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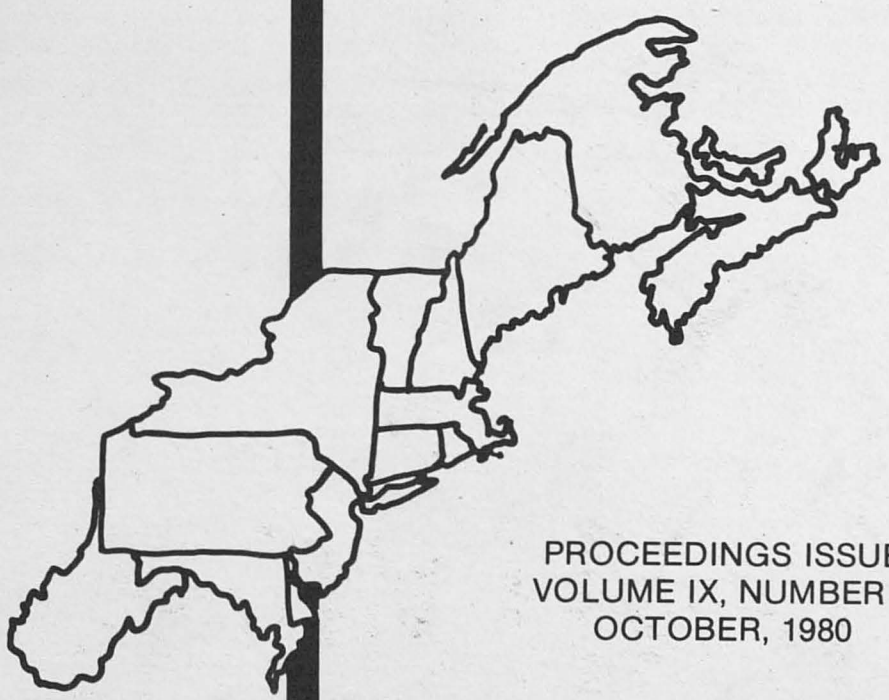

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NEW MEASURES FROM INPUT-OUTPUT STUDIES: A COMPARISON OF TRADITIONAL MULTIPLIERS AND GROWTH-EQUALIZED MULTIPLIERS

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The use of traditional multipliers in analyzing the impact of alternative development policies should only be undertaken with a full understanding of the theoretical constraints inherent in such an approach. Theoretical input-output models assume perfectly elastic supply of all inputs and demand for all outputs. Thus, traditional multipliers abstract from the relative size of changes in final demand, or production, since any change is theoretically possible. In actuality, supply and demand elasticities are not infinite. It may not be possible to increase sales to final demand by 300 percent; nor (due to land, labor or capital input scarcities) is it likely that a sector's production can increase by 100 percent. Therefore, in practice, some measure of the feasibility of a proposed change needs to be considered.

Recently it has been suggested by Gray, et al., and Ayer and Baskett, that the traditional multiplier be modified so that it takes into account the relative size of the sector. Both newly suggested statistics use the percentage change of deliveries to final demand as a weighting scheme for the multiplier.

The purpose of this paper is to 1) describe the new growth-equalized measures, 2) to present the traditional multipliers from an input-output study done for Sussex County, Delaware and compare them to the new growth-equalized measures for the same region; and 3) to evaluate the new elasticity measure as a policy statistic using examples from Sussex County.

THE GROWTH-EQUALIZED MULTIPLIERS

There are many multiplier statistics which can be developed from an I-O study. A commonly used one is the output multiplier which shows by how much the total dollar value of output (production/sales) of a region will increase as a result of a one dollar change in final demand for a given sector.[1] This can be represented by:

$$(1) \qquad M_j = \frac{\Delta X_T}{\Delta FD_j}$$

where M_j is the multiplier for sector j, X_T is total regional output and FD_j is the final demand for sector j.[2]

A similar output multiplier which is derived by row sums rather than column sums of coefficients can predict the impact on any one sector's production if all sectors are assumed to increase production due to a one dollar increase in deliveries to final demand. In addition, expected impacts on income and employment, resulting from either a given sector's change in sales or a region-wide change in sales of all sectors, can be measured by income and employment multipliers.[3]

