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Interdependencies in a Rural Economy

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Introduction

What happens to local businesses when dairy plant sales increase or decrease? This type of question is frequently asked in Minnesota's rural areas. When a plant expands or cuts back, local community leaders and business people are concerned about possible effects on the rest of the local economy. A decision by a business also affects its customers and suppliers. Unfortunately, the extent of one business' impact on others is frequently unknown. Thus, there is apprehension when businesses announce plans involving change.¹

A study of business interrelationships in west central Minnesota and the area known as Development Region Six East follows. Figure 1 shows the region which consists of Kandiyohi, McLeod, Meeker, and Renville counties. Although the results are for Development Region Six East, similar interrelationships exist for other agriculturally oriented rural areas in Minnesota.



Figure 1. Four counties of Development Region Six East in south central Minnesota

The research technique used is called an input-output model.² This tool helps measure businesses' interdependencies. Input-output models have frequently been used to trace the local effects of a change in sales.

Small Area Economies and Exports

Every small area in Minnesota is economically specialized. No area can produce all the goods and services its citizens need.³ All small economies must export in order to earn money to import products not made locally.⁴ For instance, Region Six East exports milk products and uses part of the proceeds to import automobiles from Detroit and from outside the United States.

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¹Any study like this requires a great deal of data. Information was provided by managers of dairy plants and grain elevators and other business people in Region Six East. Also helpful were state agencies such as the Department of Agriculture, Department of Education, Department of Employment Services, Department of Finance, Department of Public Service, Department of Revenue, Highway Department, and State Auditor. The study could not have been completed without such generous cooperation.

²Anyone interested in how the model was constructed should request Technical Bulletin 313, 1978 from the Bulletin Room, 3 Coffey Hall, 1420 Eckles Ave., University of Minnesota, St. Paul, MN 55108.

³See Russell Youmans, William Rompa, and Edward Ives, *The Tillamook County Economy: A Working Model for Evaluating Economic Change*, Oregon State University, Extension Service, Special Report 478, March 1977.

⁴Exports and imports, in this context, include sales and purchases arranged with other parts of the United States and outside the United States.

Table 1 shows the importance of exports to Region Six East by sector. (See table 2 for a detailed definition of each sector.) Each sector is a group of similar businesses.

For example, all the dairy plants in Region Six East are in the dairy products manufacturing sector. The region as a whole exports about 42 percent of its total output (table 1). However, several sectors export over 50 percent of their output. The sector that exports the largest share of its output is the other manufacturing sector. Except for grain elevators, each of the agriculturally oriented sectors exports at least half of its output. Other sectors are more oriented toward the local economy. Sectors such as construction, trade, communications, utilities, and ser-

Sectors	Multiplier
1. Crops	2.17
2. Livestock	2.52
3. Agricultural services	1.74
4. Construction	1.78
5. Dairy products manufacturing	2.37
6. Other agricultural products processing	1.77
7. Other manufacturing	1.42
8. Transportation	2.11
9. Communication	1.82
10. Utilities	1.70
11. Trade	2.17
12. Grain elevators	2.23
13. F.I.R.E. ^a	2.17
14. Medical services	2.33
15. Education	2.43
16. Other services	2.21
17. Households	1.82

^aFinance, insurance, and real estate

vices export smaller portions of sales.

Because exports form such a large portion of the output in Region Six East, it is useful to understand what happens to the local economy when a business increases or decreases its export sales. The effects of changes in exports can be measured through the use of the following export multipliers.

Multipliers derived from the input-output model show how much total sales in the region increase when a particular sector increases its sales by \$1 to firms located outside the region. For instance, if exports from the crop sector increase by \$1, total sales in the region increase by \$2.17. The original \$1 increase in exports is included in the \$2.17 total sales increase.

Each export multiplier summarizes the chain reaction of local sales occurring when a sector increases its exports. Consider the livestock sector. As its exports increase, more grains and forages must be fed to livestock. Thus, the crop sector will increase its sales to the livestock sector. If the crop sector is to sell more grains and forages, more fertilizer must be applied. The fertilizer manufacturers will increase their sales to the crop sector. If the fertilizer manufacturers are to produce more, they may have to make purchases from hardware stores and then hardware store sales will expand. This chain of sales could continue by showing how the hardware stores' purchases result in more sales. The livestock sector has input requirements other than feed. Each of these requirements prompts its own chain reaction of local sales. The livestock export multiplier adds all the sales stimulated by the livestock exports. In other words, local businesses are interdependent. When one business increases its exports, other local businesses must increase production. Sometimes the inputs necessary to produce the exports are not used directly by the exporting business, but are used instead by firms that supply the exporter.

