



The Canadian Rural Revitalization Foundation

Seven Reports on the Identification of Rural Indicators for Rural Communities

2. Global Exposure & Integration

Prepared for the Rural Secretariat
of Agriculture and Agri-Food Canada

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New Rural Economy Project, Phase 2 (NRE^2)

September 2004

The New Rural Economy Project is an initiative of CRRF

Introduction

Economic integration and exposure has had a significant impact on nations, regions and communities. Exposure to global economic markets has served to alter the way in which people perceive the role of the state and conceptualize society (Hainsworth, 1996). As a region's degree of integration and exposure to global markets changes so does its perception of both the community and the outside world. In fact, global exposure has served to diminish the importance and significance of national borders and strengthened identities beyond those rooted in a particular region or community (Mittelmann, 2002).

Global exposure has also been linked to dramatic declines in labour power as well as a de-emphasis on social programs (Esping-Andersen, 1990). It has also been argued that these changes affect both the need for and the form of employment and social policy (Rhodes, 2002). Exposure to the global economy has been shown to have profound effects on the development of a region. Communities experiencing a high degree of exposure to the global economy have witnessed population declines, increases in labour mobility and increased competition from international markets (Reimer, 2002).

Definition of Global Integration and Exposure

Global economic integration can be defined as the degree to which industries are characterized by international linkages, as measured by the level of intra-industry trade (Makhija, M. V. et al., 1997). Thus, a global economic integration index measures the extent to which an industry's various value-added activities are globally integrated and connected to international markets. While economic integration, in this sense, suggests a two-way trade flow, involving both imports and exports, global economic exposure implies a one-way flow, and may be defined as the extent to which industries are merely export-oriented (Krugman and Obstfeld, 1991).

The Global Economic Integration and Exposure (GEIE) indices were derived in order to measure how much an area, or in this case a Canadian Census Sub-division (CSD)[1], is integrated and exposed economically to the global or international market. Based on a review of economic literature, an important distinction was made between industry global integration and exposure. An industry is considered globally integrated to the extent to which it engages in *both* exports and imports. While on the other hand, an industry is classified as globally exposed to the extent to which it engages in *only* exports.

[1] A census subdivision (CSD) is the general term for municipalities (as determined by provincial legislation) or an area treated as municipal equivalents for statistical purposes (Statistics Canada, 2004). Geographic boundaries are based on 2001 Statistics Canada census definitions. CSDs with populations of less 250 people have been excluded from this analysis since the values become unreliable due to confidentiality transformations.

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Indicator Development

Extensive reviews of economic literature and research on globalization led us to distinguish three types of measures for global economic integration and exposure:

1. Level of Intra-Industry Trade (IIT)

The first type of index, based on the standard Grubel and Lloyd Index of Intra-Industry Trade (IIT), measures the degree of industry global integration as the extent to which firms within an industry perform different value-added activities across national contexts (Grubel, 1975). The IIT index is defined and calculated as the ratio of the absolute value *of net exports* to total trade within an industry: $IIT_{it} = 1 - \frac{|X_{it} - M_{it}|}{X_{it} + M_{it}}$ where X_{it} and M_{it} are, respectively, the levels of industry i's exports and imports in a given period t. This index lies between zero and one, with zero indicating no intra-industry trade (trade consisting *only* of either exports or imports) and one indicating "complete" intra-industry trade (exports equal to imports within the industry).

2. The Level of Industry Exposure: Export Proportion of Total Trade (EPTT)

From the above formulation, a second related index was derived, which measures the degree of industry global *exposure* in terms of the weight of exports in an industry's total trade. The Export Proportion of Total Trade (EPTT) index is defined and calculated as the ratio of exports to total trade rather than the ratio of net exports to total trade: $EPTT_{it} = \frac{X_{it}}{X_{it} + M_{it}}$, where X_{it} and M_{it} are defined as above. Like the IIT index, the value of the EPTT index lies between zero and one, with zero indicating no industry exposure (trade consisting of only of imports), and one indicating "complete" exposure (trade consisting *only* of exports)[2].

3. The Level of Industry Exposure: Export Proportion of GDP (EPGDP)

The third type of index also measures the degree of industry global *exposure*, but defines it in terms of the weight of exports in an industry's total output or gross domestic product (GDP). The Export Proportion of GDP (EPGDP) index is defined and calculated as the ratio of *exports* to GDP: $EPGDP_{it} = \frac{X_{it}}{GDP_{it}}$, where X_{it} is defined above and GDP_{it} is the amount of goods and services produced in the industry. Like the IIT and EPTT indices, the value of the EPGDP index lies between zero and one, with zero indicating no industry exposure (nothing

[2] In cases where there is no trade in the industry, the EPTT and EPGDP indices are mathematically *undefined* (due to a division-by-zero problem). In such events, however, the result can still be rationally interpreted to mean a zero global exposure because if the industry is not exporting and importing anything it can be classified as globally unexposed.

exported from the industry), and one indicating "complete" exposure (all industry output is exported)[2].