In a recent article S. Gray, et al., have suggested that these traditional I-O multipliers are misleading in evaluating the relative value of sectors to a region. They propose that these multipliers *be modified.* Rather than having a multiplier that shows the impact on the economy of a *one dollar* change in final demand for each sector; they present a "growth-equalized multiplier" which shows the change in region-wide output resulting from equal *percentage changes in deliveries to final demand.*[4] This can be shown by equation (2):

$$(2) \qquad GEM = \frac{\Delta X_T}{\%\Delta FD_j} = \frac{\Delta X_T}{\frac{\Delta FD_j}{FD_j}100} = \frac{\Delta X_T}{\Delta FD_j} \cdot \frac{FD_j}{100}$$

substituting from equation (1)

$$(3) \qquad = M_j \frac{FD_j}{100} = M_j\,(.01\ FD_j)$$

where GEM is the growth-equalized multiplier; X_T, FD_j are defined above.

They also present growth-equalized employment multiplier, which would be:

$$(4) \qquad GEEM = \frac{\Delta E_T}{\%\Delta FD_j}$$

where GEEM is growth-equalized employment multiplier; and E_T is number of people employed in the region.

Such a growth-equalized employment multiplier would, for example, enable the researcher to determine how many more jobs would be created in a region by the same percentage increase in various sectors. Thus, policy makers could compare the benefits of encouraging one sector's growth over another's. The researcher could also assess how much new production would be needed in each sector when all sectors' final demand increases by an equal percent rather than when they grow by an equal dollar amount.

Another suggestion for the need of a similar statistic can be found in Ayer and Baskett's 1978 article. In their work they too express concern that I-O multipliers can lead to *incorrect judgments on sector's relative importance to a region.* Their improved statistic is different from Gray, et al., Ayer and Baskett present an elasticity concept where the regional sales elasticity with respect to a given sector would be:

$$(5) \qquad n_j = \frac{\frac{\Delta X_T}{X_T}}{\frac{\Delta FD_j}{FD_j}} = M_j \frac{FD_j}{X_T}$$

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[1]Some of the studies that used these are Bills and Barr, Doeksen and Schreiner, Farler and Tyner, Grubb, and Hiser and Fisher.

[2]This statistic is calculated by summing the column of coefficients for a given sector from the interdependence matrix (the Leontief inverse).

[3]For a discussion of this see Bills and Barr, Doeksen and Schreiner or Miernyk.

[4]This is relatively easy to calculate since an identity matrix is merely replaced by a matrix where one percent changes in final demand are on the diagonal.

This elasticity measure is interpreted as the percentage change in a region's total output associated with a one percent change in final demand sales by a given sector. It is easy to calculate since the traditional multiplier is simply weighted by the ratio of original final demand of the sector to total output of the region.

Ayer and Baskett also present an employment and income measure. The regional income elasticity would be expressed:

$$(6) \qquad n_j(\text{income}) = \frac{\frac{\Delta Y_T}{Y_T}}{\frac{\Delta FD_j}{FD_j}} = IRC\left(\frac{FD_j}{Y_T}\right)$$

where $n_{j(\text{income})}$ is the regional income elasticity, Y_T is total (regional) income, and the IRC is the income retention coefficient or the amount of total income resulting from a one dollar additional sale to final demand $\frac{\Delta Y_T}{\Delta FD_j}$

The regional employment elasticity would be expressed:

$$(7) \qquad n_{j(\text{employment})} = n_j(\text{employment}) = \frac{\frac{\Delta E_T}{E_T}}{\frac{\Delta FD_j}{FD_j}} = ECC\ \frac{FD_j}{E_T}$$

where E_T is total (regional) employment, and ECC is the employment creation coefficient or $\frac{\Delta E_T}{\Delta FD_j}$

Ayer and Baskett claim that these elasticities are preferable measures than the multipliers for two reasons. First, the elasticities yield results in percentage terms which are more familiar, accessible and usable since growth and employment needs are often expressed as percentages. Second, the elasticity measure enables comparisons of sector's values as sources of development even though the sectors vary greatly in absolute size.

