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How Diversified is Your State's Agriculture?

Loren W. Tauer

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Department of Agricultural Economics  
Cornell University Agricultural Experiment Station  
New York State College of Agriculture and Life Sciences  
A Statutory College of the State University  
Cornell University, Ithaca, New York, 14853

## How Diversified is Your State's Agriculture?

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### Abstract

Each state's agricultural production diversification is measured for 1984 and 1988. Very little difference existed between the type of index used or the year computed. Linear regressions of the coefficient of variation of receipts on diversification measures implies diversification among states have no impact on variability of receipts.

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\*Loren Tauer is an associate professor in the Department of Agricultural Economics, Cornell University, Ithaca, NY 14853. B.F. Stanton provided helpful comments. Presented at the American Agricultural Economics Association Annual Meeting, August 5-8, 1990 at Vancouver, Canada. This research was completed under Cornell University Experiment Station Hatch Project 121-7519.

## How Diversified is Your State's Agriculture?

Many states are promoting alternative agricultural commodities and enterprises in an attempt to diversify their farmers and agriculture. The belief is that additional diversification will reduce the exposure of individual farmers and the state to financial crises similar to those that occurred during the decade of the 80s. This paper measures each state's diversification of agricultural production in 1988 and 1984 using the Herfindahl and Entropy indices. This provides information on the current extent of diversification and any progress made from 1984 to 1988. The impact of diversification on variability of total state cash receipts is also estimated.

### Diversification Indices

The study of industrial organization has devised various indices to measure the degree of concentration within an industry. In a review of those studies, Hannah and Kay state that most of the common indices are special cases of the form

$$I_{\alpha} = \left( \sum_{i=1}^N S_i^{\alpha} \right)^{\frac{1}{1-\alpha}}$$

where  $S_i$  is the market share of the  $i$ th firm and  $\alpha$  is a parameter,  $\alpha > 0$ ,  $\alpha \neq 1$ .

For  $\alpha = 2$ , this index becomes  $1 / \sum_{i=1}^N S_i^2$ , or the inverse of the

Herfindahl index. For the limit  $\alpha \rightarrow 1$ , the index becomes the Entropy index -  $\sum_{i=1}^N S_i \ln S_i$ .

This general index and its special forms measures both the number of firms and the evenness of market share within the industry. The parameter  $\alpha$  indicates how the index is influenced by the presence of larger firms; a high value for  $\alpha$  will give more weight in the index to larger than to smaller firms. A value of  $\alpha = 0$  simply counts the number of firms.

The field of ecology has used identical indices with different names to measure species diversification and number. Five common values of  $\alpha$  used and the information they provide are:  $\alpha = -\infty$ , reciprocal of the proportional abundance of the rarest species;  $\alpha = 0$ , total number of species present;  $\alpha = 1$ , Shannon's Entropy;  $\alpha = 2$ , reciprocal of Simpson's index; and  $\alpha = \infty$ , reciprocal of the proportional abundance of the commonest species (Hill).

In this study  $S_i$  is the proportion of the commodity group (or commodity) to the total cash receipts for each state. Three measures of  $\alpha$  are reported:  $\alpha = 0$  (count),  $\alpha = 1$  (Entropy) and  $\alpha = 2$  (Herfindahl). A general index was also formulated in the LOTUS 123 worksheet for any value of  $\alpha$ .<sup>1</sup>

#### Procedure

Cash receipts by commodity groups and selected commodities by state are available from the USDA in a LOTUS 123 worksheet of the publication, Economic Indicators of the Farm Sector: State Financial Summary, 1988 (USDA). That readily allowed computing a Herfindahl and an Entropy index using both commodity groups and the selected commodities under

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<sup>1</sup>The LOTUS 123 worksheets constructed are available from the author.

each commodity group. Indices were computed for 1988 and 1984 data from Table 5 of that publication.

