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MEASUREMENTS OF ECONOMIC GROWTH AND DEVELOPMENT OF  
VARIOUS SIZED CENTRAL PLACE AREAS IN PENNSYLVANIA, 1960-70

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Problem Statement

There has been increasing concern over the past decade about the lack of economic activity in a number of major cities, many intermediate and small sized cities, and a significant number of rural areas within various regions of the United States. This concern about the depressed conditions in these urban and rural areas, relative to the nation, has attracted country-wide attention. [9,18,20,21] 1/

It has been customary to measure a State's or region's economy by means of its production and consumption aggregates, without regard to the geographic distribution of economic activity. However, a changing mix of economic activity in the country has resulted not only in sectoral but also spatial dislocations, often causing lags or imbalances among the various regions. As a result, increasing pressure has been brought to bear on the Federal and State governments to provide economic assistance to lagging urban and rural areas by means of industrial and commercial projects, public facilities, and occupational training. [2,7,14,15]

Within the framework of regional economic growth and development [6,13,16,19], the conceptual issues of central place theory and the role of natural resources on regional economic activity will be examined in this

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1/ Underlined numbers in parentheses refer to the list of references at end of the report.



report. 2/ Central place theory is defined as the spatial distribution of cities and towns over a given region. [3] A central place is a town or city which provides goods and services to an area larger than itself. In general, the larger the central place the larger the market area it serves and the more specialized the services offered. Central place theory was used in this report to develop a system or hierarchy of central place areas in Pennsylvania. [3,8]

The second conceptual issue examines the relationship between natural resources and regional economic growth and development which is of interest to the quality of life. The general opinion is that the importance of natural resource endowment changes as a region passes through the agricultural, industrial, and tertiary or service periods of economic growth and development. [11,12,22] Perloff [11] and Barnett and Morse [1] contend that the time has arrived to change the concept of natural resources from a strictly commodity (land and mineral) orientation to a more general environmental orientation. 3/

To date, most studies measuring regional economic activity have focused on individual county disaggregation of data. However, if we want to analyze the detailed structure of a region, we must look at economic entities smaller than the county. The next section of this paper will develop a system or hierarchy of central place areas of various sizes. The following sections will analyze various aspects of this system to determine the direction and magnitude of economic growth and development of Pennsylvania.

#### A Hierarchy of Central Place Areas

The delineation of central place areas in this study was based on all incorporated central places (boroughs and cities) in Pennsylvania with populations of 1,000 or more in 1960. Complementary or hinterland areas were delineated around each central place, based on the central place's population. The larger the population of the central place the larger the hinterland area surrounding the center. There are 177 central place areas in Pennsylvania, delineated into 8 class sizes (table 1). The delineation of the central place areas was made, beginning with the largest cities of Philadelphia and Pittsburgh (class 8) to the smaller towns of 1,000 to 2,499 population (class 1).

The principal data used for measuring the economic activity of the various central place areas were population, income, education, and occupational and industrial employment (see appendix). Data were compiled by minor civil divisions which provided a detailed analysis of Pennsylvania's

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2/ A more detailed review of the conceptual issues related to regional economic growth and development is presented in: R. Gar Forsht, "Measurements of Economic Activity of the Central Place Areas in Pennsylvania, 1960-1970" (unpublished Doctor of Philosophy Thesis, Pennsylvania State University, University Park, Pennsylvania, 1972)

3/ Environmental orientation includes land, minerals, water, air, space and amenity type resources.

Table 1.  
Central Place Areas, Pennsylvania, 1960

Class number	Population of central place	Radius of central place area	Observation	Share of State's population
	<u>Number</u>	<u>Miles</u>	<u>Number</u>	<u>Percent</u>
8	500,000 or more	SMSA's <sup>a/</sup>	2	56.16
7	100,000 - 499,999	15 <sup>b/</sup>	3	10.37
6	50,000 - 99,999	10 <sup>b/</sup>	6	9.74
5	25,000 - 49,999	5	6	3.26
4	10,000 - 24,999	5	27	6.59
3	5,000 - 9,999	5	32	4.08
2	2,500 - 4,999	5	38	2.68
1	1,000 - 2,499	5	63	2.60
0	Under 1,000	(not included in the study)		4.52
Total			177	100.00

<sup>a/</sup> Standard Metropolitan Statistical Area counties. [In general, each SMSA includes the county or counties which have a city or cities totaling 50,000 or more people, plus the economically integrated surrounding counties.]

