RESEARCH NOTE/NOTE DE RECHERCHE

INTERINDUSTRY RELATIONS OF A FRONTIER ECONOMY*

Jack C. Stabler
Department of Economics and Political Science
University of Saskatchewan
Saskatoon, Saskatchewan
S7N 0W0

Introduction

Numerous interindustry studies of subnational economies have been conducted since Moore and Petersen's [6] pioneering effort nearly 30 years ago. Provinces and states, metropolitan areas, river basins and even counties have been subjects for analysis using the input-output technique. Some of these studies have relied on primary data collected as a part of the study, while others have been derived from national models either through disaggregation or by adjusting national coefficients according to some method of regional weighting [7].

The interindustry study described in the following pages differs somewhat from previous studies of other subnational economies. First, the area of analysis, the Yukon, is one of the most geographically isolated units of the Canadian economy. Second, its industrial structure still reflects its frontier heritage to an unusual degree; e.g., a mining sector which "exports" virtually all of its product is the largest commercial activity providing support for the rest of the economy. These characteristics provide some unique

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opportunities for observations on the extent and strength of interindustry linkages in a geographically isolated setting.

Model Structure

The model's structure, 13 industries, 6 final payments categories and 5 final demand categories[1] was based on both data availability and a desire to include separately some of the sectors unique to the Yukon; e.g., Placer (gold) Mining and the traditional economy (Hunting, Fishing, Trapping and Subsistence).

Three additional conventions deserve mention [7]. Prices used were those charged by the producer rather than prices paid by the purchaser, a nearly universal practice. Second, the table was constructed on a gross domestic product basis, focusing on production within the geographic boundaries of the Yukon. Finally, it is common practice in North America to define the output of wholesale and retail trade and many of the service industries as their gross margins. As a result, sales of finished goods by the processing sectors are not traced through wholesale and retail outlets even in cases where they are not sold directly to final consumers. The argument is that this procedure allows the output of individual sectors to retain their identity so that final demand purchases can be directly related to the producing sector. On the other hand, use of gross margins rather than actual transactions obscures some transactions actually taking place. In the preparation of the Yukon table, actual transactions were used rather than gross margins. More interindustry detail was thus provided with little loss, since most of the products sold into final demand in the Yukon were produced elsewhere in any case.

Data Sources

Since 1967 the Department of Indian Affairs and Northern Development (DIAND) has prepared income and product accounts for the Yukon [4]. The worksheets from which these accounts were prepared provided an invaluable, high quality source of data for the construction of the I-O model. By rearranging and recombining the data from these worksheets to accommodate the informational requirements of the I-O framework, it was possible to construct the final demand columns and final payments rows of a 1978 table.[2]

[1]The Imports column serves no functional purpose.

[2]Preparation of the accounts was discontinued after 1978 but has recently been resumed.

The primary data source for the interindustry transactions portion of the table was questionnaires distributed to 747 of the Yukon's approximately 1360 business firms. Of these, 107 questionnaires were returned. This information was supplemented by interviews held with the 15 largest economic entities in the Territory, which included government as well as private organizations. These 15 organizations paid well over one-half of the household income received by Yukon workers (mining and government together accounting for 48 percent) and in other ways accounted for the major portion of economic activity in the Yukon.

The questionnaire data were for 1981 while, as noted previously, those from the DIAND worksheets were for 1978. Interindustry coefficients were derived from the questionnaires. The absolute magnitude of interindustry transactions for 1978 were inferred from the ratio of total final demand (or payment) figures from the questionnaires to the sums obtained from the DIAND worksheets. The detailed distributions of final payments and final demands used were those from the DIAND worksheets, since they were available in greater detail than those asked for in the questionnaires.

Observations

The Yukon transaction table for 1978 is shown as Table 1. From this table it is clear that, in terms of absolute size, the Hard Rock Mining industry and the Government sector dominate the economy. Between them they account for 48 percent of direct labour income paid to the Household sector and 42 percent of total final payments (less imports) with Government ranking first in labour income and Hard Rock Mining first in total final payments.

In terms of support, it is argued in the context of the export-base literature that income received from export sales, when locally spent, provides the support for the non-basic or "residentiary" sectors of the regional economy. By this criterion, the importance of the Hard Rock Mining sector appears even greater than the previous comparisons suggest, as it accounted for 76 percent of export sales in 1978. The export sales of the Services and Retail Trade sectors represent sales to tourists and temporary non-residents and together account for an additional 22 percent of total exports. Exports by the Placer Mining and traditional sectors, while important to the people engaged in these activities, are today of limited overall significance to the Yukon economy.

