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A Pedagogical Note on the Interregional Economic Base Model: Canada, 2004

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Abstract: Interregional economic-base models are typically presented in the abstract as a prelude to more complex interregional input-output models. The interregional economic-base model presented here reverses the process, deriving its data from a larger interregional input-output model of Canada. It is sufficiently compact to be a useful classroom tool.

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1. INTRODUCTION

In the 1970s and especially in the 1980s, computer technology developed so rapidly that simple economic-base models were quickly replaced by input-output models. The same can now be said about interregional economic-base models. Still, a search of key literature sources reveals no empirical developments of interregional economic-base models, while interregional input-output models have become commonplace. The time of economic-base models appears to have passed. Nevertheless, the economic-base family remains a highly effective approach to understanding models that are more complex. We present this model as a pedagogical example based on actual data.

The model reported here is a simple byproduct of assembling a 13-province/territory, 26-industry input-output model of Canada in 2004.¹ The process involves summing interindustry transactions in each region. Since an economic-base model is a Keynesian model tracing circular flows through economies, the household sector plays a strong part in the system. We have thus included the household sector as endogenous to the system. The regions in this model are made up of Canada's 10 provinces and 3 territories. To facilitate presentation, we have aggregated these 13 areas into 6 traditional regions, moving from east to west and then to the north, as shown in Table 1. The groupings are easily justified as follows:

- **The Atlantic Provinces** are a region because of geography and economic structure.
- **Quebec** is treated as one region because of its unique culture.

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¹ The year is of little consequence since the numbers are relatively stable. Our objective is to examine the interactions among regions.

Table 1. Definitions of Regions

Region	Provinces
Atlantic Provinces	Newfoundland and Labrador, Prince Edward Island, Nova Scotia, New Brunswick
Quebec	Quebec
Ontario	Ontario
The Prairies	Manitoba, Saskatchewan, Alberta
British Columbia	British Columbia
The Territories	Yukon, Nunavut, and Northwest Territories

- **Ontario**, the industrial heartland, with more than double the production of any other province, is also given special standing.
- **The Prairies** includes Manitoba, Saskatchewan, and Alberta, even though the latter differs significantly in geography and large oil production.
- **British Columbia** is sufficiently dissimilar from its neighbors in geography and economic structure to warrant separation.
- **The Territories** combine because of economic similarity as well as latitude and size.

One of the problems associated with aggregation—and this is especially true where politically-defined areas are vast—is the loss of geographical information, a loss critical to most regional scientists. A national economic-base model would not tell us that the Atlantic Provinces and the Territories have characteristics different from the rest of the regions. In addition, a six-region model would not tell us that Nunavut, as well as Newfoundland and Labrador, have trade patterns that are quite different from those of Quebec and Ontario. To satisfy the curious, we have appended statistics on the 13-province/territory model and will make the complete model available upon request.

2. BUILDING THE MODEL

The steps taken in building this model are traditional; in fact, they are identical to those used for an input-output model—we have simply replaced the industries with regions. First, we construct a set of identities representing flows between regions:

$$x_{11} + x_{12} + \dots + x_{1n} + d_1 = x_1.$$

$$x_{21} + x_{22} + \dots + x_{2n} + d_2 = x_2.$$

.....

$$x_{n1} + x_{n2} + \dots + x_{nn} + d_n = x_n.$$

$$v_1 + v_2 + \dots + v_n = v.$$

$$x_{.1} + x_{.2} + \dots + x_{.n} + d_{.} = x_{nn}$$

Here, x_{ij} is purchases from region i by region j , d_i represents other final demand and national exports for the products of region i , and v_i includes other final payments and national imports from outside the interregional system (nation) by region i . Table 2 shows these values in millions of Canadian dollars (CDN).

Table 2. Flows in the Interregional Economic-Base System for Canada, 2004
(millions of dollars, CDN)

	Atlantic Provinces	Quebec	Ontario	The Prairies	British Columbia	The Terri- tories	Other final demand	Total sales
Atlantic Provinces	110,507	4,272	5,247	1,298	545	101	69,630	191,599
Quebec	5,816	403,768	28,802	6,941	4,353	362	206,615	656,658
Ontario	10,889	35,797	826,444	26,056	13,776	688	400,424	1,314,074
The Prairies	1,902	5,944	23,915	391,079	13,362	798	203,406	640,405
British Columbia	817	3,144	6,811	11,514	241,080	445	118,298	382,108
The Territories	29	71	583	210	658	7,497	5,959	15,006
National imports	61,639	203,662	422,272	203,308	108,335	5,116		
Total purchases	191,599	656,658	1,314,074	640,405	382,108	15,006		

Table 3. Interregional Transactions as Shares of Total Transactions of Each Region, Canada, 2004