The IIT integration measure is likely to be more useful than the EPTT and EPGDP exposure measures for rural communities in which firms rely substantially on imported intermediate inputs and households depend on imported consumer products. On the other hand, the EPTT and EPGDP indexes are likely to be more relevant for communities in which incomes of local industries and of the workers employed by these industries are dependent on exports.

Each of the three types of indices was estimated for three industry classifications: agricultural, manufacturing and communication and other utilities industries. There were four types of datasets used to estimate the indices: trade data, production data, industry labour force data, and income data:

(a) Exports and imports data for the years 1993 to 2002 was collected for each industry category at the provincial level[3];
(b) Gross Domestic Product (GDP) data for 1993-2002 was collected for each industry category at the provincial level[4];
(c) Statistics Canada census data on industry shares of CSD labour for 1996 and 2001 was used;
(d) Statistics Canada census data on CSD-level median household income data for 1996 and 2001 was also utilized.

In order to compute the IIT and EPTT indices, estimates of the amounts of exports and imports for each of the three industries in each CSD for the period 1993-2002 were calculated. An industry's export estimate in a given CSD in year T was obtained by multiplying its proportional share of labor force in the CSD by the amount of its year-T export in the province in which the CSD was located. It is important to point out two key assumptions that underlined this approach. First, since the industry shares or proportions of labour force in a CSD were taken on a single constant year, 1996 or 2001, the obvious assumption was that such industry shares were stable over time in the CSD.

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[3] Export and Import data was obtained via Trade Data Online (http://strategis.ic.gc.ca/sc_mrkti/tdst/engdoc/tr_homep.htm) and is coded in accordance with the North American Industrial Classification System (NAICS). Only three industrial classifications were available for this analysis: (1) Agriculture, Fishing, Forestry, Hunting; (2) Utilities; and (3) Manufacturing.

[4] Gross Domestic Product (GDP) data was obtained via the Canadian Socio-Economic Information Management System (CANSIM) and measured at basic prices (using 1997 constant dollars) by the North American Industrial Classification System (NAICS) at the provincial and territorial level for the years 1993 to 2002. The three industrial classifications included in this analysis were: (1) Agriculture, Fishing, Forestry, Hunting; (2) Utilities; and (3) Manufacturing.

Second, by taking the product of an industry's share of labour force in a CSD and its province-level export amount as its export estimate at the CSD level, we have made the assumption that such export estimates are directly proportional to the industry shares of labour forces across CSDs within any given province. This means, for instance, that CSDs with higher agricultural proportions of labour force within a province were likely to have higher agricultural exports than those with lower proportions within the same province.

The approach used to derive an industry's import estimate was a bit more indirect than the one used in obtaining the export estimate. Theoretically, imports are considered to be more sensitive to income than to labour participation (Dixit and Norman, 1980; Mankiw, 2001). As a result, industry proportional shares of income in a CSD were utilized rather than labour shares. Due to the lack of available data for these industry shares of income directly, they were extrapolated from the available CSD-level household income data.

Using CSD-level median household income data from the 1996 and 2001 Statistics Canada census, estimates of each industry's share of income in a CSD were calculated by weighting the CSD-level median household income by each of the three industry's proportional shares of labour force. The sum of the resulting three industry labour share-weighted income amounts gives us an estimate of total industry income at the CSD level. This weighting process was required to isolate the part of household income that was attributable to industry labour employment. The level of household income may have other sources beside industry employment especially in places with large number of people with multiple income sources. The ratio of each industry's labour-weighted income to the estimated total industry income was then calculated and used to compute its import estimate at the CSD level. This latter estimate was obtained by multiplying the industry's estimated income ratio in the CSD by the amount of its import in the province in which the CSD was located.

Once again, the method used here was based on the assumptions similar to those made in deriving the industry export estimates. For instance, by considering the product of an industry's income ratio in a CSD and its province-level import amount as its import estimate at the CSD level, we assumed that such an import estimate is directly proportional to the industry shares of income across CSDs within any given province. This means, for instance, that CSDs with higher agricultural income shares within a province were likely to have higher agricultural imports than those with lower income shares within the same province. Having obtained the CSD-level industry export and import estimates, the IIT and EPTT formulas were applied in order to derive these two types of indices. Each type of index was computed for each of the three industries, each of the ten years (1993-2002), and all CSDs in Canada.

