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URBAN INFLUENCES ON FARMLAND USE IN NEW YORK STATE

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Abstract

This article assesses the relationship between demographic change and structural adjustments in agriculture. A number of demographic and economic analyses have posited an inverse relationship between post-1950 exurban population growth and agricultural viability, especially in the Northeast region of the United States. To test this hypothesis, a multivariate model of percent change in county land in farms over the period 1950-1987 is estimated, and the findings only partially support the population hypothesis. Estimation results indicate that the effect of core metropolitan status is significant, but that the effects of rural population change, rural nonfarm population change, and county population deconcentration are not. The analysis demonstrates that maintenance of land in farm use largely depends upon economic forces that are national and regional in scope and are almost exclusively outside the purview of state and local farmland protection programs.

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Introduction

The policy discussion over rural land use includes concerns about the effect that urbanization has on the availability of land for agriculture. That discussion intensified after World War II when increasing numbers of citizens chose residences outside the urban core and population spilled over to open country along the urban fringe and beyond. During the 1970s, population growth in rural communities distanced from the urban core became a national phenomenon, and marked the first time in this century that nonmetropolitan communities in the U.S. attracted more new residents than metropolitan ones (Fuguitt, 1985). Often referred to as the "population turnaround", this development signaled a reversal of long-standing trends toward depopulation of more thinly settled rural communities and more dense settlement in or at the fringe of the urban core.

These developments were accompanied by a perception that population growth and redistribution jeopardized the Nation's farmland base. State and local governments stepped up their farmland protection efforts. Legislation was introduced in the U.S. Congress to provide federal funding for stronger measures to protect agricultural land from conversion to a built-up urban use. Despite much debate and exposure in both the popular press and the scientific community, however, a national consensus on the need for agricultural land protection has not emerged. Early in the 1980 decade, aggregate export demand for U.S. food and fiber commodities eroded and very substantial acreages

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of cropland were once again idled under federal supply management/income maintenance programs. These shifts in market conditions also eroded the public perception of farmland scarcity. And demographers concluded that rural population growth, so prominent in the previous decade, stalled in the 1980s (Richter, 1985). These developments coincided with the completion of a National Agricultural Lands Study (NALS), which did not provide conclusive evidence on serious conflicts between accommodating new land requirements for urban development and the Nation's aggregate capacity to produce agricultural commodities. The farmland sufficiency issue and its relation to demographic change, as a consequence, has virtually disappeared from the national land policy agenda.

This positioning of the farmland adequacy issue nationally contrasts very sharply with the public dialogue over rural land use in the older, more densely settled Northeast states. In this region, major structural changes in commercial farming, at work since the turn of the century, not only greatly reduced agricultural labor requirements, but also released millions of acres from agricultural use. These releases, combined with expansion in the nonfarm economy and a growing appetite for country living, have worked together to reshape the rural landscape.

The reshaping is clearly evident in New York State. While terms like 'suburban,' 'urban fringe' and 'metropolitan' have been used since the 1950s to help describe new settlement on open land in close proximity to large core cities, rural New York has shared in the State's population growth since the 1920s. Although overshadowed in absolute numbers by population increases in larger urban places, well over one million new residents were added to rural areas between 1920 and 1950 (U.S. Bureau of the Census, 1975:32), and nearly another 700,000 were added between 1950 and 1990 (U.S. Bureau of the Census, 1992). Concerns about these rural, exurban population increases helped to prompt passage of the 1971 Agricultural Districts Law and its provisions for agricultural assessments on farmland. Further legislation discussed, but not to date, enacted would entail sweeping changes to existing law and commit additional New York State funding to farmland protection efforts (Bills, 1992). Farmland protection has been and continues to be a viable issue in New York State.

The purpose of this article is to further disentangle and assess the relationship between farmland decreases, demographic change and structural adjustment in New York agriculture. This assessment entails two analytical goals. First, to determine whether common measures of population change and metropolitan status are related to the loss of farmland. Second, to test whether this relationship, if one is found, persists when controls for land productivity and farm structure are added. The second goal is accomplished by estimating a multivariate model of percent change in county land in farms over several time intervals between 1950-1987. But before proceeding to these analytical tasks, we first endeavor to summarize the literature that has accumulated around the issue of farmland use and population expansion. Emphasis is placed on studies which have focused on the New York situation.

