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Marginal Economic Impacts for Selected Industries in the Tri-Cities Market Area

Introduction

This paper presents a methodology which allows one to rank an industry according to its marginal economic impact. The marginal economic impact for a given industry, chemical manufacturing for example, is measured as the "change in total earnings paid to households employed in all industries for each job created or lost in the chemical manufacturing industry." The marginal economic impact is not the same as an industry's total contribution to the local economy. Some service industries provide thousands of jobs in the local economy, but have small marginal economic impacts, whereas some with far fewer employees have large marginal impacts.

The marginal economic impacts may be used to answer questions, such as: (a) How do industries rank in terms of their marginal economic impact? (b) What is the economic impact of the gain or loss of 100 jobs in an industry? (c) Which industries have the potential to broaden the economic base of a region? These are just a few of the questions that may be answered with the aid of marginal analysis.

Marginal economic impacts were calculated for industries in the Tri- Cities combined statistical area (TC - CSA). The TC- CSA as defined by the U.S. Census Bureau consists of the Kingsport, Bristol and Johnson City metro areas. This market area includes Carter, Hawkins, Sullivan, Unicoi, and Washington counties in Tennessee; Virginia locations include Bristol city and Scott and Washington counties.

Economic Impact Multipliers

The Bureau of Economic Analysis (BEA) in the US Department of Commerce makes regional economic impact multipliers available through its Regional Input-Output Modeling System (RIMS II). These multipliers allow users to estimate the extent to which a change in an industry's output will affect total employment and earnings in the region. These multipliers underpin calculations of the marginal economic impacts presented in this paper.

The RIMS II multipliers used for this report are based on national interindustry or input-output relationships in 2007. These national multipliers are adjusted for regional supply conditions and trading patterns in 2016. These adjustments are necessary because local industries often do not supply all the intermediate inputs needed to produce the region's output. Industries must purchase (import) some inputs from suppliers outside the region. Purchases of inputs from suppliers located outside the region reduce the multiplier effect on employment and earnings within the region.

The employment and earnings multipliers shown in Appendix Table A1 are total (Type II) multipliers. These multipliers include *direct, indirect* and *induced* economic impacts … Type I multipliers exclude the induced impacts. To illustrate, suppose 100 workers are hired to undertake a construction project (direct impact). Employment will increase by more than the 100 jobs directly tied to the project. As the materials and equipment needed to complete the project are purchased, additional jobs are created in the businesses that supply these materials and equipment (indirect impact). As people are put to work, directly and indirectly, they purchase more consumer goods and services. This new spending creates jobs in industries that supply consumer goods and services (induced impact).

(The following link provides additional information on the construction, use and limitations of RIMS II multipliers: http://bea.gov/regional/pdf/rims/rimsii_user guide.pdf .)

Conceptual Model and Explanation for Industry Rankings

Conceptual Model

Conceptually, the marginal economic impact (M_x) for industry X is: $M_x = E_x + (J_1E_1 + J_2E_2 + …+J_nE_n)$ +Induced Earnings,

where

E_x = average annual earnings for industry X, the direct earnings; $J_1E_1 + J_2E_2 + …+J_nE_n$ are the indirect earnings, where

J = the (fractional) number of jobs in each local industry, 1 through n, supported by one job in industry X, and

E = the average annual earnings for each local industry, 1 through n.

Induced earnings are a fraction of the sum of direct and indirect earnings. This fraction is the 'final demand' earnings multiplier for households (row 62 in Table A1) … 0.2478 for the TC-CSA.

Explanation for Industry Rankings

The conceptual model indicates that the magnitude of the marginal economic impact for an industry, X, is positively related to the level of average earnings in industry X and in the other industries, 1 through n, which supply inputs to industry X. The marginal impact depends also on the number, n, of local industries which supply inputs to industry X and the size of the 'J' coefficients … these two factors are related to the jobs multiplier for an industry.

The RIMS II multipliers presented in Table A contain all the information needed to solve the conceptual model given above. The information is not readily apparent as it is "buried" in the output tables. What follows is a procedure to calculate the marginal economic impact for any industry listed in the RIMS II tables. Two examples will be worked to illustrate the procedure.

The first example is for the "accommodation" industry in the TC-CSA. The RIMS II information for the industry is given in row 61 in Table A and is reproduced below, except for the footnotes accompanying the table.

