Commercial Agriculture in Metropolitan Areas: Economics and Regulatory Issues

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Metropolitan agriculture is economically important, especially in the Northeast. While faced with substantial economic and regulatory obstacles, commercial farming in urban areas is surviving and even prospering. In terms of standard models of agriculture in economic development, this is a puzzle. But more detailed, spatial economic models indicate how labor-intensive production of perishable commodities in urbanized areas can make economic sense, especially when coupled with environmental amenities that farming generates for nonfarm people. At the same time, environmental disamenities of agriculture are larger in densely populated areas. The political economy outcomes have tended to be favorable to continued farming, albeit with increased regulation. Nonetheless, many questions remain about the dynamics of agricultural adjustment to urbanization, and the possible steady-state mix of farm and nonfarm activities.

Agriculture in an urbanized area faces both problems and opportunities that are specific to such locations, and which have been somewhat neglected in the main stream of work by agricultural economists. The most salient current issues involve policy and regulation, generated by the more intense interaction between farm and nonfarm activities that results from close proximity of farm and nonfarm people, and from increased competition for natural resources such as water, air quality, and environmental amenities.

The issues confront more than a small minority of farmers, especially in the Northeast. About 30 percent of U.S. farms (by the U.S. Census farm definition) are located in metropolitan statistical areas, and in the Northeast (New England, New York, New Jersey, Delaware, Pennsylvania, and Maryland) a majority of all farms are in metropolitan areas (Heimlich and Barnard, 1992). Moreover, the level of commercial activity on these farms is comparable to farms outside urbanized areas. In 1989 the mean sales of agricultural products from farms located in metropolitan statistical areas was $54,100 while the comparable figure for farms outside metro areas was $53,700. Estimated net returns to farm assets were $7,800 for metro-area farms and $9,100 for nonmetro farms (Heimlich and Barnard, 1991).

This paper considers both positive and normative issues. After discussing the implications of some basic hypotheses in economic development and locational economics, a framework for analyzing the policy issues is developed in more detail. Some pertinent data evidence is then considered.

Economic Development and Metropolitan Agriculture

Economic development theory tends to emphasize sharp distinctions between agriculture and the nonagricultural economy. "Dual economy" models, for many years the bread and butter of the economic development literature, postulate an agricultural sector characterized by backwardness, in technology, attitudes, and integration with the market economy. The U.S. domestic literature adapted some aspects of this idea in work in the 1950s on the "urban-industrial hypothesis." The hypothesis is that rural areas are economically more stagnant, while growth and industrial development are typically based in urbanized areas. This causes increased factor prices in metropolitan areas and permits faster adjustment of surplus agricultural labor to nonfarm employment. The hypothesis was originally developed by Schultz (1953) and was elaborated and empirically con-

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firmed by Nicholls (1961), Ruttan (1955), and Tang (1958) using data of the 1940s and 1950s.

Neither the dual economy models nor the urban-industrial hypothesis have strong a priori grounding. They are empirical propositions that in principle could fail as well as succeed as a scientific explanation. Perhaps the best established building block in such models is Engel's Law. The declining demand for food as compared to nonfood goods as income grows makes it likely that agriculture's importance in the economy will decline under economic development. Particular countries, and regions within countries, may remain agricultural indefinitely because of specialization and trade, but these areas will tend to shrink in economic importance in the whole picture.

Under these circumstances one might expect agricultural retrenchment to hit urbanized areas first and hardest. However, locational issues bring in additional complications. These have been addressed in a literature on spatial economics largely distinct from the theory of economic development. What can this literature contribute to our understanding of metropolitan agriculture in the United States?

Spatial economic theory gets off on the wrong foot by offering a standard model in which the subject of this article—agriculture in metropolitan areas—does not exist. The basic von Thuenen model (see Muth, 1961 or Katzman, 1974) consists of a city surrounded by farming. In Muth's two-commodity model, as a city expands, its boundary expands via rural-to-urban land conversions. In a more current metaphor we might say farmland is sucked into a black hole of urban development.