Previous Studies

When demographic processes are measured in terms of population deconcentration, or the spilling out of a county population from its urban boundaries, a distinct set of expectations has been noted in the literature. Specifically, an inverse relationship between population deconcentration and land available for agriculture is hypothesized in a number of demographic (Brown and Beale, 1981; Lichter and Fuguitt, 1982; Voss, 1988) and economic (Allee et al., 1970; Conklin and Dymsza, 1972) studies. However, because this hypothesized relationship has received very limited empirical assessment, we have little systematic and general knowledge about how differing rates and levels of population deconcentration affect agricultural activity in a county.

On the basis of a characterization of nonmetropolitan population and economic change during the 1970s, Brown and Beale (1981) hypothesize a negative relationship between post-1970 nonmetropolitan population growth and the quantity of land in agriculture. This hypothesis is derived from three characteristics of post-1970 nonmetropolitan population change. First, renewed population growth during the 1970s (the "population turnaround" era) has largely occurred in rural areas of nonmetropolitan counties, thus bringing residential land use into conflict with farming. Second, during this period there were increases in nonagricultural economic activity such as manufacturing which may be conflictual with agricultural land uses. Third, most of the growth in nonmetropolitan housing has been in single, detached units which consume more land than other housing types. Although Brown and Beale (1981) present no direct evidence for a loss of agricultural land due to renewed nonmetropolitan population growth, they believe this to be the case.

In a study of population deconcentration within nonmetropolitan counties, Lichter and Fuguitt (1982) found evidence that population growth between 1970 and 1975 was faster in rural than in urban places. According to Lichter and Fuguitt (1982), faster rural growth is "... creating problems of political coordination between urban places and the surrounding rapidly growing countryside, and contributing to a more rapid conversion of prime agricultural land for residential purposes" (*ibid*:220). Unfortunately, Lichter and Fuguitt (1982) present no evidence to support this statement about agricultural land.

One of the study findings Lichter and Fuguitt (1982) note is that the Northeast region is unlike other regions in terms of population deconcentration. A county is "deconcentrating" when the rural component grows faster than the urban component.[1] Nonmetropolitan counties in all four census regions except the Northeast experienced population concentration (faster urban growth than rural growth) between 1950 and 1970; conversely, the nonmetropolitan Northeast underwent deconcentration during both decades. During the period 1970-1975, the nonmetropolitan part of the other three

[1]Population deconcentration (PD) is defined as: $PD = rate_{rural\ population\ change} - rate_{urban\ population\ change}$.

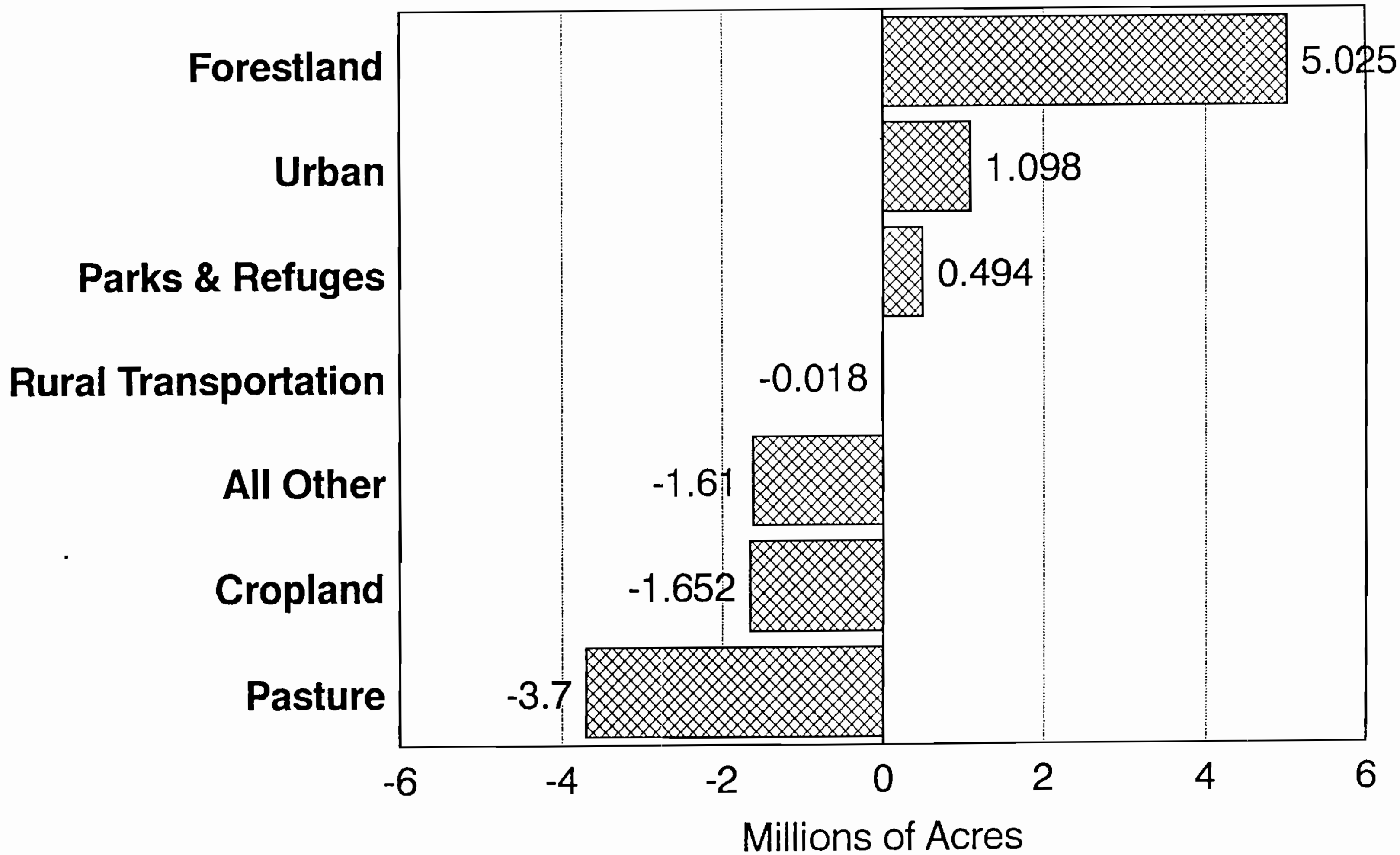
census regions "turned around" and underwent deconcentration; however, the Northeast's rate of deconcentration during this period was four times greater than any of the other census regions. In summary, nonmetropolitan counties in the Northeast region have been deconcentrating longer and at higher rates than nonmetropolitan counties in other regions.