The twelve commodity groups are: meat animals, dairy products, poultry/eggs, miscellaneous livestock, food grains, feed grains, cotton, tobacco, oil crops, vegetables, fruits/nuts, and all other crops. Most states had ten of the twelve groups. A few did not have oil crops, and many of the Southern states also had cotton and tobacco. The proportions of the commodity groups were used to compute Herfindahl and Entropy indices for 1988.

Indices were also computed using selected commodities. These selected commodities are listed under each commodity group and vary by state. The largest listing occurred under vegetables for those states that are major vegetable producers, such as California and Florida.

Some selected commodities were not used. For instance, milk retail and milk wholesale are listed under the dairy products group. At the same level of division cattle and calves are not divided into retail and wholesale. Thus, the group dairy products was used as the commodity milk. Likewise, the cotton group is broken up into the selected commodities cotton lint and cottonseed. However, the small grains are not broken up into seed and straw (i.e. for flax) so the cotton group was used as the commodity cotton. Some selected commodities are further broken up at another level of division. The most common is fresh versus processed vegetables or potato production by season. However, since a commodity like wheat is not separated in Table 5 by winter versus spring production, or by use, no third levels of division were used.

Unfortunately, selected commodity proportions did not sum to one for all states since selected commodities under a commodity group often

do not total to the value listed for the commodity group. The discrepancies were determined for those states whose proportions summed to less than .99. The corrections (in \$1,000) for 1988 by state were as follows: Colorado \$78,250 was added to other poultry; Connecticut \$588 added to other poultry, \$832 to miscellaneous fruits and nuts, and \$19,354 to other field crops; Louisiana \$150,717 to farm chickens; Maine \$4,378 to other poultry; Missouri \$79,134 to other poultry; Tennessee \$113,274 to farm chickens; Texas \$72,297 to other poultry; Utah \$5,500 to other field crops; West Virginia \$10,140 to other poultry; and Wisconsin \$59,622 added to other poultry. Similar adjustments were made to the 1984 data.

#### Results

Computed 1988 State indices using the commodity groups are reported in Table 1. The Herfindahl index ranged from a low of .13 for Louisiana and South Carolina (most diversified) to a high of .50 for Vermont (least diversified). Both Louisiana and South Carolina have an even mix of livestock and crops. In contrast, Vermont produces mainly milk. Most of the other more diversified states have a mixture of livestock, crops, vegetables and fruit. In contrast, poorly diversified states tend to have a major crop (Kansas, wheat) or a major livestock (Wisconsin, dairy).

The Entropy indices produce similar results. South Carolina and then Louisiana are the first and second most diversified, and Vermont is the least diversified. Since the Herfindahl has a larger alpha value of 2 compared to an alpha value of 1 for the Entropy, the Herfindahl gives more weight to larger group proportions. The strong relationship

