AN ANALYSIS OF LINKAGES BETWEEN THE MANUFACTURING
AND AGRICULTURAL SECTORS IN VIRGINIA

by

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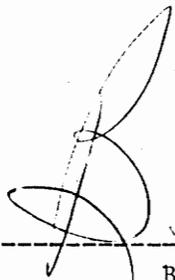in partial fulfillment of the requirements for the degree of
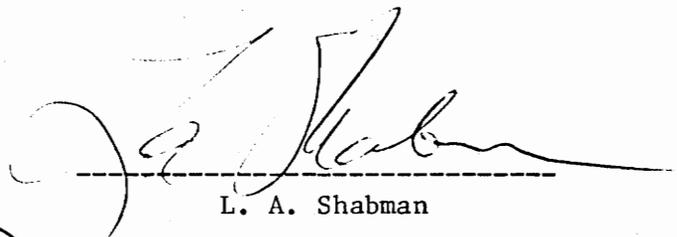
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CHAPTER I

INTRODUCTION

Over the past quarter century Virginia has experienced a great
deal of economic change in both the manufacturing and agricultural
sectors. In the manufacturing sector, the trend toward dispersion of
manufacturing plants to rural areas has continued and intensified.
Virginia's Division of Industrial Development indicates: "The new
manufacturing facilities of the sixties have been more widely dis-
tributed among the geographic areas of the state and between rural
and urban areas than during the past, with over two-thirds of the
new manufacturing jobs created in Virginia since 1966 being located
in non-metropolitan areas."[1] As has been true of the whole southeast-
ern region of the country, Virginia's manufacturing employment has
grown at a faster rate than the U.S. average. During the period
from 1950 through 1974, the number of manufacturing employees in
Virginia increased by 57 percent while the country as a whole ex-
perienced only a 31 percent increase.[2]

During this same period there was a continuation of the state-
wide trends in agriculture which have prevailed for some time. The

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[1] Ben A. Vorhies, Manufacturing in Virginia (Richmond, Va.:
Division of Industrial Development, 1970), p. 9.

[2] Economic Report of the President (Washington, D.C.: U.S.
Government Printing Office, February, 1975).

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number of farms and farm families decreased by more than 50 percent
while average farm size increased from 103 to 173 acres. At the
same time, the total acreage of land in agricultural use declined by
38 percent from 15,572,295 to 9,601,092 acres.[3]

While the farm population declined, agricultural productivity
increased. A better balanced mix of crop and livestock production
has been adopted which helped to improve farm income. There has
been a trend toward farm ownership and away from tenancy as well as
a widespread shift from labor to capital intensive methods of pro-
duction.[4] Yet, in spite of such pervasive changes in the structure
of the agricultural sector and the size of the farm population, mea-
sures which may be considered indicators of well-being such as edu-
cational levels, housing conditions, income and percent of families
with incomes below the poverty level show rural families to be at a
relative disadvantage when compared to the urban population of the
state.

In the face of declining agricultural employment and persis-
tent rural-urban migration, government at all levels has sought to
improve employment opportunities in rural areas by attracting manu-
facturing firms as a partial solution for the problems of those
areas. Many communities have welcomed and even subsidized manufac-
turing plants only to discover to their dismay, however, that the
distribution of benefits is not necessarily in favor of the original

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[3] Sada L. Clarke, The Changing Face of Fifth District Agricul-
ture (Richmond, Va.: Federal Reserve Bank of Richmond, 1973), pp.
12-14.

[4] Ibid., pp. 1-2.

community residents. In fact, several studies have indicated that inmigration related to manufacturing employment may result in a relative income disadvantage for the original residents.[5] That is, the original residents' incomes may remain unchanged while the costs of land, housing, and taxes, and the wealth of their neighbors increases. "This suggests that the people who bear the cost of the development (by increased taxes for land development, for example) may not be the same people who will capture the benefits, and in fact they may find themselves in a worse relative position after development than before."[6] Thus, while it is clear that change has been taking place in Virginia's manufacturing and agricultural sectors and that the farm population lags behind other groups on various measures of well-being, the impact of the dispersion of manufacturing plants on agriculture and the farm population have not been fully investigated.

Problem Statement

Information is available describing the changes in Virginia's manufacturing employment both in number of employees and in the trend toward metropolitan location. Information is also available detailing the changes in Virginia's agricultural sector. At the present time, both the increase of rural employment opportunities

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[5] Gene F. Summers, et al., Industrial Invasion of Nonmetropolitan America: A Quarter Century of Experience (New York: Praeger, 1976), pp. 69-70.

[6] Ibid., pp. 69-70.

through industrial development and the preservation of a viable agricultural sector are sought in Virginia. However, there is lack of information regarding the interrelationships between the manufacturing and agricultural sectors in rural areas and, therefore, the tradeoffs between those above two goals are not clearly defined. This study will seek to begin filling this information gap by asking the question: "What is the relationship between change in manufacturing employment and changes in the structure of the agricultural sector and employment and incomes of farm families in Virginia?"

Objectives

The general objective of this study will be to determine the relationships between changes in the magnitude of manufacturing sector employment and changes in the allocation of land, labor and capital and income levels in the agricultural sector of nonmetropolitan areas of Virginia.

The specific objectives of the study in terms of agricultural sector changes are:

1. To determine how changes in the magnitude of manufacturing sector employment are related to changes in the allocation of agricultural sector labor resources, including the changes in: the level of agricultural employment, the level of employment of farm women, the level of off-farm employment of farm operators, the employment of farm residents in agriculture and manufacturing, and farm population size.

2. To determine how changes in manufacturing sector em-
ployment are related to changes in the magnitude and
mix of farm land use in cropland and woodland, the
distribution of the total land area between farm and
nonfarm usage, and changes in the number of farms,
their average size and their distribution among farm
size groupings.

3. To determine how changes in manufacturing sector em-
ployment are related to changes in the level of in-
vestment in agricultural capital goods, including
changes in the value of land and buildings, machinery
and equipment, and changes in the number of farm
operators who are full or part owners.

4. To determine how changes in manufacturing sector
employment are related to changes in the levels of
farm family income.

The fulfillment of these objectives should provide information which
will improve decision making relative to the tradeoffs between rural
industrialization and agricultural preservation.

Content of the Study

In the following chapter, past studies of the relationships
between the agricultural and manufacturing sectors will be review-
ed. Special emphasis will be placed on the conceptual basis and
empirical work relating to the allocation of farm labor resources
together with adjustments in the use of capital and land resources

in rural areas. The implications of this conceptual and literature review will be utilized to develop the study's hypotheses. In Chapter III, the procedures, methodology, and data to be utilized in the analysis will be presented and discussed. A detailed partial correlation analysis of selected time-series variables relating manufacturing and agricultural changes across all counties in Virginia will be presented in Chapter IV. This analysis will be interpreted in terms of the hypotheses posed in Chapter II. In Chapter V, the analysis will be utilized in a case study approach to examine in detail the agricultural-manufacturing sectors' interrelationships in a selected multi-county area in Virginia--the Piedmont Planning District No. 14. The final chapter will include a summary of the study, its conclusions, and implications for further research.

CHAPTER II

A REVIEW OF PREVIOUS STUDIES AND THE
DEVELOPMENT OF A CONCEPTUAL FRAMEWORK

Introduction

In this chapter, the literature relating to rural and regional
development in general will be reviewed and discussed first. An ef-
fort will be made to select the most pertinent works rather than to
provide a comprehensive review of the available literature. Fol-
lowing the development of the theoretical foundation for this study
the literature related to the interaction of agriculture and manu-
facturing through markets and the allocation of resources within
the agricultural sector will be reviewed and discussed.

Rural Development Theory

The word "rural" has been defined in a number of different
ways for a number of different purposes - as has the term "rural de-
velopment." This study does not seek to construct a precise struc-
tural definition of rural areas, but designates as "rural" those
areas with several common functional characteristics. These char-
acteristics as developed by Marshall[1] include: (1) the dependence

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[1] Ray Marshall, Rural Workers in Rural Labor Markets (Salt Lake
City, Utah: Olympus, 1974), pp. 16-18.

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on informal, rather than formal social relationships; (2) labor mar-
kets which are less structured and which offer fewer employment al-
ternatives than do those in urban areas; (3) a population which is
relatively disadvantaged in terms of education, skills, health, age,
housing, and incomes; and (4) an economy which is highly dependent
on agriculture. From this perspective, rural development may be
"loosely defined" as the change from a society with primarily rural
characteristics to one with increasingly urban aspects, generally
through the introduction of manufacturing or other industrial ac-
tivity with its concommitant economic and social impacts.

In his seminal work on rural economic development, Schultz
hypothesized that:

1. Economic development occurs in a specific loca-
   tional matrix; there may be one or more such ma-
   trices in a particular economy. This means that
   the process of economic development does not neces-
   sarily occur in the same way, at the same time, or
   at the same rate in different locations.

2. These locational matrices are primarily industrial-
   urban in composition; as centers in which economic
   development occurs, they are not mainly out in rural
   or farming areas although some farming areas are
   situated more favorably than are others in relation
   to such centers.

3. The existing economic organization works best at
or near the center or a particular matrix of eco-
nomic development and it also works best in those
parts of agriculture which are situated favorably
in relation to such a center; and it works less
satisfactorily in those parts of agriculture which
are situated at the periphery of such a matrix.[2]

In addition, Schultz suggests that disparities in per capita
income between communities have been increasing over time and that
standards of living are increasing most rapidly in those communities
which are favorably located in relation to an industrial-urban ma-
trix.[3]

Since Schultz laid this theoretical foundation for the study
of regional development in the early 1950's, several researchers
have sought to test his locational hypothesis of regional growth.
In their cooperative effort to test related sub-hypotheses, Nicholls
and Tang undertook a comparison of rural counties in Tennessee,
Georgia, and South Carolina.[4] One of the three major hypotheses
which they tested and which their findings supported was "that the

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[2] Theodore W. Schultz, The Economic Organization of Agricul-
ture (New York: McGraw Hill, 1953), p. 147.

[3] Ibid., pp. 156-162.

[4] William H. Nicholls, "Industrialization, Factor Markets, and
Agricultural Development," Journal of Political Economy, Vol. LXIX,
No. 4 (1961), pp. 319-340 and Anthony M. Tang, Economic Development
in the Southern Piedmont 1860-1950 (Chapel Hill, N.C.: University
of North Carolina Press, 1958).

labor, capital, and product markets facing agriculture are relatively more efficient in local areas which have enjoyed considerable industrial-urban development that in similar nearby areas which have not."[5]

Bryant, analyzing changes across the United States, argued that the effects of influxes of industrial capital on local agriculture are more important than the effects of increased factor market efficiency in raising agricultural incomes.[6] Regardless of which effect is most important, there appears to be general agreement that industrial-urban development results in agricultural reorganization and an increase in the agricultural capital/labor ratio.

There have been many case studies of the impact of new industry on rural communities across America. Recently, Summers and others completed an attempt to synthesize a major part of this body of literature. Among the factors which they found to be associated with non-metropolitan industrial development are: (1) population growth and increased concentration; (2) preferential hiring of the white, younger and better educated workers; and (3) straining of local government resources. They conclude that, "The pattern of population growth and residential location associated with industrial development in non-metropolitan areas is

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[5]William H. Nicholls, op. cit., p. 320.

[6]W. Keith Bryant, "Industrial-Urbanization and the Spatial Distribution of Income in Agriculture," Income Distribution Analysis (Raleigh: North Carolina State University, 1966), p. 149.

certain to exacerbate the taxation of agricultural land and further weaken the economic viability of farm enterprises."[7]

Nicholls, Tang, and Bryant have based their conclusions about the effect of industrialization on a model of rural development, which is based on considerations of Pareto efficiency, Summers, on the other hand, has analyzed the differential impacts of rural development on various aspects of society and has tackled some of the issues involved in income redistribution. The difference in their approaches and conclusions about rural industrialization can be traced to their underlying assumptions. This disparity points out the need for a broader approach to the study and evaluation of rural industrialization which will encompass both efficiency and distributional considerations.

With this theoretical orientation as a basis, the following portions of the review of literature and conceptual framework will focus on factor markets and their changes related to the creation of manufacturing employment in rural areas. The effects on both market efficiency and income distribution will be discussed.

Labor Resource Allocation

In this section, the allocation of rural labor resources will be considered based on both the review of previous studies and the use of illustrative empirical data for Virginia. The characteristics of the

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[7]Gene F. Summers, et al., Industrial Invasion of Non-metropolitan America: A Quarter Century of Experience (New York: Praeger, 1976), p. 6.

rural labor force will be considered first, followed by a discussion of
rural labor markets and their manufacturing and agricultural components.

The Rural Labor Force

The "civilian labor force" was defined by the Bureau of the Census
in 1967 to include persons 16 years old and older, who are employed or
actively seeking employment; a change from the previous definition of
the "civilian labor force" being comprised of persons 14 years of age
and over. Under the present definition, the data on employment of the
civilian labor force include both employed and unemployed persons, but
exclude students, housewives, and retired persons. A larger proportion
of Virginia's rural farm women than rural nonfarm women (68 percent
versus 61 percent) are not included in the labor force as presently de-
fined--it is generally observable that rural farm women often may be
considered "unpaid farm workers." In addition, based on the same pre-
mise, it is probable that a higher proportion of rural farm youths than
nonfarm youths may be "unpaid farm workers." As a result of the omis-
sion of housewives (farm women) and students (farm youth) from the enu-
meration of the civilian labor force, the actual level of agricultural
employment may be significantly underestimated by the data available.

The rural labor force consists of persons, both farm and nonfarm
residents, who are employed (or unemployed) workers in either urban or
rural locations. While there are no doubt crossovers between rural and
urban residence and rural and urban employment, this study will be
mainly concerned with that portion of the rural labor force residing on
farms and working on farms or in manufacturing, or both. Whether the

farm population or the farm labor force (employed and unemployed farm residents) is considered, either one is a small proportion of the rural nonfarm category. In Table II-1, the relative sizes in 1970 of the rural nonfarm and farm populations and labor forces is shown.

Within the rural labor force, there are a number of characteristics which differentiate between farm and nonfarm residents.[8] One of the most obvious differences is in educational levels. Farm residents trailed urban and rural nonfarm residents in terms of median years of schooling in 1970 with 8.9 median years of education compared to the State median of 11.7 years for the population 25 years of age and older.[9] The lowest level of schooling attained was that of black males residing on farms--6.3 median years of schooling.[10] The gap between white and black educational levels in rural areas does not appear to be closing.[11]

The relation of education level attained to migration out of agriculture has been explored by a number of authors.[12] In a study of migration in Virginia, Serow and Spar found that the highest rate of

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[8] Gene F. Summers, et al., op. cit.

[9] U.S. Bureau of the Census, Census of Population: 1970, General Social and Economic Characteristics, Final Report PC(1)-C48 (Washington, D.C.: U.S. Government Printing Office, 1972).

[10] Ibid.

[11] Ibid.

[12] Lianos suggests that those who have decided to leave may prepare for nonfarm occupations by obtaining more education and not vice versa. See: Theodore P. Oianos, Labor Mobility From Agriculture: Review of the Evidence (Raleigh, N.C.: North Carolina State University Press, January 1975), p. 19.

Table II-1. Virginia's Rural Farm and Rural Nonfarm Population and
            Labor Force, 1970.[a]

Population Category	Number in Population	Number in Labor Force
Rural Farm	267,283	101,431
Rural Nonfarm	1,450,057	547,706
Total Rural	1,717,340	649,137
Rural Farm as a Percentage of Rural Nonfarm	18.5%	18.5%

[a]U.S. Bureau of the Census, Census of Population: 1970, General Social and Economic Characteristics, Final Report PC(1)-C48 (Washington, D.C.: U.S. Government Printing Office, 1972).

migration from rural areas was among recent high school graduates.[13] In

spite of the continued residential and occupational migration away from

farms, the most important source of employment for farm residents is

still agricultural, although manufacturing of both durable and nondur-

able goods is running a close second as a source of employment. Services

and wholesale and retail trade are the other two major sources of employ-

ment.

Rural Labor Markets

Rural labor markets have typically shown evidence of labor sur-

pluses. In rural areas of Virginia, the 1970 Population Census showed

that the rate of unemployment (3.44 percent) was higher than the rate

in urban areas (2.67 percent).[14] At the same time the rate of labor

force participation was lower in rural areas than in urban areas as

shown in Table II-2. The rates of labor force participation for farm

and nonfarm residents, both male and female, were lower than for their

urban counterparts. These statistics appear to indicate the persistence

of a rural labor surplus in spite of the massive rural-urban migration

which has taken place. Indeed the fact that the labor force participa-

tion rates for male and female farm residents are the lowest of the

three population categories may indicate that an equilibrium still has

not been reached. Nixon and Musser contend that the unemployment rate

for the rural Southeast grossly understates the true unemployment

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[13]William J. Serow and Michael A. Spar, Virginia's Population: A
Decade of Change (Charlottesville, Va.: University of Virginia, January
1974), p. 42.

[14]U.S. Bureau of the Census, op. cit.

Table II-2. Virginia's Labor Force Participation Rates by Urban,
            Rural Nonfarm, and Rural Farm Population Categories,
            1970.[a]

Population Category	Percent of Population 16 Years and Over in the Labor Force	
	Male	Female
Urban	82.0	44.8
Rural Nonfarm	73.4	39.1
Rural Farm	72.8	32.2

[a]William J. Serow and Michael A. Spar, Virginia's Population:
A Decade of Change (Charlottesville, Va.: University of Virginia,
January, 1974), p. 42.

picture due to the pervasiveness of part-time and seasonal employment in agriculture.[15]

As compared to urban labor markets, rural labor markets are less structured. Information sources are diffuse and often poorly coordinated. Unions are seldom present and employee benefits such as workman's compensation and unemployment insurance are often lacking. In addition, there are fewer employment alternatives than in urban areas and most of them are relatively low-wage.[16] As a result, rural labor markets may be conceived of as relatively less efficient with more persistent barriers to equilibrium adjustments than urban markets. The existence of manufacturing employment opportunities for alternative employment in rural areas may serve to integrate rural and urban-industrial labor markets.

Manufacturing Labor Markets

Virginia tends to have a diverse manufacturing base even though the production of nondurable goods predominates. Increasing diversity is illustrated by the fact that the five mose important industries in 1950--textiles, chemicals, lumber, apparel and furniture have experienced a decline in employment share, while plastics, machinery and electrical equipment have made rapid gains in their share of total employment. Since 1950, Virginia's share of all U.S. manufacturing

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[15]John W. Nixon and Wesley Musser, Rural Manpower Situations and Needs in the Southeast (Athens, Ga.: University of Georgia, 1974), pp. 26-34.

[16]Ray Marshall, op. cit., p. 17.

employment has increased and within the State the trend has been toward a more equal distribution of jobs between urban and rural areas. Since 1966, 66 percent of the new manufacturing jobs have been located in non-metropolitan areas.[17]

Wage rates in Virginia's manufacturing industries are generally 25 to 15 percent less than the national average. The absence of unions and the presence of surplus labor in rural areas appear to contribute to this situation.[18] In addition, the relatively low educational and skill levels of the workers may be contributing factors.

In rural areas, manufacturing employees, on average, tend to be younger, better educated, and more highly skilled than the local population as a whole. The labor pool from which new manufacturing industry hires tends to include not only residents of the immediate locality, but also residents of surrounding counties and former out-migrants who return to the region.[19] Because of the relatively elastic supply of labor for manufacturing employment, firms can often fill their labor requirements without alleviating the unemployment problems of a locality's disadvantaged and minority groups.[20] Several studies concerned with the

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[17]Ben A. Vorhies, Manufacturing in Virginia (Richmond, Va.: Division of Industrial Development, 1970), p. 9.

[18]Ibid., p. 7.

[19]U.S. Department of Agriculture, Economic Research Service, Migrant Response to Industrialization in Four Rural Areas, 1965-70 (Washington, D.C.: U.S. Government Printing Office, September 1974).

[20]John M. Peterson, "Effects of Rural Industrialization on Labor Demand and Employment," Rural Industrialization: Problems and Potentials (Ames, Iowa: Iowa State University Press, 1974), p. 112.

exclusion of blacks from employment in rural manufacturing are discussed by Summers, with the general conclusion that blacks are not employed in proportion to their share of the population.[21]

Agricultural Labor Markets

The agriculture labor market has been historically characterized by increasing labor productivity and net outmigration of the farm population. This trend, while appearing to have slowed, persists in the 1970's. The disequilibrium in the labor market results largely from technological change which improved the productivity of agricultural inputs coupled with the relatively inelastic demand for agricultural products. This has led to a decreased demand for agricultural labor inputs. According to neoclassical economic theory, the flow of labor from agriculture should continue until the wage rate of a unit of labor in agriculture is equal to that of the same unit in alternative uses.

