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## CHAPTER 8

### The Sources of Diversification

THIS chapter studies the nature of the primary industries of diversifying firms. It was shown in Chapter 3 that sharp differences exist in the extent to which firms in various industries (classified by primary activity) tend to diversify. The industry class of a company is associated with a large number of economic variables. Consequently, identification of differences in the extent to which firms in various parts of the economy diversify, while of descriptive interest, represents only a first step in isolating the relevant economic forces.

In the discussion below, attention is first focused on the relation between the degree to which firms with a given primary industry diversify and the economic characteristics of the industry. In this part of the analysis the data consist of industry aggregates showing the volume of employment in nonprimary activities for companies classified by primary industry. Next, for the 111-firm sample, growth rates of primary industries are compared with those of the industries in which the companies added products.

#### *Summary*

In the preceding chapter, it was shown that industries which have complex and changing technologies and which require relatively large numbers of technical personnel have proved the most attractive as diversification outlets. It follows, therefore, that firms which have large numbers of technical employees in connection with their primary activities are in a better position to diversify than those that do not. The technical personnel ratio was strongly correlated with the ratio of nonprimary to primary employment in the industry.<sup>1</sup> As a determinant of which firms will diversify, this points to the importance of similarities in requisite skills between primary activities and those attractive as diversification outlets. In a sense, therefore, diversification paradoxically depends upon specialization, except that the relevant form of specialization is in technical skills rather than in the specific goods and services produced. However, even assuming that the advantages of specialization by products rather than by skills were large, one would still expect to find some diversification as a consequence of the effects of random forces in determining which firms discover profitable investment opportunities. These forces render it likely

<sup>1</sup> However, the technical personnel ratio was more strongly associated with the extent to which an industry was an outlet than a source for diversification, the ratio being negatively related to that for nonprimary to external employment. External employment is defined in Chapter 7.

## THE SOURCES OF DIVERSIFICATION

that attractive projects will sometimes be found first by firms with primary activities outside the relevant industries.

To a large degree, firms diversify rather than pursue further growth within their primary industries because of limits to their growth within the latter. These limits are of two types. Type 1 arise from the rate of growth in primary industry demand. Type 2 arise from obstacles to a faster growth in the sales of an individual producer than in market demand.

With respect to Type 1 limits, the net relation (after due account is taken of the role of the technical personnel ratio) between primary industry growth and the ratio of nonprimary to primary employment was negative. Also, for the 111-firm sample, there were roughly twice as many product additions in industries with higher growth than that of primary industries as there were in those with lower growth.

For reasons explained later in the chapter, Type 2 limits are particularly strong in industries in which sellers are large and few in number—a phenomenon roughly measured by the concentration ratio (that is, the proportion of industry sales or shipments contributed by the leading four producers). This ratio was related positively to that of nonprimary to primary employment.

### *The Magnitude of Nonprimary Activities and Industry Characteristics*

In the analysis below, the objective is to establish functional relations between diversification and primary industry characteristics. No attempt is made to identify the conscious motives of managers. Rather the objective is to determine those characteristics of industries that serve as constraints on the alternatives open to firms. For example, managers may wish to enter an industry new to the firm in order to increase earnings—but which of the many industries will they choose? A choice consistent with the purpose of increasing earnings may be affected by a wide array of factors, such as the content of the managers' knowledge and experience, and the ability to use existing machinery, research facilities, or marketing outlets.

Generally, the prospective return on investment in diversification will be higher if the firm undertaking it has, in the new activity, a competitive advantage over most firms in the economy. As shown in Chapter 7, industries that have attracted diversification have been associated with large requirements for technical personnel. Consequently, a firm with a high rate of employment of technical personnel in connection with its primary activity has the advantage of Type 2 technical propinquity (the use of common skills) to the more attractive diversification outlets, and should enter these outlets more frequently than other firms. As a result, a higher

## THE SOURCES OF DIVERSIFICATION

technical personnel ratio in the primary activities of firms should produce a lower specialization of output in the primary industry. Further, while most technical employees are not engaged in research and product development, the number so engaged is likely to be positively correlated with the total number employed. Activities in research frequently lead to new or improved products in a variety of industries, thus generating investment opportunities outside the primary one.

Since the managerial resources available to a firm are limited, high rates of growth may entail the dilution of scarce managerial skills over a large number of projects. Capital resources are also limited in the sense that increases in capital requirements will, beyond some level, have to be financed at a rising cost of capital. Thus firms must even choose from among investment opportunities which, if undertaken singly, would yield a rate of return higher than the cost of capital. A high growth rate for the primary industry increases the attractiveness of investment opportunities within the scope of a firm's existing activities and thus tends to reduce diversification.