Rural, nonfarm population growth trends obviously entail conversion of open land to residential, commercial, industrial, and transportation uses. This makes conversion of once farmed land parcels to built-up uses and constitute the most visible manifestation of shifting rural land use patterns. However, only about 9 percent of New York's total land area is built-up in the sense that it is urban by census definition or classified as rural transportation by the USDA (Daugherty, 1991).[2]

Some idea of trend in allocation of land to urban or built-up uses can be gained by looking at changes in land use since 1950 (Figure 1). Changes in built-up land uses are dominated by increases in urban acreage to accommodate new population in urban areas. Urban acreage in New York increased by nearly one million acres or 110 percent over the 1950-87 span. Surprisingly, the State realized only a small net change in land devoted to rural transportation uses. This occurred because some very sizable expansions in rural acreage used for airports, roads, and highway mileage -- including New York's share of construction of a federally subsidized interstate highway network beginning in the mid-1950s -- were largely offset by reductions in acreage used to support rail transportation. In part due to more intense competition from motor carriers making use of new highway construction, the Nation abandoned very substantial mileages of railroad

[2]The comparable figure for the U.S. is 3 percent; the USDA estimate is conservative and is Census-defined urban acreage plus rural transportation areas, the acreage taken up by rural highways and roads, railroads, and rural airports. Excluded from this definition are other rural lands in residential, commercial, or industrial uses. The 1987 USDA National Resource Inventory used a more expansive definition and counted 77.4 million acres in developed uses for the U.S., defined to include all urban and built-up areas of 10 acres or more (USDA, Soil Conservation Service, 1987). The comparable figure from the inventory for New York is 2.5 million acres, or 8.2 percent of the State's total land area.

Figure 1: Changes in Major Uses of Land for New York, 1950-87



Source: USDA, 1987

lines. These abandoned rail rights-of-way, in turn, often revert to an open land use and offset the acreage converted to highways or airports.[3] For the Eastern U.S., ratios of land urbanized to unit change in population appear to be in the range of 0.2 acre per capita in localities realizing rapid population growth (Allee, et al., 1985; Vesterby and Brooks, 1988).

Land released from farming is far in excess of the amount developed, and the available data clearly demonstrate that farmland trends are dominated by two, not one, major forces. The first is that structural adjustments in the New York farm sector, as reflected in number, type and size of farm, often lead to releases of land from active farm use because of unfavorable cost/price relationships for farm commodities. Second, land well suited to agricultural use also has the requisite physical and topographical features that make it well suited for development. Too often, patterns of settlement have put some of the State's most productive farmland directly in the path of major transportation corridors and associated residential and commercial development. These relationships are indicated in several studies that show, in general, that a considerable amount of farm production is in close proximity to urban population concentrations (Gustafson and Bills, 1984; Heimlich and Brooks, 1989; Heimlich and Barnard, 1991; Otte, 1984).