Table 1. Diversification of States' Agriculture Using Twelve Commodity Groups

| State         | 1988  |                 |        |         |        | Average Cash Receipts<br>(Million \$) |        | Coefficient of<br>Variation |        |
|---------------|-------|-----------------|--------|---------|--------|---------------------------------------|--------|-----------------------------|--------|
|               | Count | Her-<br>findahl | (Rank) | Entropy | (Rank) | 1984-1988                             | (Rank) | 1984-1988                   | (Rank) |
| Alabama       | 12    | .27             | 32     | 1.70    | 31     | 2,170                                 | 25     | .068                        | 23     |
| Alaska        | 7     | .30             | 34     | 1.49    | 37     | 27                                    | 50     | .088                        | 34(t)  |
| Arizona       | 11    | .19             | 13(t)  | 1.87    | 16     | 1,711                                 | 31     | .098                        | 40(t)  |
| Arkansas      | 11    | .24             | 28(t)  | 1.73    | 26(t)  | 3,385                                 | 14     | .107                        | 47     |
| California    | 10    | .16             | 5(t)   | 1.99    | 7(t)   | 15,194                                | 1      | .065                        | 21(t)  |
| Colorado      | 9     | .43             | 44(t)  | 1.30    | 43     | 3,301                                 | 16     | .070                        | 25(t)  |
| Connecticut   | 9     | .23             | 26(t)  | 1.71    | 30     | 372                                   | 45     | .036                        | 10     |
| Delaware      | 10    | .50             | 48     | 1.22    | 45     | 523                                   | 41     | .080                        | 32     |
| Florida       | 12    | .22             | 25     | 1.72    | 28(t)  | 5,102                                 | 8      | .098                        | 40(t)  |
| Georgia       | 12    | .21             | 21(t)  | 1.96    | 11(t)  | 3,352                                 | 15     | .065                        | 21(t)  |
| Hawaii        | 7     | .34             | 37(t)  | 1.35    | 39(t)  | 554                                   | 40     | .031                        | 4(t)   |
| Idaho         | 9     | .19             | 13(t)  | 1.83    | 18     | 2,136                                 | 26     | .074                        | 29     |
| Illinois      | 10    | .26             | 31     | 1.50    | 35(t)  | 6,774                                 | 5      | .104                        | 44(t)  |
| Indiana       | 11    | .21             | 21(t)  | 1.77    | 22(t)  | 4,171                                 | 10     | .092                        | 38     |
| Iowa          | 10    | .34             | 37(t)  | 1.28    | 44     | 9,002                                 | 3      | .032                        | 6(t)   |
| Kansas        | 11    | .43             | 44(t)  | 1.19    | 46     | 5,950                                 | 7      | .075                        | 30     |
| Kentucky      | 11    | .18             | 11(t)  | 1.90    | 15     | 2,613                                 | 22     | .088                        | 34(t)  |
| Louisiana     | 11    | .13             | 1(t)   | 2.15    | 2      | 1,576                                 | 32     | .132                        | 50     |
| Maine         | 8     | .20             | 18(t)  | 1.77    | 22(t)  | 406                                   | 42     | .070                        | 25(t)  |
| Maryland      | 11    | .19             | 13(t)  | 1.96    | 11(t)  | 1,200                                 | 34     | .033                        | 8(t)   |
| Massachusetts | 9     | .23             | 26(t)  | 1.68    | 32     | 397                                   | 44     | .033                        | 8(t)   |
| Michigan      | 10    | .14             | 3      | 2.07    | 4      | 2,720                                 | 21     | .052                        | 14     |
| Minnesota     | 10    | .19             | 13(t)  | 1.84    | 17     | 6,128                                 | 6      | .047                        | 13     |
| Mississippi   | 11    | .17             | 8(t)   | 1.97    | 9(t)   | 2,117                                 | 27     | .104                        | 44(t)  |
| Missouri      | 12    | .21             | 21(t)  | 1.80    | 19     | 3,680                                 | 12     | .031                        | 4(t)   |

t = tied for that rank.



Table 1. Diversification of States' Agriculture Using Twelve Commodity Groups, continued.