The opportunity for a faster growth in the sales of an individual firm than in market demand is affected by the concentration ratio for the industry. In a market characterized by high concentration, the outputs of at least the larger producers are interdependent in that a substantial increase in the output of one, not accompanied by a proportionate rise in market demand, must result in a reduction in price or in a significant contraction in output for some or all producers. Thus if the managers of a firm in a concentrated industry seek a faster growth rate than that for primary industry demand, usually they must either diversify or encroach noticeably on the market of a competing producer.<sup>2</sup> Since the latter alternative is frequently expensive and hazardous, a firm in a highly concentrated industry will be more prone to seek investment opportunities outside its primary activity.

The extent of diversification for firms classified in a given industry was measured on the basis of 1954 ratios of employment outside the primary industry to employment in the primary industry (Appendix Table D-6). Analysis was restricted to manufacturing industries for which data on explanatory variables were available. The ratios were taken as of a single point in time, so that nonprimary employment may have been generated in a period which antecedes that to which our measures of explanatory

<sup>2</sup> At times the firm can also grow by merger within the primary industry, or through integration. These alternatives are, however, frequently unattractive or not practicable for legal and other reasons.

THE SOURCES OF DIVERSIFICATION

variables refer. However, inasmuch as nonprimary activities can be contracted as well as expanded, a continuous process of adjustment of nonprimary employment to the relevant variables is at work. This reduces the error of using diversification measures as of a single date. Industry growth was based on data for the period 1939-53, the technical personnel ratio was measured for the year 1950, and concentration ratios were based on 1947 data. An additional variable, average firm size for the industry, was used to test whether the concentration ratio was only a proxy for it in the relation of concentration ratio to diversification. Firm size was measured for the year 1947. The sources of information, methods of measurement used, and units in which these four explanatory variables are expressed are indicated in Appendix D.

Below are the four equations derived from the above-mentioned data. Table 59 shows the relevant multiple and partial correlation coefficients for each of the four equations. In addition, it shows the simple correlations for various pairs of variables.

- (1)  $X_1 = 5.8236 + .0004 X_2 + .3605 X_3$   
(.0003)      (.1163)
- (2)  $X_1 = 9.3187 + .0593 X_4 - .0209 X_5$   
(.0130)      (.0101)
- (3)  $X_1 = 9.2734 + .0005 X_2 + .0381 X_4$   
(.0002)      (.0085)
- (4)  $X_1 = -.3923 + .3497 X_3 + .0286 X_4$   
(.0998)      (.0090)

$X_1$  is the ratio of nonprimary to primary employment multiplied by 100.  $X_2$  is the firm-size variable,  $X_3$  the concentration ratio,  $X_4$  the technical personnel ratio, and  $X_5$  is industry growth. The standard errors applicable to the regression coefficients are indicated in parentheses.

As may be judged from the table, equation 4, using the concentration ratio and the technical personnel ratio as independent variables, yields the highest correlation coefficient, .614. Both of the partial, as well as the multiple, correlation coefficients for equation 4 were statistically significant at the .01 level.<sup>3</sup> As anticipated, in equation 2 growth exhibited a negative relation to the relative importance of nonprimary operations. The partial correlation coefficient was - .280 and, though small, was significant at the .05 level. Firm size, though correlated with the concentration ratio, contributed less than the latter toward explaining the variance in the

<sup>3</sup> The correlation was substantially reduced by one extreme observation, namely, that for the electrical machinery industry. Without the latter,  $R_{1,34} = .841$ , while  $r_{14,3} = .614$  and  $r_{13,4} = .743$ .

THE SOURCES OF DIVERSIFICATION

TABLE 59  
CORRELATION COEFFICIENTS FOR RATIO OF NONPRIMARY TO PRIMARY  
EMPLOYMENT AND INDUSTRY VARIABLES

Equation <sup>a</sup>	Simple Correlation <sup>b</sup>	Multiple Correlation <sup>b</sup>	Partial Correlation <sup>b</sup>
(1) $N = 54$	$r_{12}$ (.3071) $r_{13}$ <u>.4607</u> $r_{23}$ (.3273)	$R_{1\cdot23}$ <u>.470</u>	$r_{12\cdot3}$ .2345 $r_{13\cdot2}$ (.3731)
(2) $N = 55$	$r_{14}$ <u>.5261</u> $r_{15}$ <u>.2386</u> $r_{45}$ <u>.7525</u>	$R_{1\cdot45}$ <u>.576</u>	$r_{14\cdot5}$ <u>.5419</u> $r_{15\cdot4}$ (—2808)
(3) $N = 62$	$r_{12}$ (.3160) $r_{14}$ <u>.5325</u> $r_{24}$ <u>.2254</u>	$R_{1\cdot24}$ <u>.569</u>	$r_{12\cdot4}$ (.2882) $r_{14\cdot2}$ <u>.4991</u>
(4) $N = 56$	$r_{13}$ <u>.4942</u> $r_{14}$ <u>.4811</u> $r_{34}$ <u>.2617</u>	$R_{1\cdot34}$ <u>.614</u>	$r_{13\cdot4}$ <u>.4352</u> $r_{14\cdot3}$ <u>.4192</u>