But as the data on metropolitan areas indicate, there is actually a great deal of farming life in the black hole. How are we to understand this in terms of spatial theory? Lopez, Adelaja, and Andrews (1988) couch their analysis in terms of the "suburbanization" of agriculture. This is important because the farming activities to be investigated do not take place in central cities, but in areas surrounding them that can generally be classified as suburban. These areas are rightly placed within metropolitan areas for statistical purposes because their economic activity is heavily oriented toward central cities. A large fraction of the residents commute to the cities and a large fraction of suburban businesses provide services for these commuters or urban industries. We have to refine our thinking not so much about the spatial economics of agriculture as the spatial economics of nonagricultural industries and residence patterns. Urban workers choose to live in less densely settled places and like greenery, even if they must incur substantial commuting costs. When enough people live in suburban areas, it becomes economical for employers, too, to locate in suburbs.

What are the economic implications of this form of metropolitan development for agriculture? In seeking better understanding of suburban agriculture two aspects of its locational economics should be distinguished: static and dynamic.

The static economics can be seen best in a model of a steady state in a suburbanized metropolitan area. Agriculture in such an area is faced by the following economic differences from a nonmetropolitan area: (i) greater nonfarm demand for land, and hence higher land prices, (ii) differences in competition and the functioning of product and factor markets, (iii) comparative advantage in transport costs of farm goods to nonfarm buyers, and (iv) higher population density, hence more congestion and cost of externalities.

These economic differences have both positive and negative consequences for agriculture. Higher land prices imply higher (opportunity) costs of farm products; but lower transport costs imply higher farm product prices for metropolitan areas. Products which are less land intensive (higher value added per acre) have a comparative advantage in metro areas, as well as products which have high transportation costs and high perishability. Apart from less easily transportable products, and specialized urban demand creating "niche" markets for specialties of a city, demand preferences of urban people are expected to be less important. If urbanites decide they like grass-fed hamburgers rather than organic vegetables, the beef for the burgers will still be grown on the distant range where land prices are low.

Item (ii), differences in the functioning of markets, has not received much analytical attention since studies of the urban-industrial hypothesis in the 1950s and 1960s. It is unclear if the hypothesis still holds. Reasons for doubt are much lower outmigration rates from rural areas in recent years; and higher rural relative to urban incomes. These changes make the picture of excess resources and poorly functioning factor markets in rural areas less plausible. Moreover there is a counter argument that some farm input and product transactions costs are *higher* in metro areas. The greater concentration of agricultural activities in rural areas creates economies of scale and scope that are not available in metropolitan areas where nonagricultural economic activities congest the infrastructure for input delivery and bulk output marketing.

The dynamic economics of suburban agriculture involve the continued growth of urban populations, and consequent absence of a steady-state equilibrium. This growth implies that while metropolitan agriculture survives, it continually shrinks in acreage. What does this mean for the economic situation of commercial agriculture? Essentially that the forces at work in the static picture are intensified. Real estate prices, already high in the static picture, keep trending upward. Political pressures to restrain farm-generated externalities, but also to preserve the dwindling farm acreage, increase. The mix of agricultural goods moves further toward concentration on land-efficient and perishable products. And, if the process goes far enough, as in Manhattan (N.Y.) all the farmland does eventually disappear into an urban black hole. Yet the surprising story in the data is how well agriculture is doing in these areas. While the number of farms is declining in metro as in nonmetro areas, the rate of decline is not much higher in metro areas. Lockeretz (1986) studied paired counties inside and outside 143 standard metropolitan areas. The average annual rate of decline in the number of farms was 2.26 percent in the metro counties and 2.02 percent in the nonmetro counties over the period 1944–1982.

Another stream of literature concerning the dynamics of urban growth and agriculture has been a sometimes apocalyptic extrapolation of the idea of disappearing farmland to a national scale. Academic interest in the "vanishing farmland crisis" mushroomed in the 1970s, culminating in the National Agricultural Lands Study (NALS, 1981). While generally circumspect in its conclusions, this study gave unwarranted oxygen to the idea that farmland conversion posed a threat to the nation's agricultural production capacity (see Fischel, 1982; Dunford, 1983; Heimlich, Vesterby, and Krupa, 1991).