| State          | 1988  |                 |        |         |        | Average Cash Receipts<br>(Million \$) |        | Coefficient of<br>Variation |        |
|----------------|-------|-----------------|--------|---------|--------|---------------------------------------|--------|-----------------------------|--------|
|                | Count | Her-<br>findahl | (Rank) | Entropy | (Rank) | 1984-1988                             | (Rank) | 1984-1988                   | (Rank) |
| Montana        | 9     | .36             | 40     | 1.32    | 41     | 1,295                                 | 33     | .088                        | 34(t)  |
| Nebraska       | 10    | .46             | 46     | 1.13    | 48     | 7,185                                 | 4      | .069                        | 24     |
| Nevada         | 9     | .34             | 37(t)  | 1.36    | 38     | 233                                   | 47     | .044                        | 11     |
| New Hampshire  | 8     | .21             | 21(t)  | 1.77    | 22(t)  | 121                                   | 48     | .130                        | 49     |
| New Jersey     | 10    | .19             | 13(t)  | 1.91    | 14     | 596                                   | 39     | .071                        | 27(t)  |
| New Mexico     | 11    | .37             | 41     | 1.50    | 35(t)  | 1,110                                 | 35     | .101                        | 42     |
| New York       | 10    | .32             | 35     | 1.59    | 33(t)  | 2,606                                 | 23     | .013                        | 1      |
| North Carolina | 12    | .18             | 11(t)  | 1.99    | 7(t)   | 3,966                                 | 11     | .053                        | 15     |
| North Dakota   | 10    | .20             | 18(t)  | 1.78    | 21     | 2,472                                 | 24     | .064                        | 19(t)  |
| Ohio           | 11    | .17             | 8(t)   | 1.94    | 13     | 3,675                                 | 13     | .063                        | 18     |
| Oklahoma       | 11    | .33             | 36     | 1.59    | 33(t)  | 2,863                                 | 19     | .111                        | 48     |
| Oregon         | 9     | .17             | 8(t)   | 1.97    | 9(t)   | 1,862                                 | 29     | .077                        | 31     |
| Pennsylvania   | 11    | .24             | 28(t)  | 1.74    | 25     | 3,185                                 | 17     | .022                        | 3      |
| Rhode Island   | 8     | .48             | 47     | 1.18    | 47     | 74                                    | 49     | .088                        | 34(t)  |
| South Carolina | 12    | .13             | 1(t)   | 2.23    | 1      | 1,019                                 | 36     | .103                        | 43     |
| South Dakota   | 10    | .38             | 42     | 1.35    | 39(t)  | 2,782                                 | 20     | .093                        | 39     |
| Tennessee      | 12    | .16             | 5(t)   | 2.08    | 3      | 2,008                                 | 28     | .046                        | 12     |
| Texas          | 11    | .28             | 33     | 1.72    | 28(t)  | 9,389                                 | 2      | .064                        | 19(t)  |
| Utah           | 9     | .24             | 28(t)  | 1.73    | 26(t)  | 600                                   | 38     | .086                        | 33     |
| Vermont        | 8     | .57             | 50     | .96     | 50     | 402                                   | 43     | .032                        | 6(t)   |
| Virginia       | 12    | .16             | 5(t)   | 2.06    | 5      | 1,756                                 | 30     | .058                        | 17     |
| Washington     | 9     | .15             | 4      | 2.00    | 6      | 2,981                                 | 18     | .071                        | 27(t)  |
| West Virginia  | 10    | .20             | 18(t)  | 1.79    | 20     | 240                                   | 46     | .055                        | 16     |
| Wisconsin      | 11    | .41             | 43     | 1.31    | 42     | 4,990                                 | 9      | .017                        | 2      |
| Wyoming        | 9     | .56             | 49     | .99     | 49     | 628                                   | 37     | .104                        | 44(t)  |
| United States  | 12    | .15             |        | 2.18    |        | 142,602                               |        | .041                        |        |

t - tied for that rank.

between the two indices are indicated by a correlation coefficient of  $-.96$  based upon their numerical values.

There is little relationship between the size of a state's agriculture, as measured by average cash receipts from 1984 through 1988, and the level of diversification. By size Louisiana and South Carolina ranked 32 and 36 respectively but are the most diversified. Nebraska has a diversification rank of 46 or 48 but is ranked number 4 by cash receipts. The correlation between average cash receipts and the Entropy index for all fifty states based upon numerical values is only  $.03$ .

There also appears to be little relationship between a state's diversification and the variability of its cash receipts as measured by the coefficient of variation (standard deviation divided by the average of cash receipts from 1984 through 1988). The correlation between the Entropy index and the coefficient of variation is only  $.09$ . Variation of cash receipts may be more a function of commodity group. New York and Wisconsin have the lowest and second lowest coefficient of variation; both are major dairy states but neither are well diversified, especially Wisconsin. Also having low coefficients of variation are Pennsylvania and Vermont.

