On the Appropriate Interpretation of the Revealed Comparative Advantage Index: Implications of a Methodology Based on Industry Sector Analysis

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I. Introduction

In various studies relating to commercial policy and structural adjustment problems, both academic and government economists have drawn on the concept of revealed comparative advantage (RCA)[1]. A particular attraction of the approach is that it can be easily quantified in the form of an index that is used in various types of inter-country and inter-industry comparisons. However, in spite of the fact that there have been numerous empirical applications there appears to have been no detailed analyses of the properties of the RCA index. The purpose of this study is to examine some of these properties with a view toward assessing the true utility of the index for economic analysis.

Stated simply, a country's revealed comparative advantage in the trade of a particular industry has generally been measured by the share of that industry in the country's total exports relative to the industry's share in total world exports of manufactures[2]. If this ratio (index) is less than unity this is generally interpreted to mean that the country is at a comparative *disadvantage* in the trade of the product in question. However, if the RCA index exceeds unity

Remark: The views expressed in this paper need not reflect those of the United Nations or its staff.

[1] For examples of previous studies which have employed the RCA concept see Balassa [1965; 1979], UNCTAD [1983] or UNIDO [1982].

[2] Specifically, if x_{ij} is the value of country i's exports of j and X_{it} is the country's total exports of manufactures its revealed comparative advantage index is

$$(1) \qquad RCA_{ij} = (x_{ij}/X_{it})/(x_{jw}/X_{tw})$$

where the w subscripts refer to world trade totals. A somewhat different measure of revealed comparative advantage has been developed by Donges and Riedel [1977].

(which occurs when the industry's share in the country's exports exceeds its share in world trade) this is taken to indicate that the country has a revealed comparative *advantage* in the sector[1].

Given the nature of the applications in previous studies, there are several key characteristics of the index that need to be verified. A major point is whether the index accurately ranks industries according to a country's comparative advantage (i.e. is it an ordinal measure), or does it have stronger properties that allow it to serve as a cardinal measure[2]? This study develops information relevant to such questions through the use of a new methodological approach to RCA analysis. Since this approach also provides insights into comparative advantage on an industry sector basis it is used to examine the consistency of results generated by the RCA model with those predicted by factor proportions theory. The study closes with an evaluation of new lines of research suggested by the empirical findings and an assessment of the proper use of the RCA concept in future trade and structural adjustment studies.

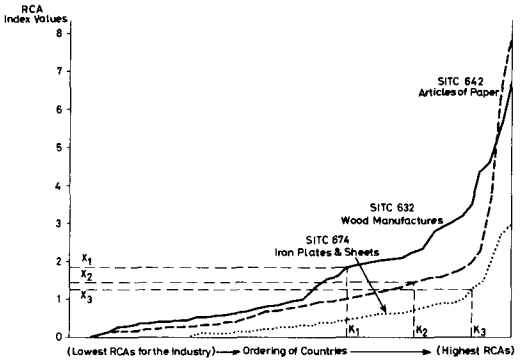
II. Characteristics of RCA Index Distributions

The major difficulties associated with the use of the RCA index for economic analysis stems from the fact that little or no evidence has been compiled concerning the distribution of country index values within different industries. For example, if for a given *industry* the associated *country* index values are all highly concentrated in a range slightly above or below unity the nation with the greatest comparative advantage in the industry may have a relatively low RCA index value. Conversely, if production and exports of a second industry are highly concentrated in a relatively few countries it is possible that a nation which does not have the greatest comparative advantage (relative to other countries) may still have a very high index value. As such, the numeric values of the RCA index need not provide

[1] A number of the basic assumptions of the model have been challenged as being at odds with existing institutional realities. For example, the RCA model requires that existing trade barriers do not discriminate among alternative suppliers of the same product. However, voluntary export restraints, general versus most-favored-nation tariffs on the same item, or the provisions of the Multifibre Arrangement clearly have such discriminatory effects. Furthermore, the model cannot account for trade distortions associated with national exports incentives (like subsidies) that are applied to a wide range of agricultural and manufactured products. It has not proved possible to assess empirically the degree to which these factors bias RCA results.