In order to compute the EPGDP index, estimates of the amounts of GDP for each of the three industries in each CSD for the years 1993-2002 were calculated. An

industry's GDP estimate in a given CSD at year-T was obtained by multiplying its share of labour force in the CSD by the amount of its year-T GDP in the province in which the CSD was located. This approach was again based on the assumption that the industry proportions of labour force in a CSD were stable over time in the CSD, and that such GDP estimates are directly proportional to industry shares of labour forces across CSDs within provinces.

Evaluation of the Indicator

In order to obtain an overall measure of Global Exposure and Integration for all CSDs in Canada using all three of the indexes discussed in the previous section, the averages of the three indexes was calculated and a new index was created and termed "Overall Global Connectedness". Of course, the assumption is made that each of the three indexes contributes equally to the overall connectedness of a CSD.

The following table breaks down each of the four global integration and exposure indexes for 1996 and 2001:

Table1:
Average Levels of Intra-Industry Trade (IIT), Export Proportion of Total Trade (EPTT), Export Proportion of GDP (EPGDP) and Overall Global Connectedness (CSDCON) of CSDs in Canada (1996 and 2001)

	N	ITT	EPTT	EPGDP	CSDCON
1996	4058	0.22	0.18	0.59	0.33
2001	4028	0.31	0.26	0.71	0.42

Based on the results in the table above, we see that the average overall global connectedness of a CSD has increased from 0.33 in 1996 to 0.42 in 2001. All three indexes which make-up the global connectedness index witnessed increases over the 5-year period with export proportion to GDP experiencing the largest such increase.

The following table provides the breakdown of each of the four global integration and exposure indexes averages for CSDs for 1996 by province and territory:

Table 2:

Average Levels of Intra-Industry Trade (IIT), Export Proportion of Total Trade (EPTT), Export Proportion of GDP (EPGDP) and Overall Global Connectedness (CSDCON) of CSDs by Province and Territory (1996)

Province	ITT	EPTT	EPGDP	CSDCON
Newfoundland	0.28	0.16	0.78	0.41
Prince Edward Island	0.28	0.47	0.52	0.42
Nova Scotia	0.17	0.29	0.68	0.38
New Brunswick	0.33	0.17	0.79	0.43
Quebec	0.24	0.12	0.44	0.27
Ontario	0.18	0.09	0.66	0.31
Manitoba	0.21	0.22	0.55	0.33
Saskatchewan	0.10	0.31	0.66	0.36
Alberta	0.31	0.27	0.66	0.41
British Columbia	0.18	0.09	0.67	0.31
Yukon	0.00	0.00	0.07	0.02
Northwest Territories	0.03	0.08	0.05	0.05
Total	0.22	0.18	0.59	0.33

Based on the table above, we see that overall global connectedness averages were highest in CSDs located in Newfoundland and New Brunswick in 1996. This statistic the result of CSDs located in these two provinces having experienced the highest average rate of exports in proportion to their provincial GDPs (EPGDP) in Canada. In other words, CSDs in the provinces of Newfoundland and New Brunswick tended to export, on average, the majority of the output their province produces within the industries used for this analysis making their level of average overall global connectedness index fairly high. In terms of the intra-industry trade index (IIT), CSDs in Newfoundland and New Brunswick tended to have slightly higher than average levels of intra-industry trade. In terms of the export proportion to total trade index (EPTT), CSDs located within these two provinces actually had average index scores that were fairly close to the national average of 0.18.

Aside from the territories, CSDs in the province of Quebec actually had the lowest degree of global connectedness in 1996. While levels of intra-industry trade (IIT) in Quebec CSDs were close to the national average, the EPTT and EPGDP indexes were below the national average. CSDs in Ontario and British Columbia followed next with lowest average overall global connectedness scores in Canada.

The following table presents a breakdown of these four global exposure and integration indexes by province and territory for 2001:

Table 3:

Average Levels of Intra-Industry Trade (IIT), Export Proportion of Total Trade (EPTT), Export Proportion of GDP (EPGDP) and Overall Global Connectedness (CSDCON) of CSDs by Province and Territory (2001)

Province	ITT	EPTT	EPGDP	CSDCON
Newfoundland	0.34	0.40	1.03	0.59
Prince Edward Island	0.10	0.59	0.60	0.43
Nova Scotia	0.20	0.34	0.80	0.44
New Brunswick	0.40	0.33	1.03	0.59
Quebec	0.38	0.21	0.50	0.36
Ontario	0.26	0.13	0.77	0.38
Manitoba	0.33	0.33	0.84	0.50
Saskatchewan	0.14	0.32	0.78	0.41
Alberta	0.40	0.32	0.68	0.47
British Columbia	0.32	0.16	0.79	0.42
Yukon	0.01	0.00	0.16	0.06
Northwest Territories	0.15	0.24	0.13	0.18
Total	0.31	0.26	0.71	0.42