Step 1: The "final demand" earnings multiplier is per dollar of additional output, while the final demand employment multiplier is based on jobs per million dollars of additional output (footnotes 2 and 3, Table A). To put the multipliers on the same dollar basis, the final demand earnings multiplier is multiplied by 1,000,000 … 1,000,000*0.4322 = $432,200.

Step 2: To find the number of accommodation jobs associated with $1,000,000 of output, divide the final demand jobs multiplier for the industry by the direct effect jobs multiplier … 13.1779/1.3912 = 9.472326.

Step 3: Divide the result from Step 1 by the result from Step 2 … $432,200/9.472326 = $45,628. This is the marginal economic impact in 2016 dollars for the accommodation industry.

Step 4: The result in Step 3 is the marginal economic impact in 2016 dollars. The Consumer Price Index rose 6.53% percent from 2010 to 2013. The result from Step 3 is multiplied by 1.0653 to put the value in 2019 dollars … $45,628*1.0653 = $48,607.

The marginal economic impact for accommodation in the TC-CSA is $48,607. This means that for each additional job created in this industry, total earnings paid to households employed in all industries in the region increase by $48,607. The marginal economic impact for each job lost in the industry is a negative $48,607.

The direct effect jobs multiplier for the industry is 1.3912, indicating that for each job created or lost in the accommodation industry another 0.3912 jobs are created or lost in all other sectors of the regional economy. The marginal economic impact of $48,607 is, therefore, total earnings from 1.3912 jobs.

The second example is for" chemical manufacturing" in the TC-CSA. The RIMS II information for retail trade is found in Table A, row 25, and is reproduced below.

The marginal economic impact for chemical manufacturing is calculated by the four-step procedure used earlier (see the earlier example for explanations of the calculations).

Step 1: $1,000,000*0.2812 = $281,200

Step 2: 4.7031/2.3461 = 2.00465

Step 3: $281,200/2.004646008 = $140,274

Step 4: $140,274.14*1.0653 = $149,434.

The marginal economic impact for chemical manufacturing in the Tri-cities is $149,434. This means that for each additional job created in this industry, total earnings paid to households employed in all industries in the region increase by $149,434. The marginal economic impact for each job lost in the industry is a negative $149,434.

The direct effect jobs multiplier for chemical manufacturing is 2.3461, indicating that for each job created or lost in the retail trade industry another 1.3461 jobs are created or lost in all other sectors of the regional economy. The marginal economic impact of $149,434 is, therefore, household total earnings from 2.3461 jobs.

	Multiplier					
	Final Demand				Direct Effect	
Table A. TC-CSA	Output (dollars)	arnings (dollars)	loyment (jobs)	ue-added (dollars)	arnings (dollars)	loyment (jobs)
61. Accommodation	1.4917	0.4322	13.1779	0.9170	1.5513	1.3912
25. Chemical Manufacturing	1.4493	0.2812	4.7031	0.6279	1.8785	2.3461

Conclusions

Table 1 presents marginal economic impacts for industries which account for most of the jobs in the TC-CSA. The industries are listed from largest to smallest in terms of marginal economic impact. There are 32 industry/industry aggregations listed in the table. The top 50 percent have marginal economic impacts greater than $90,000; the bottom 50 percent have impacts less than $80,000.

 The lowest ranked industries in terms of marginal economic impact are service providers whose primary locally purchased input is hired labor, with average earnings at the low end of the scale. Manufacturing industries characterized by relatively high average earnings and extensive supplier linkages, and the higher-paying service and healthcare activities dominate the top of the rankings.

  The information presented in Table 1 allows one to compare any two industries in terms of their relative marginal economic impact. For example, it takes the creation of 5.37 jobs in the "limited-service restaurants" industry to match the economic impact of one chemical manufacturing job … $149,434 / $27,802 = 5.37. To put it another way, it would take an additional 5.37 jobs in limited – service restaurants to replace the total earnings lost by the elimination of one job in chemical manufacturing.

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Marginal Economic Impact of Nonresident Spending

Tourism, or more broadly, nonresident spending, is an important industry in the TC-CSA and expansion in this industry is widely believed to be an important factor in the area's future economic growth. In this section we develop a marginal economic impact for nonresident spending based on RIMSII multipliers for (1) retail trade, (2) accommodation, (3) food services and drinking places, (4) amusements, gambling and recreation and (5) performing arts, spectator sports, museums, zoos and parks. The relevant multipliers are the "final demand earnings" multipliers in Table A:

 Line 31: Other Retail … 0.5051

Line 61: Accommodation … 0.4322

Line 62: Food Services & Drinking Places … 0.4924

Line 60: Amusements, Gambling & Recreation … 0.4709

Line 59: Performing Arts, Spectator Sports, etc. … 0.6777.