Agricultural labor markets have a number of aspects which serve to limit labor mobility, including a lack of generally available information regarding employment alternatives. Where residential as well as occupational mobility is required for employment, there are both direct and psychic costs of movement. Income expectations, which are influenced by the unemployment rate in nonfarm occupations affect the decision to migrate as indicated by a decreased rate of outmigration during periods of high unemployment in the nonfarm sectors. In addition, farm owners allocate their labor on the basis of their expected returns

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[21]Gene F. Summers, et al., op. cit., pp. 51-53.

from both labor and capital, so that employment alternatives are not the only factor affecting farm labor mobility.[22]

In regard to farm operators, Nixon and Musser foresee an adjustment problem in the future due to concentration of the remaining labor in older age categories.[23] Presently, it is not clear whether the number of younger people entering the farm operator labor pool will increase. In addition, the supply of hired farm labor at traditional wages is much less than the quantity sought by farm operators. The increase in wage rates required to hire farm laborers is causing many farm operators to reorganize their production systems or substitute capital for labor.

Linkages Between Agricultural and Manufacturing Labor Markets

Neoclassical economic theory leads to the assumption that the existence of alternatives to agricultural employment for farm residents creates an interaction between manufacturing and agricultural labor markets in which the marginal values of labor in both sectors are equated. The interaction of a manufacturing labor market with a higher wage rate and an agricultural labor market with a lower wage rate would result in an equilibrium wage rate if there were a flow of labor out of the agricultural labor market to the manufacturing labor market assuming that the two labor markets remain separate. This is the basis of the proposition that the improved efficiency of markets created by the existence

[22]Theodore P. Lianos, op. cit., pp. 6-16.

[23]John W. Nixon and Wesley Musser, op. cit., pp. 8-15.

of an industrial-urban development matrix will increase the mobility of factors of production between alternative uses and enable farm labor to move rapidly toward income maximization.

Lianos makes the point, however, that the flow of labor between the farm and nonfarm sectors is not symmetrical, due to differences in the requirements for entry into the two labor markets. Labor movements into agriculture are unhindered while those into manufacturing are affected by unions, skill levels, and educational standards, and discrimination against minority groups.[24]

A number of previous studies indicated that the percent of the population which is non-white will be positively associated with imperfections in the interaction of the agricultural and manufacturing labor pools so that in areas with a relatively high percentage of non-white farm population, median farm family income and labor productivity may remain relatively low.[25]

In regard to the effect of industrial-urban development on the efficiency of labor markets, Nicholls says: "...local industrialization increases the actual or imputed cost of the human agent in agriculture toward . . . the prevailing level of nonfarm wages, in turn forcing those who remain in agriculture to reorganize their farms to raise labor productivity enough to cover the high labor cost."[26] According to the

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[24]Theodore P. Lianos, op. cit., pp. 6-7.

[25]Gene F. Summers, et al., op. cit., p. 69 and Ray Marshall, op. cit., pp. 74-76.

[26]William H. Nicholls, op. cit., p. 337.

results of Nicholls' research, this farm reorganization takes two forms:
(1) the conversion of unprofitably small farms to part-time farms and
(2) the expansion of larger farms with an accompanying decrease in labor
intensity of production.[27] These results are supported by another study
which found that average farm size and gross farm sales were inversely
related to the number of days worked off the farm by farm operators.
Not only did those operators with lower farm incomes work off the farm
a greater percentage of the time, but two-thirds of the farm operators
indicated a desire for full-time nonfarm employment.[28]

Changes in Agricultural Production and Organization

The major trends in agriculture over the last century have resulted
from changes in agricultural technology and rising national income coup-
led with a greater income elasticity of demand for industrial than agri-
cultural goods. In addition, there have been higher population repro-
duction rates in rural than in urban areas.[29] Over the past fifty years,
the relocation of manufacturing firms and the establishment of new firms
in rural areas has occurred at an increasing rate. This influx of manu-
facturing has both resulted from agricultural trends and accelerated
them.[30] The overall pattern of change from this interaction may be

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[27]Ibid.

[28]R. J. Hanson and R. G. F. Spitze, "Farm Size Characteristics Af-
fecting Off-Farm Earnings of Illinois Farmers," Illinois Agricultural
Economics, Vol. XIV, No. 1 (1974), p. 29.

[29]Stephen L. McDonald, "Farm Outmigration As An Integrative Adjust-
ment to Economic Growth," Social Forces, Vol. XXXIV, No. 2 (1955), p. 123.

[30]Gene F. Summers, et al., op. cit., p. 18.

outlined as shown in Figure II-1. Within this pattern of agricultural
sector change lies the the adjustments of individual farms and farm
families to maximize income through occupational mobility have been
previously discussed. For those remaining in agriculture, whether
they are full or part-time farm operators, there are characteristic ad-
justments made in their farm operations.

In response to the outmigration of agricultural labor, and espe-
cially to rising agricultural wage rates where other employment alterna-
tives exist, farmers have tended to shift to less labor intensive enter-
prises. In one study it was found that the main shift in production was
from cotton, tobacco, and truck crops to soybeans, pasture, and hay.[31]
Similar changes which have occurred in Virginia from 1950 to 1970 are
shown in Table II-3, in terms of harvested acres of selected crops.

With the change in relative costs of capital and labor, adjustments
are also made which substitute capital for labor. The growth in capital
investment in Virginia's agricultural sector which is discussed in the
next section is consistent with the reorganization of land holdings to
attain the greatest possible economies of scale. This has resulted in
increasing average farm size for commercial farms.[32]

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[31]Joe A. Martin, Off-Farm Migration: Some of Its Characteristics
and Effects Upon Agriculture in Weakley County, Tennessee (Knoxville,
Tennessee: University of Tennessee, 1958), p. 33.

[32]Sada L. Clarke, The Changing Face of Fifth District Agriculture
(Richmond, Va.: Federal Reserve Bank of Richmond, 1973), pp. 13-14.
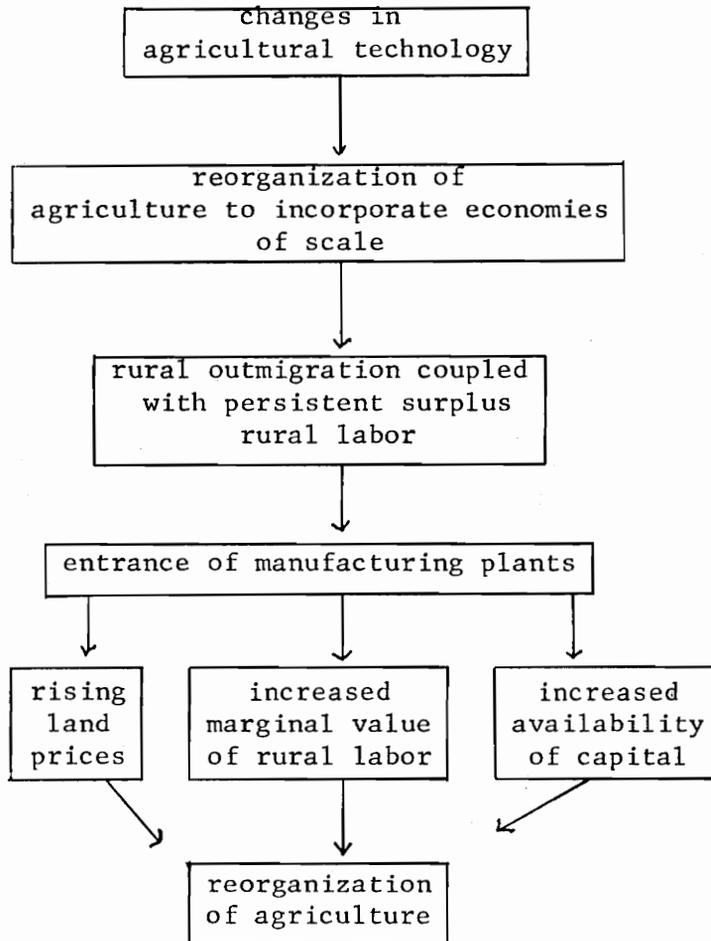
Figure II-1. A Schematic Depiction of the Forces Acting to Change the Organization of Agricultural Production in the Southeast.

Table II-3. Changes in Acres Harvested of Selected Crops in Virginia, 1950-1970.[a]

	Number of Acres Harvested			Change in Acres Harvested, 1950-1970
	1950	1960	1970	
Corn	899,000	627,000	458,000	-49%
Cotton	18,000	15,500	4,300	-76%
Hay	1,350,000	1,204,000	1,054,000	-22%
Soybeans (for beans)	152,000	320,000	339,000	+123%
Tobacco	118,800	89,300	68,300	-43%

[a]U.S. Department of Agriculture, Agricultural Statistics, 1975 (Washington, D.C.: U.S. Government Printing Office, 1975).

Capital Resource Allocation

Among the durable production inputs classified as capital, land
has the highest total value in Virginia's agriculture. Between 1970
and 1974, the average value per acre of farmland and buildings across
the State almost doubled, rising from $286 to $528 per acre. Total value
of land and buildings in the State reached about 4 billion dollars in
1974.[33] The proportion of farm operators who are full or part owners of
the land they work has increased greatly because of a greater decline in
tenancy than the overall rate of decline in farm operators. In the
portion of his study devoted to capital markets, Tang found that the
rate of decline in tenancy was greatest in those counties with the
highest level of industrial-urban development.[34] Thus, the influx of
capital associated with manufacturing may serve to increase agricultural
investment. The changing pattern of farm ownership and average value of
land and buildings per acre in Virginia is shown in Table II-4 for the
1950-1974 time period.

While the total value of land forms the largest part of agricul-
tural investment, the rate of growth in the total value of capital in-
vestment is greatest for farm machinery and equipment.[35] The average
value of machinery and equipment per farm in 1974 was $12,700 with a
total value for the state of about 700 million dollars. The growth in

[33]Virginia Cooperative Crop Reporting Service, Virginia Agricul-
tural Statistics, Bulletin No. 40 (Richmond, Va., State of Virginia,
1975), p. 57.

[34]Anthony M. Tang, op. cit., p. 137.

[35]Sada L. Clarke, op. cit., p. 81.

Table II-4. Change in the Average Value of Farm Land and Buildings and Farm Ownership Characteristics in Virginia, 1950-1974.[a]

Year	Average Value of Land & Buildings Per Acre ($)	Number of Tenants	Percent of Tenants	Number of Part-Owners	Percent of Total	Number of Full Owners	Percent of Total	Total Number of Farm Operators
1950	82	25,879	17	16,209	11	108,338	72	150,997
1954	106	23,557	17	18,545	14	93,783	69	136,416
1959	139	14,395	15	17,556	18	65,137	67	97,623
1964	183	11,044	14	17,019	21	51,734	64	80,354
1969	286	5,409	8	12,886	20	46,277	72	64,572
1974	528	4,104	7	11,910	21	39,657	71	55,581

[a]Virginia Cooperative Crop Reporting Service, Virginia Agricultural Statistics, Bulletin No. 40 (Richmond, Va.: State of Virginia, 1975), p. 57.

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investment in machinery and equipment may be an indication of the con-
tinued substitution of capital for labor linked to changes in the agri-
cultural labor market.

Levels of farm indebtedness have also increased greatly. The level
of farm real estate indebtedness in 1974 was 487 million dollars. Clarke
suggests that farm operators with off-farm income may have an advantage
over others in obtaining credit.[36] This seems to be a logical interpre-
tation, however, Hanson and Spitze found an inverse relationship be-
tween total farm assets and off-farm income in thier study of Illinois
farmers.[37]

In relation to capital markets, Nicholls and Tang both found that
the rate of local industrial-urban development was positively associated
with the local rate of capital formation in agriculture and the rate of
investment in local agricultural land.[38] Nicholls attributes the posi-
tive changes in agricultural investment and income to increased capital
market efficiency resulting from the influx of non-agricultural capital
to an area and the accompanying increase in personal incomes, savings
and loanable resources of local banking institutions. This greater
availability of capital benefits agriculture through the facilitation

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[36]Ibid.

[37]R. J. Hanson and R. G. F. Spitze, op. cit., p. 28.

[38]Anthony M. Tang, op. cit., p. 145.

of land improvement, increases in scale of farming operations, and the transition to more capital intensive and profitable enterprises.[39]

Land Resource Allocation

Based on neoclassical economic theory, the introduction of alternative uses for land in formerly isolated agricultural areas should lead to changes in the quantity of land in agricultural use. Price adjustments would occur until the marginal values of land in alternative uses are equated. Scott and Summers indicate from their study of the initial impact of a steel mill in Illinois that land for the industrial site is generally purchased for an amount greater than its agricultural use value. Some of the displaced farmers reinvest their money in nearby farmland, thus, driving up the price of farmland.[40] If the introduction of a manufacturing plant creates a demand for new residences for inmigrants, there will be additional upward preseure on the price of land. Since new plants in rural areas generally stimulate population growth, the demand for industrial and residential sites will increase and the proportion of land area in agricultural use will decrease.[41]

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[39] William H. Nicholls, op. cit., p. 32.

[40] John T. Scott, Jr. and Gene F. Summers, Problems and Challenges Faced by Rural Communities With Industrial Development (Madison, Wisc.: University of Wisconsin, 1972), p. 97-102.

[41] Gene F. Summers, et al., op. cit., pp. 21-23.

Farm Family Income
Distribution and Composition

Farm family income in the broadest sense consists of the returns to related household members from the labor and capital resources which they own and control. The returns to labor may be drawn from farm or nonfarm sources, be paid to the farm operator, spouse, or children, and include the value of food produced and processed for home consumption. Returns to farm family owned capital may include dividends, interest and capital gains (especially from the sale of land). See Figure II-2 for an outline of typical income sources of farm families.

While the effect of a given amount of nonfarm income on a family may be the same regardless of who earns it, the change in median farm family income in an area accompanying a change in the level of manufacturing employment may differ depending on the sex of the majority of employees. Since firms which manufacture durable goods, requiring higher skill levels and paying higher wages, are generally associated with the employment of males, many of whom may be new inmigrants, their direct contribution to farm family incomes may be negligible.

Industries, on the other hand which hire males with lower skill levels may lead to increased farm family incomes and be strongly associated with part-time farming operations. In the case of either a high or low wage industry which hires primarily male labor there is also likely to be an increase in farm family income resulting from population growth and the associated demand for land, goods, and services.[42] The

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[42]_Ibid._, pp. 62-70.

CASH SALE
RECEIPTS

HOME
CONSUMPTION

HOUSING VALUE

INVENTORY
CHANGE

MACHINERY
CUSTOM RETURNS —————→ FARM
EARNINGS

FARM RENTAL
INCOME

GOVERNMENT
PAYMENTS

LABOR EARNINGS
FROM STATE FARM

RECREATIONAL
INCOME

TOTAL FARM
FAMILY
INCOME

OFF-FARM
EARNINGS

WAGES AND
SALARIES

NONFARM
BUSINESS
INCOME

LABOR EARNINGS
FROM FARM
CUSTOM WORK

RENTAL INCOME

INTEREST

DIVIDENDS

PENSIONS

ROYALTIES

TRUSTS

MISCELLANEOUS

Source: Robert G. F. Spitze and Ronald J. Hanson, "Part-Time Farm-
         ing as a Part of Rural Development Concepts and Findings,"
         in Rural Community and Regional Development: Perspectives
         and Prospects (Urbana-Champaign, Illinois: University of
         Illinois, 1974), p. 34.

Figure II-2. A Schematic Outline of Sources of Total Farm Family
              Income.

employment of females, which tends to be concentrated in lower wage, nondurable manufacturing industries, is unlikely to be accompanied by population growth from inmigration. One study has indicated that the employment of rural women may slow the rate of outmigration and lead to a higher rate of unemployment for males.[43] In general, the level of median farm family incomes may be expected to increase given the impact of new manufacturing employment.

The percentage of all farms which are part-time farms (those with sales under $2,500 and an operator with 100 or more days of off-farm employment yearly) has been increasing. The change in Virginia from 1950 to 1974 has been from 14 to 45 percent of all farms.[44] This development appears to reflect the efforts of farm families to maximize income by employing their excess labor off the farm. The decision to maintain dual employment may be influenced by the farmers' perceptions of the variability in their potential nonfarm and farm incomes. Total family income may be maximized in the long run by combining variable nonfarm income with low but stable farm income.[45]

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[43]John T. Scott, Jr., and Gene F. Summers, op. cit., p. 103.

[44]U.S. Bureau of the Census, Census of Agriculture (Washington, D.C.: U.S. Government Printing Office, 1950, 1954, 1959, 1964, 1969, 1974).

[45]Charles E. Bishop, "Economic Development and Adjustments in Southeastern Low Income Agriculture," Journal of Farm Economics, Vol. XXXVI, No. 5 (December, 1954), p. 1151.

In the United States as a whole, nonfarm income had reached 53 percent of average total farm family income in 1971.[46] In their study of Illinois farmers, Hanson and Spitze found that when farms were grouped by level of total farm sales, total off-farm income and net farm income were inversely related.[47] While families with the highest net farm incomes and the highest average total family incomes had the lowest average off-farm incomes, those off-farm sources still accounted for almost one-fourth of their total income.[48] A contradictory suggestion was made by Scott and Chen based on linear programming simulation that opportunities for off-farm employment will result in a redistribution of income away from larger and toward smaller farms.[49]

Using the percent of population which is nonfarm as an index of urban-industrial development, Ruttan found that the income level of farm families is positively related to the level of urban-industrial development.[50] Ruttan concluded that the availability of off-farm employment is the major means through which the benefits of urban-industrial development are transmitted to farm families. The next most important

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[46]U.S. Department of Agriculture, Economic Research Service, Farm Income Situation (Washington, D.C.: U.S. Government Printing Office, July, 1974), p. 43.

[47]R. J. Hanson and R. G. F. Spitz, op. cit., pp. 27-28.

[48]Ibid.

[49]John T. Scott, Jr., and C. T. Chen, "Expected Changes in Farm Organization when Industry Moves into a Rural Area," Illinois Agricultural Economics (January, 1973), pp. 41-46.

[50]Vernon W. Ruttan, "The Impact of Urban-Industrial Development on Agriculture in the Tennessee Valley and the Southeast," Journal of Farm Economics, Vol. XXXVII, No. 1 (February, 1955), pp. 38-56.

positive effect on farm family incomes resulted from the improved efficiency of capital markets and a relatively minor effect resulted from the improvements in product and input (other than labor) markets.[51]

In a national study designed to explain why in a country with relatively efficient trade and transportation, income differentials between state economic areas "not only persist but show increasing disparity," Sisler examined five possible causes of unequal growth in income between communities:

1. The differential impact of the technological advancement on production functions,

2. Impediments to factor adjustments, especially imperfect knowledge and barriers to resource mobility,

3. Secular drifts in commodity prices placing some communities at a disadvantage,

4. Communities unequally endowed with natural or human resources, and

5. Income differentials that are the result of differing rates of development of the urban-industrial sector.[52]

While Sisler's study showed that the first four factors have a role in creating income disparities, he concluded that the fifth factor is of critical importance in the South in explaining the level of farm income.[53]

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[51]Ibid.

[52]Daniel G. Sisler, "Impact of Urban-Industrial Development on Agriculture," Journal of Farm Economics, Vol. XLI, No. 5 (December, 1959), p. 1101.

[53]Ibid.

Summary and Implications

There is general agreement in the literature that there has been a trend toward increasing disparities in per capita income between areas as some experience economic development and others stagnate. Both Nicholls and Tang found historical evidence of this in their studies.[54] Schultz attributed these income disparities in part to the relative proportion of the population which is unproductive, the amount of productivity increasing investment in human capital, the degree of specialization of labor and the availability of opportunities for continuous employment.[55]

Even in a county which experiences a relatively high degree of industrial-urban development, there may be an uneven distribution of income between groups of farm residents depending on their relative ability to participate in the labor market. People who are black, retired, or extremely poor are unlikely to have increased incomes.[56] From the studies which he reviewed, Marshall clearly documents the disproportionate share of blacks in underemployment and poverty.[57]

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[54]William H. Nicholls, op. cit., p. 327 and Anthony M. Tang, op. cit., p. 69.

[55]Theodore W. Schultz, op. cit., pp. 163-168.

[56]Gene F. Summers, et al., op. cit., p. 69.

[57]Ray Marshall, op. cit., pp. 74-76.

Hypotheses of the Study

The implications from the preceding literature review and conceptual discussion as they relate to the objectives of this study lead to the formulation of the following hypotheses:

1. The levels of manufacturing and agricultural employment are inversely related.

    There are several closely related subhypotheses:

    a. The level of employment of farm women increases as opportunities for manufacturing employment increase.

    b. The levels of off-farm employment for both commercial and farm operators as a whole increase as manufacturing employment increases.

    c. As manufacturing employment increases in an area there is a shift in the employment of farm residents from the agricultural to the manufacturing sector.

    d. The farm population size declines as the level of manufacturing employment increases.

    e. The percent of total employment in agriculture decreases as the percent of total employment in manufacturing increases.

2. As the level of manufacturing employment increases:

    a. the number of farms decreases;

    b. average farm size increases;

    c. the percent of all farms which are part-time (noncommercial) increases;

d.   the percent of land area which is devoted to nonfarm
     usage increases;

e.   the mix of acreage between cropland and woodland will
     shift toward increased cropland; and

f.   the distribution of farms among size groupings will shift
     toward larger farm units.

3. As the level of manufacturing employment increases:

a.   the average value of land and buildings per farm in-
     creases;

b.   the average value of farm land and buildings per acre
     increases;

c.   the total value of machinery and equipment increases;
     and

d.   the percent of farm operators who are tenants declines.