There is less agreement on the implications such proximity might have on the longer-term viability of commercial farming. Research conducted in the late 1960s and early 1970s stressed that population growth in farming communities sets in motion forces which encourage land to be prematurely withdrawn from or underutilized for farming

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[3]Trends in conversion of land to built-up uses vary materially from region to region in the U.S. The largest conversions since 1950, both in relative and absolute terms, have occurred in the "Sunbelt" states of the Southeast and the Southwest. The densely populated Northeast states realized the Nation's third largest net increase in built-up acreage -- 5.8 million acres -- which amounted to a 97 percent increase. The rapidly growing Pacific region had a similar rate of increase but from a smaller base of built-up land. Just over 4.3 million acres have been added to built-up acreage in California, Oregon, and Washington since 1950.

purposes. Allee, et. al. (1970:4) argued that urban growth materially affects land that is not put directly into urban use:

> "Owners expect conversion to take place, but just when is very uncertain. The effect seems to be to allow some land to be idle and to reduce the maintenance of capital investments (barns, drainage works, long-term fertility, fences and the like) in some active farmland".

The Allee et al. (1970) study did not yield any empirical estimates of the magnitude of such indirect impacts of population expansion, but the idea that uncertainty over both the timing and location of future nonfarm growth has been a central theme in studies of farmland use in New York. Case studies conducted in Central New York concluded that speculation over the timing and location of nonfarm growth was the major disrupter of farming in rings of urban influence around the central city (Conklin and Dymsza, 1972). Such speculative influences affect farm operators and are often referred to as the "impermanence syndrome," and may help explain a spatial gradient in long-term capital investment, with an increasing frequency of investment as distance to the urban core increases. In addition, speculation was detected in local land markets with land prices falling on a gradient of distance from the urban core (Bryant, 1975). A significant amount of the variation in land values was attributed to buyer-seller expectations regarding future nonfarm development; more than a quarter of all buyers were identified as nonfarm absentee owners whose principal motive for purchase was the anticipation of profits from a future sale.

Farmers near the urban core are in close proximity to nonfarm neighbors. Farming operations that seem routine to farm operators can aggravate otherwise well-intended nonfarm neighbors (Bills, 1988). Nearby residential and commercial development can also increase the frequency of problems with trespass, vandalism, and create new safety hazards for farm equipment on more congested roads and highways. Similarly, co-mingling of farm and nonfarm land uses increases the possibility of farm businesses being confronted with the need to ward off costly legal disputes with nonfarm neighbors.

Recent USDA studies point out, however, that many opportunities for agriculture are inherent in an urban environment (Heimlich and Brooks, 1989). These prospects are often overlooked but include access to specialized markets and off-farm employment, higher equity in farm real estate assets, and political support for farmland retention measures (Heimlich and Barnard, 1991).

Data and Methods

Our primary hypothesis is that population growth and metropolitan status negatively affect the quantity of land used for agriculture. Four alternate measures of demographic change are considered: percent change in population density, percent change in rural population, percent change in rural nonfarm population and population deconcentration. Metropolitan status is based on county designation for 1980. The first variable, percent change in population density, measures the change in total county population relative to county land area. The next three variables tap the change pattern of county subpopulations most likely to be in conflict with agricultural land uses, and quantify an important type of county population change characteristic of the Northeast since at least 1950. Percent change in rural population and in rural nonfarm population measure population growth outside of urban centers. Population deconcentration is computed with the same procedure used by Fuguitt and Lichter (1982) referred to in earlier paragraphs. It is the difference between the rate of rural population growth and the urban rate. Counties with a positive value are classified as "deconcentrating" since the rural growth rate exceeds the urban growth rate.

Each of the four demographic variables are computed for the decade 1940-1950, 1950-1960, 1960-1970 and 1970-1980 in order to estimate their lagged effect on land in farms reported in subsequent time periods in the Census of Agriculture (1950-1959, 1959-1969, 1969-1978 and 1978-1987). The dependent variable is change in land in farms, and the expression used is percentage increase in land released from farming in order to frame the primary hypothesis in positive terms (the mean value for this variable is positive). The lagged cross-sections are pooled, and the parameters estimated using ordinary least squares (OLS). OLS parameter estimates for pooled, time series data typically suffer from contamination due to heteroscedasticity (Sayrs, 1989). The approach taken in this paper is to include a series of period dummies, and examination of the residuals indicate that this eliminated the problem.