A dynamic factor that has received more attention in recent years is the "impermanence syndrome," described as "the tendency for disinvestment in agricultural activity to occur well in advance of actual conversion to urban uses" (Andrews and Lopez, 1989, p. 53). There exist both a weak and a strong form of this hypothesis. The weak impermanence syndrome results in a reduction in investment in long-lived fixed farm assets (buildings, land improvements such as drainage or irrigation) when the probability of conversion before the end of the asset's normal life is sufficiently large. The strong form of the hypothesis extends the idea to a reluctance to invest in (portable) new technology or even to maintain and replace farm machinery (Lopez, Adelaja, and Andrews, p. 347), i.e., the impermanence syndrome affects mobile as well as fixed capital, and results in an actual decline in the capital stock per acre. The result can be farmland held idle in anticipation of conversion. The same result can occur because of diseconomies of scale increasing the costs of marketing and input supply as farms become fewer in an urbanizing area. Empirical literature has reached conflicting conclusions on the extent of disinvestment and "premature" land idling, with Lopez, Adelaja, and Andrews (1988) confirming the phenomenon, and Lockeretz (1986) denying its importance. Simply from the data on sales and income, it appears that farmers in metropolitan areas generally are not just going through the motions of farming while waiting for the developers.

Finally, the dynamics of suburbanizing areas open up marketing opportunities not available in rural areas for supplying high-value products containing service or quality dimensions that may place the producer in the position of essentially selling a branded (firm-specific) product. Heimlich and Barnard (1992) investigate farmers in metropolitan areas who have taken advantage of these opportunities, denoted by the term "adaptive" farms. These farms are defined as farms with sales of more than $10,000, and with sales of more than $500 per acre or more than one-third of sales composed of high-value products. In a sample of 577 Northeastern farms in metropolitan counties in the 1989 Farm Costs and Returns Survey of USDA, the adaptive farms had an average net farm income more than twice the income of "traditional" metro farms, and more than twice the income of the average Northeastern nonmetro farm (Heimlich and Barnard, p. 54).

Item (iv), high population density and congestion, affects agriculture through increasing some marketing costs. But more important in recent policy discussion is the increase in externalities. For example, the cost of sprayed herbicides which drift onto a neighbor's farm is likely to be less than the perceived cost of herbicide drift into suburban back yards. At the same time, the increased nonfarm population brings new problems of crime, congestion, and insecurity to farmers.[1] The preference for low-density housing and green spaces that leads people to the suburbs in the first place also leads them to support policies that will help maintain farming in metropolitan areas, notably property tax breaks and farmland preservation pol-

[1] For detailed investigations of the security issues in a highly urbanized state, see Lisansky (1986) and Lisansky, Andrews, and Lopez (1988).

icies. Analysis of these issues requires a fuller description and involves the theory of public choice or political economy.

Political Economy of Metropolitan Farming

The main areas in which local, state, and occasionally federal regulation influence commercial farming in metropolitan areas are:

- environmental regulation
- "right-to-farm" legislation
- preferential property taxation of farmland
- farmland preservation through purchase of development rights
- land use regulation (zoning)

Federal environmental regulation affecting agriculture includes the Clean Water Act's Section 404 wetlands protection, the Coastal Zone Management Act, the Endangered Species Act, and conservation and environmental provisions of the 1985 and 1990 Farm Acts. None of this legislation singles out farming in metropolitan areas. But the impacts in some cases are greater in metropolitan areas because of higher population density. The expanded Conservation Reserve Program in the 1990 Farm Act is targeted at the goal of water quality improvement. Farmers' bids of acreage to enter the program are benefit-weighted by including a number of factors that affect the water quality benefits of an acre added to the Conservation Reserve (Osborn and Heimlich, 1993). One of these factors is the population density of the area, on the grounds that the harm caused by a gallon of contaminated water is proportional to the probability that a human will use that water. Moreover, the 1990 Act provisions permit land with a higher market value to enter the program by considering environmental benefits per dollar of rental payment to the farmer. In fact, the share of Northeastern land enrolled in the 1992 CRP signup increased 50 percent from the average enrollment of previous signups. However, it is not known how much of this acreage is in metropolitan counties.

Local regulation of commercial agricultural effluent, noise, and odors through zoning and penalties is a subject that has not been comprehensively documented, but which undoubtedly exists and which has led farm interests to exert political pressure for "right-to-farm" laws. These laws have become quite pervasive and have led to an uneasy political equilibrium between farm and nonfarm residents of suburban areas (Hand, 1984; Lisansky, 1986). Most affected have been livestock enterprises, which have been largely forced out of some areas.