The multipliers presented for Region Six East are rather small. Because the region is small, a large portion of the inputs required by

Table 1. Exports and sales by each of Region Six East's sectors in 1972

Sector	Exports	Total sales or output	Exports as a percentage of sales or output
	thousands of dollars		
1. Crops	59,050	116,380	51
2. Livestock	57,498	112,846	51
3. Agricultural services	6,218	12,431	50
4. Construction	23,317	86,336	27
5. Dairy products manufacturing	62,441	85,524	73
6. Other agricultural processing	72,342	85,319	85
7. Other manufacturing	262,754	284,042	93
8. Transportation	5,404	15,804	34
9. Communication	1,155	6,267	18
10. Utilities	—	18,684	—
11. Trade	5,829	98,252	6
12. Grain elevators	2,022	4,888	41
13. F.I.R.E. ^a	—	26,990	—
14. Medical services	2,664	19,731	14
15. Education	—	33,003	—
16. Other services	2,506	23,610	11
17. Households	27,715	384,900	7
Total	590,915	1,415,007	42

^aFinance, insurance, and real estate.

each sector must be imported. Many inputs simply are not available locally. Importing reduces the size of the local sales that results from an increase in exports. The reduced increase in local sales results in a smaller multiplier. Larger regions, however, such as states or the nation, contain a wider variety of businesses. When larger regions have export increases, fewer imports occur and more sales occur within the region. The larger regional sales are reflected in larger multipliers. Region Six East's multipliers can be compared to the multipliers for a large state such as Texas. The Six East multipliers range from 1.4 to 2.5, while multipliers for Texas range from 1.5 to 4.7.⁵

Use of Multipliers

Export multipliers apply whenever a particular sector in the economy experiences a change in exports. The effects of equal expansions in exports from the dairy products manufacturing sector and the other manufacturing sector have been studied because these sectors are important in Minnesota. Minnesota is a leading dairy state

⁵Herbert W. Grubb, *The Structure of the Texas Economy*, Vol. II (Office of the Governor, Austin, Texas, 1973), pp. 273-360.

and manufacturing employment has expanded in parts of rural Minnesota.

The first step is to apply multipliers to see how the regional economy is affected. Assume that exports by the dairy products sector and by other manufacturing each increase by \$1 million. To estimate the total effects of the increased dairy products exports, the dairy manufacturing multiplier from table 3 is multiplied by \$1 million. Or,

$$\begin{aligned} \text{Dairy Products} \\ \text{Manufacturing Multiplier} \times \$1,000,000 = \\ 2.37 \times \$1,000,000 = \\ \$2,370,000 \end{aligned}$$

So, when dairy manufacturing increases its exports by \$1 million, total regional sales increase by \$2,370,000.

Other information provided by the input-output model shows how each regional sector shares in the \$2,370,000 increase. The distribution of the increase among the regional sectors follows:

Sector	Sales increase
1. Crops	\$ 155,000
2. Livestock	482,000
3. Agricultural services	22,000
4. Construction	8,000
5. Dairy products manufacturing	1,157,000

Table 2. A list of Region Six East's sectors

1. Crops — production of grains, hay, and other plant products
2. Livestock — production of milk and livestock for slaughter
3. Agricultural services — hatcheries, veterinarians, custom crop work, artificial insemination
4. Construction^a — repair construction, new construction, mining
5. Dairy products manufacturing — processors of milk
6. Other agricultural products processing — processing of agricultural goods other than milk
7. Other manufacturing — manufacturing other than agricultural processing
8. Transportation — trucking firms, railroads, school bus companies
9. Communication — radio companies and telephone companies
10. Utilities — electric companies, natural gas companies, water supply
11. Trade^b — wholesale trade, building material stores, hardware stores, farm equipment dealers, food stores, automobile dealers, service stations, clothing stores, restaurants, bars, other retail establishments
12. Grain elevators^b — establishments buying grain from farmers for resale
13. Finance, Insurance, and Real Estate — banks; credit agencies; insurance companies; insurance agents; firms that buy, sell or manage real estate
14. Medical services — hospitals, rest homes, physicians, dentists, chiropractors
15. Education — private and public primary and secondary schools, area vocational technical institutes, Willmar Community College
16. Other services — lawyers, amusements, repair services, business services, nonprofit membership organizations, engineering firms, accounting firms, personal services, hotels
17. Households^c — families. "Sales" of the household sector are wage and salary receipts, family rent and dividend receipts, and other miscellaneous income families receive

^aConstruction exports are items built outside the region by firms headquartered in the region.

^bSales of the trade and grain elevator sectors are defined as gross margins, or markup on items bought for resale.