4. As the level of manufacturing employment increases, the level
    of median farm family income increases. This relationship
    will be affected by the percent of the farm population who
    are white which will be positively correlated with the level
    of farm family income.

CHAPTER III

ANALYTIC PROCEDURES AND METHODOLOGY

Introduction

The analysis of the relationships between Virginia's agricultural
and manufacturing sectors involved a number of choices--among possible
data sets, methods of control of variance, statistical analysis tech-
niques, and methods of testing hypotheses. This chapter includes
sections on the choice of geographical units of analysis for purposes
of consistency over time and control of extraneous variables, the choice
of the data set and variables and the application of partial correlation
analysis to the problem.

Geographic Units of Analysis

The laws governing annexation of county land by independent cities
in Virginia have allowed drastic changes in governmental unit boundaries
over time. Indeed, several cities and counties have disappeared alto-
gether as administrative, political and geographic entities. To insure
that the data used in this study pertain to the same land area over time,
data for Virginia's independent cities will be aggregated with data for
the county continguous to each city to establish a data set for the 100

geographical units listed in Appendix A.[1] Since the boundaries of the

listed geographical units have been relatively stable over time, this

aggregation minimizes the effects of changes in Virginia's governmental

unit boundaries which tend to distort most time series measures of

economic and demographic change. These aggregated units are shown in

Figure III-1.

Virginia covers a variety of types of terrain ranging from moun-

tainous areas typical of Appalachia, rough hilly country of the Central

Piedmont area, and the plains of the Eastern Seacoast area. This vari-

ation in terrain is associated with various types of agriculture pre-

valent in each area which are affected by changes in agricultural

parameters which are not common to the State as a whole. To control

for the effects of changes in or on individual types of agricultural

production, the State was divided into six agricultural productivity

regions on the basis of the volume of production per acre of the major

types of agricultural products in 1974. Since these regions are based

on production in 1974 the boundaries may not be the same as they would

be if 1950 or any other year were used as the base year. A list of the

geographic units contained in each of these regions and the criteria

used in grouping the geographic units are given in Appendix B. In ad-

dition to controlling for product specific agricultural change, the

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[1]These 100 geographic units closely correspond to those used in
a previous M.S. Thesis: Richard A. March, "An Analysis of Alternative
Multivariate Measures of Economic Growth and Development Applied to
Virginia Counties and Independent Cities," (Unpublished M.S. Thesis,
Virginia Polytechnic Institute and State University, Blacksburg, Vir-
ginia, May, 1976).

Figure III-1. Geographic Units of Analysis for Virginia Formed by the Aggregation
of Counties with Independent Cities.   .

regions provide a means of examining differential impacts of change in manufacturing employment in various types of agricultural production areas. The agricultural productivity regions are depicted in Figure III-2. There is no correspondence between any combination of these regions and the "urban-rural regions" discussed next.

The rural development theory on which this study is based includes the premise that agriculture is affected in a number of ways by its proximity to an urban center, therefore, the geographical units were also aggregated into "Urban," "Semi-urban" and "Rural" regions. These regions were designated by the Rural Affairs Study Commission of Virginia on the basis of the presence or absence and size of an urban center.[2] In Figure III-3, the geographic units comprising these three regions are shown and a complete listing of the units by region appears in Appendix C. The rural-urban grouping of counties has the drawback of being a static measure of a changing situation. Since the grouping was devised in 1971 by the Rural Affairs Study Commission, many urban changes have occurred in Virginia which would affect the groupings based on their criteria.

Data Set for the Analysis

Both time-series and cross-sectional data for Virginia geographical units will be used in the analysis of this study. The time period covered will be the 25 year period from 1950 to 1974. The data will be

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[2]Rural Affairs Study Commission, A Report to the Governor and the General Assembly of the Commonwealth of Virginia (Richmond, Va.: Commonwealth of Virginia, 1971), pp. 37-38.
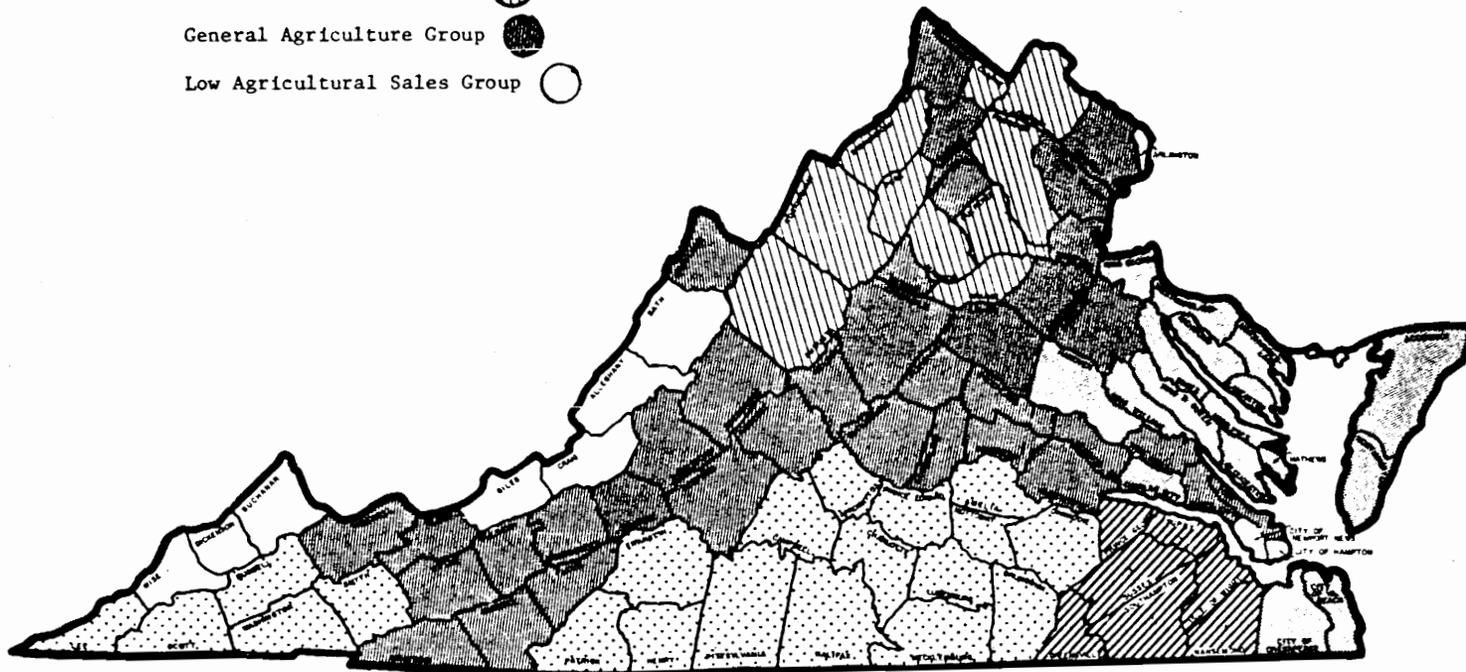
Figure III-2. Agricultural Productivity Regions in Virginia Representing Major
Types of Agricultural Production in 1974.

Figure III-3. Urban, Semi-urban, and Rural Regions in Virginia as Delineated by the Rural Affairs Study Commission of Virginia.

compiled from the United States Censuses of Agriculture, Manufactures and Population. The variables compiled for the analysis include demographic information (such as population, race and sex), information as to the sector of employment of various population subgroups, farm family income statistics, and agricultural characteristics relating to land use, farm size, and capital investment. A complete list of these variables is contained in Table III-1. In addition, a list of "transformed variables" (variables computed for the analysis from the original variable set) is also included in Table III-1. A total of 46 variables were tabulated and formed into a "Data Bank for Virginia Counties and Independent Cities"--the list of these variables is presented in Appendix D.

Statistical Methodology

The statistical methodology to be utilized to test the hypotheses of this study is that of "partial correlation analysis," Correlation analysis is based on least squares estimation of a linear relationship between data points. It is used to determine the degree of a relationship as well as its form. It is well suited to a situation where an effort is being made to identify major variables for further use in developing a predictive model.

The correlation coefficient (r) estimates the spread of points about the linear least squares equation or in other words the "goodness of fit" of the linear regression equation. The formula for the computation of a correlation coefficient is as follows:[3]

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[3]Hubert M. Blalock, Jr., Social Statistics, 2nd Edition (New York: McGraw Hill, 1972), p. 378.

Table III-1. The Variables Compiled and Computed for the Analysis of the Interrelationships Between Manufacturing and Agricultural Sector Changes in Virginia.

Variable	Variable Acronym	Data Years	Data Source
1. Total Area Population Employed in Agriculture	TOAGEM	1950, 1960, 1970	U.S. Census of Population
2. Total Area Employment in Manufacturing[a]	EMPMFG	1954, 1958, 1963, 1967, 1972	U.S. Census of Manufactures
3. Total Area Population Employed in Manufacturing[a]	TOTMFG	1950, 1960, 1970	U.S. Census of Population
4. Area Population Per Square Mile	POPDEN	1950, 1960, 1970	U.S. Census of Population
5. Total Area Population Employed	EMPLOY	1950, 1960, 1970	U.S. Census of Population
6. Percent of Total Area Population Employed Who are Employed in Manufacturing	PERMFG	1950, 1960, 1970	TOTMFG/EMPLOY
7. Percent of Total Area Population Employed Who are Employed in Agriculture[b]	PEAGEM	1950, 1960, 1970	TOAGEM/EMPLOY
8. Percent of Total Area Population Employed Who are Employed in Non-agricultural and Non-manufacturing (other) activities[b]	PEROEM	1950, 1960, 1970	1-PEAGEM-PERMFG
9. Area Female Farm Residents, over 14 or 16, Employed[c]	FFPEM	1950, 1960, 1970	U.S. Census of Population
10. Total Area Female Farm Residents, over 14 or 16[c]	FEFAP	1950, 1960, 1970	U.S. Census of Population
11. Percent of Female Farm Residents Employed[b]	PERFEM	1950, 1960, 1970	FFPEM/FEFAP
12. Total Area Population	TOTPOP	1950, 1960, 1970	U.S. Census of Population
13. Area Rural Farm Population	RFPOP	1950, 1960, 1970	U.S. Census of Population
14. Percent of Total Area Population Classified as Rural Farm Population[b]	PERFPO	1950, 1960, 1970	RFPOP/TOTPOP
15. Area White Farm Population	WFPOP	1950, 1960, 1970	U.S. Census of Population

[a]The distinction between variable 2 and 3 is that of "source versus residence"--the U.S. Census of Manufactures reports employment (variable 2) based on its geographic location (source) regardless of the geographic residence of the employees; whereas the U.S. Census of Population reports employment (variable 3) based on the geographic location of the residence of the employee (residence) regardless of the geographic location of the source of employment.

[b]This variable was computed from variables compiled from Census sources. In addition to the footnoted variables, these include variables 36-66, inclusively. Refer to Appendix D for the meaning of some of the acronyms not shown in this table.

[c]In 1950, the U.S. Population Census' definition of the labor force included persons aged 14 years and over; in 1960 and 1970, this definition was changed to include persons aged 16 years and over.

Table III-1 -- Continued.

Variable	Variable Acronym	Data Years	Data Source
16. Percent of Total Area Farm Population Classified as White[b]	PERWFP	1950, 1960, 1970	WFPOP/RFPOP
17. Area Median Rural Farm Family Income	MFFINC	1959, 1969	U.S. Census of Population
18. Area Rural Farm Residents With Less than Poverty Level Income	FAREPO	1969	U.S. Census of Population
19. Area Rural Farm Population Employed in Manufacturing	FMFGEM	1960, 1970	U.S. Census of Population
20. Area Farm Operators Reporting an Occupation Other than Farming or Working 100 or More Days Off-farm	OCCOTH	1950, 1954, 1959, 1964, 1969, 1974	U.S. Census of Agriculture
21. Area Commercial Farm Operators Reporting Off-farm Income[b]	COMOFI	1950, 1959, 1964, 1969, 1974	U.S. Census of Agriculture
22. Total Area Farm Operators	TOTFOP	1950, 1954, 1959, 1964, 1969, 1974	U.S. Census of Agriculture
23. Total Area Noncommercial Farms	NONCOM	1950, 1954, 1959, 1964, 1969, 1974	U.S. Census of Agriculture
24. Percent of Commercial Farm Operators Reporting Off-farm Income[b,d]	PEROFI	1950, 1974	COMOFI/(TOTFOP-NONCOM)
25. Area Average Value of Land and Buildings Per Farm	AVLBF	1950, 1954, 1959 1964, 1969, 1974	U.S. Census of Agriculture
26. Area Average Value of Land and Buildings Per Acre	AVLBA	1950, 1954, 1959, 1964, 1969, 1974	U.S. Census of Agriculture
27. Area Acres of Harvested Cropland	ACHCRP	1950, 1954, 1959, 1964, 1969, 1974	U.S. Census of Agriculture
28. Area Acres of Woodland and Woodland Pasture	ACWOOD	1950, 1954, 1959, 1964, 1969, 1974	U.S. Census of Agriculture
29. Total Area Farm Population Employed	TOTFEM	1950, 1960, 1970	U.S. Census of Population

[b] This variable was computed from variables compiled from Census sources. In addition to the footnoted variables, these include variables 36-66, inclusively. Refer to Appendix D for the meaning of some of the acronyms not shown in this table.

[d] In this computation, "Total Area Noncommercial Farms" (NONCOM) is used as a proxy measure of the "number of noncommercial farm operators."

Table III-1 -- Continued.

Variable	Variable Acronym	Data Years	Data Source
30. Percent of Area Farm Population Employed Who are Employed in Manufacturing[b]	PERFAM	1960, 1970	FMFGEM/TOTFEM
31. Total Area Farm Population Employed in Agriculture	FAGEMP	1950, 1960, 1970	U.S. Census of Population
32. Total Area Number of Farms	FARMS	1950, 1954, 1959, 1964, 1969, 1974	U.S. Census of Agriculture
33. Area Average Farm Size	AVFSIZ	1950, 1954, 1959, 1964, 1969, 1974	U.S. Census of Agriculture
34. Percent of Total Area Acreage in Nonfarm Use	NONFAR	1950, 1954, 1959, 1964, 1969, 1974	U.S. Census of Agriculture
35. Area Value of Farm Machinery and Equipment (thous. $)	VME	1969, 1974	U.S. Census of Agriculture
36. Change in Manufacturing Employment as a Percent of Total Employment	MEMCNG	1950 to 1970	PERMFG70 - PERMFG50
37. Percent Change in Manufacturing Employment	MFGCNG	1950 to 1970	(TOTMFG70 - TOTMFG50)/ TOTMFG50
38. Change in Agricultural Employment as a Percent of Total Employment	AGEMCNG	1950 to 1970	PEAGEM70 - PEAGEM50
39. Percent Change in Agricultural Employment	CNGAG	1950 to 1970	(TOAGEM70 - TOAGEM50)/ TOAGEM50
40. Change in Other Employment as a Percent of Total Employment	OEMCNG	1950 to 1970	PEROEM70 - PEROEM50
41. Change in the Percent of Female Farm Residents Employed	FFEMCNG	1950 to 1970	PERFEM70 - PERFEM50
42. Percent Change in Manufacturing Employment of Farm Residents	FMFGCNG	1960 to 1970	(FMFGEM70 - FMFGEM60)/ FMFGEM60
43. Change in Manufacturing Employment as a Percent of Total Employment of Farm Residents	FAMACNG	1960 to 1970	PERFAM70 - PERFAM60
44. Percent Change in Population Per Square Mile	DENSCNG	1950 to 1970	(POPDEN70 - POPDEN50)/ POPDEN50
45. Change in Agricultural Employment as a Percent of Total Employment of Farm Residents	FAEMCNG	1960 to 1970	FAGEMP70/TOTFEM70 - FAGEMP60/TOTFEM60

[b]This variable was computed from variables compiled from Census sources. In addition to the footnoted variables, these include variables 36-66, inclusively. Refer to Appendix D for the meaning of some of the acronyms not shown in this table.

Table III-1 -- Continued.

Variable	Variable Acronym	Data Years	Data Source
46. Percent Change in Agricultural Employment of Farm Residents	FAGCNG	1960 to 1970	(FAGEMP70 - FAGEMP60/ FAGEMP60
47. Percent Change in Median Rural Farm Family Income	MFFICNG	1959 to 1969	(MFFINC69 - MFFINC59/ MFFINC59
48. Percent Change in Rural Farm Population	RFPCNG	1950 to 1970	(RFPOP70 - RFPOP50/ RFPOP50
49. Changes in Whites as a Percent of Rural Farm Population	WFPCNG	1950 to 1970	PERWFP70 - PERWFP50
50. Percent Change in the Number of Farms	FARMCNG	1950 to 1974	(FARMS74 - FARMS50)/ FARMS50
51. Percent Change in Average Farm Size	AFSCNG	1950 to 1974	(AVSIZ74 - AVFSIZ50)/ AVFSIZ50
52. Change in Percent of Total Area in Nonfarm Use	NFARCNG	1950 to 1970	NONFAR74 - NONFAR50
53. Percent Change in the Total Value of Farm Machinery and Equipment	VMECNG	1969 to 1974	(VME74 - VME69)/VME69
54. Change in Percent of Farm Operators Who are Tenants	CGPERTN	1950 to 1974	FOPTEN74/TOTFOP74 - FOPTEN50/TOTFOP50
55. Change in Percent of Farms Which are Noncommercial	NCOMCNG	1950 to 1974	NONCOM74/FARMS74 - NONCOM50/FARMS50
56. Change in Percent of Farm Operators Reporting an Occupation Other than Farming or Working Off-farm 100 or More Days	OCOTCNG	1950 to 1974	OCCOTH74/TOTFOP74 - OCCOTH50/TOTFOP50
57. Change in Percent of Commercial Farm Operators With Off-farm Income	COFICNG	1950 to 1974	PEROFI74 - PEROFI50
58. Percent Change in the Average Value of Farm Land and Buildings Per Farm	AVLBFCG	1950 to 1974	(AVLBF74 - AVLBF50)/ AVLBF50
59. Percent Change in the Average Value of Farm Land and Buildings Per Acre	AVLBACG	1950 to 1974	(AVLBA74 - AVLBA50)/ AVLBA50
60. Percent Change in Acres of Cropland Harvested	HCRPCNG	1950 to 1974	(ACHCRP74 - ACHCRP50)/ ACHCRP50
61. Percent Change in Acres of Woodland and Woodland Pasture	AWODCNG	1950 to 1974	(ACWOOD74 - ACWOOD50/ ACWOOD50

Table III-1 -- Continued.

Variable	Variable Acronym	Data Years	Data Source
62. Change in the Percent of Area Farms Under 10 Acres	PCU10	1950 to 1974	PERU1074 - PERU1050
63. Change in the Percent of Area Farms From 10 to 49 Acres	PCA10	1950 to 1974	PERA1074 - PERA1050
64. Change in the Percent of Area Farms From 50 to 179 Acres	PCA50	1950 to 1974	PERA5074 - PERA5050
65. Change in the Percent of Area Farms From 180 to 499 Acres	PCA180	1950 to 1974	PEA18074 - PEA18050
66. Change in the Percent of Area Farms Over 500 Acres	PCA500	1950 to 1974	PEA50074 - PEA50050

$$r = \frac{\Sigma (X-\overline{X})(Y-\overline{Y})}{\sqrt{[\Sigma(X-\overline{X})^2][\Sigma(Y-\overline{Y})^2]}} = \frac{\Sigma xy}{\sqrt{(\Sigma x^2)(\Sigma y^2)}}$$

where: $x = X-\overline{X}$

$y = Y-\overline{Y}$

The formula for the correlation coefficient shows that r is a ratio of

the covariation of X and Y to the product of the variation in X and in

Y. The correlation coefficient is sensitive to extreme values and is

best used with relatively homogeneous groupings of data. The correla-

tion coefficient's relation to the regression equation may be seen in the

formula[4] given for two variables X_1 and X_2:

$$r_{12} = b_{12} \, (S_1/S_2) \, .$$

The coefficient is shown to be a function of the slope of the regression

equation and the ratio of the standard deviations. Using this formula

then it is possible to construct the regression equation for two varia-

bles if their means, standard deviations and correlation coefficient are

known. Since partial correlation and multiple regression are related in

the same way, the same basic formula also holds for them. For the case

of first order partial correlation with X_1, X_2 and X_3 as the variables

the formula for the regression coefficient for X_2 for the equation:

$$[X_1 = \alpha + b_{12.3} \, X_2 + b_{13.2} \, X_3]$$

is given by:[5]

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[4]Ibid., p. 384.