Following the line of thought of the export-base literature, it is possible to develop an aggregate multiplier which expresses total

Table 1

TRANSACTIONS TABLE, YUKON 1978
(In Thousands of Dollars)

Industry		I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11
Hard Rock Mining	I1	-	-	-	-	-	-	-	-	-	-	-
Placer Mining	I2	-	-	-	-	-	-	-	-	864	-	-
Oil and Gas	I3	-	-	-	-	-	-	-	-	-	-	-
Forestry	I4	170	-	-	-	-	-	182	-	-	-	-
Hunting, Trapping, Fishing and Subsistence	I5	-	-	-	-	-	-	-	-	-	-	-
Transportation	I6	14193	347	6	80	-	1412	8549	2714	17155	9186	1784
Construction	I7	584	100	1	130	-	11812	19074	4119	13444	15396	436
Utilities	I8	7177	11	-	5	-	685	621	788	748	1116	1058
Wholesale Trade	I9	2584	730	2	3	-	2383	2354	209	2607	7857	1775
Retail Trade	I10	56	63	1	-	1032	1588	1160	-	81	179	1766
Services	I11	9304	507	-	-	-	3285	2810	3291	1408	8091	5724
Finance, Insurance and Real Estate	I12	36	82	-	-	-	3300	3940	3091	4248	8287	7215
Manufacturing	I13	9403	17	-	-	-	93	28	186	35	1046	59
Total Processing	14	43507	1857	10	218	1032	24558	38718	14399	40591	51158	19817
Indirect Taxes Less subsidies	15	840	-	7	76	4	1757	3016	-2	1	211	2344
Other Operating Surplus	16	35234	-	-193	-9178	-	-23397	7602	-	1995	2328	13150
Depreciation	17	13096	-	-	9832	-	35578	4602	-	122	141	4659
Net Income of Unincorporated Business	18	-	1350	-	10	3594	-	660	210	99	915	3068
Labour Income*	19	37053	1352	220	1096	-	13543	21636	2482	11130	13874	23864
Imports	20	20863	1867	13	13	-	6278	5597	4469	17973	8379	3872
Total Final Payments	21	107086	4569	47	1849	3598	33759	43112	7159	31318	25847	50958
Total Outlays	22	150593	6425	57	2067	4630	58317	81830	21559	71909	77005	70755

Table 1 (cont.)

Industry		I12	I13	Total Int. Prod. 14	VPIC 15	X 16	G 17	GFCF 18	C 19	M 20	GDP 21	Total Prod. 22
Hard Rock Mining	I1	-	-	-	17378	133213	-	-	-	-	150591	150591
Placer Mining	I2	-	861	1725	-	4700	-	-	-	-	4700	6425
Oil and Gas	I3	-	-	-	-	57	-	-	-	-	57	57
Forestry	I4	-	1596	1948	-	-	119	-	-	-	119	2067
Hunting, Trapping Fishing and Subsistence	I5	-	-	-	-	934	-	-	3696	-	4630	4630
Transportation	I6	26	284	55737	-	-	2580	-	-	-	2580	58317
Construction	I7	3030	4	68131	-	-	2302	11398	-	-	13700	81831
Utilities	I8	932	268	13410	-	724	238	-	7187	-	8149	21559
Wholesale Trade	I9	1869	89	22463	-	-	24486	24961	-	-	49447	71910
Retail Trade	I10	124	516	6565	-	25687	7183	-	37571	-	70441	77006
Services	I11	113	89	34622	-	12983	2143	-	21027	-	36153	70775
Finance, Insurance and Real Estate	I12	3291	409	33900	-	1309	-	-	11810	-	13119	47019
Manufacturing	I13	18	49	10934	-	-	635	-	-	-	635	11569
Total Processing	14	9403	4165	249434	17378	179607	39686	36359	81291	-	354322	603756
Indirect Taxes Less Subsidies	15	3891	43	12187	-	-	-	-	-	-	-	12187
Other Operating Surplus	16	29070	2139	58749	-	-	-	-	-	-	-	58749
Depreciation	17	181	196	68406	-	-	9861	-	3240	-	13101	81507
Net Income of Unincorporated Business	18	558	46	10509	-	-	-	-	7047	-	7047	17556
Labour Income*	19	3527	1331	131108	-	-	50226	-	-	-	50226	181334
Imports	20	389	3649	73363	225	-	6969	78244	7181	-	92619	165982
Total Final Payments	21	37615	7404	354322	225	-	67056	78244	17468	-	162993	517315
Total Outlays	22	47019	11569	603756	17603	179607	106742	114603	98759	-	517315	1121071

* Column and row entries may not sum precisely to totals because of rounding.

personal income as a multiple of personal income earned in each sector due to that sector's exports. The calculation is (Total Personal Income ÷ Sum of Personal Income Earned in Each Sector Due to That Sector's Exports) [2]. In the case of the Yukon, the income earned from exports probably should be augmented by a portion of personal income paid by government. This is because government expenditures in the Yukon typically exceed, by a substantial margin, taxes and other government revenues collected in the Yukon, the balance being financed by transfers from the federal treasury. Thus government is in a sense like an export industry in that it generates a net flow of income from outside sources. Treating the excess of government revenues over government receipts collected in the Yukon as if they were export sales and adjusting personal income earned from government accordingly produces an aggregate multiplier of 2.59. This is a relatively large multiplier for a small regional economy, which suggests fairly extensive interactions within the economy. By comparison a similar multiplier calculated for Saskatchewan produced a value of 2.39.[3]