An amicable political equilibrium within suburban communities becomes possible because nonfarm residents often agree with farmers on the desirability of keeping farms in metropolitan areas. Each of the 50 states has a law granting preferential tax assessment on agricultural land, so that such land is taxed on the basis of its value in agricultural use rather than its market value. Taxing on the basis of market value would hasten the conversion of metropolitan land from farming to other uses. However, 31 states have provisions that require farmers to give back all or part of their tax preference if their land is subsequently converted to nonfarm use (Aiken, 1989).

Farmland preservation through other means is also predominantly a local issue, although the 1990 Farm Act contains a "Farms for the Future" title with the aim "to promote a national farmland protection effort" (U.S. Code 104 STAT. 3616). However, the program has been funded only for a pilot effort in Vermont. Local and state mechanisms include agricultural districts for the targeting of tax breaks, purchase of development rights from owners of farmland, and zoning requiring houses to be built only on very large lots, up to 160 acres (Hand, p. 295). There is controversy over the political reasons for these measures. Dillman (1989) cites environmental amenities, protecting economies of scale in service provision, orderly development, and a preference for local food sources, while raising questions about each of these rationales. Fischel (1989) believes the national-level debate about allegedly excessive farmland conversion has played a role in providing political cover for farmland preservation measures, which local residents want for exclusionary reasons, particularly to keep the urban poor out of their communities.[2]

Recently an analytical approach to the economics of regulation and income redistribution has been developed that may help in sorting out the political economy of these issues (Peltzman, 1976; Becker, 1983). The basic issue is characterizing the political equilibrium in the presence of externalities; in particular, is the political equilibrium efficient in the sense of yielding the highest possible real income (including environmental amenities) given the political forces in play?

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[2] Some of the discussion in Heimlich (1989) seems to view this preference tendentiously as a matter of taste or discrimination. But Lisansky, Andrews and Lopez (1988) find evidence that there are real external costs of urbanization on farming.

Consider two interest groups in a suburban area, farmers and nonfarmers. The well-being of each that is subject to change by policies is:

$$W_i = Y_i + S_i + E_i, \qquad i = 1, 2,$$

where $i = 1$ for farmers, $i = 2$ for nonfarmers, and W is a measure of well-being, composed of Y, net income (after taxes), S, consumer net rents (equivalent/compensating variation), E, the value of environmental amenities.

The policies that have been listed above may be modelled as either monetary taxes/subsidies or quantitative restrictions of land use or farm production. In a static model of a suburban community, we investigate policy issues through comparative statics analogously to the approach in Gardner (1991). For a policy instrument T, we estimate the effects on each group,

$$\frac{\partial W_i}{\partial T} = \frac{\partial Y_i}{\partial T} + \frac{\partial S_i}{\partial T} + \frac{\partial E_i}{\partial T}.$$

Since the policies are local, assume that T has no effect on product or factor prices (except for land). Then $\partial S_i/\partial T = 0$, and $\partial Y_i/\partial T \neq 0$ only through taxes or subsidies or direct restriction of production practices and land use. These restrictions yield a model simple enough to represent two-dimensionally.

Figure 1 shows an initial situation with well-being of farmers and nonfarmers given by the levels of W_1 and W_2 at point E. Policies are then introduced to regulate farming or land use. For example, effluent regulation reduces Y_1 and increases E_1 and E_2. Farmers on net lose because $\partial Y_1/\partial T < -\partial E_1/\partial T$ (otherwise farmers would have been calling for the regulation themselves),[3] but for a low level of regulation their net losses are small. Nonfarmers gain, $\partial E_2/\partial T > 0$, and gain most rapidly when the first, most egregious practices are stopped. The effects of different levels of T on W_1 and W_2 are traced out by the transformation curve EP_2R_2.

The main issues concerning such policies are:

- Is a net gain to both farmers and nonfarmers possible?
- What is the effect of interest-group politics?
- What policy is optimal from an overall social viewpoint?

A net gain to both farmers and nonfarmers occurs if we move in the direction of the arrow, northeast from point E in figure 1. This would be a strict Pareto gain. Most policy instruments, like the regulations that generate the transformation curve EP_2R_2, make one group better off and the other worse off. But, a policy will cause an increase in the *sum* of W_1 and W_2 if it generates an equilibrium northeast of the initial sum-of-welfare line W_0, which has a slope of -1. The possibility of a gain in $W_1 + W_2$ arises because of market failure. Social optimization of land use with environmental amenities, for example, has been analyzed in detail by McConnell (1989) and Lopez, Shah, and Altobello (1994).