^cExports of the household sector include commuters' wages. Since this family income does not come from local businesses, it is considered an export.

6. Other agricultural products processing	19,000
7. Other manufacturing	10,000
8. Transportation	14,000
9. Communication	5,000
10. Utilities	31,000
11. Trade	83,000
12. Grain elevators	5,000
13. F.I.R.E. ^a	34,000
14. Medical services	13,000
15. Education	16,000
16. Other services	17,000
17. Households	298,000
TOTAL	\$2,370,000

The column does not add to total due to rounding.

^aFinance, insurance, and real estate.

Naturally, the largest impact is on the dairy products manufacturing sector with a \$1,157,000 sales increase. There are also large impacts on crops (\$155,000), livestock (\$482,000), households (\$298,000), and trade (\$83,000). The livestock sector provides the raw materials for processing, while the crop sector supplies the feed to the livestock sector for its dairy cattle.

Although these figures are only approximate, it's clear that the dairy products manufacturing sector has many direct and indirect connections with other sectors of the local economy. Any increases in output by the dairy products sector has a large impact on the rest of the economy; any decreases in dairy

product manufacturing would also negatively affect the rest of the economy.

A similar procedure can be used to estimate the effects of an expansion of the other manufacturing sector. One million dollars is multiplied by the other manufacturing multiplier:

$$\begin{aligned} \text{Other} & \\ \text{Manufacturing Multiplier} \times \$1,000,000 &= \\ 1.42 \times \$1,000,000 &= \\ &= \$1,420,000 \end{aligned}$$

The next list shows how each sector shares in the \$1,420,000 increase. The sectors most affected are the other manufacturing sector, households, and the trade sector. The low multiplier shows how the other manufacturing sector depends heavily on imports of raw materials from outside the region. The main requirement from within the region is labor purchased from households.

Sector	Sales increase
1. Crops	\$ 1,000
2. Livestock	2,000
3. Agricultural services	—
4. Construction	5,000
5. Dairy products manufacturing	1,000
6. Other agricultural products processing	3,000
7. Other manufacturing	1,013,000
8. Transportation	5,000
9. Communication	3,000
10. Utilities	16,000
11. Trade	51,000
12. Grain Elevators	—
13. F.I.R.E. ^a	13,000
14. Medical services	12,000
15. Education	7,000
16. Other services	14,000
17. Households	269,000
TOTAL	\$1,420,000

The column does not add to total due to rounding.

^aFinance, insurance, and real estate.

Some interesting relationships appear when the effects of increased exports by the dairy products manufacturing and other manufacturing sectors are compared. Expanding the dairy sector results in greater production by the other sectors. When the other manufacturing sector expands exports, more inputs are imported and total

local production increases less than in the dairy example. However, payments to households in the two examples are fairly close. Dairy products manufacturing's payments to households totaled \$298,000, while other manufacturing paid \$269,000 to households.

Summary and Conclusions

The sectors of Region Six East are interrelated. Changes in the exports from one sector can affect other sectors. These interrelationships are summarized by the export multipliers. The multipliers can be used to measure the impacts of changes in specific sectors of the regional economy. One would expect multipliers for small regions to be fairly small. The multipliers for Region Six East range from 1.4 to 2.5. Although the relationships discussed here are specifically for Region Six East, similar interdependence in purchases and sales holds true for any area's local businesses.

This information can have some very practical uses. The multipliers

can help estimate how changes in the economy affect an individual firm. For instance, if a local business announces a major sales expansion, another local business could use multiplier analysis to see how the expansion would affect the sector containing that firm. Multiplier analysis may also prove useful to local government officials in anticipating how major business changes will affect other businesses. If a plant closes, for instance, multiplier analysis could help local officials see which sectors would be most affected. Steps could then be taken to counteract the effects of the closing.

Despite the usefulness of multipliers, there are limitations. Care must be exercised in applying these multipliers from Region Six East to other regions. No two regional economies are identical. Multipliers for different regions can be quite different. Also remember that multipliers are only a simplification of the real world to explain how local economies function. Due to assumptions and data problems, mul-

tipliers are not as exact as the results from a chemist's laboratory experiments. To illustrate, if one sector has an export multiplier of 1.20 and another has an export multiplier of 2.40, it is evident that more exports from the second sector will result in considerably more local activity than more exports from the first sector.

This does not mean that the local effects of expanded exports from the second sector will be exactly double the local effects of exports from the first sector. Furthermore, the sector multipliers alone do not show how payments to households are affected by changes in exports. However, in their place, multipliers still are useful. They provide a general idea of an economy's interdependencies.

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