MULTIPLIERS AND ELASTICITIES FROM SUSSEX COUNTY

The Sussex County I-O model has 42 size-diverse sectors.[5] The "Other Manufacturing" sector is the largest ($378 million of total sales in 1972). Several retail sectors were kept disaggregated in order to identify the various recreational visitors' impacts on the economy and are quite small (one having only $350,000 in sales). Also, the various types of agricultural production activities were defined as separate sectors in order to highlight the agricultural activities and to ascertain their impacts on the economy.

When trying to identify the area of increased production which would have the greatest growth impact on the whole county, a simple ranking of output multipliers (see Table 1) would suggest that Livestock farms have the most potential for providing economic growth to Sussex County. However, if Ayer and Baskett's elasticity is used, the Livestock production is ranked fifteenth. The elasticity shows that in order for regional output to increase by one percent, the livestock sales to final demand would have to increase by 48 percent. [.02075 = $\eta_{\text{livestock}}$ = % change total production/% change livestock sales to FD = $1/\%\Delta FD_{\text{livestock}} = \%\Delta FD_{\text{livestock}} = 1/.027075 = 48.2$].

Viewed differently, the elasticity indicates by what percent total county production will increase if the sector sales to final demand increases by one percent. So, if Livestock sales increase by one percent, then total county output will increase by 0.02 percent. By comparison, if Other Manufacturing increases by one percent, total county output will increase by .67 percent.

Table 1 also reports the Gray, et al. GEM (growth-equalized multipliers). These represent the county-wide increase in dollar volume of sales resulting from a one percent change in sales to final demand by the sector named on the left. It can be seen that the rankings of the impacts by various sectors using this GEM and the Ayer and Baskett regional elasticity are the same. In fact, the GEM is merely the elasticity (which is the percentage change in total output) for a one percent change in final demand changed to fractional form and multiplied times the total output of the region ($942,879,588).[6]

Clearly, the table shows that the sectors which would be considered to have the greatest potential to impact the growth of county economic activity have changed drastically when the newer elasticity or GEM are used rather than the traditional multiplier.

Since income and employment are two variables which concern policy makers, it is interesting to compare the difference between ranking sectors on an income, or job multiplier and regional income and job elasticity basis. In Table 2, the income multiplier and income retention coefficients are compared to the regional income elasticities. The traditional income retention coefficients show how much county-wide income will be generated by direct, indirect and induced effects on an original dollar increase in a sector's deliveries to final demand. The newer income multiplier indicates by what multiple county-wide income will increase for every dollar of new *direct* income paid out in a given sector.[7] Again, both abstract from the relative size of the sector in the region's economy. The regional income elasticity shows the percentage change in county-wide income resulting from some percentage change in a sector's deliveries to final demand. The elasticity coefficients in Table 2 can be interpreted as the percent change in total county income if the sector's deliveries to final demand were to change by 1.0 percent.

It is instructive to note again the very different picture of which sectors would be attractive targets for development using the elasticity coefficient approach. The sector with the smallest income multiplier, Other Manufacturing (15), has the largest regional income elasticity.

This is a frequent bias in this type of income multiplier (the ratio of indirect and induced income effects to direct effect); for large sectors the direct effect is so large that a relatively large indirect effect will not be as great a multiple of it as the same indirect effect would be of a smaller direct effect. If we compare the elasticity measure with the income retention coefficients, the sectors with the

[5]See Brucker and Cole, page 18.

[6]In general form, from equation 3 and 5 above

$$n_j = M_j \frac{FD_j}{X_T} \quad n_j(X_T) = M_j(FD_j) \text{ where } GEM = M_j(.01FD_j) =$$

$$\frac{GEM}{.01} = M_jFD_j \quad \text{therefore } n_jX_T = GEM(100) \quad \frac{n_jX_T}{100} = GEM.$$

[7]This "version" of an income multiplier is used in models developed in studies by Bills and Barr, Doeksen and Schreiner, Farler and Tyner, Grubb, and Hiser and Fisher.