Under economic regulations as analyzed by Peltzman, policy intervention moves the economy inside the W_0 line, and point E represents the maximum attainable level of $W_1 + W_2$. With respect to local policies for suburban areas we have both positive (green space) and negative (pollution) externalities, as opportunities for policies that will increase $W_1 + W_2$.

Conceptually, the level of pollution regulation that maximizes the sum of well-being generates point P_2, the point at which the transformation curve has a slope of -1. At this point the marginal gain to nonfarmers, $\partial E_2/\partial T$, just equals the marginal loss to farmers, $-(\partial E_1/\partial T + \partial Y_1/\partial T)$.

Consider an alternative policy, to conserve green space by giving property tax relief to farmers. This would also generate environmental amenities, but in this case $\partial Y_1/\partial T > 0$. Increasing the amount of tax relief from zero traces out a transformation curve such as EP_1R_1. The maximum sum-of-welfare is at point P_1. In this case, farmers are made better off at the expense of nonfarmers.

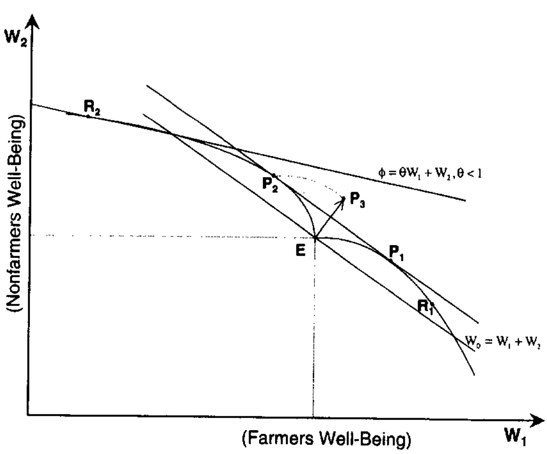

Figure 1.

[3] If E_1 were internal to each farm, there would be no demand for regulation. The supposition here is that an individual farmer's acts of environmental degradation affect other farmers; so they call for regulation of one another.

A possible Pareto-superior move is to enact *both* regulation and tax breaks at once. Assuming the effects on farm returns and on environmental benefits are independent—the benefits of agricultural pollution controls can simply be added to the benefits of green space—then having both policies in place simultaneously doubles the sum-of-welfare gains of either P_1 or P_2 separately. In terms of figure 1, we can think of moving first to P_2 via regulation and then moving to P_3 via the tax break. Thus, it may well be that it makes sense to have both farmer-costly and farmer-friendly policies in place at the same time, a situation that has evolved over time in many locations, with tax breaks first and regulations later.[4] A choice to both regulate farm practices and preserve farmland through subsidies is not as contradictory as Fischel (1989, p. 201) suggests.

Now consider the consequences of interest-group politics. Analytically, the simplest procedure is to specify an additive welfare function in which nonfarmers' well-being is the numeraire, while farmers' well-being has a weight of θ:

$$W = \theta W_1 + W_2.$$

If $\theta < 1$, political choice favors redistribution from farmers to nonfarmers. In the example of figure 1, such a political equilibrium is shown at point R_2. Not only is there a large reduction in farmers' well-being, but $W_1 + W_2$ is driven below its no-regulation level at E. In this sense there is a substantial deadweight loss to the policy.[5]

On the other hand, if farmers were heavily favored politically, $\theta > 1$, then we would expect to see an equilibrium like R_1. The fact that suburban communities typically have a mix of environmental regulation and subsidies to farmers suggests that farmers and nonfarmers typically have roughly equal weight in (local) politics.

Note that the analytical approach outlined here has no place for the "polluter pays" principle. Who pays depends on (a) political power and (b) the costs of alternative policies. This is in the spirit of Coase's discussion of all externalities being essentially reciprocal (Coase, 1960). When a dairy is located near a house whose residents do not like the smell of a feedlot, the principal economic issue is not a matter of rights (to farm or to breathe air free of cow-sign) but of costs of alternative policy interventions. The prediction of political efficiency in environmental regulation is that local governments will adopt the least costly of: relocating the dairies, deodorizing the dairies, placing barriers between dairies and residents, or residents living with the odors.