[5]J. Johnson, Econometric Methods, 2nd Edition (New York: McGraw
Hill, 1972), p. 63.

$$\left[b_{12.3} = r_{12.3} \; \frac{s_{1.3}}{s_{2.3}} \right]$$

Partial correlation analysis is similar to simple correlation with the added capacity of controlling variance. The effect of controlling for a variable is the same as the effect achieved if all cases in a sample were forced to have the same value for that variable, thus eliminating all variation in the study variables associated with the control variable. An example may help to clarify this type of analysis. The zero order correlation matrix for the percent change in manufacturing (FMFGCNG) and the percent change in agricultural employment of farm residents (FACCNG) and the percent change in rural farm population (RFPCNG) is shown below:

	FMFGCNG	FACCNG	RFPCNG
FMFGCNG	1.0000	.4689	.8007
FAGCNG	.4689	1.000	.5124
RFPCNG	.8007	.5124	1.000

Each of these variables exhibits a positive correlation with the others. Using only simple correlation both FAGCNG and RFPCNG might be included in a predictive model for changes in FMFGCNG. However, when partial correlation analysis is applied to the problem the coefficient for FMFGCNG with FAGCNG controlling for RFPCNG is found to be .1139. Thus it becomes apparent that essentially all of the correlation between FAGCNG and RFPCNG is the same as the correlation between RFPCNG and FMFGCNG so that only the variable with the stronger partial correlation coefficient (RFPCNG) need be retained in the model.

Change in the agricultural sector may be influenced by a number of independent variables such as the urban unemployment rate, international exchange rates, the development of new technology and a myriad of other possible factors. In this study, only one of the possible independent variables, "manufacturing employment," will be utilized for detailed examination of its relationship to various aspects of change in the agricultural sector. Scattergrams relating manufacturing employment change to variables from the agricultural sector[6] indicate that the assumption of linear relationships requisite for correlation analysis holds for the data. While manufacturing employment may not be the major determinant of agricultural change it is somewhat responsive to regional policy and control, in contrast to most other variables which are national in scope. The problem thus defined is to determine which of the dependent variables describing agricultural change are affected by manufacturing employment change and to what degree.

Summary

To achieve consistency within the data set Virginia's counties and independent cities will be aggregated into geographical units with relatively stable boundaries. The data for these units covering the period from 1950 to 1974 will then be analyzed within the context of two sub-regional grouping systems, one consisting of "Urban," "Semi-urban" and

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[6]Scattergrams for variable relationships covered in this study are available in unpublished form in the Department of Agricultural Economics, Virginia Polytechnic Institute and State University, Blacksburg, Virginia.

"Rural" regions depending on the presence and size of a population center
and the other consisting of six agricultural regions based on the rela-
tive productivity of major agricultural products. The method of analysis
chosen is partial correlation analysis since it is well suited to the
problem of identifying related variables and indicating the strength and
direction of that relationship.

CHAPTER IV

AN ANALYSIS OF THE LINKAGES BETWEEN MANUFACTURING AND AGRICULTURAL ACTIVITIES IN VIRGINIA, 1950-1974

Introduction

In this chapter, the hypotheses of the study are restated, fol-
lowed by a statement of the procedure and variables to be used in test-
ing each hypothesis and the findings corresponding to each hypothesis
tested are presented and discussed. The analysis will be presented in
four major sections centering on changes in: (1) the employment of labor
resources; (2) the use of land resources; (3) agricultural capital in-
vestment; and (4) the economic and social characteristics of farm resi-
dents. The analytic findings will be drawn together in a summary sec-
tion.

Changes in the Employment of Labor

In this section, the relationships and changes in the allocation
of labor between manufacturing and agriculture will be considered.
Labor allocation and its changes will be described, first, on the basis
of total employment in each sector; second, on the basis of sectoral em-
ployment of farm residents; and, third, for employment of farm women and
farm operators.

Total Employment

Two hypotheses will be tested relative to total employment change
between the two economic sectors under consideration. The first hypoth-
esis is: "The levels of manufacturing and agricultural employment are
inversely related." This hypothesis will be tested by the correlation
of two different sets of variables. First, total agricultural employment
(TOAGEM) will be correlated with total manufacturing employment (TOTMFG)
for the years 1950, 1960, and 1970 controlling for the level of popula-
tion density (POPDEN).

In the analysis population density was found, with one or two ex-
ceptions, to be positively correlated with both total agricultural em-
ployment and total manufacturing employment. This indicates that as
population density increases, the level of both manufacturing and agri-
cultural employment increases. The main exception to this generaliza-
tion was found in the "Urban" region where population density and agri-
cultural employment are negatively correlated.

When total manufacturing and total agricultural employment are cor-
related, controlling for their mutual correlation with population density,
a positive partial correlation coefficient is found for all regions and
all time periods as reported in Table IV-1, with the exception of the
"Low Agricultural Sales" agricultural subregion. In this region, there
are both "Appalachian counties" and "metropolitan areas". The inclusion
of the highly urbanized geographical units may be producing the negative
correlation. Considering the State as a whole and most of the sub-
regions, the degree of the positive relationship between the levels of

Table IV-1. Percentage Changes in and Partial Correlation Coefficients for Changes in Employment in the Manufacturing and Agricultural Sectors of Virginia by Subregions, 1950-1970.

Variables	All Counties	Agricultural Regions						Urban-Rural Regions		
		General Agriculture	Low Agricultural Sales	Tobacco	Peanut	Livestock and Corn	Soybean and Corn	Urban	Semi-Urban	Rural
		------------------------------ Percentage Changes ------------------------								
Change in the percent share of manufacturing employment (MEMCNG), 1950-70	.07	.05	.07	.16	.09	.08	.02	.02	.07	.10
Percent change in manufacturing employment (MFGCNG), 1950-70	.97	1.10	.96	1.20	.59	1.08	.50	1.88	.75	.85
Change in the percent share of agricultural employment (AGEMCNG), 1950-70	-.19	-.18	-.11	-.27	-.23	-.21	-.13	-.08	-.18	-.23
Percent change in agricultural employment (CNGAG), 1950-70	-.62	-.60	-.54	-.74	-.66	-.57	-.54	-.34	-.66	-.66
Change in the percent share of other employment (OEMCNG), 1950-70	.12	.13	.03	.12	.15	.14	.11	.07	.11	.14

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Table IV-1 -- Continued.

Variables	All Counties	Agricultural Regions							Urban-Rural Regions		
		General Agriculture	Low Agricultural Sales	Tobacco	Peanut	Livestock and Corn	Soybean and Corn	Urban	Semi-Urban	Rural

-------------------------- Partial Correlation Coefficients ---------

Variables	All Counties	General Agriculture	Low Agricultural Sales	Tobacco	Peanut	Livestock and Corn	Soybean and Corn	Urban	Semi-Urban	Rural
Change in the percent share of manufacturing employment (MEMCNG) with change in the percent share of agricultural employment (AGEMCNG) controlled for change in population density[a]	-.6126	-.5119	-.6437	-.8489	-.7848	-.3789	.0461	-.5052	-.4503	-.6791
Percent change in manufacturing employment (MFGCNG) with percent change in agricultural employment (CNGAG) controlled for change in population density[a]	-.2142	-.4243	-.7794	.1452	-.0121	-.6322	.2245	-.0712	.1004	-.2578
Manufacturing employment (TOTMFG) with agricultural employment (TOAGEM) controlled for population density, 1950[a]	.2406	.2701	-.5138	.3248	.3542	.2872	.0698	.2050	.5467	.4352
Manufacturing employment (TOTMFG) with agricultural employment (TOAGEM) controlled for population density, 1960[a]	.2990	.3583	-.0962	.3547	.6599	.0708	.1215	.2194	.5589	.4598
Manufacturing employment (TOTMFG) with agricultural employment (TOAGEM) controlled for population density, 1970[a]	.4201	.2314	.3832	.6880	.9567	.1791	.0490	.3382	.6226	.3983

[a]The correlation coefficients analysis were controlled for by population density because population density was found to be moderately, positively correlated with both agricultural and manufacturing employment.

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Table IV-1 -- Continued.

Variables	All Counties	Agricultural Regions							Urban-Rural Regions		
		General Agriculture	Low Agriculture Sales	Tobacco	Peanut	Livestock and Corn	Soybean and Corn	Urban	Semi-Urban	Rural
		----------	------------------- Partial Correlation Coefficients ----------						------------------		
Percent of agricultural employment (PEAGEM) with percent of manufacturing employment (PERMFG) controlled for population density, 1950[a]	-.2069	-.1436	-.1339	-.3474	-.4111	-.5871	.1661	-.4465	-.0633	-.3732
Percent of agricultural employment (PEAGEM) with percent of manufacturing employment (PERMFG) controlled for population density, 1960	-.0767	-.1401	.2354	-.4354	.7688	-.6924	-.1780	-.3471	.4034	-.3006
Percent of agricultural employment (PEAGEM) with percent of manufacturing employment (PERMFG) controlled for population density, 1970	-.0108	-.0049	.1215	-.1030	-.2941	-.7159	-.1713	-.1213	-.0268	-.1147

[a]
The correlation coefficients analysis were controlled for by population density because population density was found to be moderately, positively correlated with both agricultural and manufacturing employment.

Source: U.S. Bureau of the Census, Census of Population, 1950 and 1970 (Washington, D.C.: U.S. Government Printing Office, 1952 and 1972).

manufacturing and agricultural employment exhibited an increasing trend over the 1950-1970 time period.

Second, in testing the hypothesis, the percent change in total agricultural employment (CNGAG) will be correlated with the percent change in total manufacturing employment (MFGCNG) for 1950 to 1970, controlling for the change in population density (DENSCNG) during this time period.

During 1950-1970, manufacturing employment increased in a range of from about 50 percent in regions dominated by commercial agriculture to a high of 188 percent in the "Urban" region. During the same time, agricultural employment decreased by an average of 62 percent state-wide with a higher rate of decrease in the "Semi-urban" and "Rural" regions than in the "Urban" region. The percent decrease in agricultural employment was greatest in the "Tobacco" agricultural region which also exhibited the greatest percent increase in manufacturing employment of all the agricultural regions.

The partial correlation coefficients between changes in manufacturing and agricultural employment were generally negative (Table IV-1), and although they were weak to moderate in strength, indicate a negative relationship between the percent change in both sectors' employment.

The findings indicate in a static cross-sectional analysis that manufacturing and agricultural employment levels are positively correlated. However, in contrast, over time the percentage changes in the employment levels of these two sectors are directly but negatively related. Examination of the percent changes in manufacturing and

agricultural employment shown in Table IV-1 indicates that the rate of change in the "Urban" region is quite different from the other regions. This may indicate the presence of a population density level effect which has not been controlled. However, the findings do support the hypothesis that "the levels of manufacturing and agricultural employment are inversely related" in terms of changes over time, but not for a given year.

The second hypothesis relating to total employment change is: The percent of total employment in agriculture decreases as the percent of total employment in manufacturing increases." First, this hypothesis will be tested by correlating the percentage share of manufacturing employment (PERMFG) with the percentage share of agricultural employment (PEAGEM) for 1950, 1960, and 1970 controlling for population density (POPDEN).

The partial correlation coefficients are moderately negative overall (Table IV-1), although weakly negative for the State as a whole. These findings imply that there is an inverse relationship between the percentage shares of manufacturing and agricultural employment.

As a second test of the hypothesis, the change in the percentage share of manufacturing employment (MEMCNG) will be correlated with the change in the percentage share of agricultural employment for 1950-60 and 1960-70 controlling for changes in population density (DENSCNG).

As shown in Table IV-1, during the study time period the employment share of manufacturing increased and the employment share of agriculture decreased in all of the regions. The share of agricultural employment,

however, declined three times as fast on the average as that of manufac-
turing and it declined more rapidly in the "Rural" than in the "Urban"
region.

Because the partial correlation coefficients for this test were
generally negative at moderate to strong levels, the implication is that
the degree of relationship between changes in the relative employment
shares of manufacturing and agriculture is greater than the degree of
relationship between the percentage shares themselves. The negative
signs of the partial correlation coefficients reveal a direct relation-
ship between the changes. Therefore, the greater the increase in the
percentage share of manufacturing employment, the greater the decrease
in the agricultural share. These findings support the hypothesis that
"the percent of total employment in agriculture decreases as the per-
cent of total employment in manufacturing increases."

Farm Residents' Employment

In considering farm residents' employment, it is hypothesized that:
"There is an inverse relationship between changes in the agricultural
and manufacturing employment of farm residents." For the first test of
this hypothesis, the change in the percent of employed farm residents
accounted for by manufacturing (FAMACNG) will be correlated with the
change in the percent of employed farm residents accounted for by agri-
culture (FAEMCNG) for the time period 1960-70.

The percent of farm residents employed in manufacturing has in-
creased in all areas of the State, but has increased more in rural than
in urban areas as shown in Table IV-2. At the same time, the percent of

farm residents employed in agriculture in the State declined by 16 per-
cent during the decade from 1960 to 1970. The simple correlation of
FAMACNG with FAEMCNG produced negative coefficients ranging from weak to
strong. The negative signs indicate a direct correspondence between de-
clining agricultural employment and increasing manufacturing employment
of farm residents.

As a second test of the hypothesis, the percent change in farm
residents' manufacturing employment (FMFGCNG) will be correlated with
the percent change in farm residents' agricultural employment (FAGCNG)
for 1960-70 controlling for the percent change in the farm population
(RFPCNG).

The share of farm residents manufacturing employment (FAMACNG) has
increased across all regions of the State, however, the levels of their
employment in manufacturing (FMFGCNG) show a broad range of change from
-10 percent to +42 percent during the 1960-70 time period (Table IV-2).
In the same period, farm residents' employment in agriculture declined
by an average of 60 percent. The partial correlation coefficients for
this relationship, from which the effects of declining farm population
on both measures have been eliminated, are generally weak and vary in
sign. It appears that the extreme variation in the percent change in
farm residents' manufacturing employment (FMFGCNG) between geographic
units results in an unclear relationship.

The findings of the analysis tend to support the hypothesis that
"an inverse relationship exists between changes in the agricultural and
manufacturing employment of farm residents". The relationship is

Table IV-2. Percentage Changes in and Partial Correlation Coefficients for Changes in Employment of Farm Residents and Farm Women in the Manufacturing and Agricultural Sectors of Virginia by Subregions, 1950-1970 and 1960-1970.

Variables	All Counties	Agricultural Regions						Urban-Rural Regions		
		General Agriculture	Low Agricultural Sales	Tobacco	Peanut	Livestock and Corn	Soybean and Corn	Urban	Semi-Urban	Rural
Percentage Changes										
Change in percent share of farm residents' manufacturing employment (FAMACNG), 1960-70	.05	.03	.08	.10	.06	.03	.03	.02	.05	.06
Change in percent share of farm residents' agricultural employment (FAEMCNG), 1960-70	-.16	-.16	-.15	-.21	-.24	-.13	-.12	-.19	-.18	-.14
Partial Correlation Coefficients										
Change in percent share of farm residents' manufacturing employment (FAMACNG) with change in percent share of farm residents' agricultural employment (FAEMCNG)	-.4352	-.3346	-.2035	-.2183	-.8150	-.6010	-.2027	-.4333	-.5769	-.4068
Percent Changes										
Percent change in farm residents' manufacturing employment (FMFGCNG), 1960-70	-.04	-.10	.42	.04	.00	-.22	-.08	.28	-.08	-.09
Percent change in farm residents' agricultural employment (FAGCNG), 1960-70	-.60	-.61	-.60	-.61	-.67	-.60	-.56	-.63	-.60	-.60

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Table IV-2 -- Continued.

Variables	All Counties	Agricultural Regions							Urban-Rural Regions		
		General Agriculture	Low Agricultural Sales	Tobacco	Peanut	Livestock and Corn	Soybean and Corn	Urban	Semi-Urban	Rural

-------- ------------------- Partial Correlation Coefficients --------- -------------------

Variables	All Counties	General Agriculture	Low Agricultural Sales	Tobacco	Peanut	Livestock and Corn	Soybean and Corn	Urban	Semi-Urban	Rural
Percent change in farm residents' manufacturing employment (FMFGCNG) with percent change in farm residents' agricultural employment (FAGCNG) controlled for farm population change[a]	.1139	.0565	-.0594	.4212	-.5890	-.4347	.1908	.2610	-.4225	.2221
Percent of manufacturing employment (PERMFG) with percent of farm women employed (PERFEM) controlled for population density and percent share of other employment, 1950[b]	.2799	.3785	----	.6478	.7733	-.3350	-.1971	.1861	.4158	.2046
Percent of manufacturing employment (PERMFG) with percent of farm women employed (PERFEM) controlled for population density and percent share of other employment, 1960[b]	.1392	.2883	----	.4158	.0981	-.1152	-.5028	.5093	.2332	.2321

[a]Rural farm population change has been used as a control variable to separate the portion of change in manufacturing employment of farm residents who remain in farming from those who relocate or cease farming.

[b]Population density has been used to control the variation due to heterogeneity within the subregions and percent share of other employment has been used to control variation due to employment change outside the scope of this study.

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Table IV-2 -- Continued.

Variables	All Counties	Agricultural Regions						Urban-Rural Regions		
		General Agriculture	Low Agricultural Sales	Tobacco	Peanut	Livestock and Corn	Soybean and Corn	Urban	Semi-Urban	Rural
				--- Partial Correlation Coefficients ---						
Percent of manufacturing employment (PERMFG) with percent of farm women employed (PERFEM) controlled for population density and percent share of other employment, 1970[b]	-.0252	.4001	----	.3750	-.2317	-.4243	-.1463	.1483	.0253	-.2161
Percent change in manufacturing employment (MFGCNG) with change in percent of female farm residents employed (FFEMCNG) controlled for change in percent share of other employment[a]	.0248	.2850	-.4744	.0404	-.3259	-.4106	-.1907	.0071	-.0232	.0077
				--- Percent Change ---						
Change in percent of female farm residents employed (FFEMCNG), 1950-70	.16	.16	.10	.15	.17	.17	.19	.18	.16	.15

[a]Rural farm population change has been used as a control variable to separate the portion of change in manufacturing employment of farm residents who remain in farming from those who relocated or cease farming.

[b]Population density has been used to control the variation due to heterogeneity within the subregions and percent share of other employment has been used to control variation due to employment change outside the scope of this study.

Source: U.S. Bureau of the Census, Census of Population, 1950, 1960 and 1970 (Washington, D.C.: U.S. Government Printing Office, 1952, 1962 and 1972).

supported by the negative correlation between the changes in shares of farm resident employment in agriculture and manufacturing. However, the relationship becomes clouded when percent changes in employment in these two categories are correlated--no consistent results emerged from the analysis. This may be attributable to the effects of differing base magnitudes in calculating the percentage changes.

Employment of Farm Women

Relative to the employment of farm women, it is hypothesized that: "The percent of farm women employed is directly related to the level of manufacturing employment." As a first test of this hypothesis, the percent of farm women employed (PERFEM) will be correlated with manufacturing as a percentage of total employment (PERMFG) for the years 1950, 1960, and 1970 controlling for population density (POPDEN) and other employment as a percent of total employment (PEROEM).

The partial correlation coefficients reported in Table IV-2 indicate a direct positive relationship between percent of farm women employed and percent of manufacturing employment, however, the coefficients are weak and somewhat inconsistent.

As a second test of the hypothesis, the change in the percent of female farm residents employed (FFEMCNG) will be correlated with the percent change in manufacturing employment (MFGCNG) for the period 1950-70 controlled by the change in the percent of other employment (OEMCNG).

The percent of employed farm women appears to have increased to a greater extent in the "Urban" than in the "Rural" region and increased by an average of 16 percent across the State during 1950-1970. Since

the partial correlation coefficients between the two variables analyzed
are weak and vary in sign they do not help to illuminate the relation-
ship. Perhaps, changes in other employment (OEMCNG) would better ex-
plain changes in the employment of farm women.

The findings tend to support the hypothesis that "the percent of
farm women employed is directly related to the level of manufacturing
employment." The hypothesis was supported by the static cross-sectional
analysis of the State which resulted in positive correlation coefficients
between the two variables. However, the time series analysis which ex-
amined changes in the two variables produced inconclusive correlation
results.

Farm Operators' Employment

In considering off-farm employment of farm operators, the first
hypothesis is that" "Change in the off-farm employment of farm operators
is directly related to change in manufacturing employment levels." To
test this hypothesis, the change in the percent of farm operators working
off their farm at least 100 days (OCOTCNG) will be correlated with the
percent change in manufacturing employment (MFGCNG) for the period 1950-
1974 controlling for changes in population density (DENSCNG) and other
employment (OEMCNG).

The proportion of off-farm employment of farm operators has in-
creased in all areas of the State. The partial correlation coefficients
reported in Table IV-3 exhibit a great deal of difference between sub-
regions, although most areas and the State as a whole, show direct

Table IV-3. Percent Changes in and Partial Correlation Coefficients for Changes in Farm Operators' Employment in the Manu-facturing and Agricultural Sectors of Virginia by Subregions, 1950-1974.

Variables	All Counties	Agricultural Regions							Urban-Rural Regions		
		General Agriculture	Low Agricultural Sales	Tobacco	Peanut	Livestock and Corn	Soybeans and Corn	Urban	Semi-Urban	Rural
		---------------------------- Percentage Changes -------------------									
Change in the percent share of non-commercial farms (NCOMCNG), 1950-74[a]	-.08	-.08	-.07	.05	.00	-.06	-.27	-.13	-.04	-.09
Change in the percent share of non-commercial farms (NCOMCNG) with percent change in manufacturing em-ployment (MFGCNG) control-led for change in popula-tion density and percent share of other employment[b]	.3936	.4600	-.0065	.1456	.1137	.6384	.1868	.5603	.0310	.4540
Change in the percent share of farmers working off-farm 100 days or more (OCOTCNG), 1950-74	.13	.15	.14	.20	.10	.15	.01	.10	.16	.11
		------------------ Partial Correlation Coefficients -----------									
Change in the percent share of farmers working off-farm 100 days or more (OCOTCNG) with percent change in manu-facturing employment (MFGCNG) controlled for change in population density and percent share of other employment[b]	.2236	.3559	----	-.1386	-.7758	.2205	.4513	.4896	-.0423	.3115

[a]Commercial farms for the purposes of this study are those which had a value of farm products sold over $2,500. All other farms are included in the noncommercial category.

