intensify competition between productive firms operating in these areas.

In terms of intensive use of human capital, the EU15 has shifted in a skill-intensive direction. It reached Japan and Korea during the latter half of the 1990s and early 2000s. Also in this group there seems to be considerable overlap in comparative advantage. In terms of intensive use of human capital, the EU15 is not, however, a homogeneous group. The most skill intensive exports are sent by Ireland, the UK and the Netherlands, which are almost at the same level as the U.S. Finland represents the upper average of the EU, with Sweden and Belgium following closely. The other EU nations are in this respect very close to the countries that have been able to increase the use of human capital in their exports and have converged towards the most advanced countries in this respect.

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Appendix 1

Table A1.1. The shares of selected countries' and EU15 RCA sectors in skill-capital-intensity classes in 2002 and the change in shares from 1996 to 2002 using non-normalised trade shares

	1	*2*	*3*	*4*	*5*	*3+4*	*1+2+5*	*Total*
EU	16.5	11.1	3.7	20.5	2.1	24.2	29.8	53.9
Brazil	1.6	12.9	2.6	20.7	14.1	23.3	28.6	51.9
China	17.0	9.8	18.2	28.3	0.5	46.5	27.2	73.7
India	5.7	6.0	28.0	31.6	3.5	59.6	15.2	74.8
Korea	31.2	7.1	12.9	21.3	0.0	34.1	38.3	72.4
Mexico	13.6	8.6	0.6	8.8	2.9	9.3	25.0	34.4
Russia	1.3	1.0	0.0	16.3	0.9	16.3	3.2	19.4
Thailand	20.2	11.1	12.6	26.7	4.3	39.2	35.6	74.8
Turkey	0.7	6.5	33.8	25.1	6.7	58.9	13.8	72.8
U.S.	28.3	18.4	0.9	5.1	2.0	6.0	48.6	54.7
Canada	12.2	9.6	1.5	12.4	10.5	13.9	32.3	46.2
Indonesia	10.7	11.2	25.5	17.8	4.7	43.3	26.6	69.9
Japan	22.3	15.7	1.7	31.2	0.0	32.9	38.0	71.0

	1	*2*	*3*	*4*	*5*	*3+4*	*1+2+5*
EU	4.8	-5.6	-1.6	-2.0	-0.2	-3.5	-1.0
Brazil	0.0	-2.8	-1.0	0.2	-3.5	-0.8	-6.3
China	11.6	1.8	-6.1	-5.2	-0.3	-11.3	13.1
India	2.3	-3.3	-0.7	0.7	-1.8	0.0	-2.8
Korea	4.4	0.2	2.3	-0.5	0.0	1.7	4.6
Mexico	4.1	1.7	-0.6	-14.1	-1.5	-14.7	4.2
Russia	-0.7	-0.2	-0.1	-6.4	-0.2	-6.5	-1.1
Thailand	0.2	-1.6	0.1	5.6	-3.6	5.7	-5.0
Turkey	-3.9	0.6	-4.0	8.6	-3.5	4.5	-6.8
U.S.	4.2	4.7	-0.3	-1.9	-1.0	-2.2	7.9
Canada	1.7	2.9	0.5	-3.1	-5.1	-2.6	-0.5
Indonesia	7.1	-0.1	-0.5	-4.4	-0.4	-4.9	6.6
Japan	-1.7	1.2	0.1	1.8	0.0	1.9	-0.4

Source: Author's calculations. The last column gives the percentage of trade in commodities that can be divided into the five categories.

Appendix 2. Classification of sectors (NACE CLIO) according to factor intensities by Neven (1995)

Category 1
2500 Chemical industry
2510 Manufacture of basic industrial chemicals
2550 Manufacture of paint, varnish and printing ink
2560 Manufacture of other chemical products, mainly for industrial and agricultural purposes
2570 Manufacture of pharmaceutical products
2580 Manufacture of soap, synthetic detergents, perfume and toilet preparations
2590 Manufacture of other chemical products, chiefly for household and office use
2601 Chemical and man-made fibres
3300 Manufacture of office machinery and data processing machinery
3440 Manufacture of telecommunications equipment, electrical and electronic measuring and recording equipment and electro-medical equipment
3450 Manufacture of radio and television receiving sets, sound reproducing and recording equipment and of electronic equipment and apparatus, manufacture of gramophone records and pre-recorded magnetic tapes
3640 Aerospace equipment manufacturing and repairing