Two paradigmatic legal cases that bear on this issue are cited in Hand (1984). In *Rowe V. Walker* (1982)

> the defendant was the owner of a ten-acre parcel of land in a neighborhood of similar holdings approximately fifty miles from Detroit. Soon after he bought the property in 1969, the defendant began a corn-farming operation which grew to encompass approximately 1600 acres of leased land. In order to process his corn, he purchased a large grain dryer which, according to neighbors, was a nuisance because of the noise it produced. When defendant Walker and his neighbors were unable to settle their differences, ten owners of neighboring properties filed suit, alleging first a violation of deed restrictions and second that the defendant was operating a nuisance. Defendant Walker filed a motion for summary judgment on the nuisance claim, raising the Michigan Right-to-Farm Act as a defense (Hand, p. 311).

The defendant prevailed despite the fact that he began the objectionable practices after the nonfarm residents were in place.

In the second case, in the absence of right-to-farm legislation, Spur Industries, a feedlot operator,

> began operation in an area far removed from development. Several years later a developer, Del Webb, began a massive residential community which developed in the direction of the feedlot operation.
>
> Del Webb soon found it difficult to sell residences on its property in the vicinity of the feedlot and filed suit to enjoin the feedlot operation. The Arizona Supreme Court held that Del Webb was entitled to an injunction against Spur, despite the fact that it had come to the nuisance. This victory turned out to be a pyrrhic one for the developer, because the court also concluded that Del Webb, "[h]aving brought people to the nuisance to the foreseeable detriment of Spur" should be required to indemnify Spur for the

[4] An analogous situation has arisen at the Federal level with respect to commodity programs and environmental regulation. After receiving price-support benefits for decades, the 1985 Farm Act and other legislation has required farmers to meet conservation compliance and "swampbuster" requirements in order to be eligible for certain commodity program benefits.

[5] Although figure 1 shows a deadweight loss at R_2, it is possible that environmental regulation could cause a large reduction in W_1 yet still yield a gain in $W_1 + W_2$. It is possible, for example, that the environmental regulations that forced diaries north of Lake Okechobee (Florida) out of business created a net social gain, because the environmental damage the diaries caused was even larger than their financial losses from having to relocate.

costs of moving or shutting down (Hand, p. 348).

In both cases, being there first did not prevail when there was an indication that changes were on net advantageous to both sides together. The legal framework and "grandfather" priorities did play a key role in who paid whom. Thus, the courts here seem to be fulfilling the Coasian functions of minimizing transactions costs by assigning liability while permitting economic activity to be conducted efficiently.

In practice, the big departure from what might be called a politically driven optimum appears to be the conflict of interest, emphasized by Fischel (1989) and others in the Heimlich (1989) volume, involving farmers and nonfarmers in the suburbs versus people who live outside the suburban area but would like to move in. The outsiders are expected to have a very low θ in local suburban politics. For this reason, from the perspective of overall welfare one needs to be wary of the Florida land-use planner whom Heimstra (1989, p. 115) quotes as saying "what we do need out of the Feds is for them to stay out of the way while local governments do their thing." The political situation is similar to that of immigration policy at the national level, but in local regulation the case for omitting the interests of "foreigners" is weaker.

Trends in Metropolitan Agriculture

Table I summarizes information about farms in a sample of 42 metropolitan counties, in a "greater Northeast" region bounded by North Carolina to the South and Illinois to the West. The sample includes only counties that had at least 100 farms in the 1987 Agriculture Census. The range is from counties from which farms have largely disappeared (Westchester, NY; DuPage, IL) to counties in smaller metropolitan areas in which over three-fourths of the land area remains in farms (Henry, IL; Shelby, IN; Pickaway, OH). The percentage population increase in these counties ranges from well over doubling (Rockingham, NH; Wake, NC; Chesterfield, VA) to an actual population decline (Erie, NY; Oneida, NY).

The simple average percentage loss in farm numbers in these counties between the agriculture censuses of 1964 and 1987 was 41 percent. This is a substantial loss, but perhaps surprisingly close to the 34 percent farm number decline for the United States as a whole. On the other hand, farmland acreage did fall much more sharply in metropolitan areas, with a 32 percent reduction in the sample metropolitan counties and a 13 percent U.S. aggregate decline.

Heimlich and Barnard (1992) and Lopez, Adelaja, and Andrews (1988) have provided helpful analyses of the economic situation of metropolitan agriculture. The following regressions use the sample counties to explore a little further the issue of longer-term survival of agriculture in metropolitan areas, and some of the linkages with policy.