Using selected commodities rather than commodity groups results in slightly different state rankings (Table 2). California, with its vast number of vegetables and fruits, as well as other crops and livestock (70 commodities), is ranked as the most diversified state in 1988 and 1984 using either the Herfindahl or the Entropy index (Table 2). Ranked second is Oregon. Previously, using commodity groups, California was ranked five or seven and Oregon was ranked eight or nine. Florida

Table 2. Diversification of States' Agriculture Using Selected Commodities

| State         | 1988  |        |                 |        |         | 1984   |                 |        |         |        |
|---------------|-------|--------|-----------------|--------|---------|--------|-----------------|--------|---------|--------|
|               | Count | (Rank) | Her-<br>findahl | (Rank) | Entropy | (Rank) | Her-<br>findahl | (Rank) | Entropy | (Rank) |
| Alabama       | 29    | 19(t)  | .21             | 31(t)  | 2.11    | 25     | .15             | 16(t)  | 2.36    | 14(t)  |
| Alaska        | 9     | 50     | .27             | 37     | 1.63    | 42(t)  | .27             | 39     | 1.68    | 42     |
| Arizona       | 39    | 8      | .15             | 15(t)  | 2.36    | 12     | .16             | 21     | 2.39    | 11     |
| Arkansas      | 30    | 18     | .16             | 21(t)  | 2.21    | 20(t)  | .15             | 16(t)  | 2.25    | 18     |
| California    | 70    | 1      | .06             | 1      | 3.31    | 1      | .06             | 1      | 3.32    | 1      |
| Colorado      | 32    | 17     | .39             | 46(t)  | 1.68    | 41     | .34             | 45(t)  | 1.80    | 37     |
| Connecticut   | 17    | 44(t)  | .19             | 28     | 2.01    | 33(t)  | .19             | 25(t)  | 1.96    | 32     |
| Delaware      | 22    | 37(t)  | .46             | 48     | 1.41    | 48     | .42             | 48     | 1.51    | 48     |
| Florida       | 48    | 3      | .10             | 4(t)   | 2.77    | 3(t)   | .09             | 3(t)   | 2.87    | 3      |
| Georgia       | 33    | 14(t)  | .14             | 13(t)  | 2.48    | 10     | .11             | 5(t)   | 2.54    | 9      |
| Hawaii        | 21    | 40     | .20             | 29(t)  | 2.07    | 30(t)  | .26             | 36(t)  | 1.91    | 35     |
| Idaho         | 33    | 14(t)  | .15             | 15(t)  | 2.32    | 15(t)  | .13             | 12(t)  | 2.38    | 12(t)  |
| Illinois      | 22    | 37(t)  | .22             | 34     | 1.76    | 38     | .22             | 32(t)  | 1.72    | 39     |
| Indiana       | 28    | 21(t)  | .16             | 21(t)  | 2.10    | 26(t)  | .17             | 22(t)  | 2.09    | 27     |
| Iowa          | 25    | 32(t)  | .21             | 31(t)  | 1.70    | 40     | .21             | 30(t)  | 1.71    | 40(t)  |
| Kansas        | 27    | 26(t)  | .37             | 45     | 1.50    | 47     | .33             | 43(t)  | 1.54    | 47     |
| Kentucky      | 22    | 37(t)  | .15             | 15(t)  | 2.12    | 24     | .17             | 22(t)  | 2.05    | 28(t)  |
| Louisiana     | 26    | 29(t)  | .12             | 9      | 2.39    | 11     | .13             | 12(t)  | 2.34    | 17     |
| Maine         | 17    | 44(t)  | .17             | 24(t)  | 2.08    | 28(t)  | .19             | 25(t)  | 1.95    | 33(t)  |
| Maryland      | 29    | 19(t)  | .16             | 21(t)  | 2.27    | 18     | .17             | 22(t)  | 2.24    | 19     |
| Massachusetts | 20    | 41(t)  | .18             | 27     | 2.10    | 26(t)  | .20             | 28(t)  | 2.00    | 31     |
| Michigan      | 44    | 6(t)   | .10             | 4(t)   | 2.76    | 5      | .11             | 5(t)   | 2.76    | 4      |
| Minnesota     | 34    | 12(t)  | .13             | 10(t)  | 2.30    | 17     | .13             | 12(t)  | 2.36    | 14(t)  |
| Mississippi   | 24    | 34(t)  | .15             | 15(t)  | 2.21    | 20(t)  | .15             | 16(t)  | 2.20    | 20(t)  |
| Missouri      | 26    | 29(t)  | .15             | 15(t)  | 2.26    | 19     | .15             | 16(t)  | 2.19    | 22(t)  |

t = tied for that rank.