From the results in Table 3, we see that there has been little change in global exposure and integration since 1996. CSDs in Newfoundland and New Brunswick once again experienced the highest levels of global connectedness and CSDs in Quebec once again experienced the lowest among the ten Canadian provinces. Table 5 presents a breakdown of the four global exposure and integration index averages for CSDs by Urban-Rural status[5]:

Table 5:

Average Levels of Intra-Industry Trade (IIT), Export Proportion of Total Trade (EPTT), Export Proportion of GDP (EPGDP) and Overall Global Connectedness (CSDCON) of CSDs by Urban-Rural status (1996 and 2001)

	1996				2001			
Urban area/Rural area	ITT	EPTT	EPGDP	CSDCON	ITT	EPTT	EPGDP	CSDCON
Urban Core	0.20	0.12	0.60	0.31	0.35	0.22	0.73	0.44
Urban Fringe	0.24	0.16	0.67	0.36	0.35	0.23	0.81	0.46
Rural Fringe, in CMA/CA	0.22	0.17	0.61	0.33	0.31	0.25	0.73	0.43
Urban, outside CMA/CA	0.24	0.18	0.67	0.36	0.36	0.27	0.78	0.47
Rural, outside CMA/CA	0.21	0.19	0.56	0.32	0.29	0.27	0.68	0.41
Total	0.22	0.18	0.58	0.33	0.31	0.26	0.71	0.42

[5] These breakdowns include urban core, urban fringe and rural fringe and distinguish between central and peripheral urban and rural areas within or outside of a census metropolitan area (CMA) or census agglomeration (CA) (Statistics Canada, 2004).

Based on the results in Table 5, we see that levels of global connectedness are fairly similar across all types of urban and rural CSDs. Levels of global connectedness were found to be highest in CSDs located within urban areas outside of census metropolitan areas (CMA) and census agglomerations (CA). CSDs in rural areas outside of CMA/CAs experienced the highest average of exports to total trade (EPTT) while CSDs in urban core areas experienced the lowest average of EPTT for both 1996 and 2001.

Future Research

In future, the development of an economic exposure and integration indices might want to include more industries. Currently, we are limited to focusing on agricultural, forestry, fishing, hunting, utilities and manufacturing industries due to the lack of available GDP and import/export data at the industry and provincial level. It might also be pertinent to explore the subject of GDP at the regional level. We are currently limited to exploring GDP only at the provincial level due to data limitations.

References

BALASSA, B. (1986) "The Determinants of Intra-Industry Specialization in United States Trade", Oxford Economic Papers, 38, pp. 220-33.

BOLLMAN, R.D. and BRYDEN, J.M. (1997) Rural Employment: An International Perspective, CAB International: Wallingford, U.K.

DIXIT, A. and NORMAN, V. (1980) Theory of International Trade, Cambridge University Press.

ESPING-ANDERSON, G. (1990) The Three Worlds of Welfare Capitalism, Princeton University Press: Princeton.

GRUBEL, H.G. (1975) “Intra-Industry Trade: The Theory and Measurement of International Trade in Differentiated Products”, Riley: NY.

HAINSWORTH, S. (1996), “Sovereignty, Economic Integration, and the World Trade Organization”, Osgood Hall Law Journal, Vol. 33, No. 3, pp. 583-622.

LEVITT, T. (1983) "The Globalization of Markets", Harvard Business Review, Vol. 61, pp. 92-102.

MAKHIJA, M. V., KIM, K. and WILLIAMSON, S. (1997) "Measuring Globalization of Industries Using a National Industry Approach: Empirical Evidence Across Five Countries and Over Time", Journal of International Business Studies, May, Fourth Quarter.

MANKIW, N. G. and SCARTH, W. (2001) Macroeconomics, Second Canadian Edition, Worth Publishers: New York.

MITTELMANN, J.H. (2000) “The Globalisation Syndrome: Transformation and Resistance”, Princeton University Press: New Jersey.

REIMER, W. (2002) “A Sample Frame for Rural Canada: Design and Evaluation”, http://nre.concordia.ca.

RHODES, M. (2002) “Globalisation, European Economic Integration and Social Protection”, European University Institute: Italy.

STATISTICS CANADA (2004) 2001 Census Handbook, Statistics Canada: ON.