Table 1.
Comparison of Traditional Output Multipliers to Growth Equalized Multipliers and Elasticities

Sector No.	Sector Name	Output Multiplier	Rank	Growth-Equalizer[1] Output Multiplier	Elasticity[2]	Rank
1	Field Crop Farms	2.638	8	11,905	.0013	39
2	Fruit & Vegetable	2.500	12	113,400	.0120	20
3	Livestock Farms	2.771	1	195,605	.0207	15
4	Int. Broiler Ind.	1.620	41	1,121,241	.1189	2
5	Farm Rental	2.736	4	134	.0000	42
6	Vet. Services	2.225	23	49,900	.0052	35
7	Farm Equipment	2.621	9	31,800	.0034	37
8	Ag. Supply & Ser.	2.514	11	67,076	.0071	33
9	Poultry, Meat & Dairy	1.804	34	913,894	.0969	4
10	Veg. & Fish Proc.	1.676	40	675,351	.0716	5
11	Fish, Forest & Mining	2.588	10	2,898	.0030	41
12	New Construction	1.840	32	982,424	.1042	3
13	Maintenance Con.	1.930	31	272,941	.0289	10
14	Apparel & Textile	1.361	42	460,594	.0488	7
15	Other Manuf.	1.694	39	6,312,583	.6695	1
16	Transportation	1.830	33	246,612	.0262	12
17	Communication	1.958	29	110,261	.0117	21
18	Elec., Gas & Sanitary	1.795	35	136,845	.0145	18
19	Wholesale Trade	2.200	25	97,970	.0104	25
20	Building Materials	2.438	17	92,781	.0099	27
21	Mobile Homes	1.734	37	63,197	.0068	34
22	General Merchand.	2.238	22	225,861	.0239	14
23	Food Stores	1.958	28	346,537	.0367	9
24	Motor Veh. & Parts	2.389	18	149,747	.0159	17
25	Gas Stations	2.470	14	97,081	.0103	26
26	Boats & Trailers	2.463	15	8,640	.0009	40
27	Furniture	2.477	13	92,107	.0098	28
28	Eating and Drinking	1.952	30	379,599	.0403	8
29	Liquor Stores	2.718	5	78,347	.0083	31
30	Fuel	2.153	26	72,313	.0077	32
31	Miscellaneous Retail	2.307	20	91,493	.0097	29
32	Bank, Credit & Sec.	2.751	2	103,223	.0110	23
33	Insurance	1.747	36	244,908	.0260	13
34	Real Estate	2.742	3	250,531	.0266	11
35	Hotels & Apartments	2.680	7	109,127	.0116	22
36	Camps & Parks	2.282	21	44,312	.0045	36
37	Personal Services	2.381	19	102,976	.0109	24
38	Repair Services	1.710	38	31,589	.0033	38
39	Amusements	2.139	27	80,227	.0085	30
40	Educational	2.706	6	495,918	.0525	6
41	Professional Ser.	2.460	16	152,954	.0162	16
42	Other Services	2.215	24	116,888	.0124	19

[1]These represent the dollar change in country-wide production resulting in a one percent change in sales to final demand by the sector named at the left. The ranking is the same as for the elasticity measure.

[2]This is the same as the GEM except it is expressed as a percentage of total regional output. It can be calculated from the traditional multiplier times the ratio of sector sales to final demand/total county output. Where total county output was $942,879,588.

ten largest elasticity coefficients each have less than $.50 county income resulting from each dollar of increased deliveries to final demand.

For example, if a five percent increase in county-wide incomes were the target, it could be accomplished by a 11.3 percent increase in "Other Manufacturing." However, to get the same five percent increase in county income would necessitate a 769 percent increase in Agricultural Supply Dealer deliveries to final demand or a 308 percent increase in livestock sales. If only income retention coefficients had been considered, these two sectors would have seemed to be ideal targets for development. They may still be good targets; however, the elasticity statistic highlights the magnitude of the relative changes needed and, by implication, the infeasibility of pursuing a given strategy.