[2] There is no doubt that previous studies have, at the least, assumed that the RCA index possessed ordinal properties. See, for example, Balassa [1965; 1979] or UNCTAD [1983]. It should be noted that a cardinal index would be far more useful for most commercial and public policy applications since it would provide a measure of the magnitude of the differences in a country's comparative advantage among industries. In contrast, an ordinal index would merely rank industries in terms of comparative advantage, but would not indicate whether the differences were large or small.

Illustration of the Potential for True Industry Comparative Advantage Reversals in RCA Indices. - Industry Distribution Based on RCA Data for Fourty-Seven Countries



Source: UNIDO [1982].

an ordinal ranking of a country's comparative advantage if the underlying distributions of index values are different across industries.

This point concerning the potential bias due to differences in country-industry index distributions is illustrated in the accompanying figure. Here, RCA indices for 47 countries (over the period 1976–1978) have been ordered (positioned) from lowest to highest values within industries on the horizontal axis while the vertical axis records actual index values (for details concerning this information see UNIDO [1982]). Thus, the curves show the distribution of the countries' RCA index values for three industries: paper articles, wood manufactures, and iron plates and sheets. Using this framework, the position of an individual country (the Republic of Korea) has been located on the horizontal axis (OK_1 to OK_3) in each of the three industries with its corresponding RCA indices shown on the vertical scale. Since the procedure shows that OK_3 exceeds OK_2 (which in turn exceeds OK_1) Korea is seen to have its greatest comparative advantage relative to other exporters in iron plates and sheets (SITC 674) while its relative position in paper articles (SITC 642) is lowest. However, because of the *different distributions* of country indices within these industries the actual RCA index values reflect a profile that is the *direct opposite* of the Korean true comparative advantage in each industry. Specifically, the index value for paper articles (OX_1) is highest while that for iron plates (where Korea is among the most efficient producers) is only OX_3, the lowest RCA value recorded for the country[1].

[1] Aside from the practical problems relating to the RCA measure as a cardinal or ordinal measure, the index may not even be able to make a dichotomous distinction between industries in which a country has or does not have a revealed comparative advantage. This potential problem is due to the fact that the index has always been presented as a point estimate with no indication provided as to the possible magnitude of random or cyclical factors that influence the export statistics upon which

It follows from the analysis presented in the figure that the potential for these RCA index "reversals" hinge on different country distributions of the index over industries. If the distributions are similar in shape and not widely dispersed the reversals will not occur or will be relatively minor. However, there has been empirical analysis relating to this basic question.

III. Methodological Issues in RCA Analysis

In order to examine these key properties of the RCA index a recent UNIDO [1982] study was employed as a basic data source since it estimated 1976–1978 indices for 129 industries whose output was traded by 47 developed and developing countries[1]. Given the extensive body of empirical information in this document it provided a basis for examining the properties of the RCA (country) distributions across industries.

To hold the analysis to workable levels, country RCA indices were compiled from this report for 40 manufacturing industries. Next, the country indices were ranked within each industry in ascending order from lowest to highest RCA values (see the figure for an illustration of the approach). This procedure permitted the location of any given country's position in each industry relative to its competitors, and also identified the country with the highest RCA index in the industry. It also provided basic information for analysis of the magnitude and effects of differences in country distributions of RCA indices across industries.

Using this framework, Table 1 provides information concerning the extent to which the traditional (country-industry) approach to RCA analysis can bias the empirical findings. Shown here are the country leaders for each industry (i.e. the nation registering the highest RCA index in the *industry*) and information relating to the difference between this figure and the highest RCA index recorded for the *country*. Comparison of the maximum country index for the industry with the position of this value in the country's RCA indices for all industries shows the extent to which the latter distribution may fail to reflect the nation's position as the industry leader in terms of comparative advantage.

An illustration can help clarify this approach. Specifically, Table 1 shows that Switzerland has the highest revealed comparative advantage index (2.63)

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the index is based. Stated differently, if an RCA index of unity is taken to represent a neutral position for a country (i.e. in that it neither has a comparative advantage or disadvantage) a key question is how far above or below unity must one go before it can be said with any degree of certainty that the results are significant and not due to random or cyclical factors. It is possible that the appropriate "confidence interval" for the index may be so wide that all index values below unity fall *within* its range.