Category 2
2430 Manufacture of concrete, cement of plaster products for constructional purposes
2460 Production of grindstones and other abrasive products
3200 Mechanical engineering
3220 Manufacture of machine tools for working metal, and of other tools and equipment for use with machines
3230 Manufacture of textile machinery and accessories; manufacture of sewing machines
3240 Manufacture of machinery for the food, chemical and related industries
3250 Manufacture of plants for mines, the iron and steel industry and foundries, civil engineering and the building trade; manufacture of mechanical handling equipment
3270 Manufacture of other machinery and equipment for use in specific branches of industry
3280 Manufacture of other machinery and equipment
3400 Electrical engineering
3420 Manufacture of electrical machinery
3460 Manufacture of domestic type electrical appliances
3480 Assembly and installation of electrical equipment
3600 Manufacture of other means of transport
3700 Instrument engineering
3710 Manufacture of measuring, checking and precision instruments and apparatus
3720 Manufacture of medical and surgical equipment and orthopaedic appliances
3730 Manufacture of optical instruments and photographic equipment
4110 Manufacture of vegetable and animal oils and fats
4150 Processing and preserving of fish and other seafood fit for human consumption
4170 Manufacture of spaghetti, macaroni etc.
4190 Manufacture of bread and flour confectionery
4290 Manufacture of tobacco products
4380 Manufacture of carpets, linoleum and other floor coverings, including leather cloth and similar supported synthetic sheeting
4930 Photographic and cinematographic laboratories

Category 3
2220 Manufacture of steel tubes
2480 Manufacture of ceramic goods
3110 Foundries
3140 Manufacture of structural metal products
3150 Boilermaking, manufacture of reservoirs, tanks and other sheet-metal containers

3210 Manufacture of agricultural machinery and tractors
3520 Manufacture of bodies for motor vehicles and of motor-drawn trailers and caravan
3610 Shipbuilding
3620 Manufacture of standard and narrow-gauge railway and tramway rolling stock
3740 Manufacture of clocks and watches and parts thereof
4350 Jute industry
4360 Knitting industry
4400 Leather and leather goods industry
4420 Manufacture of products from leather and leather substitutes
4500 Footwear and clothing industry
4510 Manufacture of mass-produced industry
4530 Manufacture of ready-made clothing and accessories
4560 Manufacture of furs and of fur goods
4630 Manufacture of carpentry and of joinery components and of parquet flooring
4670 Manufacture of wooden furniture
4920 Manufacture of musical instruments
5000 Building and civil engineering
5010 Construction of flats, office blocks, hospitals and other buildings, both residential and non-residential
5020 Civil engineering, construction of road, bridges, railway
5030 Installation
5040 Building completion work
5100 Building and civil engineering without specialisation

Category 4
2200 Production and preliminary processing of metals
2210 Iron and steel industry excluding integrated coke ovens
2230 Drawing, cold rolling and cold folding of steel
2240 Production and preliminary processing of non-ferrous metals
2400 Manufacture of non-metallic mineral products
2410 Manufacture of clay products for constructional purposes
2440 Manufacture of articles of asbestos
2450 Working of stone and of non-metallic mineral products
2470 Manufacture of glass and glassware
3100 Manufacture of metal articles (except for mechanical, electrical and instrument engineering and vehicles)
3120 Forging, closed-died forging, pressing and stamping
3130 Secondary transformation, treatment and coating of metals
3160 Manufacture of tools and finished metal goods, except electrical equipment
3190 Other mechanical workshops not elsewhere specified
3260 Manufacture of transmission equipment for motive power
3470 Manufacture of electric lamps and other electric lightning equipment
3500 Manufacture of motor vehicles and of motor vehicles parts and accessories
3510 Manufacture and assembly of motor vehicles, manufacture of motor vehicle engines
3530 Manufacture of parts and accessories for motor vehicles
3630 Manufacture of cycles and motorcycles and parts and accessories thereof
3650 Manufacture of transport equipment not elsewhere specified
4120 Slaughtering, preparing and preserving of meat
4210 Manufacture of cocoa, chocolate and sugar confection
4300 Textile industry
4320 Cotton industry
4330 Silk industry
4370 Textile finishing
4390 Miscellaneous textile industries
4410 Tanning and dressing of leather
4550 Manufacture of household textiles other make-up textile goods
4600 Timber and wooden furniture industries
4610 Sawing and processing of wood
4620 Manufacture of semi-finished wood products
4640 Manufacture of wooden containers
4650 Other wood manufacture
4660 Manufacture of articles of cork and articles of straw and other plant materials, manufacture of brushes and brooms
4720 Processing of paper and boards
4730 Printing and allied industries
4800 Processing of rubber and plastics
4810 Manufacture of rubber products
4830 Processing of plastics

4900 Other manufacturing industries
4910 Manufacture of articles of jewelry and goldsmiths' and silversmiths' wares
4940 Manufacture of toys and sports goods
4950 Miscellaneous manufacturing industries

Category 5
2300 Extraction of minerals other than ferrous metals and energy-producing minerals; peat extraction
2420 Manufacture of cement, lime and plaster
4100 Food, drink and tobacco industry
4130 Manufacture of dairy products
4140 Processing and preserving of fruits and vegetables
4160 Grain milling
4180 Manufacture of starch and starch products
4200 Sugar manufacturing and refining
4220 Manufacture of animal and poultry food
4230 Manufacture of other food products
4240 Distilling of ethyl alcohol from fermented materials; spirit distilling and compounding
4250 Manufacture of wine of fresh grapes and of beverages based thereon
4270 Brewing and malting
4280 Manufacture of soft drinks, including the bottling of natural spa water
4700 Manufacture of paper and paper products; printing and publishing
4710 Manufacture of pulp, paper and board

Source: Kaitila (2004).