The correlation matrix for the four measures of demographic change are presented in Table 1 and the matrix indicates a systematic pattern of relationships. Definitional factors cause percent change in population density to be negatively correlated with population deconcentration (population deconcentration is a negative function of urban population change; percent change in density is a positive function of urban population change). On the other hand, because population deconcentration is a positive function of rural population change, it is positively related to rural population change and to rural nonfarm population change. Finally, there is a strong correlation between percent rural population change and percent rural nonfarm population change.

New York State counties are divided into three categories: metropolitan core counties, metropolitan fringe counties and nonmetropolitan counties. This classification system is based on the federal 1980 metropolitan area definition that applies size and density criteria to identify metropolitan counties containing an urban core, and fringe counties which are economically and socially integrated with the urban core. Metropolitan area definitions are periodically revised, and we select the 1980 definition because it corresponds to the final cross-section of demographic data for this study. We note, however, that there was little change in the New York State metropolitan area definitions between 1980 and 1990 (Brown, Brown and Hirschl, 1991).

There are 62 counties in New York State, but not all of these have land devoted to agriculture. Since our primary hypothesis concerns the relationship between agriculture and demographic change, we exclude nonagricultural counties, specifically, the five New

Table 1. Correlations Among Ten-Year Measures of Demographic Change, 1940-1980, for 52 New York Counties.

	1	2	3	4
1. Population density, % Δ				
2. Rural population, % Δ	.272***			
3. Rural nonfarm population, % Δ	.204**	.723***		
4. Population deconcentration	-.569***	.491***	.329***	
Mean (N=208)	9.98	9.69	25.7	.964
St. deviation	13.0	13.1	26.4	36.0

*Coefficient is significant at the .05 level according to a two-tail t-test.
**Coefficient is significant at the .01 level according to a two-tail t-test.
***Coefficient is significant at the .001 level according to a two-tail t-test.

York City counties (or boroughs), Hamilton, Westchester, Rockland, Putnam and Nassau. Except for Hamilton county, each of these counties are within the New York City area where the level of urbanization precludes any extensive agricultural land use. Hamilton County is located in the central Adirondack region where soils and climate are unfavorable for agriculture. This brings the total number of counties included in the study to 52.

The study spans the 1950-1987 time period when three alternate definitions of a farm were used by the U.S. Bureau of the Census. However, changes in farm definition have very small effects on the county-to-county differences in farm acreage between census periods -- the focus of our analysis. For the 1950 Census, a place with three or more acres was counted as a farm if the annual value of agricultural products, whether for home use or sale, amounted to $150 or more (U.S. Bureau of the Census, 1961). For 1959, the definition was altered so that a place with 10 or more acres was counted as a farm if the estimated sales were $50 or more during the census year. Places with less than 10 acres were also counted if sales amounted to at least $250. According to census estimates, the change in definition was responsible for about 15 percent of the aggregate decrease in farms reported between 1954 and 1959 for New York (U.S. Bureau of the Census, 1961). However, the reduction in farmland reported was only 0.9 percent (127,200 acres) due to the definition changes.

In 1974, the farm definition was changed to include those places with agricultural products sold with a value of $1,000 or more during the census year; it was estimated that the change in definition reduced the count of farms in the 1974 Census for New York from about 46,700 to 43,700 farms (U.S. Bureau of the Census, 1977). Land in farms excluded was about 168,000 acres or about 1.8 percent of land in farms for 1974.

To obtain a measure of real changes in farm parameters measured in dollar terms over the 1950-87 span, values reported in the 5-year Census of Agriculture were deflated using the USDA's Index of Prices Received by Farmers, using 1977 as a base year. The index is national in scope and cannot be desegregated to reflect New York conditions.

However, alternate indices are available for commodity categories and indices were applied separately for crop and livestock sales to gain some added precision by taking New York's commodity mix into account. Index values for "all crops" were applied to county crop sale data and values for "dairy products" were applied to county information on total livestock sales. The latter procedure acknowledges the dominance of dairy farming in the New York livestock sector.