<sup>b/</sup> The central places in classes 6 and 7 are also central cities for a SMSA.

economy.<sup>4/</sup> Two major sources were the County Labor Force Reports, published by the Pennsylvania Department of Internal Affairs, and the Census Tracts, published by the U.S. Department of Commerce. Several other publications provided data at the minor civil division level.<sup>5/</sup>

#### Measurements of Economic Growth and Development

##### Rate of Population Growth

The first measure used to evaluate the economic activity of the various sized central place areas in Pennsylvania was the rate of population growth

<sup>4/</sup> A minor civil division is a city, borough, or township.

<sup>5/</sup> R. Gar Forsht, op. cit.



from 1960 to 1970. Multiple regression analysis was used to relate the selected independent variables ( $X_1 - X_{25}$  in the appendix) to the rate of population growth for the 177 areas. The most important variable was the rate of growth in the 1940's, which had a highly significant positive coefficient. Conversely, the rate of growth in the 1950's did not have a significant effect on the dependent variable. These results indicate that the rate of growth of the 177 central place areas in the 1960's corresponded more nearly to the decade of the 1940's than to the decade of the 1950's. The log of total population and log of distance to the nearest standard metropolitan statistical area (SMSA) center were also highly significant. Both had negative coefficients, indicating that the smaller sized areas located near but outside the SMSA's had the higher rates of growth.

Five of the nine industrial variables had significant positive effects on the dependent variable. The more important industrial variables were the percentage of employees in manufacturing durable and nondurable goods industries in 1960. The other three variables were the percentage of employees in agriculture, construction, and government activities. The importance of the manufacturing industries suggests that the small, rapidly growing areas might be in the industrial period of development. [12] These areas apparently have a sound manufacturing base on which to build and become even more industrialized.

Median school years completed and average per capita income had negative coefficients indicating the areas with the higher growth rates tend to have populations with lower levels of schooling and lower per capita incomes. One explanation for these findings is that manufacturing industries which pay lower wages are moving into the smaller rural areas. [5] This hypothesis was tested by incorporating more detailed manufacturing data into the model. Changes in specific manufacturing durable and nondurable goods employment for the same period were substituted for the manufacturing employment variables for 1960. Using these new manufacturing variables ( $X_{26} - X_{36}$  in the appendix), multiple regression analyses were conducted on three class size groupings for central places with populations below 25,000: classes 1 through 4, classes 1 and 2, and class 1 areas. The results tend to substantiate the above findings, i.e. that the smaller sized rural areas nearer the SMSA's had the higher rates of population growth.

The smaller the class size grouping (class 1 areas only), the more important were the specific changes in manufacturing employment from 1960 to 1966 in explaining the rate of population growth from 1960 to 1970. The results also indicated that the greater the percentage increase in employment in nondurable goods industries for the period 1960 to 1966, the higher the rate of growth. Conversely, the greater the percentage increase in durable goods employment from 1960 to 1966 the lower the rate of growth. These findings tend to agree with a previous study by Smith [17] on Pennsylvania's economy; he found that the higher county growth rates were associated with higher levels of employment in manufacturing nondurables. In another recently completed study, Fuller [4] found that in the rural areas with central places under 25,000 population, durable goods industries tend to pay medium to high wages while nondurable goods industries tend to pay

low to median wages. The results of this study also indicated that in smaller areas with higher growth rates, employees tend to have lower levels of education and lower per capita incomes. Thus, the growing areas attracted the nondurable goods manufacturers who tend to pay low wages. Conversely, the high wage industries were less likely to be attracted to the small rural areas.