Table 2. Diversification of States' Agriculture Using Selected Commodities, continued.

| State          | 1988  |        |                   |                |                   | 1984           |       |        |                   |                |
|----------------|-------|--------|-------------------|----------------|-------------------|----------------|-------|--------|-------------------|----------------|
|                | Count | (Rank) | Herfindahl (Rank) | Entropy (Rank) | Herfindahl (Rank) | Entropy (Rank) | Count | (Rank) | Herfindahl (Rank) | Entropy (Rank) |
| Montana        | 23    | 36     | .32               | 42             | 1.63              | 42(t)          | .30   | 41     | 1.60              | 44             |
| Nebraska       | 27    | 26(t)  | .35               | 44             | 1.55              | 46             | .33   | 43(t)  | 1.59              | 45             |
| Nevada         | 15    | 46     | .31               | 39(t)          | 1.57              | 45             | .29   | 40     | 1.63              | 43             |
| New Hampshire  | 13    | 48(t)  | .17               | 24(t)          | 2.08              | 28(t)          | .26   | 36(t)  | 1.81              | 36             |
| New Jersey     | 35    | 9(t)   | .15               | 15(t)          | 2.52              | 9              | .12   | 9(t)   | 2.72              | 5              |
| New Mexico     | 28    | 21(t)  | .34               | 43             | 1.81              | 36             | .25   | 35     | 2.05              | 28(t)          |
| New York       | 45    | 4(t)   | .31               | 39(t)          | 2.01              | 33(t)          | .34   | 45(t)  | 1.95              | 33(t)          |
| North Carolina | 35    | 9(t)   | .11               | 7(t)           | 2.59              | 7              | .12   | 9(t)   | 2.53              | 10             |
| North Dakota   | 28    | 21(t)  | .17               | 24(t)          | 2.20              | 23             | .19   | 25(t)  | 2.14              | 24             |
| Ohio           | 35    | 9(t)   | .14               | 13(t)          | 2.32              | 15(t)          | .13   | 12(t)  | 2.35              | 16             |
| Oklahoma       | 27    | 26(t)  | .31               | 39(t)          | 1.77              | 37             | .32   | 42     | 1.71              | 40(t)          |
| Oregon         | 52    | 2      | .07               | 2              | 3.16              | 2              | .08   | 2      | 3.00              | 2              |
| Pennsylvania   | 33    | 14(t)  | .20               | 29(t)          | 2.21              | 20(t)          | .21   | 30(t)  | 2.20              | 20(t)          |
| Rhode Island   | 13    | 48(t)  | .29               | 38             | 1.71              | 39             | .26   | 36(t)  | 1.77              | 38             |
| South Carolina | 28    | 21(t)  | .08               | 3              | 2.73              | 6              | .09   | 3(t)   | 2.68              | 6              |
| South Dakota   | 26    | 29(t)  | .26               | 35(t)          | 1.90              | 35             | .22   | 32(t)  | 2.01              | 30             |
| Tennessee      | 25    | 32(t)  | .13               | 10(t)          | 2.34              | 13             | .12   | 9(t)   | 2.38              | 12(t)          |
| Texas          | 45    | 4(t)   | .26               | 35(t)          | 2.07              | 30(t)          | .24   | 34     | 2.12              | 25             |
| Utah           | 24    | 34(t)  | .21               | 31(t)          | 2.07              | 30(t)          | .20   | 28(t)  | 2.11              | 26             |
| Vermont        | 14    | 47     | .57               | 50             | 1.03              | 50             | .64   | 50     | .86               | 50             |
| Virginia       | 28    | 21(t)  | .11               | 7(t)           | 2.56              | 8              | .11   | 5(t)   | 2.55              | 8              |
| Washington     | 44    | 6(t)   | .10               | 4(t)           | 2.77              | 3(t)           | .11   | 5(t)   | 2.67              | 7              |
| West Virginia  | 19    | 43     | .13               | 10(t)          | 2.33              | 14             | .15   | 16(t)  | 2.19              | 22(t)          |
| Wisconsin      | 34    | 12(t)  | .39               | 46(t)          | 1.59              | 44             | .39   | 47     | 1.58              | 46             |
| Wyoming        | 20    | 41(t)  | .49               | 49             | 1.30              | 49             | .50   | 49     | 1.30              | 49             |
| United States  | 125   |        | .10               |                | 3.04              |                | .09   |        | 3.04              |                |