Table 3 provides similar comparisons for employment projections. The employment creation coefficient indicates how many jobs will result in the county for every additional dollar of sales to final demand by a given sector. The employment multiplier

Table 2.
Comparison of Traditional Income Retention Coefficients and Income Multipliers to Regional Income Elasticities

Sector No.	Sector Name	Income Retention Coefficient	Rank	Income Multiplier	Rank	Regional Income Elasticity	Rank
1	Field Crop Farms	0.771	20	2.466	2	0.0008	39
2	Fruit & Vegetable	0.775	19	2.022	5	0.0090	21
3	Livestock Farms	0.898	11	2.003	7	0.0162	14
4	Int. Broiler Ind.	0.248	42	3.101	1	0.0440	4
5	Farm Rental	1.149	1	1.408	38	0.0000	42
6	Vet. Services	0.804	17	1.411	37	0.0046	34
7	Farm Equipment	0.971	6	1.554	25	0.0030	37
8	Ag. Supply & Serv.	0.960	8	1.449	33	0.0065	32
9	Poultry, Meat, Dairy	0.314	40	1.791	10	0.0407	5
10	Veg. & Fish Proc.	0.325	39	2.103	3	0.0336	6
11	Fish, Forest, Mining	1.024	5	1.421	36	0.0002	41
12	New Construction	0.431	36	1.966	9	0.0589	2
13	Maintenance Con.	0.528	29	1.683	18	0.0191	12
14	Apparel & Textile	0.242	41	1.371	41	0.0210	10
15	Other Manufacturing	0.469	33	1.362	42	0.4425	1
16	Transportation	0.477	32	1.593	20	0.0164	13
17	Communication	0.630	28	1.398	40	0.0090	22
18	Elec., Gas & San.	0.452	33	1.579	22	0.0088	24
19	Wholesale Trade	0.656	26	1.775	11	0.0074	30
20	Building Materials	0.881	13	1.501	28	0.0110	18
21	Mobile Homes	0.368	38	2.069	4	0.0034	35
22	General Merchandise	0.766	22	1.496	29	0.0198	11
23	Food Stores	0.501	30	1.713	16	0.0227	9
24	Motor Veh. & Parts	0.856	15	1.493	30	0.0137	17
25	Gas Stations	0.810	16	1.723	15	0.0081	28
26	Boats & Trailers	0.898	12	1.477	31	0.0007	40
27	Furniture	0.862	14	1.589	21	0.0082	26
28	Eating & Drinking	0.480	31	2.003	6	0.0239	7
29	Liquor Stores	1.104	2	1.437	34	0.0081	27
30	Fuel	0.678	24	1.569	23	0.0058	33
31	Miscellaneous Retail	0.770	21	1.559	24	0.0078	29
32	Bank, Credit & Sec.	1.080	3	1.540	26	0.0103	19
33	Insurance	0.452	35	1.533	27	0.0162	15
34	Real Estate	0.970	7	1.732	14	0.0227	8
35	Hotels & Apartments	0.928	10	1.738	13	0.0096	20
36	Camps & Parks	0.650	27	1.977	8	0.0032	36
37	Personal Services	0.791	18	1.626	19	0.0087	25
38	Repair Services	0.382	37	1.707	17	0.0018	38
39	Amusements	0.714	23	1.464	32	0.0068	31
40	Educational	1.068	4	1.429	35	0.0502	3
41	Professional Ser.	0.953	9	1.405	39	0.0152	16
42	Other Services	0.661	25	1.757	12	0.0089	23

predicts how many jobs will eventually result in the county for every job originally created by the increase in sales to final demand. The regional job elasticity coefficient will show by what percent regional employment will change for every percent change in deliveries to final demand for a given sector.

Once again, a very different ranking for the sectors emerges when the elasticity measure rather than the multiplier is used. An added benefit of using the employment elasticity measure is that it is not subject to the inherent biases associated with the traditional multiplier, the ECC and the IRC.