	AP	QC	ON	TP	BC	TT
Atlantic Provinces	0.577	0.007	0.004	0.002	0.001	0.007
Quebec	0.030	0.615	0.022	0.011	0.011	0.024
Ontario	0.057	0.055	0.629	0.041	0.036	0.046
The Prairies	0.010	0.009	0.018	0.611	0.035	0.053
British Columbia	0.004	0.005	0.005	0.018	0.631	0.030
The Territories	0.000	0.000	0.000	0.000	0.002	0.500
<i>Interprovincial Sum</i>	0.678	0.690	0.679	0.683	0.716	0.659
National imports	0.322	0.310	0.321	0.317	0.284	0.341
Total	1.000	1.000	1.000	1.000	1.000	1.000

The purpose of this system is to demonstrate the impact of new expenditures in one region on transactions in all regions. Now, following standard procedures for constructing macroeconomic models, we develop regional “input-output” coefficients and then invert this matrix to complete the model. Results appear in Tables 3 and 4. Table 3 parallels the direct-requirements table in a regional interindustry model, but its cells represent the allocation of trade to various regions. Thus, economic units in the Atlantic Provinces make 58 percent of their purchases within the region, 3 percent with Quebec, 6 percent with Ontario, and 32 percent outside of Canada.

3. COMPARISONS OF MULTIPLIER CONCEPTS

Table 4 parallels the “total-requirements” table in conventional input-output analysis, but has been revised to reflect flows between regions rather than flows between industries. Each entry shows the total purchases from the regions named on the left for each dollar of final demand originating in the regions identified across the top.

Table 5 compares the multiplier details. First, the value of the simple economic-base multiplier, which is calculated as the ratio of the total economy to its export base, includes no interregional feedback and is determined purely by asking “Who buys the most locally produced goods?” As expected, these simple multipliers are highest in Ontario and British Columbia, where local interaction due to concentration and diversity of industrial activity is the largest: the lowest simple multiplier is in The Territories, where manufacturing is extremely limited. Links

Table 4. The Solution of the Interregional Economic-Base System for Canada, 2004

	AP	QC	ON	TP	BC	TT
Atlantic Provinces	2.370	0.045	0.029	0.017	0.015	0.039
Quebec	0.214	2.627	0.164	0.096	0.108	0.161
Ontario	0.408	0.407	2.743	0.315	0.313	0.328
The Prairies	0.088	0.085	0.137	2.598	0.264	0.310
British Columbia	0.040	0.045	0.048	0.133	2.729	0.183
The Territories	0.001	0.001	0.003	0.002	0.010	2.000
<i>Output multipliers</i>	<i>3.122</i>	<i>3.210</i>	<i>3.125</i>	<i>3.162</i>	<i>3.439</i>	<i>3.021</i>

Table 5. Results of Multiplier Decomposition Results for a Six-region Model

Region	Simple Economic-base		Interregional		Interregional Spillovers		Intra-regional	
	Multiplier	Rank	Multiplier	Rank	Multiplier	Rank	Multiplier	Rank
Atlantic Provinces	2.363	5	3.122	5	0.752	2	2.370	5
Quebec	2.597	3	3.210	2	0.583	4	2.627	3
Ontario	2.695	2	3.125	4	0.381	6	2.743	1
The Prairies	2.569	4	3.162	3	0.564	5	2.598	4
BC	2.709	1	3.439	1	0.710	3	2.729	2
The Territories	1.998	6	3.021	6	1.021	1	2.000	6
Mean	2.488		3.180		0.669		2.511	

between imports and exports between the provinces do not exist in this simple system. British Columbia and Ontario are virtually tied, with differences only in the third decimal—both have local propensities to spend of 0.63. At the other extreme, the Territories have a multiplier of 2.00 implying a local spending propensity of 0.50.

Next, interregional multipliers, which now include interaction between the areas, are simply column sums of the inverse and appear in the row of total output multipliers in Table 4. They are reasonably close together, ranging from 3.02 in the Territories to 3.44 in British Columbia. The Territories import more from other nations (32 percent) while, at the other extreme British Columbia imports less (28 percent)—this is money that mostly does not recirculate, which seems to make a difference.

These interregional multipliers can be divided into two parts: 1) the total effect on self, which appears in the diagonal of the inverse matrix, and 2) the interregional effect on others. The total effects on self, seen as the diagonal elements in the inverse for each region, closely parallel the simple economic-base multipliers, with the greatest deviation appearing in Ontario as 0.05, which is less than two percent of either number. Finally, the remainder, the total interregional impact on others (the off-diagonal sums of inverse columns), is highest for the Territories: they import over 16 percent of their purchases from other regions, and 34 percent from other nations.

4. CONCLUSION

Discussion of the interregional economic-base model has been bypassed over the years, largely for good technological reasons. But, just as the economic-base model was an interesting and useful stepping-stone to the regional input-output model, the interregional economic-base system is an effective pedagogical bridge to interregional input-output models.