Estimating the impact of a change in retail sales on earnings and employment requires special treatment. In RIMS II output for retail activities is taken to be the retail margin, because only the retail margin affects regional economic activity. For the other four industries, we can apply their "final demand earnings" multipliers to sales or nonresident spending to calculate the impact on household earnings.

 The retail margin is defined as sales receipts less the cost of goods sold. These costs include the value of goods purchased from manufacturers and the cost of transporting these goods to retailers. The economic impact of new retail sales is considerably smaller when the products are sold, but not manufactured nor shipped by firms located in the in the region. The average retail margin for the United States is 27- 28 percent according to the U.S. Census Bureau, although it varies considerably from one type of retail establishment to another, ranging from less than 20 to nearly 50 percent. We use a margin of 35 percent, the midpoint of the range, to adjust the RIMS II final demand earnings multiplier ... 0.35 times 0.5051 = 0.1768. The adjusted multiplier may be applied to sales or dollar spending.

The average of the adjusted final demand earnings multiplier for retail sales and the multipliers for the other four industries is 0.45. This average assumes that nonresident spending is equally weighted across the five categories. This is not likely to be the case. Nevertheless, the multiplier provides a first approximation of the effect of an increase in nonresident spending on household earnings in the TC- CSA. The final demand earnings multiplier of 0.45 indicates that for every $100 increase in nonresident spending, total earnings of households employed in all industries in TC-CSA increase by $45. In other words, 45 cents of every dollar of tourist or nonresident spending ends up in the paychecks of TC-CSA households.

Table 1. Tri-Cities Combined Statistical Area	MEI[1]	Jobs
Row Industry / Industry Aggregation:	Dollars	Multiplier[2]
Chemical Manufacturing	149,434	2.3461
Management of companies and enterprises	145,697	2.0213
Offices of physicians	139,422	1.9654
Transportation equipment manufacturing	134,526	2.2494
Federal Reserve banks, credit intermediation & related activities	130,642	2.1632
Primary metal manufacturing	121,954	2.1705
Machinery manufacturing	119,258	2.1491
Wholesale trade	113,701	1.9033
Plastics and rubber products manufacturing	111,226	2.0983
Professional, scientific, and technical services	107,463	1.7602
Fabricated metal product manufacturing	106,400	1.9788
Insurance carriers and related activities	104,186	1.7861
Ambulatory health care services	100,704	1.6993
Waste management and remediation services	91,609	1.8622
Wood product manufacturing	91,543	2.067
Hospitals	91,381	1.6743
Construction	90,667	1.7272
Motor vehicle and parts dealers	77,104	1.4975
Warehousing and storage	61,624	1.5099
Jr. colleges, colleges, universities& professional schools	53,284	1.3685
Accommodation	48,607	1.3912
Administrative and support services	48,182	1.3278
Nursing and residential care facilities	48,027	1.3246
Real estate	44,701	1.4584
Other retail[3]	42,088	1.3315
Food and beverage stores[3]	40,536	1.3056
General merchandise stores[3]	39,446	1.3215
Performing arts, spectator sports, museums & related activities	39,127	1.2801
Elementary & secondary schools	37,285	1.2481
Full-service restaurants	36,241	1.2711
Social assistance	33,294	1.229
Limited-service restaurants	27,802	1.2222

[1] MEI: Marginal Economic Impact … the increase (decrease) in total annual earnings paid to households employed in all industries for each job created (lost) in the row industry / industry aggregation, 2019 dollars … author's calculation.

[2] Increase (decrease) in the number of jobs in all industries for each job created (lost) in the row industry/industry aggregation … see footnote 6 to Table A.

[3] Output for retail trade is not measured by sales, but by the retail margin, that is, sales receipts less the cost of goods sold.

APPENDIX

Table A. Total Multipliers (Type II) for Output, Earnings, Employment and Value Added by Industry and Industry Aggregation in the Tri-Cities CSA

Table A.