The indexing procedure was not straightforward in two cases. First, to express farm real estate value in real terms, the crops and dairy products indices were applied to per acre real estate values reported in the census by arbitrarily assigning each an equal weight. This assumes that crop sales and dairy sales make equiproportionate contributions to land values. The assumption seems ambitious but a superior alternative may not be available. Finally, it was desirable to apply the indices to census counts of farms by sales class -- a very convenient and very conventional measure of farm size. The specific need was to derive an estimate of the number of farms with a real value of product sales above $10,000 for each census period. However, no published data are available to show the distribution of farms by amount of product sales within each sales class interval. To overcome this problem, the interval was compared in nominal and real terms, and it was assumed that the share of farms that might fall in each real sales class was rectangularly distributed within each sales class. For example, the 1969 Census reported farms in the sales interval $5,000-10,000, or about $9,400-18,000 in real (1977) terms. It was arbitrarily decided that, in this case, 93 percent of the farms in this interval should be included in the estimate of farms with real sales of $10,000 or more during the 1969 Census year.

In the multivariate tests of the hypothesis, three classes of economic control variables are included. First, the opportunity costs of maintaining land in agriculture is operationalized in terms of real value of land and buildings per acre, percent of labor force unemployed, and real median family income. The first variable is expected to have a positive effect on the dependent variable since higher land prices are expected to be a factor in the conversion of farm land to other nonfarm uses. The other two variables indicate the opportunity costs facing farm labor. Counties with low unemployment and high median family income have higher opportunity costs.

Second, land productivity is measured in terms of real net return per harvested acre. This variable is defined as gross farm receipts returns minus cash expenses per acre, and is expected to have a negative impact on release of land from agriculture. Third, farm structure is measured by percent of farms with real gross receipts greater than $10,000, by percent of land classified as cropland, and by percent of income from crops.

Analysis

The purpose of this article is to determine whether demographic change and status causes land to be released from farming. This purpose is pursued via two analytical goals: 1) by testing for an aggregate relationship between various measures of population change and release of farmland, and 2) whether this relationship, if one is found, persists when appropriate controls are added.

Results from the aggregate test for the effect of demographic change and status on release of farmland are presented in Table 2. The table provides unstandardized regression coefficients from five separate OLS estimations. Estimations including only the demographic variables were conducted, but are not presented in Table 2; these estimations were contaminated by high levels of heteroscedasticity, and were corrected by including period dummies in the estimations. The period dummy coefficients are not presented in Table 2 to conserve space, but are available from the authors upon request.

Because the dependent variable in Table 2 is percent land released from farming, our hypothesis suggests that each of the coefficients should be positive. Three findings are noteworthy about Table 2. First, the three variables measuring within-county population growth all have negative coefficients (two are statistically reliable). Thus, we find

Table 2. The Aggregate Effect of Demographic Change on Land in Farms: Unstandardized Partial Regression Coefficients, Standard Errors and Adjusted R^2, 52 New York Counties, 1950-1987. [1]

Independent Variable	*B*	St. Error	Adjusted R^2
Percent change in population density	.0905*	.0436	.473
Percent change in rural population	-.0301	.0448	.425
Percent change in rural nonfarm population	-.0826**	.0282	.447
Population deconcentration	-.0331*	.0158	.436
County metropolitan status:			
Core	4.16**	1.30	.468
Fringe	-2.15	1.34	--

*Coefficient is significant at the .05 level according to a two-tail t-test.
**Coefficient is significant at the .01 level according to a two-tail t-test.
***Coefficient is significant at the .001 level according to a two-tail t-test.

1 The dependent variable is a change score measuring percent of land released from farming. The independent variables are change scores measured in the decade prior to the dependent variable. The four cross-sections are pooled, generating 208 units of observation (4*52). Each estimation includes three period dummies to control for period effects and heteroscedasticity (Sayrs, 1989).

no evidence that dispersed population growth, characteristic of the Northeast region, has meaningful effects on the release of farm land. The coefficients are not in the hypothesized direction, and the significance levels changed to zero under more exacting multivariate tests (not shown here, but available from the authors upon request). Second, core metropolitan status has a strong effect on the release of farmland, but not fringe metropolitan status. Relative to the omitted category nonmetropolitan, core counties experienced a 4.2 percent higher rate of farm land release. There was no statistically reliable difference between fringe metro counties and nonmetro counties. This finding suggests that the broad classification "metropolitan" is not meaningful with regard to expectations about agricultural dynamics, unless separated into core and fringe. Third, there is a slight but statistically significant effect of percent change in population density and release of farm land. This effect is in the hypothesized direction, and indicates that for every percentage increase in population density, 0.09 percent of land is released from agriculture.