If the retail sector were measured on the same basis, all other sector employment creation coefficients and IRC's by sector would be theoretically comparable. However, the value of retail trade output is measured on a value added basis. Therefore, if a change in final demand is denominated in dollars of sales, it is necessary to adjust it by some fraction to make it representative of the change in demand for the output (on a value added only basis) of the retail trade sector. To the extent that this adjustment is not made, the increase in final demand for a sector's output is overstated and the income and employment impacts will be overstated also. The regional employment elasticity using percentage changes makes it possible to see clearly which sectors should be stimulated to best accomplish a change in level of employment.

An unemployment rate of 9.6 percent in Sussex County in February 1980 (a seasonally high period) would translate into a needed 3,820 jobs. If the goal were to reduce unemployment to a

Table 3.
Comparison of Traditional Employment Multipliers to Regional Employment Elasticity

Sector No.	Sector Name	Regional Employees per $1,000 Additional Final Demand (ECC)	Rank	Employment Multiplier	Rank	Employment Elasticity	Rank
1	Field Crop Farms	.077	26	1.39	30	.023[1]	20[1]
2	Fruit & Vegetable	.086	21	1.72	13	.025	17
3	Livestock Farms	.065	30	3.04	5	.015	26
4	Int. Broiler Ind.	.032	40	2.10	7	.082	4
5	Farm Rental	.049	34	3.74	3	.002	42
6	Vet. Services	.090	19	1.45	25	.012	28
7	Farm Equipment	.099	16	1.64	17	.005	39
8	Ag. Supply & Serv.	.076	27	1.73	12	.013	27
9	Poultry, Meat, Dairy	.060	32	1.38	31	.095	3
10	Veg. & Fish Proc.	.047	35	1.65	16	.060	7
11	Fish, Forest, Mining	.092	18	1.62	18	.003	41
12	New Construction	.063	31	1.97	.8	.106	2
13	Maintenance Con.	.060	33	1.90	10	.038	12
14	Apparel & Textile	.039	37	1.23	40	.041	10
15	Other Manufacturing	.034	39	1.67	15	.402	1
16	Transportation	.087	20	1.28	36	.045	9
17	Communication	.026	41	5.04	1	.007	36
18	Elec., Gas. & San.	.024	42	4.64	2	.012	29
19	Wholesale Trade	.142	6	1.27	37	.037	14
20	Building Materials	.151	5	1.27	38	.026	16
21	Mobile Homes	.041	36	1.96	9	.005	38
22	General Merchandise	.116	11	1.34	33	.037	13
23	Food Stores	.070	28	1.46	24	.038	11
24	Motor Veh. & Parts	.103	14	1.47	23	.022	21
25	Gas Stations	.102	15	1.71	14	.018	22
26	Boats & Trailers	.344	1	1.11	41	.004	40
27	Furniture	.078	25	1.94	11	.009	34
28	Eating & Drinking	.095	17	1.39	29	.059	8
29	Liquor Stores	.108	13	1.58	19	.010	32
30	Fuel	.081	23	1.51	20	.012	30
31	Miscellaneous Retail	.117	10	1.34	32	.016	24
32	Bank, Credit & Sec.	.066	29	2.92	6	.029	15
33	Insurance	.035	38	3.24	4	.024	19
34	Real Estate	.183	3	1.28	34	.011	31
35	Hotels & Apartments	.119	9	1.50	22	.015	25
36	Camps & Parks	.150	4	1.25	39	.009	33
37	Personal Services	.124	7	1.39	28	.017	23
38	Repair Services	.082	22	1.28	35	.007	37
39	Amusements	.081	24	1.42	27	.009	35
40	Educational	.116	12	1.51	21	.067	6
41	Professional Serv.	.316	2	1.11	42	.081	5
42	Other Services	.120	8	1.43	26	.025	18

[1]If Agricultural production were aggregated then the employment elasticity would be 0.145.

more acceptable 4.6 unemployment rate, we would be talking about creating 1,990 jobs or 5.5 percent of the 35,969 existing jobs. The employment elasticity coefficient would show by how much sales to final demand a given sector would have to increase in order to reach 4.6 unemployment in the region.[8] If Other Manufacturing were to increase sales to final demand by 13.75 percent, then the 4.6 target level of unemployment would be reached.

$$[.40 = \frac{5.5}{13.75}].$$

However, if the unemployment level were to be improved by increasing agricultural production, it would take a 239.0 percent increase in Field Crops or 67.0 percent increase in Broiler Contracts. Even if aggregated, all agricultural production would have to increase by 38 percent.