#### Average Per Capita Income

The second measure of economic activity -- the level of per capita income in 1963 -- was restricted to multiple regression analyses on the three class size groupings of central places with populations under 25,000: classes 1 through 4, classes 1 and 2, and class 1 areas. <sup>6/</sup> The most important explanatory variables were the rate of population growth, and the percentage of workers in the various employment categories -- professional and managerial positions, durable goods and nondurable goods manufacturing and wholesale and retail trade in 1960. The results indicated that the level of average per capita income tended to decrease as the population of the study areas within the range covered increased.

The rate of growth in the 1950's was the variable most consistently related to average per capita income. This variable had a highly significant positive relationship with average per capita income in each analysis. Conversely, the rate of growth in the 1940's was only significant in the analysis on class 1 areas (central places of 1,000 to 2,499 population). The class 1 areas with the higher per capita incomes tended to have a high rate of growth in the 1940's and 1950's.

The percentages of workers employed in durable and nondurable goods manufacturing industries in 1960 were the most significant variables in the analysis on the combined classes 1 through 4 and classes 1 and 2. Both variables had positive coefficients, indicating that the higher the percentage of workers in these industries the higher the average per capita income. The most consistent industrial variable was the percentage of workers employed in wholesale and retail trade. This variable had a positive coefficient in each analysis. Although nondurable goods manufacturing and wholesale and retail trade tend to pay lower wages compared with the durable goods industries, the level of wages in these industries apparently provided fairly high per capita incomes. Conversely, the percentage of workers employed in agriculture and transportation and public utilities had negative coefficients indicating these types of employment provide relatively low per capita incomes.

Among the occupational variables, the percentages of workers employed as professionals and managers in 1960 were the most important. The sign on the managers' variable was positive, as hypothesized, but the sign on professional workers' variable was negative and the opposite of that expected.

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<sup>6/</sup> Median income of families in 1960 was not used as an independent variable when average per capita income was used as the dependent variable. Also, only employment percentages in durable and nondurable goods manufacturing in 1960 ( $X_{19}$  and  $X_{20}$  in the appendix) were used as independent manufacturing variables to explain average per capita income.



One explanation for this unexpected negative relationship was that a large proportion of the professional workers in the smaller rural areas (classes 1 through 4) tend to have relatively low incomes.

The negative sign on the log of total population and the positive coefficient on the log of distance from the nearest SMSA have interesting implications. These signs suggest that the small rural areas located at greater distances from the SMSA's have higher average per capita incomes. Also, these smaller rural areas tend to have higher levels of median school years completed and lower center population densities. Thus, the areas with central places of under 25,000 population and with higher average per capita incomes tend to be the smaller rural manufacturing areas located farther from the SMSA's.

#### Natural Resource Based Areas

The economic activity of those areas oriented to natural resource based industries was also analyzed. The areas were classified as agriculture, mining, manufacturing or tertiary sectors, on the basis of the largest positive deviation from Pennsylvania's percentage distribution of employment in 1960. <sup>7/</sup> The 69 areas oriented to the natural resource sectors of agriculture or mining in 1960 were examined. The 37 agricultural areas were primarily smaller sized and tended to be scattered throughout the State. Conversely, the 32 mining areas were concentrated in the Northeastern and West Central parts of the State and there was more variation in area size.

#### Rate of Population Growth

The majority of the agricultural areas had positive annual growth rates from 1940 to 1970. These results tend to support the hypothesis of North [10] that all areas within a region do not necessarily have to industrialize in order to grow and develop. Only three of the mining areas had positive growth rates from 1940 to 1970. The mining areas began to industrialize but lost their most important resource-coal. As a result, they are generally more depressed than the agricultural areas and are in need of assistance.