<sup>a</sup> The number of observations in each equation was the maximum number of industries for which data were available for all independent variables in the equation. Information was sufficient for only the manufacturing industries. The simple correlation coefficients are based on data for the industries in each equation when two independent variables are used. Thus the simple correlation coefficients for the identical variables show some variation as a result of the fact that they are based on slightly differing groups of industries.

<sup>b</sup> The ratio of nonprimary to primary employment is identified by subscript 1. The independent variables are denoted by subscripts as follows: subscript 2, firm size; subscript 3, concentration ratio; subscript 4, technical personnel ratio; subscript 5, growth. Coefficients significant at the .01 level are underlined. Those significant at the .05 level are in parentheses.

dependent variable ( $r_{13}$  was larger than  $r_{12}$  and  $R_{1\cdot34}$  was larger than  $R_{1\cdot24}$ ). Thus the concentration ratio cannot be considered a proxy for firm size.

The number of observations for each of the four equations was limited to the maximum number of industries for which information on each set of relevant variables was available; it ranged from fifty-four for equation 1 to sixty-two for equation 3. When all four explanatory variables were used, the number of industries for which data were available was reduced to thirty-six.  $R_{1\cdot2345}$  was .611 compared with .605 for  $R_{1\cdot34}$  for the thirty-six observations. Thus it is apparent that the two additional variables—growth and firm size—do not materially contribute toward explaining the variance in the nonprimary to primary employment ratio, once the technical personnel ratio and the concentration ratio are used as independent variables.

*The Relation Between Growth of Primary and of Newly Entered Industries*  
Do companies tend to enter industries that are growing faster than those

in which their largest activities are located? Stated in another way, is diversification associated with the flow of capital funds from slower to faster growing sectors of the economy? In earlier sections of this study it was shown, first, that the rate of growth of the primary industry is inversely related to diversification; and second, that firms when they diversify tend to enter high-growth industries. It follows from these facts that industries into which firms diversify will, on the average, grow faster than the primary industries of diversifying companies. To establish the extent of this, the growth rates of manufacturing industries in which the 111 large companies added products in 1939-50 and 1950-54 were compared with the rates of the primary industries of these companies.<sup>4</sup> This was done by comparing the deciles, on the basis of growth in 1939-54, into which both the primary industries of companies and the industries of product additions were classified.<sup>5</sup>

As may be judged from Table 60, when one compares the number of additions in the growth deciles above and below those of the companies' primary industries, in both periods the former were roughly twice the latter. Thus diversification is strongly associated with the flow of resources from lower- to higher-growth sectors of the economy. Nevertheless, it is interesting that as many as a fourth of all product additions in both 1939-50 and 1950-54 fell into industries growing less rapidly than the companies' primary industries.<sup>6</sup> Clearly, industry growth is not the only factor that affects diversification. Moreover, if the primary industry of a firm is itself associated with a high growth rate, it is difficult for the firm to discover industries for diversification with even faster growth rates.

Companies that diversify into rapidly growing sectors may be expected to increase their growth through diversification more than if they had entered slower growing industries. However, the effect of differences in the growth of newly entered industries was not sufficiently strong to explain the differences in the over-all growth of companies.<sup>7</sup>

<sup>4</sup> Primary industry was determined on the basis of 1954 Census data for manufacturing payrolls. Product additions were based on the product record described in Chapter 2.

<sup>5</sup> The loss of detail through the use of deciles was necessitated by restrictions on the use of individual company information. Data on growth rates of individual industries were based on Appendix Table D-3. Deciles were determined on the basis of all the industries in that table.

<sup>6</sup> This proportion was derived after excluding product additions that fell into industries for which no growth measures were available.

<sup>7</sup> Companies were grouped into deciles on the basis of growth in total assets in the period 1939-54. Those in the higher growth deciles, when compared with less rapidly growing firms, did not show a significantly higher ratio of number of entries in high growth to number of entries in all industries.