[b]Change in population density has been used to control the variation due to heterogeneity within the subregions and change in the percent share of other employment has been used to control variation due to employment change outside the scope of this study.

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Table IV-3 -- Continued.

| Variables | All Counties | Agricultural Regions | | | | | | Urban-Rural Regions | | |
		General Agriculture	Low Agricultural Sales	Tobacco	Peanut	Livestock and Corn	Soybeans and Corn	Urban	Semi-Urban	Rural
------- Percentage Changes -------										
Change in the percent share of commercial farmers working off-farm (COFICNG), 1950-74[a]	.35	.38	.36	.38	.33	.36	.25	.34	.38	.33
------- Partial Correlation Coefficients -------										
Change in the percent share of commercial farmers working off-farm (COFICNG) with percent change in manufacturing employment (MFGCNG) controlled for change in population density and percent share of other employment[b]	.1541	.2222	-.8822	.3345	-.2640	.1571	.2613	.5089	.0181	.2688

[a]Commercial farms for the purposes of this study are those which had a value of farm products sold over $2,500. All other farms are included in the noncommercial category.

[b]Change in population density has been used to control the variation due to heterogeneity within the subregions and change in the percent share of other employment has been used to control variation due to employment change outside the scope of this study.

Source: U.S. Bureau of the Census, Census of Population, 1950 and 1970 (Washington, D.C.: U.S. Government Printing Office, 1952 and 1972) and U.S. Bureau of the Census, Census of Agriculture, 1950 and 1974 (Washington, D.C.: U.S. Government Printing Office, 1952 and 1976).

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positive relationships between the two variables, supporting the hypothesis.

The second hypothesis to be tested is that: "Change in the percent of commercial farm operators with off-farm income is directly related to change in the level of manufacturing employment." This hypothesis will be tested by correlating the change in the percent of commercial farm operators with off-farm income (COFICNG) with the percent change in manufacturing employment (MFGCNG) for 1950-1974 controlled for changes in population density (DENSCNG) and other employment (OEMCNG).

The percent of commercial farm operators with off-farm income increased substantially during 1950-1974--35 percent for the State as a whole. The increase was slightly less in the "Rural" region, at 33 percent. The partial correlation coefficients, although somewhat inconsistent (Table IV-3), were generally positive, but weak. These findings tend to support the hypothesis of a direct relationship between changes in the number of commercial farmers' earning off-farm incomes and changes the level of area manufacturing employment.

The third hypothesis relative to off-farm employment is that: "The change in the percent of part-time farms is directly related to change in manufacturing employment." To test this hypothesis, the change in the percent of noncommercial farms (NCOMCNG) will be correlated with percent change in manufacturing employment (MFGCNG) for the period 1950-1974 controlling for changes in population density (DENSCNG) and other employment (OEMCNG).

The percent of noncommercial farms, which includes those classified as part-time by the Census of Agriculture, decreased in most areas of the State as reported in Table IV-3. Since the percent of noncommercial farms was decreasing, the positive correlation coefficients indicate that the change was least where manufacturing employment increased the most. Thus there is an inverse relationship between change in these two variables. The strongest correlation is found in the "Livestock and Corn" region where the structure of agricultural production lends itself to part-time farming.

While the percent of farms which are noncommercial has generally declined across the State, it is not clear whether patterns of land ownership and use have changed or whether the change is an artifact of census definitions. The inconsistency between the results which show a decline in the percentage of part-time farms and a strong increase in the off-farm employment of commercial farm operators points to a need for redefinition of commercial farming by the Agricultural Census. It appears that the present $2,500 cut-off point does little to differentiate between full and part-time farms.

Changes in the Use of Land Resources

This section will involve an analysis of changes in land use relative to changes in manufacturing. The transfer of land from farm to nonfarm use will be considered as well as changes in the mix of woodland and cropland within farming. It should be noted that these changes will be discussed in terms of economic sector definitions and not in physical terms. For example, a decrease in farm woodland acreage does

not necessarily imply that the land has been physically cleared, but that it has been transferred from the agricultural to another economic sector. Manufacturing employment changes will also be related to changes in the number of farms, average farm size and the distribution of farms among size categories. Five hypotheses will be tested in this section.

The first hypothesis is that: "The change in the percent of land area in nonfarm use is directly related to the change in manufacturing employment." To test this hypothesis, the percent change in manufacturing employment (MFGCNG) will be correlated with the change in the percent of area in nonfarm use (NFARCNG) for the period 1950-74 controlling for change in other employment (OEMCNG).

The percent of Virginia's land in nonfarm use increased by 23 percent over the 25 year study period as reported in Table IV-4. In the "Urban" region, the rate of increase appears to be slightly greater than in areas with smaller population concentrations. Based on the weak to moderate positive partial correlation coefficients, the hypothesis of a direct relationship between the change in percent of land in nonfarm use and the percent change in manufacturing employment is supported.

Land Use in Farms

The second relationship hypothesized is that: "A shift will occur in the mix of farm cropland and woodland toward decreasing farm woodland positively associated with increasing manufacturing employment." To test this hypothesis, the percent change in manufacturing employment (MFGCNG) will be correlated with the percent change in acres of harvested cropland (HCRPCNG) and the percent change in acres of woodland and

Table IV-4. Percentage Changes in and Partial Correlation Coefficients for Changes in Nonfarm and Farm Land Use Relative to Manufacturing Employment Changes in Virginia by Subregions, 1950-1974.

| Variables | All Counties | Agricultural Regions | | | | | | Urban-Rural Regions | | |
		General Agriculture	Low Agricultural Sales	Tobacco	Peanut	Livestock and Corn	Soybean and Corn	Urban	Semi-Urban	Rural
		---------------------------- Percentage Changes ------------								
Change in the percent of nonfarm land (NFARCNG), 1950-74	23.14	25.11	21.57	28.10	19.86	16.40	19.62	24.83	22.94	22.88
		--------------------- Partial Correlation Coefficients ------								
Change in the percent of nonfarm land (NFARCNG) with percent change in manufacturing employment (MFGCNG) controlled for change in percent share of other employment[a]	.2064	.0606	.6040	.1033	.2262	.5372	.4689	.1768	-.0663	.4545
		---------------------------- Percentage Changes ------------								
Percent change in cropland harvested (HCRPCNG), 1950-74	-.28	-.38	-.64	-.39	-.03	-.23	.10	-.41	-.31	-.22
		--------------------- Partial Correlation Coefficients ------								
Percent change in cropland harvested (HCRPCNG) with percent change in manufacturing employment (MFGCNG) controlled for change in percent share of other employment[a]	-.2264	-.1000	-.4518	.0206	.6985	-.6460	-.5545	-.3472	.2587	-.3699

[a]Change in the percent share of other employment has been used to control variation due to employment change outside the scope of this study.

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Table IV-4 -- Continued.

Variables	All Counties	Agricultural Regions							Urban-Rural Regions		
		General Agriculture	Low Agricultural Sales	Tobacco	Peanut	Livestock and Corn	Soybean and Corn	Urban	Semi-Urban	Rural

			-------------------- Percentage Changes --------------------							
Percent change in woodland (AWODCNG), 1950-74	-.52	-.52	-.64	-.47	-.56	-.37	-.63	-.60	-.49	-.53
			------------------ Partial Correlation Coefficients ------------------							
Percent change in woodland (AWODCNG) with percent change in manufacturing employment (MFGCNG) controlled for change in percent share of other employment[a]	.0240	-.1112	-.3305	.2554	-.4944	-.3645	-.2522	-.3936	.1932	.2504

[a]Change in the percent share of other employment has been used to control variation due to employment changes outside the scope of this study.

Source: U.S. Bureau of the Census, Census of Agriculture, 1950 and 1974 (Washington, D.C.: U.S. Government Printing Office, 1952 and 1976) and U.S. Bureau of the Census, Census of Population, 1950 and 1970 (Washington, D.C.: U.S. Government Printing Office, 1952 and 1972).

woodland pasture (AWODCNG) for the 1950-1974 period controlling for change in other employment (OEMCNG).

Acres of both harvested farm cropland and acres of farm woodland have been decreasing as shown in Table IV-4, but the rate of decrease in woodland acreage is almost twice as great as that of cropland. This indicates that the mix of agricultural sector land is shifting toward a decreased percentage of woodland. The partial correlation coefficients do not indicate a strong association between percent changes in manufacturing employment and percent changes in harvested cropland acreage and percent changes in woodland acreage, but the preponderance of negative coefficients indicates the presence of a direct negative relationship between increases in manufacturing employment and decreases in both types of farm acreage.

Number of Farms

The third hypothesis is that: "The change in the level of manufacturing employment is directly and negatively related to change in the number of farms." This hypothesis will be tested by correlating the percent change in number of farms (FARMCNG) with the percent change in manufacturing employment (MFGCNG) for 1950-1974 controlling for change in other employment (OEMCNG).

As shown in Table IV-5, about two thirds of the farms in 1950 did not exist in 1974. The results of the correlation analysis, however, do not indicate a clear relationship between manufacturing employment change and change in the number of farms.

Average Farm Size

The fourth hypothesis relating to changes in the use of land resources is: "The change in average farm size is directly related to the change in manufacturing employment." The percent change in average farm size (AFSCNG) will be correlated with percent change in manufacturing employment (MFGCNG) for 1950-1974 controlling for change in other employment (OEMCNG) to test this hypothesis.

The pattern of farm size change shown in Table IV-5 shows the greatest increases in farm size in commercial agricultural areas and the smallest increases in the more densely populated areas. Although farm size and manufacturing employment have both increased throughout the State, the partial correlation coefficients indicate an inverse relationship between their rates of change. That is, the greatest increases in farm size are occurring where manufacturing is increasing least and the hypothesis is not supported.

Distribution of Farms Among Size Groupings

The fifth hypothesis relating to land resources is that: "The distribution of farms among size groupings shifts toward larger farm units as the level of manufacturing employment increases." This hypothesis will be tested by comparing the change in percent of farms accounted for by each size grouping between regions.

Table IV-5 shows the consistency of the direction of farm size change toward larger farm units. The decrease in a farm size group was greatest in the 10 to 49 acre category. Consistent large increases are shown for the 180 to 499 acre group and slightly lesser increases are

Table IV-5. Percentage Changes in and Partial Correlation Coefficients for Changes in the Number of Farms, Average Farm Size and Size Distribution Relative to Manufacturing Employment Changes in Virginia by Subregions, 1950-1974.

Variables	All Counties	Agricultural Regions						Urban-Rural Regions		
		General Agriculture	Low Agricultural Sales	Tobacco	Peanut	Livestock and Corn	Soybean and Corn	Urban	Semi-Urban	Rural
---------- Percentage Changes ----------										
Percent change in number of farms (FARMCNG), 1950-74	-.65	-.66	-.74	-.58	-.67	-.53	-.72	-.71	-.62	-.65
---------- Partial Correlation Coefficients ----------										
Percent change in number of farms (FARMCNG) with percent change in manufacturing employment (MFGCNG) controlled for change in percent share of other employment[a]	.0612	-.0547	-.3476	.2032	-.6798	.1436	-.1230	-.1144	.0758	.2237
---------- Percentage Changes ----------										
Percent change in average farm size (AFSCNG), 1950-74	.74	.64	.57	.47	1.07	.65	1.28	.73	.70	.78
---------- Partial Correlation Coefficients ----------										
Percent change in average farm size (AFSCNG) with percent change in manufacturing employment (MFGCNG) controlled for change in percent share of other employment[a]	-.2074	-.0818	-.1729	-.3086	.3673	-.4802	-.2405	-.3868	.2514	-.3504

[a]Change in percent share of other employment has been used to control variation due to employment change outside the scope of this study.

Table IV-5 -- Continued.

Variables	All Counties	Agricultural Regions							Urban-Rural Regions		
		General Agriculture	Low Agricultural Sales	Tobacco	Peanut	Livestock and Corn	Soybean and Corn	Urban	Semi-Urban	Rural
					Percentage Changes						
Change in percent share of farms under 10 acres, 1950-74	-.05	-.07	-.08	-.01	.02	-.09	-.08	-.06	-.06	-.05
Change in percent share of farms of 10-49 acres, 1950-74	-.09	-.08	-.08	-.09	-.15	-.04	-.13	-.07	-.09	-.10
Change in percent share of farms of 50-179 acres, 1950-74	.01	.03	.05	.00	-.06	.01	.00	.02	.01	.00
Change in percent share of farms of 180-499 acres, 1950-74	.07	.07	.07	.06	.09	.06	.10	.06	.07	.08
Change in percent share of farms over 500 acres, 1950-74	.06	.05	.04	.03	.11	.06	.10	.04	.05	.07

Source: U.S. Bureau of the Census, Census of Agriculture, 1950 and 1974 (Washington, D.C.: U.S. Government Printing Office, 1952 and 1976) and U.S. Bureau of the Census, Census of Population, 1950 and 1970 (Washington, D.C.: U.S. Government Printing Office, 1952 and 1972).

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evident for the over 500 acre category. Relative changes for the rural-urban regions are shown in Figure IV-1 and are consistent with the results for the agricultural regions reported in Table IV-5. The correlation of change between size groupings with changes in manufacturing employment did not yield consistent relationships and the hypothesis is not supported.

Changes in Agricultural Capital Investment

The changes in the average value of land and buildings per farm and per acre as they relate to changes in manufacturing employment will be examined in this section. In addition, changes in the total value of farm machinery and equipment per farm will be analyzed together with changes in the percent of farm ownership as they relate to manufacturing sector employment growth.

Value of Land and Buildings

Two hypotheses will be tested relative to the value of farm land and buildings. The first is that: "The change in the level of manufacturing employment is positively related to the change in the average value of land and buildings per farm." The change in the average value of land and buildings per farm (AVLBFCG) will be correlated with the percent change in manufacturing employment (MFGCNG) for 1950-1974 controlling for change in other employment (OEMCNG) to test this hypothesis. The average value of land and buildings per farm as reported in Table IV-6 was twelve times its 1950 level in 1974 for the State as a whole. The more urban areas showed a lower rate of increase than the more rural
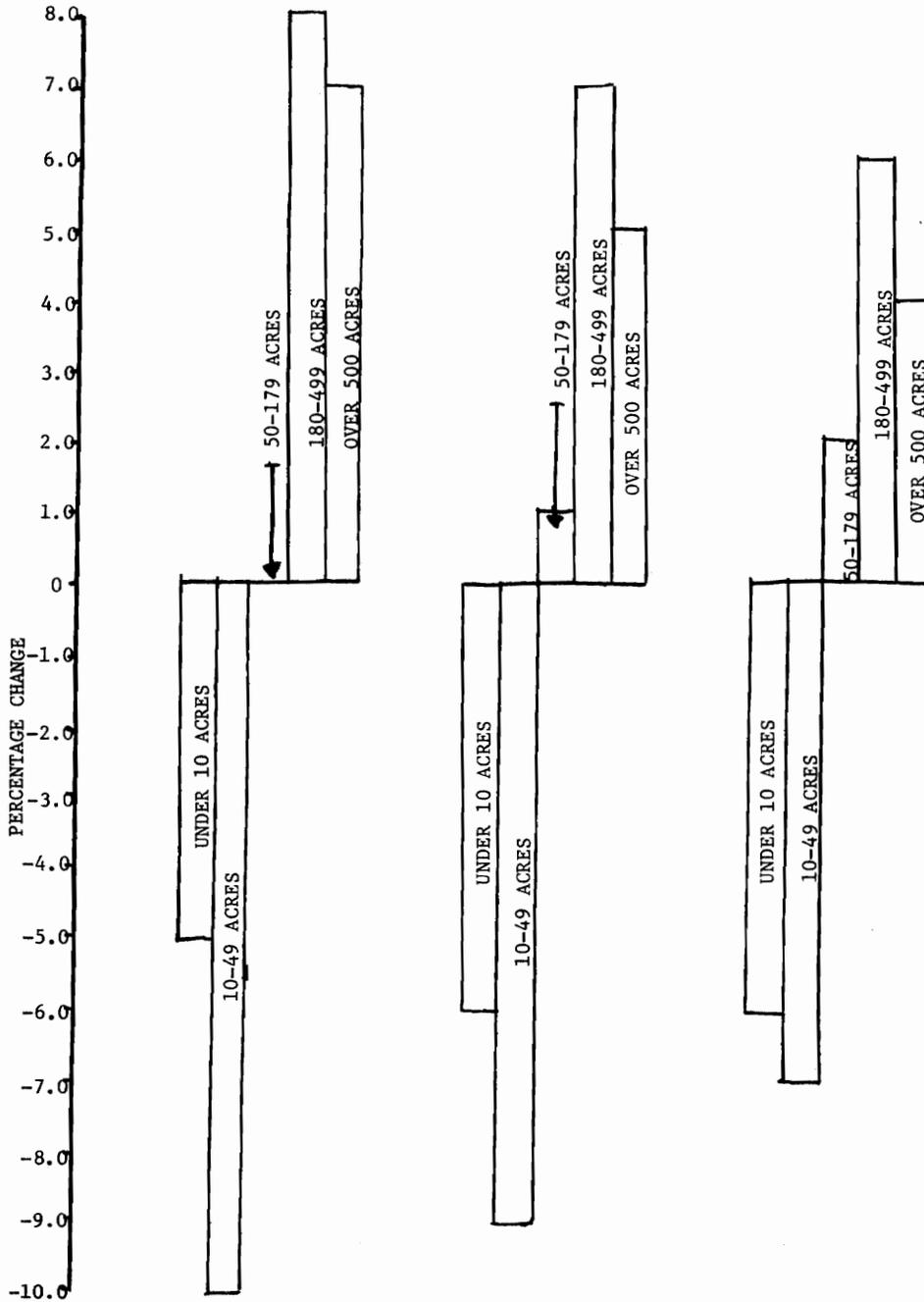
Figure IV-1. The Changes in Farm Size Distribution by Size Category for Rural, Semi-Urban, and Urban Subregions of Virginia, 1950–1974.

Table IV-6. Percentage Changes in and Partial Correlation Coefficients for Changes in Farm Capital Investment Relative to Manufacturing Employment Changes in Virginia by Subregion, 1950-1974.

Variables	All Counties	Agricultural Regions						Urban-Rural Regions		
		General Agriculture	Low Agricultural Sales	Tobacco	Peanut	Livestock and Corn	Soybean and Corn	Urban	Semi-Urban	Rural
			---------- Percentage Changes ----------							
Percent change in average value of land and buildings per farm (AVLBFCG), 1950-74	12.19	12.28	7.37	8.56	17.07	11.85	16.44	11.30	11.04	13.25
			---------- Partial Correlation Coefficients ----------							
Percent change in average value of land and buildings (AVLBFCG) with percent change in manufacturing employment (MFGCNG) controlled for change in percent share of other employment[a]	-.1208	-.0200	.3353	-.1316	.4767	-.2947	-.0126	.0888	-.0823	-.2591
			---------- Percentage Changes ----------							
Percent change in average value of land and buildings per acre (AVLBACG), 1950-74	6.52	7.07	5.03	5.59	7.82	6.44	6.59	6.50	6.07	6.86

[a]Change in percent share of other employment has been used to control variation due to employment change outside the scope of this study.

Table IV-6 -- Continued

Variables	All Counties	Agricultural Regions						Urban-Rural Regions		
		General Agriculture	Low Agricultural Sales	Tobacco	Peanut	Livestock and Corn	Soybean and Corn	Urban	Semi-Urban	Rural
------- Partial Correlation Coefficients -------										
Percent change in average value of land and buildings per acre (AVLBACG) with percent change in manufacturing employment (MFGCNG) controlled for change in percent share of other employment[a]	.0590	.1212	.2909	-.0572	-.0221	.1069	.1814	.4992	-.1387	-.0750
------- Percentage Changes -------										
Percent change in total value of farm machinery and equipment (VMECNG), 1969-74	.93	.89	.82	.92	.97	.96	1.05	.87	.91	.96
------- Partial Correlation Coefficients -------										
Percent change in total value of farm machinery and equipment (VMECNG) with percent change in manufacturing employment (MFGCNG) controlled for change in percent share of other employment, 1960-70[a]	-.2508	-.1156	-.2503	-.1236	-.3018	-.1466	-.5025	-.5032	-.0772	-.2413

[a]Change in percent share of other employment has been used to control variation due to employment change outside the scope of this study.

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Table IV-6 -- Continued.

Variables	All Counties	Agricultural Regions							Urban-Rural Regions		
		General Agriculture	Low Agricultural Sales	Tobacco	Peanut	Livestock and Corn	Soybean and Corn	Urban	Semi-Urban	Rural

-------- Percentage Changes --------

| Change in the percent share of tenant farmers (CGPERTN), 1950-74 | -.07 | -.03 | -.04 | -.15 | -.23 | -.03 | -.02 | -.02 | -.09 | -.06 |

-------- Partial Correlation Coefficients --------

| Change in the percent share of tenant farmers (CGPERTN) with percent change in manufacturing employment (MFGCNG) controlled for change in percent share of other employment[a] | .0713 | .2208 | .4238 | .1746 | -.1615 | -.0310 | .0290 | .2372 | .0556 | -.1161 |

[a]Change in percent share of other employment has been used to control variation due to employment change outside the scope of this study.