[1] Following standard practice, UNIDO has generally defined "industries" in terms of the three-digit level of the SITC system.

Table 1 - *An Analysis of National and Industry RCA Index Discrepancies for Fourty Selected Industry Groups (Based on 1976–1978 Trade Data)*

SITC	Industry Description	National Exporter with the Highest RCA Index				Position in the Country's RCA Index Distribution	Industry Country Correl. Coeff.[a]
		Country	Actual Value	Difference between (2) and Country Maximum			
				Absolute	Percent		
		(1)	(2)	(3)	(4)	(5)	(6)
512	Organic Chemicals	Switzerland	2.63	-12.71	-82.9	12	0.887[b]
531	Synthetic Dyestuffs	Switzerland	10.77	-4.57	-29.8	2	0.950[b]
541	Medicinal Products	Switzerland	5.54	-9.80	-63.9	6	0.773
551	Essential Oil	Egypt	13.25	0.00	0.0	1	0.907
554	Cleansing Preparations	Guatemala	7.59	-18.28	-70.7	3	0.800
581	Plastic Materials	Netherlands	2.38	-2.60	-52.2	11	0.837
611	Leather	India	22.98	-53.16	-69.2	2	0.967
612	Leather Manufactures	Tunisia	13.74	-26.04	-65.5	5	0.845
621	Materials of Rubber	Austria	2.23	-9.97	-81.7	18	0.793
629	Articles of Rubber N.E.S.	Spain	3.42	-9.33	-73.2	15	0.920
631	Veneers and Plywood	Philippines	11.00	-70.79	-86.6	4	0.783
632	Wood Manufactures N.E.S.	Philippines	6.72	-75.07	-91.8	6	0.778
633	Cork Manufactures	Portugal	232.39	0.00	0.0	1	0.850[b]
641	Paper and Board	Finland	13.01	0.00	0.0	1	0.828[b]
642	Articles of Paper	Colombia	7.48	-4.54	-37.8	6	0.952
651	Textile Yarn and Thread	Turkey	13.45	-133.86	-90.9	3	0.824
652	Woven Cotton Fabrics	Pakistan	24.08	-68.64	-73.3	4	0.953
653	Non-Cotton Textile Fabrics	Korea (Rep.)	4.42	-8.20	-65.0	8	0.816
656	Made Up Textile Articles	Pakistan	19.64	-73.08	-78.8	6	0.921
666	Pottery	Portugal	3.33	-229.06	-98.6	14	0.829[b]
674	Iron Plates and Sheets	Japan	2.95	-0.73	-19.8	3	0.830[b]
677	Iron Wire	Belgium	4.63	-1.01	-17.9	2	0.929[b]
678	Iron Tubes and Pipe	Japan	2.45	-1.23	-33.5	6	0.734
692	Metal Containers	Greece	4.07	-78.33	-95.1	13	0.646
693	Wire Products	Belgium	2.89	-2.75	-48.8	7	0.768
695	Hand Tools	Sweden	3.44	-4.39	-56.1	4	0.809
711	Power Generating Machinery	U.K.	1.95	-1.78	-47.7	12	0.929
712	Agricultural Machinery	U.S.A.	1.91	-1.63	-46.0	14	0.930
715	Metalworking Machinery	Switzerland	3.39	-11.95	-77.9	9	0.572[b]
717	Textile Machinery	Switzerland	6.08	-9.26	-60.4	4	1.000
725	Domestic Electric Equipment	Italy	2.86	-3.47	-54.8	8	0.543[b]
726	Electro-Medical Equipment	Netherlands	2.34	-2.64	-53.0	12	0.500[b]
732	Road Motor Vehicles	Canada	2.66	-6.06	-69.5	11	0.750[b]
831	Travel Goods & Handbags	Hong Kong	12.77	-2.63	-17.1	3	0.820
841	Clothing not of Fur	Hong Kong	15.40	0.00	0.0	1	0.809
851	Footwear	Korea (Rep.)	7.47	-5.15	-40.8	4	0.850
861	Scientific Equipment	Ireland	2.04	-14.33	-85.8	17	0.729[b]
862	Photographic Supplies	Mexico	2.80	-21.54	-88.5	19	0.700[b]
893	Art. of Artificial Plastic	Hong Kong	3.83	-11.57	-75.1	10	0.716[b]
894	Toys and Sporting Goods	Hong Kong	14.77	-0.63	-4.1	2	0.917[b]