INDUSTRY	Multiplier					
	Final Demand				Direct Effect	
	Output/1/ (dollars)	Earnings/2/ (dollars)	Employment/3/ (jobs)	Value-added/4/ (dollars)	Earnings/5/ (dollars)	Employment/6/ (jobs)
1. Farms	1.6170	0.3507	12.9506	0.6864	1.8618	1.5377
2. Forestry, fishing, and related activities	1.6054	0.5556	16.7266	0.9927	1.5309	1.4414
3. Oil and gas extraction	1.2808	0.2402	5.1163	0.8602	1.5477	1.5689
4. Mining, except oil and gas	1.3996	0.2576	6.2608	0.7880	1.7960	1.6500
5. Support activities for mining	1.4111	0.3763	6.1831	0.9081	1.4976	1.9303
6. Utilities*	1.3894	0.2725	4.0958	0.7583	1.7765	3.0056
7. Construction	1.6988	0.5811	11.7928	0.9134	1.5233	1.7272
8. Wood product manufacturing	1.7481	0.4054	9.7515	0.6721	2.0995	2.0670
9. Nonmetallic mineral product manufacturing	1.6638	0.3786	7.6725	0.7525	1.9331	2.0579
10. Primary metal manufacturing	1.4910	0.2740	5.1950	0.4990	1.9074	2.1705
11. Fabricated metal product manufacturing	1.6132	0.3658	7.2473	0.7003	1.8040	1.9788
12. Machinery manufacturing	1.5770	0.3232	6.2046	0.6697	1.9092	2.1491
13. Computer and electronic product manufacturing	1.4679	0.2684	4.3573	0.7835	1.8572	2.3859
14. Electrical equipment and appliance manufacturing	1.4837	0.2798	5.5977	0.6399	1.8462	1.9690
15. Motor vehicles, bodies and trailers, and parts manufacturing	1.6561	0.3264	6.2635	0.5565	2.0880	2.3212
16. Other transportation equipment manufacturing	1.5237	0.3307	5.8907	0.7112	1.8383	2.2494
17. Furniture and related product manufacturing	1.7455	0.3890	9.3086	0.7542	2.0234	1.9023
18. Miscellaneous manufacturing	1.5418	0.3711	7.7474	0.7659	1.7421	1.8146
19. Food and beverage and tobacco product manufacturing	1.6012	0.3081	6.7910	0.5721	2.0692	2.1702
20. Textile mills and textile product mills	1.7640	0.4215	10.0022	0.6857	1.9959	1.8945
21. Apparel and leather and allied product manufacturing	1.7016	0.5684	16.8951	0.8209	1.5908	1.4255
22. Paper manufacturing	1.6225	0.3226	5.9231	0.6457	2.1015	2.6423
23. Printing and related support activities	1.6729	0.4647	10.8937	0.8236	1.7391	1.7552
24. Petroleum and coal products manufacturing	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000
25. Chemical manufacturing	1.4493	0.2812	4.7031	0.6279	1.8785	2.3461
26. Plastics and rubber products manufacturing	1.5910	0.3221	6.4733	0.6088	1.9587	2.0983
27. Wholesale trade	1.5120	0.4622	8.2422	0.9778	1.5511	1.9033
28. Motor vehicle and parts dealers	1.4954	0.5683	11.7581	1.0628	1.3720	1.4975
29. Food and beverage stores	1.5716	0.5399	18.5247	0.9997	1.4829	1.3056
30. General merchandise stores	1.5794	0.4990	17.8087	0.9810	1.5945	1.3215
31. Other retail	1.5630	0.5051	17.0230	0.9659	1.5242	1.3315
32. Air transportation	1.3405	0.2926	5.2295	0.6401	1.5958	2.0164
33. Rail transportation	1.4309	0.3509	5.3531	0.7676	1.5979	2.2603
34. Water transportation	1.4995	0.2954	5.3923	0.5857	2.0755	2.8762
35. Truck transportation	1.6473	0.5019	10.8943	0.8076	1.7122	1.8220
36. Transit and ground passenger transportation*	1.6343	0.6216	28.4506	0.8215	1.4654	1.1973
37. Pipeline transportation	1.5167	0.4400	6.2795	0.8057	1.5611	2.4204
38. Other transportation and support activities*	1.6287	0.6007	13.3953	0.9482	1.5100	1.5901