The linear regression coefficients of Table 2 show the effects of characteristics of counties on rates of change of farming activity. Two indicators are used as dependent variables, one based on acreage in farms and the other on the number of farms.

In column (1), the dependent variable is the percentage change between 1964 and 1987 in a county's farmland, using the U.S. Census Bureau definition of a farm and land in farms. The coefficients of the independent variables provide empirical evidence for some hypotheses of the preceding discussion. The first independent variable is the rate of growth of total county population, which averaged 58.9 percent for these counties between 1960 and 1990, compared to a 38.7 percent growth rate for the overall U.S. population. The coefficient of $-.11$ for this variable in regression (1) implies that a 100 percent growth (i.e., doubling) of a county's population generates an 11 percent decline in the county's farmland, *ceteris paribus*.

The only policy variables consistently available concern state-average property taxes. Line 4 shows the effects of average property taxes per acre and line 5 shows the effects of changes in taxes per acre between 1960 and 1990. All of the sample counties had use-value taxation for farmland, but in all except 9 midwestern counties there are limitations on the use of qualifying farmland and/or "recapture" provisions that require repayment of property tax relief if development occurs. Line 6 is a dummy variable = 1 for the 9 counties with no limitations on the tax break, and = 0 otherwise. The only significant variable is the change in farmland taxes, indicating that property tax reduction—which occurred on average in these counties—played a role in keeping some land in farms.

The dependent variable in the regression reported in column (2) of Table 2 is the percentage change in the number of farms. Farm numbers are less strongly linked to the county's rate of population growth than is farm acreage. On the other hand, the county's median household income appears significant in stemming the loss of farms, but

Table 1. Data for Sample of Metropolitan Counties

STATE	COUNTY	Farm Numbers 1987	Percentage of Farm Land (acres) to Total Land (acres) 1987	Change (%) in Total Population 1960–1990	Change (%) in Farm Numbers 1964–1987	Change (%) in Farm Land Acres 1964–1987
CONNECTICUT	NEW HAVEN	407	6.7	21.8	−49.0	−55.2
DELAWARE	NEW CASTLE	380	34.5	43.8	−32.6	−22.3
ILLINOIS	DU PAGE	161	11.4	149.4	−73.2	−71.3
	HENRY	1696	92.1	3.7	−28.4	−1.4
	LAKE	448	28.6	75.9	−38.4	−30.5
	McHENRY	1136	68.8	117.6	−32.1	−12.8
	WILL	1239	61.4	86.5	−35.2	−16.7
INDIANA	ALLEN	1649	69.2	29.6	−30.5	−10.2
	MARION	361	22.5	14.3	−52.9	−38.0
	PORTER	597	60.9	113.9	−44.6	−14.2
	SHELBY	876	82.5	18.2	−32.5	−6.4
MAINE	CUMBERLAND	456	10.8	33.0	−48.1	−50.0
MARYLAND	CARROLL	1238	58.1	133.7	−28.9	−23.7
	CECIL	501	39.0	47.4	−24.0	−31.5
	PRINCE GEORGE'S	683	19.9	104.1	−37.2	−45.6
MASSACHUSETTS	NORFOLK	212	5.1	20.7	−42.2	−43.5
MICHIGAN	GENESEE	851	35.4	15.0	−52.6	−29.6
	INGHAM	960	58.1	33.4	−38.4	−19.4
	OAKLAND	596	10.7	57.0	−39.6	−53.8
NEW HAMPSHIRE	ROCKINGHAM	382	8.3	148.3	−48.0	−61.1
NEW JERSEY	BURLINGTON	834	20.0	76.0	−22.1	−37.6
	MERCER	309	28.4	22.3	−22.8	−19.6
	MORRIS	430	9.0	61.1	2.1	−25.0
NEW YORK	ALBANY	460	20.3	7.2	−40.0	−43.8
	ERIE	1201	24.8	−9.0	−45.3	−38.3
	ONEIDA	1251	36.8	−5.1	−40.3	−26.9
	ONONDAGA	772	31.6	10.9	−46.6	−31.6
	WESTCHESTER	121	3.2	8.2	−47.6	−52.6
NORTH CAROLINA	CUMBERLAND	524	23.9	85.0	−62.6	−38.7
	UNION	1086	41.7	88.5	−51.7	−31.7
	WAKE	1003	24.2	150.4	−63.6	−51.5
OHIO	FRANKLIN	581	35.3	40.8	−46.3	−31.1
	MEDINA	1012	43.0	87.3	−32.9	−27.5
	MONTGOMERY	940	40.3	8.9	−41.7	−23.7
	PICKAWAY	783	81.2	34.6	−30.5	−12.1
	PORTAGE	820	32.4	55.3	−41.3	−28.7
PENNSYLVANIA	ADAMS	1104	56.2	50.8	−34.4	−15.4
	BERKS	1809	44.2	22.2	−35.9	−21.1
	CHESTER	1573	39.3	78.7	−32.7	−29.6
	YORK	2041	48.0	42.5	−46.5	−27.4
VIRGINIA	CHESTERFIELD	169	7.3	193.9	−59.5	−64.9
	HENRICO	158	19.7	85.7	−53.1	−40.0
Simple Average of Sample		805	35.6	58.6	−40.6	−32.3
UNITED STATES		2087759	42.6	38.7	−33.9	−13.1