[a] Rank correlations between the ordered revealed comparative advantage indices for each industry and the position of these indices in the corresponding country-industry RCA distributions. See the Figure for an illustration of the basic approach. - [b] The rank correlation *fails* to achieve statistical significance at the 95 percent confidence level. Information pertaining to the number of degrees of freedom involved in each test can be derived from Table 2.

Source: Analysis based on RCA index values published in UNIDO [1982].

of all countries in the production and trade of organic chemicals (SITC 512). However, this index value was a full 12.71 *points below* the maximum RCA index recorded by Switzerland in the 127 industries (82.9 percent below the maximum) and the organic chemical index was only the twelfth highest national value for Switzerland. Thus, the traditional (country-industry) procedure for analysis masks the fact that Switzerland has the highest comparative advantage in this industry[1].

As Table 1 shows, this problem of failure to "flag" leading industries (in terms of highest comparative advantage) occurs frequently in the traditional (country-industry) approach to RCA analysis. For example, Austria has the highest revealed comparative advantage of all countries in the trade of rubber materials (SITC 621), yet its RCA index value for this industry (2.23) places the industry in eighteenth position of all Austrian industries and behind SITC 654 (Lace and Tulle), which has Austria's highest comparative advantage index. Furthermore, in almost one-third of the industries (13 out of 40) the highest index for the *industry* does not fall within the ten highest RCAs for the (industry leader) *country*. A further point is that in over one-half of the cases the highest index for the industry does not fall within the five highest RCA index values for the countries concerned.

Since Table 1 establishes that the traditional (country-industry) approach to RCA analysis often fails to indicate a nation's true position as an industry leader, rank correlations were run between the ordered RCA indices for each industry and the position of these indices in the corresponding country-industry RCA distributions[2]. The purpose of these tests was to determine the extent to which the traditional approach does or does not provide a useful ordinal guide to countries' revealed comparative advantage. These correlation results are reported in the far right column of Table 1.

The key point that follows from the correlations concerns the *general* failure of the traditional RCA approach to provide an ordinal (much less a cardinal) measure of comparative advantage. For almost 40 percent (15 of 40) of the industries tested the rank correlation coefficient does not achieve statistical significance at the 95 percent confidence level, and in only one industry (textile machinery) out of fourty there is a perfect ordering of

[1] Within its country distribution of RCA indices Switzerland registers its highest revealed comparative advantage (15.34) in SITC 864 (Watches and Clocks). In this instance, the RCA index value is a maximum in both the country-industry and industry-country distributions. However, such a joint concurrence does not appear to be a normal event.

[2] Specifically, the RCA index values for the industry (ordered from highest to lowest values) were rank correlated with the position of the index in the associated country's industry distribution. These tests were confined to nations recording a revealed comparative advantage (i.e. having an RCA index exceeding unity) due to the fact that within some industries, like electro-medical equipment, a large number of countries were bunched at zero or extremely low RCA index values (see Table 2 for a tabulation).

countries in terms of comparative advantage. However, aside from this one exception the statistics show that varying degrees of error exist in the ordinal ranking for all other industries[1]. Furthermore, the magnitude and extent of this bias (as evidenced by the correlation coefficients) appears sufficient to call into question findings and conclusions of previous studies that have employed the traditional methodological approach[2].

The previous analysis demonstrated that the traditional RCA approach does not produce a strict ordinal index and, in cases, may not even provide a statistically significant ranking of industries according to revealed comparative advantage. Concerning this problem, it is evident (see the figure above) that the potential for bias is greatest when comparisons are made between industries which have the widest differences in their underlying (country) RCA distributions. As such, there is a need for some sort of measure to "flag" industries that have major differences in distributions. Such a measure could also provide insights concerning the question whether the difficulties associated with the traditional approach to RCA analysis are due to unusual distributions for a few "special" industries or whether the problem is broader in nature.