Table 3 presents the means and standard deviations for the variables in the multivariate test of the hypothesis. Two demographic measures are included in the test: percent change in population density and a dummy variable for core metropolitan status. These variables are included since they were found to have significant and positive effects in the aggregate tests. Other variables in the model include measures of opportunity costs, land productivity and farm structure. These particular measures were selected for theoretical reasons, although several other theoretically meaningful measures were dropped after it was discovered that they introduced bias arising from multicollinearity.

The first model in Table 4 considers only demographic effects on land released from farming, as measured by percent change in population density over the previous decade, and the fixed effects of residence type and time period. The Model I estimation indicates a statistically significant relationship between percent change in population density and land released from agriculture. The hypothesized positive relation between

Table 3. Means and Standard Deviations of Study Variables for 52 New York Counties, 1950-1987.

	Mean	St. Dev.
Dependent Variable		
Land released from farming	35,919	32,844
Land in farms, beginning of decade	234,813	135,897
Percent land released from farming	15.3	10.6
Demographic Measures		
Percent change in population density during prior decade	9.98	13.0
Core metro county	.25	.43
Opportunity Costs		
Real value of land and buildings per acre	459	613
Percent of labor force unemployed	6.3	2.2
Real median family income	6,943	1,989
Land Productivity		
Real net return per harvested acre	119	71.0
Farm Structure		
Percent of farms with real gross farm receipts GT $10,000	51.8	13.0
Percent of land classified as cropland	58.1	12.3
Percent of income from crops	16.7	18.2

Table 4. Multivariate Analysis of Land Released from Agricluture: Unstandardized Partial Regression Coefficients and Standard Errors, 52 New York Counties, 1950-1987.

	Model I		Model II	
	B	St. Error	*B*	St. Error
Demographic Measures				
Percent change in population density during prior decade	.0897*	.0421	.0424	.0453
Core metro county	4.81**	1.23	4.61***	1.31
Period Dummy Variables				
1960-1970	8.79***	1.52	11.4***	2.94
1970-1980	-9.65***	1.51	-4.17	4.42
1980-1987	-4.81**	1.52	-.0742	4.68
Opportunity Costs				
Real value of land and buildings per acre x 100			.413***	.120
Percent of labor force unemployed			.341	.290
Real median family income x 1,000			-.839	1.01
Land Productivity				
Real net return per harvested acre			.0112	.0109
Farm Structure				
Percent of farms with real gross farm receipts GT $10,000			-.193**	.047
Percent of land classified as cropland			.356***	.058
Percent of income from crops			.0413	.0411
Intercept	14.7***	1.18	42.4***	5.02
Adjusted R^2	.473		.670	
N	208		208	

*Coefficient is significant at the .05 level according to a two-tail t-test.
**Coefficient is significant at the .01 level according to a two-tail t-test.
***Coefficient is significant at the .001 level according to a two-tail t-test.

increased population density and farm land release is supported. Also, Model I indicates that core metropolitan status is a statistically reliable and positive predictor of the farmland retention rate as hypothesized.

Model II presents a more complete model of land released from agriculture. Taken into account are measures of opportunity costs for both land and labor committed to farming, land productivity, and farm structure, as discussed in the paragraphs above. However, the results for this fully specified model do not support the hypothesis that change in population density dictates release of land from active farm use in any significant way. The effect of this variable on release of farmland is statistically trivial although still in the hypothesized direction. On the other hand, the positive effect of core metro county status remains statistically significant. The parameter indicates that farmland loss over a 10-year period in core metro counties is 4.6 percent higher than other counties.

Much new information on nondemographic casual factors is suggested by the Model II estimation. The results are generally encouraging inasmuch as nearly 70 percent of the variation in the farmland retention rate is explained by the independent variables. Model II conforms to *a priori* expectations about the interplay between real estate values and farmland release. Namely, real increases in the value of farm real estate are estimated to induce significant increases in the rate at which land is released from farm use. The model suggests that a $100 increase in per acre real estate value induces a 0.41 percent increase in the rate at which farmland is released from agricultural use. Results for the surrogate measures of the opportunity costs confronting farm labor are not statistically significant.

Our measure of land productivity in Model II is real net cash income per acre. In regression this variable carries the expected positive sign but the error of estimate is too large to assign any statistical reliability. We infer that land productivity, to the extent that we can measure it with census data on per acre gross receipts and cash expenditures made by farm operators, has exerted no statistically significant influence over decisions to retain land in farm use.