INDUSTRY	Multiplier					
	Final Demand				Direct Effect	
	Output/1/ (dollars)	Earnings/2/ (dollars)	Employment/3/ (jobs)	Value-added/4/ (dollars)	Earnings/5/ (dollars)	Employment/6/ (jobs)
39. Warehousing and storage	1.6100	0.5376	14.0324	0.9558	1.5424	1.5099
40. Publishing industries, except internet (includes software)	1.6563	0.4576	8.5733	0.9928	1.7775	2.1927
41. Motion picture and sound recording industries	1.3288	0.2711	6.0016	0.7341	1.6174	1.7276
42. Broadcasting and telecommunications	1.4659	0.3085	6.3470	0.8455	1.7314	1.9356
43. Data processing, internet publishing, and other information services	1.5774	0.4279	7.5383	0.8715	1.6978	2.3610
44. Federal Reserve banks, credit intermediation, and related activities	1.5698	0.4413	7.7843	0.8997	1.6780	2.1632
45. Securities, commodity contracts, and investments	1.6499	0.5767	15.6763	0.7767	1.5481	1.4520
46. Insurance carriers and related activities	1.4754	0.4256	7.7727	0.8322	1.5231	1.7861
47. Funds, trusts, and other financial vehicles	1.3475	0.2610	9.7781	0.4196	1.7396	1.3810
48. Real estate	1.4077	0.2786	9.6830	0.9403	1.8286	1.4584
49. Rental and leasing services and lessors of intangible assets	1.5176	0.3830	8.4286	0.9236	1.7710	1.8862
50. Professional, scientific, and technical services	1.5977	0.6327	11.0401	0.9756	1.4276	1.7602
51. Management of companies and enterprises	1.6099	0.6088	8.9976	0.9582	1.4472	2.0213
52. Administrative and support services	1.6044	0.6701	19.6724	1.0227	1.4036	1.3278
53. Waste management and remediation services	1.5717	0.4106	8.8916	0.7877	1.7237	1.8622
54. Educational services	1.6065	0.6328	19.4992	0.9646	1.4064	1.3176
55. Ambulatory health care services	1.6383	0.6690	12.0260	0.9946	1.4306	1.6993
56. Hospitals	1.6006	0.5956	11.6252	0.9038	1.4734	1.6743
57. Nursing and residential care facilities	1.5767	0.6274	18.4340	0.9614	1.3955	1.3246
58. Social assistance	1.6071	0.6538	25.7100	0.9526	1.4008	1.2290
59. Performing arts, spectator sports, museums, and related activities	1.5890	0.6777	23.6198	0.9389	1.3993	1.2801
60. Amusements, gambling, and recreation industries	1.5379	0.4709	20.9232	0.8665	1.5202	1.2341
61. Accommodation	1.4917	0.4322	13.1779	0.9170	1.5513	1.3912
62. Food services and drinking places	1.5728	0.4924	19.8888	0.8511	1.5402	1.2605
63. Other services*	1.6531	0.5706	15.2232	0.9265	1.5451	1.4600
64. Households	0.7668	0.2478	6.5353	0.4504	0.0000	0.0000

Tri Cities CSA: The TC- CSA as defined by the U.S. Census Bureau consists of the Kingsport, Bristol and Johnson City metro areas. This market area includes Carter, Hawkins, Sullivan, Unicoi, and Washington counties in Tennessee; Virginia locations include Bristol city and Scott and Washington counties.

*Includes Government enterprises.

1. Each entry in column 1 represents the total dollar change in output that occurs in all industries for each additional dollar of output delivered to final demand by the industry corresponding to the entry.
2. Each entry in column 2 represents the total dollar change in earnings of households employed by all industries for each additional dollar of output delivered to final demand by the industry corresponding to the entry.
3. Each entry in column 3 represents the total change in number of jobs that occurs in all industries for each additional 1 million dollars of output delivered to final demand by the industry corresponding to the entry. Because the employment multipliers are based on

2016 data, the output delivered to final demand should be in 2016 dollars.

4. Each entry in column 4 represents the total dollar change in value added that occurs in all industries for each additional dollar of output delivered to final demand by the industry corresponding to the entry.

5. Each entry in column 5 represents the total dollar change in earnings of households employed by all industries for each additional dollar of earnings paid directly to households employed by the industry corresponding to the entry.

6. Each entry in column 6 represents the total change in number of jobs in all industries for each additional job in the industry corresponding to the entry.

Multipliers are based on the 2007 Annual Input-Output Table for the Nation and 2016 regional data.

SOURCE. --Regional Input-Output Modeling System (RIMS II), Regional Product Division, Bureau of Economic Analysis.