Source: U.S. Bureau of the Census, Census of Agriculture, 1950 and 1974 (Washington, D.C.: U.S. Government Printing Office, 1952 and 1976) and U.S. Bureau of the Census, Census of Population, 1950 and 1970 (Washington, D.C.: U.S. Government Printing Office, 1952 and 1972).

areas of the State. The partial correlation coefficients generally indicate an inverse relationship between the change in the level of manufacturing employment and the change in the average value of land and buildings per farm. This relationship implies that the value of land and buildings per farm is increasing most rapidly in the same areas where average farm size is increasing most rapidly--those where manufacturing employment is increasing least rapidly. The analytic results do not support the hypothesis.

The second hypothesis is that: "The change in the average value of land and buildings per acre is positively related to change in the level of manufacturing employment." This hypothesis will be tested by correlating the percent change in the average value of land and buildings per acre (AVLBACG) with the percent change in manufacturing employment (MFGCNG) for 1950-1974 controlling for change in other employment (OEMCNG).

The rate of increase in value of land and buildings per acre has only been about half that of land and buildings per farm as shown in Table IV-6. There is less variation between regions for the increase in value per acre. The partial correlation coefficients are low and vary in sign--thus, there is no conclusive support for the hypothesis.

Value of Machinery and Equipment

Relative to the value of farm machinery and equipment, it is hypothesized that: "The change in the total value of farm machinery and equipment is positively related to the change in the level of manufacturing employment." The percent change in total value of farm machinery

and equipment (VMECNG) will be correlated with the percent change in manufacturing employment (MFGCNG) for 1960-1970 controlling for change in other employment (OEMCNG) to test this hypothesis.

All regions show an increase in the value of farm machinery and equipment with a greater increase in rural than in urban areas. The partial correlation coefficients are weak, but all are negative indicating an inverse relationship between the variables. The value of machinery and equipment has been increasing most rapidly where manufacturing employment was not increasing rapidly—thus, there is no support for the hypothesis being tested.

Farm Ownership

Considering farm ownership, it is hypothesized that: "The change in percent of farm operators who are tenants is positively related to the change in the level of manufacturing employment." To test this hypothesis, the change in the percent of tenant farmers (CGPERTN) will be correlated with percent change in manufacturing employment (MFGCNG) for 1960-1970 controlling for the change in other employment (OEMCNG).

The percent of tenant farmers as shown in Table IV-6 has declined in all regions with the greatest percent decrease in the "Peanut" and "Tobacco" agricultural regions. The partial correlation coefficients are weak, but they are predominantly positive, indicating an inverse relationship between manufacturing employment increases and decreases in the rate of tenancy. By deduction, the change in farm ownership and the change in manufacturing employment are inversely related and the hypothesis is not supported.

Changes in the Economic and Social
Characteristics of Farm Residents

In this final section, the relationships between manufacturing employment levels and characteristics of the farm population and farm family incomes will be analyzed. Three hypotheses will be tested relative to the size of the State's farm population and levels of median farm family income.

Rural Farm Population

The first hypothesis is that: "The change in the level of manufacturing employment is negatively related to the change in the farm population." The percent change in the rural farm population (RFPCNG) will be correlated with the percent change in manufacturing employment (MFGCNG) for 1950-1970 controlling for change in other employment (OEMCNG) to test this hypothesis.

In Table IV-7, the rural farm population declined by at least 60 percent in all regions during the period from 1950 to 1970. The "Rural" region in 1970 had only 15 percent of its population residing on farms—exactly the same as in the "Urban" region in 1950. In general, it appears that those agricultural regions with the greatest increase in median farm family income have experienced the least decrease in farm population. The partial correlation coefficients are inconsistent between regions, but generally indicate a weak direct relationship between decreasing farm population and increasing manufacturing employment.

Table IV-7. Percent Changes in and Partial Correlation Coefficients for Changes in the Rural Farm Population and Median Farm Family Income Relative to Manufacturing Employment Changes in Virginia by Subregions, 1950-1970.

| Variables | All Counties | Agricultural Regions | | | | | | | Urban-Rural Regions | | |
		General Agriculture	Low Agricultural Sales	Tobacco	Peanut	Livestock and Corn	Soybean and Corn	Urban	Semi-Urban	Rural
		-------------------------- Percentage Changes --------------------------								
Percent of population residing on farms (PERFPO), 1950	.43	.49	.26	.49	.38	.40	.36	.15	.43	.51
Percent of population residing on farms (PERFFO), 1970	.12	.11	.09	.19	.14	.09	.10	.04	.10	.15
Percent change in farm population (RFPCNG), 1950-70	-.69	-.72	-.74	-.63	-.62	-.70	-.71	-.66	-.68	-.71
		-------------------------- Partial Correlation Coefficients --------------------------								
Percent change in farm population (RFPCNG) with percent change in manufacturing employment (MFGCNG) controlled for change in percent share of other employment[a]	-.0473	-.0462	-.4611	.0146	.7422	-.2946	-.1626	-.1957	.2137	-.1060
		-------------------------- Percentage Changes --------------------------								
Percent white farm population (PERWFP), 1960	.79	.88	.99+	.71	.46	.90	.68	.84	.81	.76
Percent white farm population (PERWFP), 1970	.82	.89	.99+	.75	.57	.94	.69	.86	.83	.79

[a]Change in percent share of other employment has been used to control variation due to employment change outside the scope of this study.

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Table IV-7 -- Continued.

Variables	All Counties	Agricultural Regions						Urban-Rural Regions		
		General Agriculture	Low Agricultural Sales	Tobacco	Peanut	Livestock and Corn	Soybean and Corn	Urban	Semi-Urban	Rural
---- Partial Correlation Coefficients ----										
Percent white farm population (PERWFP) with median farm family income (MFFINC) controlling for percent share of agricultural employment (PEAGEM), 1960[b]	.0691	.1616	.0769	-.1480	.8289	.5309	.2274	.5177	.3914	-.0969
Percent white farm population (PERWFP) with median farm family income (MFFINC) controlling for percent share of agricultural employment (PEAGEM), 1970[b]	.0939	.2116	-.3360	-.2249	.3045	.3874	.3435	.4087	-.0411	.0023
---- Percentage Changes ----										
Percent change in median farm family income (MFFICNG), 1959-69	1.22	1.20	1.17	1.28	1.79	1.16	.98	.93	1.27	1.24
---- Partial Correlation Coefficients ----										
Percent change in median farm family income (MFFICNG) with percent change in manufacturing employment (MFGCNG) controlled for change in percent share of other employment	.0163	.0792	-.3658	.2403	-.4248	-.5193	-.0778	.4409	-.3964	.1021

[b]The percent share of agricultural employment has been used as a control variable to eliminate the effects on median farm family income of differing wage rates in manufacturing and agriculture.

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Table IV-7 -- Continued.

Variables	All Counties	Agricultural Regions						Urban-Rural Regions		
		General Agriculture	Low Agricultural Sales	Tobacco	Peanut	Livestock and Corn	Soybean and Corn	Urban	Semi-Urban	Rural
				Partial Correlation Coefficients						
Percent change in median farm family income (MFFICNG) with change in the percent share of farm residents employed in manufacturing (FAMACNG)	.1557	.1160	.6668	.1569	.0995	-.0350	.0964	.4252	.0741	.1307
				Percentage Changes						
Percent change in population density (DENSCNG), 1950-70	.23	.38	.10	-.01	.09	.25	.29	1.15	.18	-.02

Source: U.S. Bureau of the Census, Census of Agriculture, 1950 and 1974 (Washington, D.C.: U.S. Government Printing Office, 1952 and 1976) and U.S. Bureau of the Census, Census of Population, 1950 and 1970 (Washington, D.C.: U.S. Government Printing Office, 1952 and 1972.

White Farm Population

The second hypothesis relating to median farm family income is that: "The percent of the farm population who are white is positively related to the level of median farm family income." This hypothesis will be tested by correlating the percent of total farm population classified as white (PERWFP) with median farm family income (MFFINC) controlling for the percent of agricultural employment (PEAGEM) in 1960 and 1970.

The percentage of the farm population who are white has increased in all regions of Virginia during the 1960-1970 decade. In general, the partial correlation coefficients are positive indicating, that while the strength of the relationship may vary among regions, it is a direct positive relationship.

Farm Family Income

The third hypothesis of this section is that: "The change in manufacturing employment level is positively related to the change in median farm family income." As a first test of this hypothesis, the percent change in manufacturing employment (MFGCNG) will be correlated with the percent change in median farm family income (MFFICNG) for 1959-1969 controlling for change in other employment (OEMCNG).

The growth in the level of median farm family income varied a great deal between regions as shown in Table IV-7. It lagged behind the State average in the "Urban" region and was substantially above that average in the "Peanut" agricultural region. The partial

correlation coefficients do not clearly indicate the nature of the re-
lationship and therefore, the hypothesis is not supported.

As a second test of the hypothesis, the change in median farm
family income (MFFICNG) will be correlated with the change in the per-
cent of farm residents employed in manufacturing (FAMACNG) during 1959-
1969.

As shown in Table IV-7, the partial correlation coefficients
are generally positive and range from weak to moderate in strength. The
two moderate coefficients occur in the regions with the greatest urban
concentrations indicating a stronger association of farm manufacturing
employment with farm incomes in proximity to urban areas. For most of
the regions and the State a positive relationship between the variables
is evident in support of the hypothesis.

Summary

This chapter of the study covered the major areas of the allocation
of labor, land, capital investment and farm population as they relate to
changes in manufacturing employment. In the first section, the hypoth-
eses regarding the allocation of labor between manufacturing and agri-
culture--which generally posed a reallocation of labor from the agri-
cultural to the manufacturing sector--were supported by the findings,
as were those which hypothesized an increase in manufacturing employ-
ment of farm residents. The hypothesized increased employment of farm
women as manufacturing employment increased and the hypotheses relative
to the increased off-farm employment of farm operators tended to be sup-
ported by the results, but were somewhat inconclusive. The findings for

the hypothesis of a positive relationship between the change in manufac-
turing employment and the change in the percent of noncommercial farms
indicates an inverse rather than a direct relationship between the rates
of change.

In the second section, where changes in land use were examined,
the findings supported the hypothesis that nonfarm land use increases
with manufacturing employment. The mix of agricultural land was found
to be trending toward increased cropland relative to woodland, and the
relationship to manufacturing employment change was direct. The hy-
pothesis regarding change in the number of farms relative to manufac-
turing employment changes was not supported by the findings and the
relationship of changing farm size to manufacturing employment change
was found to be inverse rather than direct. Only the hypothesized
change in farm size distribution was supported by the analysis. On the
whole, the results of this section resulted in generating several re-
searchable questions.

The analysis of the hypotheses concerned with capital investment
indicated that while change in all of the variables measuring farm capi-
tal investment was positive, the relationship of increasing manufactur-
ing employment to increasing farm investment levels is inverse. That
is, capital investment in agriculture may be increasing at the greatest
rate where manufacturing is increasing at the lowest rate.

In the fourth section, examining farm population and income
changes, the hypothesized inverse relationship between manufacturing
employment change and farm population change was supported, as were the

hypotheses of positive relationships between manufacturing employment and racial composition and median farm family income levels. Results of the test of the positive relationship between farm resident manufacturing employment to farm family income supported the hypothesis.

In general, the study hypotheses have been supported in terms of the direction of change. However, in several cases the relationships found between rates of change were unexpected and resulted in implications for further explanatory research.

CHAPTER V

A CASE STUDY OF THE LINKAGES BETWEEN
MANUFACTURING AND AGRICULTURAL ACTIVITIES
IN THE PIEDMONT PLANNING DISTRICT OF VIRGINIA

Introduction

There is considerable heterogeneity among the geographic units in

the agricultural and urban-semiurban-rural groupings utilized in the

analysis of the previous chapter. The heterogeneity appeared to have

affected the analytic results because of the influence of the extremes

in variance among the geographic units. To avoid the effects of hetero-

geneity in aggregation and to provide research results for a specific

multi-county region, the manufacturing-agricultural interrelationships

will be analyzed for a relatively homogeneous group of counties. Data

from a group of seven counties which make up Virginia's Piedmont Plan-

ning District No. 14 will be analyzed.[1] These counties form a con-

tiguous area in central Virginia with Farmville as the trade center (See

Figure V-1).

General Characteristics of the
Piedmont Planning District

The general characteristics of the Piedmont District, by county,

for the study time period are reported in Tables V-1 through V-7. The

_____

[1]The Piedmont Planning District is comprised of Amelia, Buckingham,
Charlotte, Cumberland, Lunenburg, Nottoway, and Prince Edward Counties.

Figure V-1. The Location and Composition of Virginia's Piedmont Planning District No. 14.

Table V-1. Change in Total Manufacturing and Agricultural Employment for Piedmont Planning District No. 14, 1950-1970.

	Amelia	Buckingham	Charlotte	Cumberland	Lunenburg	Nottoway	Prince Edward	District Mean
Total manufacturing employment (TOTMFG), 1950	516	742	1083	386	678	894	826	732
Total manufacturing employment (TOTMFG), 1960	404	839	4409	369	925	779	893	790
Total manufacturing employment (TOTMFG), 1970	1781	535	4116	525	1519	1003	1213	1192
Percent change in manufacturing employment (MFGCNG), 1950-70	2.45	-.28	.63	.36	1.24	.12	.47	.71
Total agricultural employment (TOAGEM), 1950	1750	1489	2401	1241	2322	1264	1571	1720
Total agricultural employment (TOAGEM), 1960	905	610	1552	720	1487	730	833	977
Total agricultural employment (TOAGEM), 1970	405	376	764	295	549	342	449	454
Percent change in agricultural employment (CNGAG), 1950-70	-.77	-.75	-.68	-.76	-.76	-.73	-.71	-.73

Source: U.S. Bureau of the Census, Census of Population, 1950 and 1970 (Washington, D.C.: U.S. Government Printing Office, 1952 and 1972).

Table V-2. Change in Sectoral Shares of Total Employment for Piedmont Planning District No. 14, 1950-1970.

	Amelia	Buckingham	Charlotte	Cumberland	Lunenburg	Nottoway	Prince Edward	District Mean
Manufacturing employment as a percent of total employment (PERMFG), 1950	.20	.19	.22	.16	.14	.16	.16	.17
Manufacturing employment as a percent of total employment (PERMFG), 1960	.17	.25	.30	.18	.22	.16	.19	.21
Manufacturing employment as a percent of total employment (PERMFG), 1970	.65	.15	.43	.26	.38	.20	.22	.33
Change in manufacturing as a percent of total employment (MEMCNG), 1950-70	.45	-.04	.21	.10	.24	.04	.07	.15
Agricultural employment as a percent of total employment (PEAGEM), 1950	.67	.37	.50	.51	.49	.23	.30	.44
Agricultural employment as a percent of total employment (PEAGEM), 1960	.37	.18	.35	.35	.35	.15	.18	.28
Agricultural employment as a percent of total employment (PEAGEM), 1970	.15	.11	.19	.14	.14	.07	.08	.12
Change in agriculture as a percent of total employment (AGEMCNG), 1950-70	-.52	-.27	-.31	-.37	-.35	-.16	-.21	-.31
Change in other employment as a percent of total employment (OEMCNG), 1950-70	.07	.30	.10	.27	.12	.12	.14	.16

Source: U.S. Bureau of the Census, Census of Population, 1950 and 1970 (Washington, D.C.: U.S. Government Printing Office, 1952 and 1972).

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Table V-3. Change in Employment of Farm Residents for Piedmont Planning District No. 14, 1950-1974.

	Amelia	Buckingham	Charlotte	Cumberland	Lunenburg	Nottoway	Prince Edward	District Mean
Percent of employed farm residents in manufacturing (PERFAM), 1960	.13	.13	.19	.09	.18	.10	.15	.14
Change in percent of employed farm residents in manufacturing (FAMACNG), 1960-70	.07	.08	.16	.04	.11	-.03	.07	.07
Change in percent of employed farm residents in agriculture (FAEMCNG), 1960-70	-.14	-.20	-.22	-.22	-.25	-.24	-.18	-.21
Percent of female farm residents employed (PERFEM), 1950	.12	.13	.13	.13	.10	.19	.13	.13
Change in percent of female farm residents employed (FFEMCNG), 1950-70	.13	.18	.16	.11	.16	.15	.16	.15
Percent of farm operators working off-farm 100 or more days (PEOCOT), 1950	.26	.31	.17	.26	.14	.37	.20	.24
Change in percent of farm operators working off-farm 100 or more days (OCOTCNG), 1950-74	.17	.23	.17	.21	.21	.12	.25	.19

Table V-3. Continued.

	Amelia	Buckingham	Charlotte	Cumberland	Lunenburg	Nottoway	Prince Edward	District Mean
Percent of commercial farm operators with off-farm income (PEROFI), 1950	.25	.22	.21	.28	.13	.27	.23	.23
Change in percent of commercial farm operators with off-farm income (COFICNG), 1950-74	.39	.53	.33	.42	.41	.37	.33	.39
Change in percent of noncommercial farms (NCOMCNG), 1950-74	-.00	-.10	-.02	-.02	.13	-.15	.00	-.02

Source: U.S. Bureau of the Census, Census of Agriculture, 1950 and 1974 (Washington, D.C.: U.S. Government Printing Office, 1952 and 1976) and U.S. Bureau of the Census, Census of Population, 1950 and 1970 (washington, D.C.: U.S. Government Printing Office, 1952 and 1972).

Table V-4.   Change in Farm Characteristics for the Piedmont Planning District No. 14, 1950-1974.

	Amelia	Buckingham	Charlotte	Cumberland	Lunenburg	Nottoway	Prince Edward	District Mean
Number of farms (FARMS), 1950	1098	1520	2010	1054	1849	1226	1340	1442
Percent change in number of farms (FARMCNG), 1950-74	-.54	-.70	-.60	-.67	-.61	-.65	-.63	-.63
Average farm size (AVFSIZ), 1950	147	134	114	124	106	97	117	120
Percent change in average farm size (AFSCNG), 1950-74	.33	.50	.54	.82	.41	.80	.62	.38
Percent of farms under 10 acres (PERU10), 1950	.05	.08	.08	.11	.08	.13	.06	.09
1950-1974 Change	-.01	-.04	.02	-.02	-.01	-.07	.03	-.02
Percent of farms 10 to 49 acres (PERA10), 1950	.29	.31	.29	.31	.34	.35	.30	.32
1950-1974 Change	-.05	-.13	-.11	-.11	-.11	-.17	-.11	-.11
Percent of farms 50 to 179 acres (PERA50), 1950	.43	.40	.46	.38	.42	.36	.44	.41
1950-1974 Change	-.02	.00	-.02	.06	.05	.06	-.03	.01
Percent of farms 180 to 499 acres (PEA180), 1950	.17	.17	.14	.16	.13	.14	.17	.15
1950-1974 Change	.03	.12	.09	.04	.06	.15	.06	.08
Percent of farms over 500 acres (PEA500), 1950	.05	.04	.02	.04	.02	.02	.03	.03
1950-1974 Change	.06	.05	.03	.03	.03	.03	.05	.04

Source: U.S. Bureau of the Census, Census of Agriculture, 1950 and 1974 (Washington, D.C.:   U.S. Government Printing Office, 1952 and 1976).

Table V-5. Change in Agricultural Capital Investment for Piedmont District No. 14, 1950-1974.

	Amelia	Buckingham	Charlotte	Cumberland	Lunenburg	Nottoway	Prince Edward	District Mean
Average value of land and buildings per farm (AVLBF), 1950	5923	5742	6100	5012	5686	6623	6169	5894
Percent change in average value of land and buildings per farm (AVLBFCG), 1950-74	16.59	13.94	9.69	18.36	8.53	10.84	9.77	12.53
Average value of land and buildings per acre (AVLBA), 1950	45	43	49	39	51	59	50	48
Percent change in average value of land and buildings per acre (AVLBACG), 1950-74	10.87	8.95	6.57	10.51	6.16	6.58	5.98	7.95
Value of machinery and equipment (VME), 1969	4371	2602	5146	2626	3564	2815	3707	3547
Percent change in value of machinery and equipment (VMECNG), 1969-74	.63	.96	.79	.54	1.13	1.27	.76	.87
Percent of tenant farm operators (PERTEN), 1950	.10	.12	.31	.13	.33	.17	.16	.19
Change in percent of tenant farm operators (CGPERTN), 1950-74	-.06	-.09	-.20	-.08	-.23	-.11	-.10	-.12

Source: U.S. Bureau of the Census, Census of Agriculture, 1950 and 1974 (Washington, D.C.: U.S. Government Printing Office, 1952 and 1976).

Table V-6. Change in Land Use for Piedmont Planning District No. 14, 1950-1974.