The regression results on the rates of growth for agricultural and mining areas in the 1960's indicated that the rates of growth in the 1940's and 1950's were important. Whereas the rates of growth in the 1940's were positive for both analyses, the rates of growth in the 1950's were positive for agricultural areas and negative for mining areas. This suggests that the agricultural areas with the higher growth rates in the 1960's also had higher growth rates in the 1940's and 1950's. Conversely, the mining areas with the higher rates of growth in the 1960's had higher rates of growth in the 1940's but lower rates of growth in the 1950's. Thus, agricultural areas had a more stable type of economic activity while mining areas had a more cyclical type over the past three decades. These results support the national economic trends with respect to agriculture and mining activities.

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<sup>7/</sup> Tertiary sector included construction, wholesale and retail trade, transportation and public utilities, services, and government activities.



Although none of the occupational variables were significant in explaining the rate of growth in the agricultural or mining areas in the 1960's, one or more industrial variables were significant. The percentage of workers employed in wholesale and retail trade in 1960 was important in the agriculture analysis, and the percentages employed in manufacturing nondurable goods and in government were important in the mining analysis. — In addition, both analyses had a positive coefficient on the log of total population, indicating the larger agricultural and mining areas tended to have the higher rates of growth. Also, the regression coefficient on the log of distance to the nearest SMSA center was positive for agricultural and negative for mining areas. These results suggest that the larger agricultural areas located farther from the SMSA's and the larger mining areas located nearer the SMSA's had the higher rates of growth in the 1960's. Both the agricultural and the mining areas with the higher rates of growth tended to have the lower per capita incomes.

#### Average Per Capita Income

Examination of the regression results on the level of average per capita income in 1963 for the agricultural and mining areas indicated that different variables were important in each analysis. The most important variable for the agricultural areas was the rate of growth in the 1940's and for the mining areas it was median school years completed. The percentage of workers employed as managers (including farm managers) had a significant positive coefficient in the agricultural areas. The percentage of workers employed as operatives had a significant positive coefficient in the agricultural areas but it had a significant negative coefficient in the mining areas. The only significant industrial variables were the percentage of employees in durable goods manufacturing in the agricultural areas, and the percentage of employees in nondurable goods manufacturing in the mining areas.

The negative regression coefficients on the logs of total population and distance to the nearest SMSA center suggest the smaller agricultural areas nearer the SMSA's had the higher average per capita incomes. These same variables had positive coefficients for the mining areas, indicating the larger sized areas farther from the SMSA's had the higher per capita incomes.

#### Conclusions

The findings of this study imply that a number of factors affected the rate of population growth in the 1960's and the average per capita income in 1963 of the central place areas in Pennsylvania. A number of relationships affected the economic activity of the various areas. Some of the

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8/ Only the percentage of workers employed in durable and nondurable goods industries in 1960 ( $X_{19}$  and  $X_{20}$  in the appendix) were used as the independent manufacturing variables for the regression analyses on the natural resource based areas.

more important conclusions are:

- (1) Two commonly used measures of economic activity -- rate of population growth in the 1960's and level of average per capita income in 1963 -- are quite different measures of a community's economic performance. Areas with the higher rates of population growth tend to have lower average per capita incomes.
- (2) The higher rates of population growth in the 1960's occurred in the smaller rural areas located near but outside the SMSA's.
- (3) The most important variable in explaining population growth in the 1960's tended to be the rate of growth in the 1940's.
- (4) The manufacturing employment base in 1960 and the changes in manufacturing employment from 1960 to 1966 were important explanatory variables. The higher rates of growth were found in those areas with a high percentage of workers in durable and nondurable goods manufacturing in 1960. Also, those areas with the higher rates of population growth had higher rates of employment growth in the low-wage nondurable goods industries from 1960 to 1966. Conversely, lower rates of growth were associated with higher rates of employment growth in the high-wage durable goods manufacturing from 1960 to 1966.
- (5) Among the areas with central places under 25,000 population, the smaller rural manufacturing areas located greater distances from the SMSA's had higher average per capita incomes.
- (6) The percentage of workers in durable and nondurable goods manufacturing appeared to have an important positive effect on the level of average per capita income in the areas with central places under 25,000 population. However, the rate of growth in the 1950's was the most consistently significant variable in explaining the variation in per capita income.
- (7) The areas oriented to agriculture tended to be scattered throughout Pennsylvania and had positive annual rates of growth from 1940 to 1970. The higher rates of growth in the 1960's were in the larger areas located farther from the SMSA's. Conversely, the higher average per capita incomes were in the smaller areas located nearer the SMSA's.
- (8) The mining oriented areas tended to be spatially concentrated in the Northeastern and West Central parts of the State and had negative annual rates of growth from 1940 to 1970. The higher rates of growth in the 1960's were in the larger areas located nearer the SMSA's. The higher average per capita incomes tended to be in the larger areas located farther from the SMSA's.
- (9) Both measures of economic activity investigated in this study -- rate of population growth and per capita income -- indicated that many of the smaller rural areas in Pennsylvania are viable economic entities.