[8]A reduction of unemployment by 5.0 percent to 4.6 percent of labor force unemployed is actually a 5.5 percent increase in employment. This is true because the number of employed is by definition smaller than the labor force.

EVALUATION AND SUMMARY

The need for a statistic from input-output models which is appropriate for use with policy decision in a world of non-infinite demand and/or supply elasticities is clear. The use of growth-equalized multipliers and/or regional elasticities which use percentage change in sales to final demand as the unit of change have provided such a statistic. The growth-equalized multipliers are more realistic statistics by which to evaluate a sector's potential for impacting the regional economy. The regional elasticity, suggested by Ayer and Baskett, is a most easily interpreted statistic. With it, a policy's impact on a regional growth or employment, targets often set in percentage terms, can be readily evaluated.

Since both of these statistics are easily generated from all input-output studies, researchers and planners alike should become more familiar with them. Researchers should provide them along with other results and planners can make use of a statistic that captures two aspects of a sector's potential for contributing to the region's economic development.

However, some limitations of these new statistics should be noted. The growth-equalized multipliers and elasticities measures implicitly assume that the major constraint on growth is inelasticity of demand. The relative magnitudes of proposed growth needed in various sectors is to be captured by the percentage change of final demand. The elasticity measure's virtue is its recognition that a given dollar demand increase is not as easily attained in some sectors as in others. However, to the extent that demand growth may not be a problem in some sectors, the elasticity may overstate the magnitude of supply growth required. Since final demand is always only a portion of total production (in some sectors a relatively small fraction) the given dollar increase in sales to final demand will be a smaller percent of production than of final demand. If demand is not the significant constraint, then percent increase in production would better indicate the magnitude of proposed growth and its impacts such as: percent increased use of scarce resources, and percent increase in capacity utilization.

When the sectors vary greatly in aggregation, it may not be any more comparable to propose equal percentage changes in the sales than equal dollar changes in sales. For example, bringing in a $37,000,000 manufacturing plant (10% growth) may be more difficult and costly as a development target than increasing livestock production by 10 percent or about $2,000,000.

It may be when all costs and constraints are considered in a development effort that targeting several smaller sectors which have medium to large multipliers is more feasible and efficient than trying to accomplish all the desired growth through expanding one already large sector with a small multiplier. From the above analysis, it seems that the growth-equalized multipliers and the regional elasticity estimates are more helpful to planners than traditional multipliers but can still be misleading if equal percentage changes in deliveries to final demand cannot be accomplished with the same ease or efficiency of resource use.

In summary, there are certainly times when both the traditional growth-equalized multipliers are appropriate.

When specific expected dollar changes in production of a sector are known, the multiplier would be the statistic of choice to estimate income/employment and output impacts on the region. When comparing similar sized sectors with similar capacity for market expansion the traditional multiplier provides all the needed information. Since impacts on environment are not usually measured by linear relationships, it may be most important to have predicted dollar changes in production rather than percentage changes and, therefore, in studies of this nature the traditional multipliers would be preferred.

However, when a regional model has sectors of diverse size, the growth-equalized multiplier or elasticity statistic may prove to be more useful in estimating the impacts on the region of *comparable* changes in sector output. In cases where the predicted changes in either regional or sector growth are given in percentage terms, the elasticity would be a most helpful tool. In cases where the impact of changes on income or employment would be best utilized or understood in percentage terms the elasticity would be the measure of choice. Especially in the updating of an existing model, the use of the elasticity statistic would provide a measure that would reflect regional production shifts even if production technology was assumed to remain the same.

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