	Amelia	Buckingham	Charlotte	Cumberland	Lunenburg	Nottoway	Prince Edward	District Mean
Nonfarm land as a per-cane of total area (NONFAR), 1950	.31	.45	.24	.29	.34	.39	.32	.33
Change in percent of nonfarm land (NFARCNG), 1950-74	.27	.30	.29	.29	.28	.22	.27	.27
Change in harvested cropland as a percent of farm acreage (HCRPCNG), 1950-74	.03	-.51	-.37	-.42	-.45	-.21	-.29	-.32
Change in woodland as a percent of farm acreage (AWODCNG), 1950-74	-.56	-.61	-.49	-.55	-.49	-.47	-.56	-.53

Source: U.S. Bureau of the Census, Census of Agriculture, 1950 and 1974 (Washington, D.C.: U.S. Government Printing Office, 1952 and 1976).

Table V-7. Change in Selected Social and Economic Characteristics of the Farm Population in Piedmont Planning District No. 14, 1950-70.

	Amelia	Buckingham	Charlotte	Cumberland	Lunenburg	Nottoway	Prince Edward	District Mean
Rural farm population as a percent of total population (PERFPO), 1950	.70	.60	.71	.70	.64	.35	.45	.59
Rural farm population as a percent of total population (PERFPO), 1960	.50	.23	.50	.43	.46	.18	.27	.37
Rural farm population as a percent of total population (PERFPO), 1970	.23	.18	.32	.17	.31	.09	.14	.21
Change in rural farm population as a percent of total population (RFPCNG), 1950-70	-.69	-.74	-.63	-.79	-.60	-.77	-.70	-.70
Whites as a percent of the farm population (PERWFP), 1950	.52	.58	.68	.41	.50	.52	.44	.52
Whites as a percent of the farm population (PERWFP), 1960	.52	.73	.56	.53	.53	.72	.52	.59
Whites as a percent of the farm population (PERWFP), 1970	.69	.67	.71	.55	.51	.74	.52	.63
Change in percent of white farm population (WFPCNG), 1950-70	.17	.09	.03	.14	.01	.23	.08	.11

Table V-7. Continued.

	Amelia	Buckingham	Charlotte	Cumberland	Lunenburg	Nottoway	Prince Edward	District Mean
Median farm family in-come (MFFINC), 1959	2560	2788	2283	1803	2277	2912	2250	2410
Median farm family in-come (MFFINC), 1969	5902	5833	5689	4730	5131	5913	4914	5445
Percent change in median farm family in-come (MFFICNG), 1959-69	1.31	1.01	1.49	1.62	1.25	1.03	1.18	1.28

Source: U.S. Bureau of the Census, Census of Population, 1950 and 1970 (Washington, D.C.: U.S. Government Printing Office, 1952 and 1972).

data in these tables cover employment characteristics, farm characteristics, agricultural investment, land use, and the socio-economic characteristics of the farm population. The population density in the counties of the Piedmont District ranged from 18 to 46 persons per square mile in 1970 and declined over the 25 year study period without exception. Employment in agriculture declined in each county, while employment in manufacturing increased in each county, with the exception of Buckingham County during 1950 to 1970 (Table V-1). The region experienced dramatic changes during the twenty year period from 1950 to 1970. The share of total employment which is accounted for by manufacturing nearly doubled as shown in Table V-2. In contrast, the share of total employment in agriculture declined by more than two-thirds. The number of farms decreased by more than 60 percent from 1950 to 1970 while the proportion of part-time farms increased from about 40 percent to about 50 percent of total farms as shown in Table V-4.[2] Average farm size increased, but with the number of farms decreasing; approximately one-third of the farmland base in 1950 was transferred to nonfarm use by 1970. As is shown in Table V-4, the increase in average farm size involved an 11 percent decrease in the proportion of farms of 10 to 49 acres and an 8 percent increase in the 180 to 499 acre category.

In Table V-3, the strongest trends appear evident in the increasing off-farm employment of farm operators, during 1950 to 1974,

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[2] Since the proportion of part-time farms was approximately forty percent of the total in 1974 the increase shown in 1970 may simply reflect sampling error.

especially those which the Agricultural Census defines as commercial

farm operators.   In Table V-5, the rapidly escalating value of land

and buildings per farm is evident.   In addition, there were sizable

decreases in acreage of cropland harvested and even greater decreases

in acreage of woodland throughout all counties of the Piedmont District

(Table V-6).   The tenancy rate also showed a strong decline of 11 per-

cent or less in all counties.   The largest decline occurred in Charlotte

and Lunenburg counties which had the highest tenancy rate in 1950.   The

positive correlation coefficient in Table V-8 for change in the tenancy

rate (CGPERTN) with percent change in manufacturing employment (MFGCNG)

indicates an inverse relationship between increasing manufacturing em-

ployment and the declining percent of tenants.

Trends in Piedmont District
Labor Employment

During the period from 1950 to 1970, manufacturing's share of all

District resident employment increased by 15 percent, which is twice the

State average.   The corresponding change in the share of agricultural

employment was a decline of 31 percent.   When the effects of changes in

population density on changes in both types of employment are eliminated

in the partial correlation analysis, the change in the percent share of

agricultural employment (AGEMCNG) and the change in the percent share of

manufacturing employment (MEMCNG) during the period 1950-1970 exhibit a

strong negative correlation coefficient of -.8696.   From this it can be

determined that if the share of manufacturing employment were to increase

Table V-8. Partial Correlation Coefficients for Measures of Agricultural and Manufacturing Sector Change in Piedmont Planning District No. 14.

Variables correlated with percent change in manufacturing employment (MFGCNG) and controlled for change in population density and percent share of other employment, 1950-70	Partial correlation coefficient
Change in the percent of commercial farm operators with off-farm income (COFICNG)	.4839
Change in the percent of farm operators who are tenants (CGPERTN)	.7643
Percent change in average value of land and buildings per farm (AVLBFCG)	.7878
Percent change in average value of land and buildings per acre (AVLBACG)	.8670
Percent change in the number of farms (FARMCNG)	.9445
Percent change in average farm size (AFSCNG)	-.2102
Change in percent of farms which are noncommercial (NCOMCNG)	.6606
Change in percent of total area in nonfarm use (NFARCNG)	.5495
Percent change in acres of cropland harvested (HCRPCNG)	.8003
Percent change in acres of woodland (AWODCNG)	-.7273
Percent change in rural farm population (RFPCNG)	.2261
Change in percent of farms under 10 acres (PCU10)	.1343
Change in percent of farms from 10 to 49 acres (PCA10)	.8898
Change in percent of farms from 50 to 179 acres (PCA50)	-.1100
Change in percent of farms from 180 to 499 acres (PCA180)	-.8262
Change in percent of farms over 500 acres (PCA500)	.7047
Percent change in value of machinery and equipment (VMECNG)[a]	-.5025

[a]VMECNG for 1969-74 correlated with MFGCNG for 1960-70.

Table V-8.   Continued.

Variables correlated with change in the share of manu-facturing employment (MEMCNG) and controlled for change in population density and percent share of other employ-ment, 1950-70	Partial correlation coefficient
Change in percent of farm operators working off-farm (OCOTCNG)	.1147
Change in percent of female farm residents employed (FFEMCNG)	-.5341

Variables correlated with median farm family income (MFFINC) and controlled for level of other employment as a percent of total employment, 1954 and 1969	Partial correlation coefficient
White farm population as a percent of total farm pop-ulation (PERWFP)	.7058
White farm population as a percent of total farm population (PERWFP), 1970	.9095

by 10 percent the share of agricultural employment would decrease by 6 percent if changes in other employment had no effect.[3]

Looking at the changes in total sectoral employment, manufacturing employment increased 71 percent in the District from 1950 to 1970. Over the same time period, agricultural employment declined by 73 percent. While there was little variation between counties in the decline in agricultural employment, the change in manufacturing employment ranged from -28 percent to +245 percent.

With regard to off-farm employment of farm operators, increases in the level of manufacturing employment are positively, but moderately associated with changes in the percent of commercial farm operators with off-farm incomes. In general, the faster manufacturing employment increases in the region, the higher the rate at which the percentage of commercial farmers employed off-farm increases. Over the 25 year study period, the percentage of commercial farmers with off-farm incomes increased by 39 percent.

The employment of farm women increased at a fairly even rate in all seven counties. The analysis produced a negative correlation coefficient between percent change in employment of farm women (FFEMCNG) and change in the share of manufacturing employment (MEMCNG). This finding may imply that increases in the employment of farm women are associated with employment change other than in manufacturing and agriculture.

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[3]These changes were found through use of the formula:
$$r_{12} = b_{12}(S_1/S_2)$$
as explained in Chapter III.

Trends in Piedmont District
Land Use

The percent change in the number of farms (FARMCNG) was strongly

correlated (.9445) with the percent change in manufacturing employment

(MFGCNG). Since the number of farms has declined sharply over the

study period, it appears that the rate of decline in the number of

farms is least where the change in manufacturing employment is greatest.

In addition, the moderate positive correlation coefficient for the change

in percent of part-time farms (NCOMCNG) relative to percent change in

manufacturing (MFGCNG) may indicate that the increase in part-time farms

is moderating the decline in number of farms when manufacturing employ-

ment growth occurs.

While average farm size has been increasing in the District, the

negative correlation coefficient of -.2102 indicates a negative rela-

tionship between the rate of farm size change and increase in manufac-

turing employment. In other words, farm size may be less likely to in-

crease rapidly over time where manufacturing employment is increasing

than where it is not increasing.

There seems to be a moderately strong direct relationship between

growth in manufacturing and the percent of all land transferred from

farm to nonfarm use as evidenced by a partial correlation coefficient

of .5495. The relationship between increases in manufacturing employ-

ment and changes in harvested cropland and woodland are both strong

(.8003 and -.7273 respectively), but are interesting in terms of their

opposite relationship. These coefficients may be interpreted as indi-

cating that the percent of farm land which is in harvested cropland is

declining less rapidly where manufacturing is increasing rapidly and that the percent of farmland used as woodland is declining more rapidly where manufacturing employment is increasing.

In regard to the size distribution of farms, it appears that while the percentages of all farms in the under 10 acre and 10 to 50 acre categories are declining, they are doing so less rapidly where manufacturing employment is increasing. Of the remaining three farm size categories, which are each increasing as a percentage of all farms, only the change in the percentage of farms over 500 acres is positively related to change in manufacturing employment. The various farm size categories and changes among them were shown in Table V-4. Partial correlation coefficients for their relationship to percent change in manufacturing employment (MFCGNG) were given in Table V-8.

Trends in Piedmont District
Agricultural Capital Investment

Increases in both the average value of land and buildings per farm and per acre in the District are strongly associated with increases in manufacturing employment. The partial correlation coefficient between changes in manufacturing employment and changes in the value of land and buildings per acre is .8670, somewhat higher than that between changes in manufacturing employment and changes in the value of land and buildings per farm at .7878. The trend toward fewer farms (-63 percent) during 1950 to 1974 and the trend toward declining acreage (-42 percent) show up strongly in each of the seven counties. Between 1950 and 1970, investment in land and buildings increased from about 8 million

dollars to about 41 million dollars. Allowing for the rate of inflation, there appears to have been an absolute increase in the level of farm investment in spite of the decrease in the number of farms and farm acreage.

The .7643 partial correlation coefficient shown in Table V-8 for increases in manufacturing employment relative to decreases in the percent of farm operators who are tenants implies that the decreases in rate of tenancy and increases in the rate of farm ownership are lowest where increases in manufacturing employment are greatest. The decrease in the rate of tenancy is consistent throughout the region and tenancy ranged from .04 to .11 percent of all farm operators in 1974, while the changes in manufacturing employment show much more variation. In general, however, the rate of tenancy decreased as manufacturing employment increased.

In examining the relationship between investment in machinery and equipment and change in manufacturing employment, a partial correlation coefficient of -.5025 was found, showing a moderate negative relationship. This indication of reduced rates of investment where manufacturing is increasing is consistent with findings for the State as a whole.

Trends in Piedmont District
Population and Income Levels

The partial correlation coefficient relating percent change in rural farm population (RFPCNG) to percent change in manufacturing employment (MFGCNG) is positive, but the coefficient level (.2261) indicates only a weak relationship. While the District farm population

declined by 60 to 80 percent between 1950 and 1970, it declined less in those counties with higher increases in manufacturing employment.

The level of median farm family income is more closely associated with the percent of the farm population who are white than it is with any of the other variables examined. Variables omitted from this study such as the age distribution and educational attainment of the farm population may be more closely related to income levels than the variables examined in the analysis.

Summary

This analysis of interrelationships between manufacturing and agricultural activities provides insight into the changes taking place in one of the more rural areas of Virginia. For most of the variables examined the mean change was equal to or greater than the State mean. One notable exception to this generalization is average farm size which is only increasing about half as rapidly in the District.

The forces affecting agricultural employment appear to be largely independent of change in manufacturing employment, though to some extent increases in manufacturing employment have dampened the rural population exodus. The remaining farm operators have increasingly sought and found off-farm employment and these employment changes are directly related to increases in manufacturing employment.

Changes in manufacturing employment have been strongly associated with changes in land use, especially the increase in nonfarm land and decreases in harvested cropland and woodland. Farm units have shown strong shifts toward fewer units in the 10 to 49 acre category and more

units in the 180 to 499 acre category. Combined, these changes indicate a trend toward less area in farms, larger farm units, fewer farms over-all, and an increasing proportion of cropland relative to woodland and woodland pasture.

The increases in average value of land and buildings per farm and per acre were directly related to increases in manufacturing employment while increases in percent of farm owners and in total value of farm machinery and equipment were inversely related. The reasons for this difference in type of relationship to manufacturing employment change for measures of capital investment are not apparent from this study.

In general the findings for Planning District No. 14 are not different from those for the State as a whole, but reflect a greater extent of change and an intensification of some of the relationships.

CHAPTER VI

SUMMARY AND CONCLUSIONS

Summary

Virginia has experienced a comparatively rapid influx of manufacturing firms into rural areas in the past 25 years. At the same time agricultural activity has declined and nonfarm land use has increased to the point where it has become a legislative concern. This study attempted to determine the relationships of change in manufacturing employment to changes in various aspects of agricultural production and structure including labor allocation, changes in farm capital investment, land use changes, and farm family income changes.

In an effort to discover the trade-offs involved in pursuing the policy alternatives of increasing manufacturing employment in rural areas while still maintaining a viable agricultural sector, this study explored the interrelationships between the manufacturing and agricultural sectors. The objectives of the study were to determine the relationship of changes in manufacturing employment to agricultural sector changes in: (1) labor employment, (2) land use, (3) capital investment and (4) farm family income levels.

More specifically, the hypotheses developed for the study included:

1. an inverse relationship between manufacturing and agricultural employment,

2. a direct relationship between manufacturing employment and off-farm employment of farm residents,

3. a direct relationship between manufacturing employment and agricultural capital investment,

4. a direct relationship between manufacturing employment and farm family incomes, and

5. a shift toward increasing nonfarm land use, fewer, but larger farms, and a decreasing proportion of woodland as manufacturing employment increases.

The data for the study covered the period from 1950 to 1974 and were aggregated to provide geographical units of analysis for the entire State. Two separate regional groupings of these geographical units on the basis of the size of their population center and major type of agricultural production were used in the analysis to control for the effects of the diversity of areas in Virginia. Partial correlation analysis was used to examine the degree and direction of relationship between manufacturing and agricultural variables, while controlling for the effect of "other employment" change and other pertinent variables.

The theoretical framework for this study has as its basis Schultz's locational hypothesis of regional growth in which he postulates that agricultural markets function most efficiently and agricultural incomes increase most rapidly in proximity to industrial-urban centers.[1]

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[1]Theodore W. Schultz, The Economic Organization of Agriculture (New York: McGraw Hill, 1953).

The work of both Nicholls and Tang in developing and testing subhypotheses relating to labor and capital markets also had a strong influence on the direction of this study.

While the findings of Nicholls and Tang generally supported and expanded Schultz's hypothesis, this study did not. In regard to farm family incomes it was found that the percent change in income was greatest in the "Peanut" region where commercial agriculture is strong and least in the "Urban" region. Only in examining the relationship between manufacturing employment of farm residents and median farm family incomes was a stronger association found in urban areas and in both cases the rate of increase in median farm family income was below the State average. Thus, it appears that manufacturing employment may play a major role in increasing farm family incomes and where agricultural expansion is restricted by urban density.

The hypothesis that the efficiency of agricultural markets increases with proximity to urban centers also failed to gain support in this study. It was found that farm investment was increasing most rapidly in the areas most distant from large urban centers and in the areas with the least increase in manufacturing employment. In addition, it was found that change in the "Rural" region for many of the variables examined was as great or greater than for the rest of the State. If efficiency in the functioning of markets is dependent on freedom of movement of productive factors then Virginia's rural and urban markets are approximately equal in terms of efficiency. It is possible that Virginia no longer has isolated agricultural labor and capital markets, but

has one integrated market system. Labor resource employment was dis-
cussed in terms of agricultural and manufacturing labor markets and the
linkages between them. Rural-agricultural labor markets were generally
depicted in the literature as less structured, less efficient and lower
wage than urban-industrial labor markets. It was suggested that inter-
action between these two types of labor markets would result in a flow
of labor from agriculture to manufacturing, an interaction of labor sup-
ply and demand in both markets to produce a new equilibrium wage, and a
reorganization of agriculture away from labor intensive production.

From this study, a picture has been developed of changing labor
allocation in Virginia which involves both an exodus of labor from
agriculture and a transfer of part of that labor to manufacturing. A
positive association was found between the absolute levels of manu-
facturing and agricultural employment, while the relationship between
their rates of change was direct, but negative. Thus, the analysis in-
dicated that the levels of manufacturing and agricultural employment
tend to be inversely related over time. Considering the relative shares
of manufacturing and agricultural employment, an inverse relationship
was found and an even stronger one for changes in the shares. This
finding appears to indicate the presence of a transfer of agricultural
labor directly to manufacturing. Since the correlation coefficients for
relationships between agricultural and manufacturing employment were
generally weak, and the decline in agricultural employment was much more
consistent than were changes in manufacturing, it appears that change in

agricultural employment is largely independent of manufacturing employ-
ment change.

The findings for relationships between manufacturing employment and
the employment of farm women and farm residents in general were incon-
clusive. Changes in the employment of farm women in particular are so
consistent across the State that causal factors beyond the scope of this
study must be assumed. The employment of farm operators including com-
mercial farmers, on the other hand, appears to be directly related to
changes in manufacturing employment. Increases in manufacturing employ-
ment were also associated with increases or smaller than average de-
creases in the incidence of part-time farming. Overall, the off-farm
employment of farm operators has been increasing and at a faster rate
for commercial farmers than for others.

In describing the reorganization of agriculture and changes in
capital investment, there was conflict in the literature. Nicholls and
Tang supported the theory that industrial-urban development and agricul-
tural investment were directly related[2] while Hanson and Spitze implied
an inverse relationship.[3] There was general agreement, although, that
the presence of manufacturing plants in rural areas leads to increased
nonfarm use of land and increasing land prices.

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[2]William H. Nicholls, "Industrialization, Factor Markets, and
Agricultural Development," Journal of Political Economy, Vol. LXIX,
No. 4 (1961), pp. 319-340.

[3]R. J. Hanson and R. G. F. Spitze, "Farm Size Characteristics Af-
fecting Off-Farm Earnings of Illinois Farmers," Illinois Agricultural
Economics, Vol. XIV, No. 1 (1974), p. 26-30.

Virginia's land use patterns are clearly changing. Nonfarm land use is increasing over the State and only slightly more rapidly near urban areas than elsewhere. The hypothesis of a direct relationship between increasing manufacturing employment and increasing nonfarm use of land was supported by the analysis. On the other hand, results regarding the declining number of farms in the State did not indicate that manufacturing employment change had any explanatory power. Farm size, while increasing across the State, was found to increase inversely with manufacturing employment, which is consistent with the findings for all of the measures of farm capital investment. The value of land and buildings per acre was found to be increasing across the State with little variation between regions, lending support to the argument for the existence of an integrated land market.

Capital investment in agriculture was found to be strongest where the manufacturing sector is growing most slowly. This is in direct contradiction of the findings of Tang[4] and the hypotheses of this study, but in line with the recent Illinois study by Hanson and Spitze.[5] Tang also found the rate of tenancy declining most rapidly in areas with the greatest industrial-urban development.[6] This study found the tenancy

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[4]Anthony M. Tang, Economic Development in the Southern Piedmont 1860-1950 (Chapel Hill, N.C.: University of North Carolina Press, 1958), p. 145.

[5]R. J. Hanson and R. G. F. Spitze, "Farm Size Characteristics Affecting Off-Farm Earnings of Illinois Farmers," Illinois Agricultural Economics, Vol. XIV, No. 1 (1974), p. 28.

[6]Anthony M. Tang, op. cit., p. 137.

rate declining most rapidly where the rate had been highest at the outset of the study period. Thus the findings related to capital investment did not support the hypotheses, but indicated an inverse relationship between increasing manufacturing employment and increases in measures of investment.

In regard to farm family incomes, the literature generally held that incomes would increase as the farm population sought the highest returns to their labor and alternatives to agricultural employment became available. It was expected that income maximization would be evidenced by an increase in dual employment; that is, part-time farming and off-farm employment. Several of the hypotheses pertaining to income change were developed from the recent analysis by Gene Summers and others of research on rural change which treats the distributional effects of new manufacturing plants in rural areas.