Table 2 shows the results when an inequality index was calculated for the fourty different industry distributions of RCA indices[3]. A key point is that the index values are distributed over a wide range with a low of 0.26 occurring for power generating machinery (SITC 711) and the high for cork manufactures (SITC 633) taking a value of over eleven hundred. Furthermore, the index does *not* show a tendency to "cluster" in a narrow range with a relatively few

[1] Of course, any deviation from a perfect rank correlation shows that the traditional RCA approach does *not* provide a strict ordinal measure of comparative advantage. Also, in cases where a statistically significant association exists it is possible that the index distribution may not provide a sufficiently precise measure of comparative advantage for the analysis in which it is used.

[2] Note, for example, that Balassa [1965, pp. 110–114] provides a detailed list of products in which the United States, Canada, European Economic Community, Britain, Sweden and Japan (purportedly) have their greatest revealed comparative advantage or disadvantage. However, since the traditional (country-industry) methodological approach was used in arriving at these results they may be subject to a considerable degree of error. The issue of their accuracy will remain in doubt until these lists can be cross-checked using the industry sector RCA approach developed in the present study. Aside from Balassa [1965], the reader will find similar or closely related methodological problems in studies by UNCTAD [1983], UNIDO [1982] and Balassa [1979] among others.

[3] Specifically, the variance in industry j's (country) RCA indices was used in this context. This measure (V_j) took the form

$$(2) \qquad V_j = \Sigma\,(RCA_{ij} - \overline{RCA_{ij}})^2/m$$

where $\overline{RCA_{ij}}$ is the average revealed comparative advantage index for the industry. A particular attraction of this approach is that the measure can be used in connection with established statistical procedures to determine if a significant difference exists between any two industry distributions (i.e. the F test). As previously noted, such differences will lead to a bias in the traditional approach to RCA analysis.

Table 2 - *Basic Statistics Relating to the Country Distribution of RCA Indices within Industries*

SITC	Description	Industry Inequality Index[a]	Developing countries with RCAs > 1		Country Specialization: GDP Per Capita Average ($)[b]	Distribution of RCA Indices (No. of Countries)			
			No.	% of all Countries		Non-Producers (RCA = 0)	Countries with a Comparative Disadvantage		Specializing Countries (RCA < 1.0)
							(0 < RCA ≤ 0.1)	(0.1 < RCA ≤ 1.0)	
		High Country Concentrations							
531	Synthetic Dyes	2.52	1	25	5,556	13	18	12	4
633	Manufactures of Cork	1,154.02[c]	3	75	2,957	18	10	15	4
862	Photographic Supplies	0.51	1	20	5,260	12	14	16	5
717	Textile Machinery	0.84	0	0	5,600	4	14	13	6
674	Iron Plates and Sheets	0.41	1	17	4,857	7	11	23	6
715	Metalworking Machinery	0.45	0	0	4,757	9	15	16	7
677	Iron and Steel Wire	0.72	1	14	6,522	10	7	23	7
711	Power Generating Machinery	0.26	1	14	4,568	6	14	20	7
712	Agricultural Machinery	0.27	0	0	6,177	9	12	19	7
732	Road Motor Vehicles	0.28	0	0	6,766	4	20	16	7
726	Electro-Medical Equipm.	0.33	0	0	6,911	15	11	14	7
861	Scientific Equipm.	0.30	1	12	5,021	6	9	24	8
512	Organic Chemicals	0.41	0	0	5,687	2	14	23	8
641	Paper and Paperboard	4.54	1	12	7,313	6	10	23	8
581	Plastic Materials	0.29	1	12	5,336	3	9	27	8
		Moderate Country Concentrations							
554	Cleansing Preparations	1.46	2	22	4,085	2	4	32	9
678	Iron and Steel Pipe	0.27	2	22	3,325	5	8	25	9
894	Toys and Sporting Goods	4.76	3	33	2,265	2	6	30	9
666	Pottery	0.59	2	22	4,221	5	9	24	9
695	Hand Tools	0.50	1	9	5,462	3	7	26	11
621	Materials of Rubber	0.36	2	18	3,156	4	6	26	11
653	Non-Cotton Textiles	0.91	6	50	1,177	0	8	27	12
629	Articles of Rubber	0.64	2	17	2,946	0	12	23	12
725	Domestic Electrical Eq.	0.47	2	15	3,725	8	5	21	13
831	Travel Goods	9.68	12	80	855	3	3	26	15
541	Medicinal Products	1.20	6	38	4,719	0	6	25	16
642	Articles of Paper	1.94	4	25	4,249	1	5	25	16
692	Metal Containers	0.57	5	29	2,484	2	2	26	17
693	Products of Wire	0.57	6	35	2,729	5	4	21	17
893	Manufactures of Plastic	0.85	3	18	3,354	1	5	24	17
		Industries with Low Country Concentrations							
611	Leather	24.30	8	44	824	4	5	20	18
631	Plywoods and Veneers	7.23	9	50	1,778	4	3	22	18
551	Essential Oils	6.94	11	61	2,499	3	5	21	18
612	Leather Manufactures	6.53	12	63	1,004	0	4	23	19
851	Footwear	3.73	12	60	1,941	0	5	22	20
632	Wood Manufactures	2.11	10	48	4,290	0	3	23	21
841	Clothing, not of Fur	9.13	13	62	1,131	0	5	21	21
656	Made up Textile Articles	17.93	14	61	604	0	1	23	23
652	Woven Cotton Fabrics	16.71	18	75	569	1	4	18	24
651	Textile Yarn	8.97	11	46	921	1	5	17	24