not farmland. The coefficient of .005 in line 2 means that an increase of $1000 (1960 dollars) in per household income cuts the rate of decline of farm numbers by 5 percentage points (e.g., from −42 percent to −37 percent). The overall economic story is that urban development definitely places downward pressure on farmers and farming, but in a more affluent area farming, but not necessarily farmland, is better preserved. This confirms the point of Heimlich and Barnard (1992) that adaptive farmers, who achieve increased marketable value per acre from their operations, can thrive in a metropolitan setting.

Nonetheless, there is inexorable pressure to replace farming with nonfarm activities, and this is especially true in counties containing central cities. In this sample, 27 counties contain the central city of the metropolitan area, and 15 are suburban.

Table 2. Regression Coefficients Showing Rate of Change in Metropolitan Farms as a Function of County Characteristics

	Dependent Variable	
Independent Variables	(1) Percent Change in Farmland, 1964–1987	(2) Percent Change in Farms, 1964–1987
1. % change in county population	−.110	−.073
	(4.2)[a]	(2.0)
2. county median household income	.002	.005
	(1.5)	(2.4)
3. county contains central city (= 1)	−6.42	−14.4
	(2.3)	(3.9)
4. property tax rate per acre[b]	.407	.263
	(1.5)	(0.7)
5. change in property taxes per acre[b]	−.489	−.312
	(2.6)	(1.1)
6. unlimited farm use-value taxation (= 1)	−1.37	−8.07
	(0.4)	(1.5)
7. initial farmland share of all land	.534	.157
	(6.4)	(1.3)
observations	42	42
R^2	.830	.478

[a] *t* statistics in parentheses
[b] state-level data

Line 3 of Table 2 shows the effects of a dummy variable = 1 for the 27 central-city counties and = 0 for the others. The decline in farm numbers is 14.4 percentage points greater in the central-city counties, *ceteris paribus*.

Summary

The evidence in this sample of counties and in the more detailed empirical studies cited earlier indicate that the mix of economic and political forces in metropolitan areas has resulted in a better outcome than might have been expected for commercial agriculture in metropolitan areas. Farms survive in metro areas by adapting to urban-area product demand, by undertaking more diverse farm enterprises and by producing higher-value per acre products with a larger service component than nonmetro farms. While farms and farmland will continue to succumb to dense urbanization, continued expansion of suburban areas is likely to maintain and perhaps even increase the importance of agriculture suited to metropolitan areas in the United States.

However, the present state of knowledge about these phenomena is still quite weak. Many questions about the dynamics of agricultural adjustment to urbanization, and about a possible steady state equilibrium mix of farming and nonfarm activities remain open. It is not clear, for example, how effective farmland preservation activities are over the longer term. With respect to political economy, the systematic empirical analysis of local/state policies influencing agriculture in suburban areas has barely begun, and the relevant spatial economic theory remains to be developed in both static and dynamic versions. Heimlich and Barnard (1992) made a good start in using USDA's Farm Costs and Returns data to throw light on some of the issues. More remains to be done with these data and with the more traditional county data from the U.S. Censuses of Agriculture and Population. In sum, in terms of economic theory, policy analysis, and empirical investigation metropolitan agriculture is ripe to become one of the most exciting research areas for agricultural economists.

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