The results related to the income maximizing behavior of farm operators were generally in agreement with the literature. Increasing median farm family incomes did appear to be associated to some degree with the manufacturing employment of family members--but weakly. It was clear, however, that counties with higher percentages of whites in their farm population have higher income levels, as suggested by Summers and others. The rates of increase in the number of noncommercial farms, and in the percent of farm operators and especially commercial farmers employed off-farm were directly related to increases in manufacturing employment. These findings lend strong support to the argument that manufacturing employment alternatives lead to increasing farm family incomes.

The results of the analysis for the case study of seven relatively homogeneous counties were consistent with findings for the State as a whole in the area of changing allocation of labor, but the degree of correlation found was stronger. Unlike the State-wide study, the case study showed a strong inverse relationship between increasing manufacturing employment and the declining number of farms. It also indicated a direct positive relationship between increases in manufacturing employment and part-time farms.

Changes found in farm size, size distribution and farm land use were all similar to those for the State as a whole. For capital investment the findings for the case study area showed an inverse relationship between increasing manufacturing employment and increases in farm ownership and investment in machinery and equipment. In contrast to the State-wide study, however, changes in average value of land and buildings per farm and per acre were directly and strongly related to changes in manufacturing employment. The reason for this contradictory finding is not apparent. In the area of farm population change and farm family incomes the relationships were weak but tended to support the findings for the rest of the study.

Conclusions and Implications

From the results of this study it is apparent that increasing manufacturing employment is associated with agricultural decline. Vigorous growth in both sectors in the same area is the exception to the rule. While the decline in agricultural employment may not be affected by local activities, the resultant exodus of rural population

may be moderated by the availability of employment alternatives in manufacturing.

It is clear that dual employment of farm operators is increasing across the State and a portion of this increase appears to be accounted for by increased manufacturing employment opportunities in rural areas. What is not clear from this study is whether this dual employment is a prelude to exit from agriculture or a stabilizing force. Farm family income levels and their rate of increase were only partially explained by changes in manufacturing employment. It was apparent, however, that the majority of farm operators seek income maximization through dual sector employment.

Investment in agriculture was found in this study to be adversely affected by proximity to manufacturing employment growth. Since both the level of and change in measures of investment were not considered simultaneously in this study the possibility that more rural areas are "catching up" with the rest of the State has not been eliminated.

The increased use of land for nonfarm purposes is associated with increased manufacturing employment, although there are obviously other causal factors involved as well. For farm size changes, the trends are clear. Average farm size is increasing, the number of farms decreasing, and the proportion of farmland used for crops is increasing. All of these findings are consistent with the literature concerning agricultural reorganization in response to a rising wage rate for labor.

Since none of the basic premises of the model of change in the organization of agricultural production shown in Figure II-1 have been

refuted it may be assumed to be an accurate representation of the flow of change.

Recommendations for Further Research

The number of hypotheses for which the strength and directionality of the findings for the case study differ from those for all of the major subregions leads to the conclusion that the lack of homogeneity within subregions may well have obscured some of the results of this study. There is a need to more clearly identify and differentiate between subregions of the State in order to determine if the interaction of the manufacturing and agricultural sectors differs between types of regions. In this study the size of the urban center did not appear to differentiate between Semi-urban and Rural areas for many of the variables examined. One possibility that deserves examination is that of a threshold effect for manufacturing employment. The relationship between changes in manufacturing employment and changes in the agricultural sector may well depend on the absolute level or percentage share of manufacturing employment underlying the change.

Using the variables and relationships identified in this study as a basis, a predictive model for rural change might be developed.[7] Through use of the data collected for this study and a more homogeneous grouping of county units stages in the transition from a rural-

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[7]Such a model would need to include variables measuring employment change in all of the major private sectors as well as the public sector. In addition, measures of infrastructure investment by the public sector and capital investment by industry should be included.

agricultural economy to an urban-industrial economy or a commercial agricultural economy might be identified and used for policy formulation.

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APPENDIX A

Virginia County/City Geographic Units of Analysis[a]

1.   Accomack County
2.   *Albemarle County-Charlottesville City
3.   *Alleghany County-Covington City-Clifton Forge City
4.   Amelia County
5.   Amherst County
6.   Appomattox County
7.   Arlington County
8.   *Augusta County-Staunton City-Waynesboro City
9.   Bath County
10. *Bedford County-Bedford City
11. Bland County
12. Botetourt County
13. Brunswick County
14. Buchanan County
15. Buckingham County
16. *Campbell County-Lynchburg City
17. Caroline County
18. *Carroll County-Galax City
19. Charles City County
20. Charlotte County
21. *Chesapeake City-Norfolk City-Norfolk County-Portsmouth
     City-South Norfolk City
22. Chesterfield County
23. Clarke County
24. Craig County
25. Culpeper County
26. Cumberland County
27. Dickenson County
28. Dinwiddie County
29. Essex County
30. *Fairfax County-Fairfax City-Alexandria City-Falls Church City
31. Fauquier County
32. Floyd County
33. Fluvanna County
34. Franklin County
35. *Frederick County-Winchester City
36. Giles County
37. Gloucester County

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[a]Those localities where counties and independent cities were combined are denoted by an asterisk. Based on: Richard A. March, "An Analysis of Alternative Multivariate Measures of Economic Growth and Development Applied to Virginia Counties and Independent Cities," Unpublished M.S. thesis, V.P.I. and S.U., Blacksburg, Virginia, May, 1976, Appendix B.

38. Goochland County
39. Grayson County
40. Greene County
41. *Greensville County-Emporia City
42. *Halifax County-South Boston City
43. *Hampton City-Elizabeth City County
44. Hanover County
45. *Henrico County-Richmond City
46. *Henry County-Martinsville City
47. Highland County
48. Isle of Wight County
49. *James City County-Williamsburg City
50. King and Queen County
51. King George County
52. King William County
53. Lancaster County
54. Lee County
55. Loudoun County
56. Louisa County
57. Lunenburg County
58. Madison County
59. Mathews County
60. Mecklenburg County
61. Middlesex County
62. *Montgomery County-Radford City
63. Nelson County
64. New Kent County
65. *Newport News City-Warwick County
66. Northampton County
67. Northumberland County
68. Nottoway County
69. Orange County
70. Page County
71. Patrick County
72. *Pittsylvania County-Danville City
73. Powhatan County
74. Prince Edward County
75. *Prince George County-Colonial Heights City-Hopewell City-
    Petersburg City
76. Prince William County
77. Pulaski County
78. Rappahannock County
79. Richmond County
80. *Roanoke County-Roanoke City-Salem City
81. *Rockbridge County-Lexington City-Buena Vista City
82. *Rockingham County-Harrisonburg City
83. Russell County
84. Scott County
85. Shenandoah County
86. Smyth County
87. *Southampton County-Franklin City

88.   *Spotsylvania County-Fredericksburg City
89.   Stafford County
90.   *Suffolk City-Nansemond County
91.   Surry County
92.   Sussex County
93.   Tazewell County
94.   Virginia Beach City-Princess Anne County
95.   Warren County
96.   *Washington County-Briston City
97.   Westmoreland County
98.   *Wise County-Norton City
99.   Wythe County
100. York County

APPENDIX B

Agricultural Production Regions of Virginia

In order to control for the possible effects of commodity
specific changes in technology and prices on farm organization
and incomes, geographical units have been grouped into agricul-
tural production regions. The procedure followed, data and
indices are given below.

From the preliminary data of the 1974 Census of Agriculture
"relative productivity indices" were constructed for each county
and city for which agricultural statistics are available.
Those for which data is not collected were included in the Low
Agricultural Sales group. The indices covered each of the state's
major products on the basis of both volume and sales. The
indices were constructed by dividing the volume or gross sales
figures for a product by total county or city acreage, to get a
measure of the relative productivity of each geographical unit's
land base in production of the various agricultural products.

Example: Accomack County

Total Acreage = 304,460

Total Value of Agricultural Products Sold in $1000 = 33,992

Total Sales Index: Total Value of Agricultural Products Sold in
$1000/Total Acreage = .1116

The index weights were then used to divide the counties and
cities into mutually exclusive production groups. When geograph-
ical units qualified for inclusion in more than one group they

were classified in the category for which their relative productivity is greatest.

The grouping of counties was accomplished by listing counties by index weights and selecting the index value which separated those counties in which a particular type of agricultural production predominated from those in which it did not. The index values selected as criteria for the groupings are as follows:

Peanut Index > 44.0000

This index value is associated with an annual production of over eight million pounds. While Dinwiddie and Prince George counties both produce this amount, Dinwiddie is not included in this group because its greater area results in a much lower relative productivity index and it is also a major tobacco producer.

Tobacco Index > 4.0000

This value is associated with an annual production level of over one million pounds. Within this group there is a district subgroup consisting of Brunswick, Charlotte, Halifax, Lunenburg, Mecklenburg, and Pittsylvania counties which have a relative productivity index value greater than 18.0000.

Soybean Index > 1.0000 and Corn Index > 1.0000

In some, but not all, of these counties the livestock or poultry index value is also relatively high.

Livestock Index > .0150 and Corn Index > 1.0000

In these counties soybean production is relatively low.

Total Sales Index > .0075 and < .0500

In these counties none of the major crops predominate.

Total Sales Index < .0075

These counties are characterized by relatively low agricultural productivity overall.

Counties by Agricultural Production Region

Peanut Group

Index: Pounds of Peanuts/Total Acreage > 44.0000

Greensville
Isle of Wight
Prince George
Southampton
Suffolk
Surry
Sussex

Tobacco Group

Index: Pounds of Tobacco/Total Acreage > 4.0000

Amelia
Appomattox
Brunswick
Campbell
Charlotte
Dinwiddie
Franklin
Halifax
Henry
Lee
Lunenburg
Mecklenburg
Nottoway
Patrick
Pittsylvania
Prince Edward
Russell
Scott
Smyth
Washington

General Agriculture Group

Index: $1000's of Value of Agricultural Products Sold/Total

       Acreage > .0075 and < .0500

Albemarle	Highland
Amherst	James City
Bedford	Louisa
Bland	Montgomery
Botetourt	Nelson
Buckingham	New Kent
Caroline	Powhatan
Carroll	Prince William
Chesterfield	Pulaski
Cumberland	Rappahannock
Fairfax	Roanoke
Floyd	Rockbridge
Fluvanna	Spotsylvania
Frederick	Stafford
Goochland	Tazewell
Grayson	Warren
Greene	Wythe
Henrico	York

Low Agricultural Sales Group

Index: Total Value of Agricultural Products Sold in $1000's/

       Total Acreage < .0075

Alleghany
Arlington
Bath
Buchanan
Craig
Dickenson
Giles
Hampton
Newport News
Wise

Soybean and Corn Group

Index: Bushels of Soybeans/Total Acreage > 1.0000 and
         Bushels of Corn/Total Acreage > 1.0000

Accomack
Charles City
Chesapeake City
Essex
Gloucester
Hanover
King and Queen
King George
King William
Lancaster
Mathews
Middlesex
Northampton
Northumberland
Richmond
Virginia Beach City
Westmoreland

Livestock and Corn Group

Index: $1000's of Livestock and Products Sold/Total Acreage

         > .0150 and Bushels of Corn/Total Acreage > 1.0000

Augusta
Clarke
Culpeper
Fauquier
Loudoun
Madison
Orange
Page
Rockingham
Shenandoah

APPENDIX C

Urban--Rural Regions

This grouping of cities and counties was adapted from one developed

by the Rural Affairs Study Commission.[a]

Rural Areas: Those without a population center of 3,500 or more people
     within or on their borders.

   1.   Accomack County
   4.   Amelia County
   6.   Appomattox County
   9.   Bath County
  11.   Bland County
  12.   Botetourt County
  13.   Brunswick County
  14.   Buchanan County
  15.   Buckingham County
  17.   Caroline County
  19.   Charles City County
  20.   Charlotte County
  23.   Clarke County
  24.   Craig County
  26.   Cumberland County
  27.   Dickenson County
  29.   Essex County
  32.   Floyd County
  33.   Fluvanna County
  36.   Giles County
  37.   Gloucester County
  38.   Goochland County
  40.   Greene County
  47.   Highland County
  50.   King and Queen County
  51.   King George County
  52.   King William County
  53.   Lancaster County
  54.   Lee County
  56.   Louisa County
  57.   Lunenburg County
  58.   Madison County
  59.   Mathews County
  61.   Middlesex County
  63.   Nelson County
  64.   New Kent County
  66.   Northampton County
  67.   Northumberland County
  69.   Orange County
  71.   Patrick County

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[a]Rural Affairs Study Commission, A Report to the Governor and the
General Assembly of the Commonwealth of Virginia (1971).

73. Powhatan County
78. Rappahannock County
79. Richmond County
83. Russell County
84. Scott County
85. Shenandoah County
91. Surry County
92. Sussex County
97. Westmoreland County

Semi-urban Areas: Non-metropolitan areas with a population center of 3,500 or more people within or on their borders.

2. Albermarle County-Charlottesville City
3. Alleghany County-Covington City-Clifton Forge City
8. Augusta County-Staunton City-Waynesboro City
10. Bedford County-Bedford City
18. Carroll County-Galax City
25. Culpeper County
28. Dinwiddle County
31. Fauquier County
34. Franklin County
35. Frederick County-Winchester City
39. Grayson County
41. Greensville County-Emporia City
42. Halifax County-South Boston City
46. Henry County-Martinsville City
48. Isle of Wight County
49. James City County-Williamsburg City
60. Mecklenburg County
62. Montgomery County-Radford City
68. Nottoway County
70. Page County
72. Pittsylvania County-Danville City
74. Prince Edward County
75. Prince George County-Colonial Heights City-Hopewell City-
    Petersburg City
77. Pulaski County
81. Rockbridge County-Lexington City-Buena Vista City
82. Rockingham County-Harrisonburg City
86. Smyth County
87. Southampton County-Franklin City
88. Spotsylvania County-Fredericksburg City
89. Stafford County
90. Suffolk City-Nansemond County
93. Tazewell County
95. Warren County
96. Washington County-Bristol City
98. Wise County-Norton City
99. Wythe County

Urban Areas: Those classified as Standard Metropolitan Statistical Areas.

  5. Amherst County
  7. Arlington County
 16. Campbell County-Lynchburg City
 21. Chesapeake City-Norfolk City-Norfolk County-Portsmouth City-
    South Norfolk City
 22. Chesterfield County
 30. Fairfax County-Fairfax City-Alexandria City-Falls Church City
 43. Hampton City-Elizabeth City County
 44. Hanover County
 45. Henrico County-Richmond City
 55. Loudoun County
 65. Newport News City-Warwick County
 76. Prince William County
 80. Roanoke County-Roanoke City-Salem City
 94. Virginia Beach City-Princess Anne County
100. York County

APPENDIX D

Data Bank for Virginia Counties and Independent Cities

List of Variables[a]

01. Total population (TOTPOP__) P 1950, 1960, 1970

02. Population per square mile (POPDEN__) P 1950, 1960, 1970

03. Total white population (WPOP__) P 1950, 1960, 1970

04. Total civilian labor force (TCLF__) P 1950, 1960, 1970

05. Total female civilian labor force (TFCLF__) P 1950, 1960, 1970

06. Total area residents employed (EMPLOY__) P 1950, 1960, 1970

07. Total employed in manufacturing (EMPMFG__) M 1954, 1958, 1963, 1967, 1972

08. Total employed in manufacturing (TOTMFG__) P 1950, 1960, 1970

09. Rural nonfarm population (RNFPOP__) P 1950, 1960, 1970

10. Rural farm population (RFPOP__) P 1950, 1960, 1970

11. Median farm family income (MFFINC__) P 1959, 1969

12. White farm population (WFPOP__) P 1950, 1960, 1970

13. Female farm population (FFPOP__) P 1950, 1960, 1970

14. Median school years for the farm population 25 years of age and older (MSYFP__) P 1950, 1960, 1970

15. Farm population employed in agriculture (FAGEMP__) P 1950, 1960, 1970

16. Farm population employed in manufacturing (FMFGEM__) P 1960, 1970

[a]The last two characters of each variable name are derived from the year of each observation of the variable. The years for which observations have been included are listed for each variable.

17. Total farm population employed (TOTFEM__) P 1950, 1960, 1970

18. Farm residents with less than poverty level income (FAREPO__) P 1969

19. Total males employed in manufacturing (MMFGEM__) P 1950, 1960, 1970

20. Number of farms (FARMS__) A 1950, 1954, 1959, 1964, 1969, 1974

21. Average farm size (AVFSIZ__) A 1950, 1954, 1959, 1964, 1969, 1974

22. Number of noncommercial farms as defined by the Census of Agriculture (NONCOM__) A 1950, 1954, 1959, 1964, 1969, 1974

23. Percent of total area which is nonfarm (NONFAR__) A 1950, 1954, 1959, 1964, 1969, 1974

24. Acres of harvested cropland (ACHCRP__) A 1950, 1954, 1959, 1964, 1969, 1974

25. Acres of cropland used for pasture (ACCRPP__) A 1950, 1954, 1959, 1964, 1969, 1974

26. Acres of other cropland (ACOCRP__) A 1950, 1954, 1959, 1964, 1969, 1974

27. Acres of woodland and woodland pasture (ACWOOD__) A 1950, 1954, 1959, 1964, 1969, 1974

28. Acres of all other farm land (ALLOAC__) A 1950, 1954, 1959, 1964, 1969, 1974

29. $1,000's of value of land and buildings (VLB__) A 1969, 1974

30. Average value of land and buildings per farm (AVLBF__) A 1950, 1954, 1959, 1964, 1969, 1974

31. Average value of land and buildings per acre (AVLBA__) A 1950, 1954, 1959, 1964, 1969, 1974

32. Number of farms under 10 acres (ACU10__) A 1950, 1954, 1959, 1964, 1969, 1974

33. Number of farms, 10-49 acres (AC10__) A 1950, 1954, 1959, 1964, 1969, 1974

34. Number of farms, 50-179 acres (AC50__) A 1950, 1954, 1959, 1964, 1969, 1974

35. Number of farms, 180-499 acres (AC180__) A 1950, 1954, 1959, 1964, 1969, 1974

36. Number of farms, over 500 acres (AC500__) A 1950, 1954, 1959, 1964, 1969, 1974

37. Number of farm operators, full owners (FOPOWN__) A 1950, 1954, 1959, 1964, 1969, 1974

38. Number of farm operators, part owners (FOPPOW__) A 1950, 1954, 1959, 1964, 1969, 1974

39. Number of farm operators, tenants (FOPTEN__) A 1950, 1954, 1959, 1964, 1969, 1974

40. Number of farm operators reporting an occupation other than farming (1974) or working 100 or more days off farm (OCCOTH__) A 1950, 1954, 1959, 1964, 1969, 1974

41. Average age of farm operator (AVAGE__) A 1959, 1964, 1969, 1974

42. Number of commercial farm operators with off-farm income (COMOFI__) A 1950, 1959, 1964, 1969, 1974

43. $1000's of value of machinery and equipment (VME__) A 1969, 1974

44. Total employed in agriculture (TOAGEM__) P 1950, 1960, 1970

45. Female farm population over 14 (1950) or 16 (1960, 1970) employed (FFPEM__) P 1950, 1960, 1970

46. Female farm population over 14 (1950) or 16 (1960, 1970) (FEFAP__) P 1950, 1960, 1970

47. N1 through N46 - The geographical unit code number and variable number

Data Sources:

    A--Census of Agriculture
    M--Census of Manufactures
    P--Census of Population

VITA

Leslie Anne Dugdale Nieves was born in Morristown, New Jersey on August 12, 1944. She received her Bachelor of Arts Degree in Economics from Virginia Polytechnic Institute and State University in June, 1975. The following September she entered the graduate program at Virginia Polytechnic Institute and State University as a Research Assistant in the Department of Agricultural Economics. In May, 1977 she completed the requirements for the Master of Science Degree.

AN ANALYSIS OF LINKAGES BETWEEN THE MANUFACTURING
AND AGRICULTURAL SECTORS IN VIRGINIA

by

Leslie Anne Dugdale Nieves

In an effort to discover the trade-offs involved in pursuing
the policy alternatives of increasing manufacturing employment in
rural areas while still maintaining a viable agricultural sector,
this study explored some interrelationships between the manu-
facturing and agricultural sectors. The objectives of the study
were to determine the relationship of changes in manufacturing
employment to agricultural sector changes in: (1) labor employ-
ment, (2) land use, (3) capital investment and (4) farm family
income levels. The data covered the period from 1950 to 1974.
Partial correlation analysis was used to examine the degree
and direction of relationship between manufacturing and agricul-
tural sector variables for the State and subregions.

The results indicated that increasing manufacturing employ-
ment is associated with agricultural decline. Nonfarm land use
and the dual employment of farm operators were found to be
increasing across the State. Investment in agriculture was shown
to be adversely affected by proximity to manufacturing employment
growth. Farm family income levels and their rate of increase
were only partially explained by changes in manufacturing em-
ployment. While the decline in agricultural employment may not

be affected by local policy, the resultant exodus of rural population may be moderated by the availability of employment alternatives in manufacturing.