[a]Defined by Eq. (2) in the text. - [b] The average 1976 GDP per capita of the five countries registering the highest revealed comparative advantage indices in the industry. These data are expressed in United States dollars and have been drawn from UNCTAD, *Handbook of International Trade and Development Statistics* (New York 1979) - [c] The extreme inequality index value for this industry is due almost entirely to the fact that the RCA index value for Portugal, the industry leader, stands at 232.39 (see Table 1). This is approximately ten times the second highest RCA index value recorded for any other country in the selection of fourty industries.

industries falling outside. Specifically, one-third of the industries had an inequality index of 0.50 or less while exactly the same proportion took values which exceeded *seven times* (3.5) this figure. As such, the failure of the traditional RCA approach to serve as either a cardinal or ordinal measure of comparative advantage cannot be attributed to a few special cases, but is due to extensive differences between distributions.

Aside from the inequality indices, Table 2 provides statistics on the number of countries having a comparative advantage in each industry, or having very low or zero RCA indices. The intention here is to indicate the extent that comparative advantage, or lack of it, is concentrated in a relatively few, or large number of countries. The table also presents information on the number of developing countries with a comparative advantage in order to assess the extent to which these nations have been able to develop export capacities in each industry.

This presentation serves to further highlight the major differences in RCA distributions across industries. For example, there appears to be considerable merit in classifying industries on the basis of the number or proportion of countries that have developed a comparative advantage in the sector (i.e. those with *high country concentrations* like synthetic dyes; industries with *moderate concentrations* like pottery and hand tools; or industries in which *a large number* of countries have developed a comparative advantage, like leather, plywood or footwear[1]. While it is beyond the scope of the present study, there would appear to be considerable utility in a factor content analysis of production or market characteristics to determine the elements leading to the wide differences in these capacities to develop a revealed comparative advantage across industries[2].

Aside from its utility in making cross-industry comparisons of RCA index distributions, the presentation in Table 2 suggests other lines of analysis. One such application involves the use of these data for a test of the consistency of predictions by traditional factor proportions explanations of the determinants of trade and actual empirical results reflected in RCA indices. Specifically,

[1] The industry concentration classifications in Table 2 are based on an extensive analysis of UNIDO [1982] statistics with the limits being set so that approximately equal proportions (33 percent) of the industries fell in each group. Specifically, for the 127 industries for which data were available roughly one-third had less than nine countries with a RCA index exceeding unity while the same proportion of industries had between 9 and 17 countries with RCA indices above one.