THE SOURCES OF DIVERSIFICATION

TABLE 60  
COMPARATIVE GROWTH OF PRIMARY INDUSTRIES OF 111 LARGE COMPANIES  
AND OF MANUFACTURING INDUSTRIES IN WHICH THE COMPANIES ADDED PRODUCTS

Primary Industry of Company	1950-54 Additions				1939-50 Additions			
	Number in Higher Growth Deciles Than Primary Industry	Number in Lower Growth Deciles Than Primary Industry	Number in Same Growth Decile as Primary Industry	Number of Additions for Which No Growth Measure Was Available	Number in Higher Growth Deciles Than Primary Industry	Number in Lower Growth Deciles Than Primary Industry	Number in Same Growth Decile as Primary Industry	Number of Additions for Which No Growth Measure Was Available
Food products	19	3	1	6	18	3	6	8
Tobacco manufactures	0	0	0	0	1	0	0	0
Textile mill products	3	0	0	0	5	5	2	4
Paper products	15	6	6	10	15	8	8	7
Chemicals	9	32	22	18	11	29	15	18
Petroleum	15	4	2	0	26	4	5	1
Rubber products	29	8	2	15	34	5	0	14
Stone, clay, and glass products	6	3	2	5	12	6	2	5
Primary metals	10	4	3	5	6	0	2	1
Fabricated metal products	9	1	0	4	11	5	1	4
Machinery	14	6	7	6	15	5	5	9
Electrical machinery	8	11	6	16	15	13	10	22
Transportation equipment	38	10	10	21	31	9	11	13
Total	175	88	61	106	200	92	67	106

NOTE: Growth measured for 1939-54. The 4-digit level of industry detail was used.

SOURCE: Product record described in Chapter 2 and 1954 census data. The latter were used to determine primary 4-digit industries on the basis of information for payrolls. Growth deciles were based on information described in Appendix B.



## THE SOURCES OF DIVERSIFICATION

### *The Technical Personnel Ratio and the Flow of Resources*

It will be recalled that the technical personnel ratio was found to be positively correlated with both the nonprimary employment ratio and the ratio of external to total employment.<sup>8</sup> The non-primary employment ratio purports to measure the extent to which companies with specified primary industries diversify, and the latter measures the attractiveness of industries as outlets for diversification. The question that is now examined is whether a high technical personnel ratio for a given industry is associated more strongly with a flow of resources into that industry (from firms outside it) than with the flow of resources into other sectors from firms in the industry.

For fifty-six industries,<sup>9</sup> the simple correlation between the technical personnel ratio and the ratio of nonprimary to external employment<sup>10</sup> was only  $-.214$ , and hence not acceptable at the  $.05$  level of significance. However, the relation was obscured by the influence of another variable. It will be recalled that concentration ratios were positively related to nonprimary employment. When the ratio of nonprimary to external employment was taken as the dependent variable, and both the 1950 technical personnel ratio and 1947 concentration ratio as independent variables, the following equation was derived for the fifty-six industries:

$$X_1 = 34.1224 + 7.1780 X_2 - .4652 X_3,$$

(2.0937)      (.1879)

where  $X_1$  stands for the ratio of nonprimary to external employment multiplied by 100,  $X_2$  the concentration ratio, and  $X_3$  the technical personnel ratio.<sup>11</sup> The standard errors for the regression coefficients are indicated in parentheses. The coefficient of multiple correlation was  $.469$  and the two partial correlation coefficients were as follows:  $r_{12.3} = .428$  and  $r_{13.2} = -.337$ .<sup>12</sup> All three coefficients were significant at the  $.01$  level. Thus the technical personnel ratio is related inversely to the ratio of nonprimary to external employment. That is, the higher the technical personnel ratio, the greater will be employment (and presumably other resources) within the industry emanating from firms outside it, relative to employment outside the industry emanating from firms within it.

<sup>8</sup> As expected data for eighty-five manufacturing and mining industries also produced a positive coefficient of rank correlation ( $.461$ ) for the nonprimary and external employment ratios.

<sup>9</sup> Manufacturing industries for which data on explanatory variables were available.

<sup>10</sup> The ratio of nonprimary to external employment for all manufacturing and mining industries is shown in Appendix Table D-8.

<sup>11</sup> Expressed in units of number of technical employees per 10,000 of all employees.

<sup>12</sup> The correlation coefficients were materially reduced by the single observation for the meat-packing industry. Excluding meat packing,  $R = .679$ ,  $r_{12.3} = .663$ ,  $r_{13.2} = -.451$ .

## *THE SOURCES OF DIVERSIFICATION*

As a last comment, the positive association between the technical personnel ratio and the extent to which an industry was both a source and an outlet for diversification is, at first view, somewhat puzzling since better than average investment opportunities within the industry entail a larger demand therein for limited capital resources. This should exert a negative influence on the amount of diversification undertaken by firms classified in the industry. Apparently, however, the positive effect of technical propinquity to diversification outlets more than offset the negative effect of a higher demand for scarce resources within the primary industry.