t = tied for that rank.

increased rank significantly from 28 to four. At the other end Vermont is still ranked as the least diversified. Decreasing their rank under selected commodities compared to commodity groups were Kentucky, Louisiana, Mississippi and Tennessee. Although these Southeast states are well diversified into livestock and crop commodity groups, including cotton and tobacco, they do not have a large number of specific commodities. Although there is some additional shifting in rank the shift is minor. The correlation of the numerical value between the commodity group Entropy index and the selected commodities Entropy index for the 50 states for 1988 was .87. In fact, all the indices were highly correlated. This has been previously observed in indices of industry concentration, and is due to the close mathematic relationships of the indices (Scherer).

Of interest is that state diversification has changed little from 1984 to 1988. The average of the selected commodity Entropy Index for the 50 states was 2.11 in 1984. The standard deviation in 1984 was .46. The average and standard deviation in 1988 was also 2.11 and .46, respectively. The average and standard deviation for the Herfindahl were also identical for 1984 and 1988.

States whose diversification increased from 1984 to 1988 often did so because of lowered production of their major commodity with a resultant evenness but often decrease in the size of the state's agricultural production. Examples include some of the Northeast states with reduced dairy production; New Hampshire had an increase in it's Entropy index from 1.81 in 1984 to 2.08 in 1988.

To determine the relationship between measures of diversification and variability of cash receipts, six linear regressions were estimated.

The dependent variable in each equation was the coefficient of variation (computed from 1984 through 1988 data). The independent variable was one of the six diversification indices. Constant terms were estimated. The explanatory power of the six equations were all zero with slightly negative adjusted R-squared values, and t-values on the diversification variables all less than absolute one. Thus, diversification does not appear to reduce the relative variability of cash receipts. However, with a state average coefficient of variation of only .070 (standard deviation of .029), there is little variability of cash receipts anyway.

#### Summary and Conclusions

Diversification indices were computed using 1984 and 1988 state data on cash receipts by commodity groups and by selected commodities. Very little difference existed between the type of index used or the year computed. Some differences resulted when detailed selected commodities were used rather than more aggregated commodity groups.

These results imply that it makes little difference whether the Herfindahl or Entropy index are used to measure the diversification of a state's agriculture. Also, there has been only small changes in individual state's diversification of agriculture from 1984 to 1988. States that have many vegetables or fruits are measured as more diversified using the selected commodity list rather than commodity groups.

A linear regression of the coefficient of variation of cash receipts (1984-1988) on each measure of diversification implies that diversification among states had no impact on reducing variability of total cash receipts. However, it may be that additional diversification

within a state may reduce its cash receipts variability. A longer time series would be necessary to test that hypothesis.

This study did not measure commodity diversification at the farm or county level. The fact that a state is well diversified does not mean that its farmers are, as state diversification can result from the heterogeneity of its farms.

The tradeoff between diversification and specialization at the firm level is well known. Diversification can lead to more stable but lower incomes if diversification prevents farmers from capturing any economies of scale. The same tradeoff can occur at the state level from research and extension efforts. The existence of a major commodity in a state may allow a state to concentrate its research and extension efforts on that commodity, capturing any economies of size in research and extension. Those economies may not be captured if the state has to target a large number of commodities, especially if the state's overall research and extension funding of agriculture is small, possibly because its agriculture is relatively small.

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