[2] Such an analysis could be specifically directed at the trade performance of developing countries since it might identify industries in which these nations were rapidly developing comparative advantage. This information could be very useful to the extent that it "flagged" industries likely to come under increasing pressure from developing country exports. Given such advanced information, structural adjustment policies could be adopted for averting many of the problems associated with the NICs export expansion which occurred during the last two decades.

factor proportions theory holds that richer countries, with a relative abundance of capital, should specialize in the production and trade of goods which are relatively capital intensive in production while poorer nations should specialize in labor-intensive goods. Therefore, if indices of labor intensity (L_j) for various industries were regressed on the average per capita income level $(Y/N)_j$ of those countries having the highest RCAs in the industry the results would show the extent to which factor proportions theory accounts for the country pattern of revealed comparative advantage across industries[1].

Employing data drawn on the industries shown in Table 2, the regression equation resulting from such a test took the form

$$(3) \qquad (Y/N)_j = -2{,}522.96 + \underset{(6.22)}{75.79L_j} \qquad (\bar{R}^2 = 0.51)$$

where t-values are shown in parentheses. In addition, a second regression was tested using a dummy variable (D_j) to distinguish between industries classified as resource based in nature as opposed to those not having such a production constraint[2]. This modification was tested to determine the degree to which resource endowments alter the normal relation between labor intensity and (country) income levels. For the fourty industries shown in Table 2 the regression results took the form

$$(4) \qquad (Y/N)_j = -2{,}118.24 + \underset{(5.87)}{69.21L_j} + \underset{(1.86)}{11.29\ D_j} \qquad (\bar{R}^2 = 0.57)$$

A point that clearly emerges from both (3) and (4) is that the relation between labor intensity and income levels is statistically significant with the relation taking the direction indicated by theory. Specifically, (3) shows that factor intensities explain approximately 50 percent of the variation in income levels of countries with the highest comparative advantage in each industry while the t-statistic for the labor intensity term is significant at the 99 percent confidence level. Eq. (4) shows that the explanatory power of the relation is modestly improved by addition of the natural resource dummy with the coefficient of determination rising by 6 points. However, the key point demonstrated by (3) and (4) is that the empirical results evidenced in actual

[1] Following Lary [1968] and Tuong and Yeats [1980] value added per employee is used as the measure of labor intensity and data required for the regression analysis was drawn from these studies. In both the present and earlier studies it is assumed the higher the value added per employee the more capital intensive the industry (i.e. the *less* labor intensive) while the lower the coefficient the *more* labor intensive the industry. See Lary's study for a full discussion of the use of value added as a measure of (labor) factor intensity.

[2] The per capita income variable employed in (3) represents an average for the five countries recording the highest 1976–1978 RCA indices for the industry. UNIDO [1982] is the source for classifying resource and non-resource based industries. See Meier [1968] or Stern [1975] for discussions of theoretical models of international trade flows including factor proportions.

RCA indices is fully consistent with the predictions of factor proportions theory of the determinants of international trade[1].

IV. Summary and Conclusions

Although the revealed comparative advantage model has had rather wide applications in studies relating to structural adjustment or trade and development issues, key properties of the index have not been subject to analysis. This paper establishes a framework for examining these properties and conducts the specified empirical tests. The results show that the index, when used in the traditional manner, fails to serve as either a reliable cardinal or ordinal measure of a country's revealed comparative advantage. Recognizing this fact, a methodology is proposed that circumvents the indices' shortcomings and also provides insights into revealed comparative advantage on an industry sector level. The procedures developed in this study also provide a basis for testing the link between factor proportions theory and the empirical results associated with the revealed comparative advantage model. The findings show that the quantitative evidence developed by the RCA approach is fully consistent with the predictions of theory.

While this paper has not explored the question in depth, the new approach to RCA analysis seemingly suggests a number of lines of research that could have important policy implications. For example, it was shown (Table 2) that the number of countries recording a comparative advantage differed markedly across industries. An effort to account for the causes of these wide differences, be they attributed to "artificial" factors like government policy measures, the influence of transnational corporations, or "natural" influences like resource endowments could be very helpful in formulating trade and structural adjustment policies. Furthermore, this study developed procedures for testing the consistency of trade theories (in this case factor proportions theory) with results evidenced in RCA index values. The approach could obviously be extended in an effort to test the validity of other theoretical explanations of the determinants of international trade.