Of the farm structure variables, two are statistically significant conforming to our hypothesis. Counties with larger proportions of farms with high gross sales negatively effect the rate of farmland release; similarly, higher percentages of land in farms classified as cropland is associated with relatively higher rates of farmland retention. A one percent gain in a county's concentration of production of farms with higher gross sales reduces farmland loss by nearly 0.2 percent over a 10-year span. A one percent higher proportion of farmland for crops reduces farmland loss by 0.36 percent according to results from our analysis. Thus, to the extent that farm managers are maintaining land in crop rotation cultivation (as opposed to pasture or such extensive uses as livestock, woodland or support land), the overall loss of farm land is reduced.

Summary and Discussion

This article has dealt with farmland utilization and population change in New York, a theme that has attracted the attention of researchers since the turn of the century. Social scientists have been especially attentive to this issue since the 1920s when significant acreages of land began to be released from farm pursuits. That line of inquiry intensified once again after WWII when highway improvements, growing affluence and an acquired taste for suburban and exurban living helped trigger especially rapid changes in the rural landscape. Equally dramatic changes have occurred in production agriculture over these years as the industry is continually buffeted by shifts in cost/price relationships and new labor-saving and land-saving production technologies.

Population growth and redistribution into rural territory obviously entails conversion of open land to residential, commercial, industrial, and transportation uses. This makes conversion of once-farmed land parcels to built-up uses the most visible and dramatic example of shifting rural land use patterns. Yet, based on statewide estimates made by the USDA, well under 10 percent of total land area in New York is presently classified as built-up. The remainder is in a variety of open space uses. Crop and pasture is no longer predominate among these, however, because much farm acreage has been idled by changing social and economic circumstances and, in time, has reverted to natural forest cover. Forestland has been the fastest growing land use category in recent decades.

New York has experienced significant rural population gains over this same period. Our analysis centered on nonfarm population gains in rural hamlets and in open country and their relation to farmland use. Prevailing opinion often is that population growth and population deconcentration are inversely related to the amount of land available for agriculture. This argument implies that unchecked population growth severely hampers farming and induces farmers to release land for other uses. We arranged statistical tests by relating various measures of rural and rural nonfarm population growth rates to rates at which farmland is released from agricultural use.

Our findings only partially support the population hypothesis, and indicate that the metro or location effect is pertinent, but that the rural and rural nonfarm population effects are not. That is, the statistical relationship between rate of population growth and rate at which land is released from farming is negligible, while farmland situated in core metropolitan counties is more development prone; we estimate that core metropolitan status increases the rate of farmland loss over 10-year intervals by about 4.6 percent, compared to other counties. Interestingly, metropolitan fringe status--counties designated SMA located further from the urban core--has no statistically significant effect on farmland loss over the 1950-1990 time frame. Population pressure is more diffuse and more subtle further from the urban core. Farms situated on the outer extremities of fringe metro counties may be no more affected by urban pressure than those in rural counties.

Our results differ from anecdotal accounts and from earlier studies directed toward this issue. Many of these studies were conducted on a case or small area basis, and stress that unchecked population growth in rural communities is inconsistent with the continuation of a viable agriculture. Our analysis, on the other hand, has a statewide frame of reference and is more comprehensive because we took trends since 1950 into account and controlled for county-to-county differences in farmland values, employment opportunities off the farm, land productivity, and organization of farm businesses. These nondemographic factors, it was shown, are very important and sometimes pivotal in determining the fate of the New York farmland base.

New York has been on the vanguard of publicly sponsored efforts to protect and conserve farmland resources. Our study has direct implications for refining those programs. Although New York is an urban state by most conventional measures, the evidence suggests that, to date, population growth alone does not dictate choices on farmland use. In fact, common measures or indicators of metropolitan status and urban population are flawed and give a misleading impression of the overall environment for conducting a farm business. We achieved more precision in measurement by partitioning the overly inclusive federal designation of SMA to focus on counties containing a core urbanized area of 50,000 of more.

Rates of farmland loss were found to be significantly higher in locations close to New York's central cities. This result reinforces earlier case studies which document the problems and prospects facing farmers situated in close proximity to large urban populations. Conversely, programs designed by state and local governments to curb population increases or deflect growth from certain parcels of farmland might successfully preserve open space but will not necessarily ensure the continuation of active farming. Our analysis shows that maintenance of land in farm use largely depends on forces having to do with net farm income, farm size, and prevailing prices for farm real estate. These economic forces are regional and national in scope and almost exclusively outside the purview of state and local farmland protection programs.

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