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Appendix. List of variables used to measure economic activity of the  
central place areas in Pennsylvania

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Variable

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Dependent variables

Y<sub>1</sub> = Percentage change in total central place area population, 1960-1970

Y<sub>2</sub> = Average per capita personal income in 1963

Independent variables

X<sub>1</sub> = Median school years completed, 1960

X<sub>2</sub> = Median income of families, 1960

X<sub>3</sub> = Average per capita personal income, 1963

X<sub>4</sub> = Log of total central place area population, 1960

X<sub>5</sub> = Log of distance to nearest SMSA central city in miles

X<sub>6</sub> = Percentage change in total central place area population, 1940-1950

X<sub>7</sub> = Percentage change in total central place area population, 1950-1960

X<sub>8</sub> = Percentage employed as professional workers, 1960

X<sub>9</sub> = Percentage employed as managers, 1960

X<sub>10</sub> = Percentage employed as clerical workers, 1960

X<sub>11</sub> = Percentage employed as sales workers, 1960

X<sub>12</sub> = Percentage employed as craftsmen, 1960

X<sub>13</sub> = Percentage employed as operatives, 1960

X<sub>14</sub> = Percentage employed as household and service workers, 1960

X<sub>15</sub> = Percentage employed as laborers, 1960

X<sub>16</sub> = Percentage employed in agriculture, 1960

X<sub>17</sub> = Percentage employed in mining, 1960

X<sub>18</sub> = Percentage employed in construction, 1960

X<sub>19</sub> = Percentage employed in manufacturing durable goods, 1960

X<sub>20</sub> = Percentage employed in manufacturing nondurable goods, 1960

X<sub>21</sub> = Percentage employed in transportation and public utilities, 1960

X<sub>22</sub> = Percentage employed in wholesale and retail trade, 1960

X<sub>23</sub> = Percentage employed in services (finance, insurance, services  
and real estate), 1960

Appendix. Continued.

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X<sub>24</sub> = Percentage employed in government, 1960

X<sub>25</sub> = Density of central place (population per square mile), 1960

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X<sub>26</sub> = Change in furniture and fixture and lumber and wood products employment, 1960-1966

X<sub>27</sub> = Change in metal industries employment, 1960-1966

X<sub>28</sub> = Change in machinery industries employment, 1960-1966

X<sub>29</sub> = Change in transportation equipment industries employment, 1960-1966

X<sub>30</sub> = Change in other durable goods industries employment, 1960-1966

X<sub>31</sub> = Change in food and kindred products industries employment, 1960-1966

X<sub>32</sub> = Change in textile and apparel products industries employment, 1960-1966

X<sub>33</sub> = Change in printing and publishing industries employment, 1960-1966

X<sub>34</sub> = Change in other nondurable goods industries employment, 1960-1966

X<sub>35</sub> = Percentage change in manufacturing durable goods industries employment, 1960-1966

X<sub>36</sub> = Percentage change in manufacturing nondurable goods industries employment, 1960-1966

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