Concerning one further point, there could be considerable utility in analyzing changes in industry sector RCA information, such as that developed in this study, on a regular basis. This proposition is based on the belief that contemporary pressures for protectionism are due in part to the fact that comparative advantage in some industries changed rapidly in favor of developing countries, and that these changes were not fully anticipated. If the industry sector RCA approach developed in this study were conducted on a

[1] There would be obvious merit in testing additional explanatory variables in this context to determine the extent to which the predictive power of (3) and (4) could be further improved. See Stern [1975] for a theoretical discussion that suggests other variables that could be included in such an analysis.

regular basis it could provide basic information for anticipating similar future shifts in comparative advantage. Such information would, of course, constitute a major input into any "early warning system" designed to avoid the types of trade and structural adjustment problems associated with the NICs over the last two decades.

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Zusammenfassung: Zur richtigen Interpretation des RCA-Index: Folgerungen aus der Analyse von Industriesektoren. – In Studien, die sich mit Handel und struktureller Anpassung befassen, haben Ökonomen das Konzept des „revealed comparative advantage" (RCA) benutzt. Obwohl es in empirischen Untersuchungen häufig verwendet wurde, sind wichtige Eigenschaften dieses Index aber noch nicht gründlich analysiert worden. In diesem Aufsatz wird ein Rahmen zur Untersuchung dieser Eigenschaften aufgestellt sowie die sich daraus ergebenden empirischen Tests durchgeführt. Die Ergebnisse zeigen, daß der Index, wenn er in der üblichen Weise benutzt wird, weder als kardinales noch als ordinales Maß für komparative Vorteile geeignet ist. Daher wird eine Methode vorgeschlagen, die diese Mängel vermeidet und außerdem neue Einsichten in die komparativen Vorteile auf der Ebene von Industriesektoren vermittelt. Schließlich wird dieser neue Ansatz in einem Konsistenztest angewandt, in dem die empirischen Ergebnisse des RCA-Modells mit denen verglichen werden, die mit Hilfe der traditionellen Faktorproportionentheorie vorhergesagt werden.

Résumé: A l'interprétation appropriée de l'indice de l'avantage comparatif révélé: Implications d'une méthodologie basée sur une analyse du secteur industriel. – Dans les études qui s'occupent des aspects du commerce extérieur et d'ajustement structurel les économistes ont utilisé le concept de l'avantage comparatif révélé (ACR). Malgré des applications extensives empiriques on n'a pas analysé profondément les propriétés principales de l'indice ACR. Cet article introduit une méthode pour examiner ces propriétés et puis conduit les tests empiriques spécifiques. Les résultats démontrent que l'indice, si utilisé de manière traditionelle, ne peut pas être une mesure cardinale ou ordinale de l'avantage comparatif. A cause de cela l'auteur propose une méthodologie qui évite ces défauts et aussi rend possible des nouvelles connaissances sur l'avantage comparatif à l'échelle du secteur industriel. Finalement, ce nouvel approche est appliqué dans une analyse avec laquelle l'auteur teste la consistance entre des résultats empiriques générés par le concept ACR et ceux qui sont prédits par la théorie traditionelle de la dotation en facteurs de production.

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Resumen: Sobre la interpretación apropiada del índice de ventajas comparativas reveladas: implicaciones de una metodología basada en el análisis sectorial. – En estudios sobre problemas de comercio exterior y de ajuste estructural se ha utilizado el concepto de ventajas comparativas reveladas (VCR). Pero, a pesar de su frecuente uso en aplicaciones empíricas, las propiedades fundamentales de este índice no han sido aún objeto de estudio. En el presente trabajo se deriva un marco de análisis para poder examinar esas propiedades y se llevan a cabo tests empíricos. Los resultados demuestran que el índice fracasa como medida cardinal u ordinal de ventajas comparativas, si se lo emplea de manera tradicional. Teniendo en cuenta este hecho se propone un método que supera dichas desventajas a la vez que permite descubrir nuevos aspectos de las ventajas comparativas a nivel sectorial. Finalmente, este nuevo método es empleado para estudiar la consistencia de los resultados empíricos generados por el modelo VCR con aquellos generados por el modelo tradicional de proporción de factores.