A variety of sector multipliers are shown in Tables 2 and 3. The Type I multipliers are derived from the basic Leontief inverse matrix (with household exogenous), while the Type II multipliers are derived from an inverse with households endogenous. Thus the output multiplier for industry i indicates the sum of direct and

Table 2

OUTPUT MULTIPLIERS FOR THE YUKON

Type I	Industry*	Type II
2.127	Retail Trade	2.612
2.090	Utilities	2.495
1.978	Wholesale Trade	2.403
1.828	Construction	2.345
1.735	Transportation	2.188
1.444	Services	1.923
1.493	Hard Rock Mining	1.894
1.506	Placer Mining	1.873
1.543	Manufacturing	1.848
1.190	Forestry	1.847
1.474	Hunting	1.586
1.342	F.I.R.E.	1.500

*The Oil and Gas sector is excluded because of the anomolies that arise in immature sectors when the labour bill is several times the total output.

[3]The Saskatchewan I-O table was disaggregated from the 1971 Canada I-O table by Professor L. V. St. Louis. The Saskatchewan multiplier referred to is based solely on export sales.

Table 3

INCOME MULTIPLIERS FOR THE YUKON

Industry*	Direct Income Change	Direct and Indirect Income Change	Indirect Income Change	Type I Multiplier	Direct, Indirect and Induced Income Change	Induced Income Change	Indirect and Induced Income Change	Type II Multiplier
Utilities	0.07	0.22	0.15	3.09	0.27	0.05	0.20	3.79
Wholesale Trade	0.10	0.23	0.14	2.41	0.29	0.05	0.19	2.96
Retail Trade	0.11	0.27	0.15	2.36	0.33	0.06	0.21	2.90
Manufacturing	0.07	0.17	0.10	2.33	0.21	0.04	0.13	2.86
F.I.R.E.	0.05	0.09	0.04	1.84	0.11	0.02	0.06	2.26
Construction	0.17	0.28	0.12	1.72	0.35	0.06	0.18	2.11
Transportation	0.15	0.25	0.10	1.71	0.30	0.06	0.16	2.10
Placer Mining	0.13	0.20	0.07	1.53	0.25	0.05	0.12	1.88
Hard Rock Mining	0.15	0.22	0.07	1.43	0.27	0.05	0.12	1.76
Services	0.21	0.27	0.05	1.26	0.33	0.06	0.11	1.54
Forestry	0.33	0.36	0.03	1.09	0.44	0.08	0.11	1.33

*The Traditional sector is omitted from this table because the major portion of the income earned/received is in the form of income in kind. The Oil and Gas sector is also omitted (see note to Table 2).

indirect requirements from all sectors needed to deliver one additional dollar of output i to final demand.

The Type I income multiplier is obtained by dividing the direct plus indirect income change resulting from a one dollar increase in final demand for a given sector by the direct income change. The Type II income multiplier adds induced income change from successive rounds of consumer spending to the numerator of the Type I multiplier but is otherwise derived in the same manner.

The sector multipliers provide some insight into the magnitude of the Yukon's aggregate multiplier. The output multipliers in particular provide an indication of the degree of structural interdependence between the sector in question and the rest of the economy. As reflected by these multipliers (and the entries in the transactions table) the non-basic sectors have extensive linkages with the export sectors and between themselves as well. For the Yukon economy as a whole 41 percent of total sales are interindustry transactions compared with 26 percent for Saskatchewan. The weighted (aggregate) Type I and Type II multipliers for the Yukon are 1.71 and 2.13 respectively. For Saskatchewan these multipliers are 1.39 and 2.52, reflecting relatively greater interindustry transactions in the Yukon and relatively greater interactions with the household sector (consumer demand) in Saskatchewan.

The sector income multipliers in Table 3 reflect both the extent of linkages within the economy as well as the labour intensity of the indirect and induced interactions and consequently do not provide as good an indication of structural interdependence as such as do the output multipliers. Nevertheless, the magnitude of the income multipliers reflect, too, a substantial amount of interaction within the Yukon economy.

Conclusion

The linkages between the export sectors and local industry and between industries producing primarily for local intermediate or local final demand are most extensive than what *a priori* reasoning might suggest. These observed linkages can likely be attributed to two distinct influences. The first is the protection provided to local industry due to the transport costs associated with the Yukon's isolation from other centres of economic activity [1; 3]. The second has to do with the stimulus to local demand provided by (a) the attempts by the territorial and federal governments to encourage the export industries to purchase from local producers and distributers [5], and (b) the large ongoing transfers from the federal to the territorial government [4].

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