

Sprawl, Agricultural Subsidies, and Disappearing Farmland:  
The Causes of Changes in the Amount of Land in Agricultural Use

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## **I. Introduction**

The amount of land in agricultural production in the U.S. has declined steadily during the second half of the 20<sup>th</sup> century. Between 1950 and 2003, the total farmland acreage declined by 21.9 percent (from 1,202 to 939 million acres), or at an average annual rate of 3 percent. At the same time, U.S. aggregate agricultural output managed to grow steadily at a 1.8% annual rate over past 100 years and 2.1% for past 50 years.

The loss of farmland has raised considerable public concern. In response, a significant number of conservation and purchase program, as well as monetary compensation policies for farming have been established the federal, state and county level. At least 19 states have established either state growth management laws or task forces to protect farmland and open space (Staley, 1999). Advocates of such programs contend that since farmland is a finite natural resource and its conversion into developed uses is irreversible, the authorities should save as much agricultural land for the benefit of future generations. Most of these legislative efforts are targeted at curbing urban sprawl—perceived as a major cause of farmland loss in the states. General perceptions characterize urbanization as “encroaching subdivisions and Wal-Mart superstores [that] take prime farmland out of production” (Farming on the Edge, 2004) and “farmers and dairymen are packing up and leaving because that they can make more money from selling the land” (Farmland Vanishes, 2005).

Does urban sprawl truly deserve the bad name it had for long? How much farmland can government preserve by spending \$100,000 more in subsidy? Is it the case that the shift of farmland to alternative uses may reflect the efficient allocation of resources by market forces? Answers to these questions will allow policymakers to better determine

appropriate land use policies. While there are no analyses in the economics literature that consider the link between farmland acreage and sprawl, there are a number of analyses of the determinants of farmland prices. However, the relationship between the farmland acreage and the value of farmland is indeterminate. Increases in the economic benefits of the farmland in competitive uses converts the farmland into non-farm uses and increases the value of remaining farmland. In this case, the farmland acreage and the farmland value are positively correlated. On the other hand, government subsidies increase the amount of land under cultivation and suppress the value of farmland, a situation when these two factors move in the opposite direction.

The objective of this paper, therefore, is to examine the causes of changes in farmland acreage and to determine the relative importance of each explanatory variable. The background section presents a selective review of the studies on farmland values. The model of farmland acreage and the data are presented in section three. The next section contains a discussion of the econometric results and the final section contains conclusions and implications.

## **II. Background**

While there is no economic literature devoted to explaining differences in land in cultivation across states or the causes of the decline in the amount of land under cultivation, there is a large literature on farmland values. The literature can be organized under six main ideas: 1.) A definition and summary of farmland values; 2.) A definition and influence of agricultural productivity on farmland values; 3) A definition and influence of input costs and output prices on farmland values; 4.) The measurement and

influence of housing price on farmland values; 5.) A summary and influence of government support programs on farmland values; 6.) A summary of other variables that account for the change of farmland values.

**Farmland Value.** The value of farmland is defined as the price of cultivated farmland per acre in a voluntary transaction. Farmland excludes orchards, tea plantations, and mulberry fields. Most studies of agricultural land values express price of land in terms of the discounted expected future returns from farming the land. In a market economy, land prices determine the optimal allocation of land resources among different uses, as well as the value of land as collateral for credit and land taxes. Therefore, incorrect or misperceived land prices could lead to inefficient allocation and use of land resources. (Trivelli, 1997).

A common indicator of farmland values is the farm real estate value, which measures the value of all land and buildings on farms. This series is compiled by the USDA from estimates provided by regional crop reporters. The data is adjusted with information obtained from farm real estate brokers, local bankers, and county officials. In 2004, the average farm real estate value reached \$1,780 per acre in real terms (2004 dollars), 3.6 times greater than the average of \$496 per acre in 1950. Land values climbed through the second half of the century, and saw declines in only four years. The increase in farm real estate values is likely driven by a combination of factors including increasing agricultural productivity, high commodity production and prices, expanding trade (net export of agricultural products), and strong demand for nonagricultural land uses (captured by urbanization/price of residential housing), among others.

**Agricultural Productivity.** Based on the economics of firm, productivity is defined as the ratio of output to input. Historically, productivity is often expressed as the ratio of output to the most limited or critical input, with all the other inputs held constant. Thus, agricultural productivity is typically measured in bushels of wheat or corn per acre. By defining output as gross production leaving the farm and input as capital, labor, and intermediate inputs, Ball et al (1997) constructed indexes of total factor productivity in the U.S. agriculture, which constitute the official productivity data series provided by USDA. Between 1948 and 1994, a combination of rapid output growth and negligible input growth pushed agricultural productivity to increase at an average 1.94% annual rate. Empirical studies explain this phenomenal increase as a result of investments in research and development and public extension. Theoretically, increased agricultural productivity imposes an indeterminate influence on the value of farmland. On the one hand, it allows farmers to expand their output through efficiency rather than through additional acreage and thus may lower the value of farmland. On the other hand, increased productivity generates an expected profitability in agricultural production and therefore may raise the value of farmland.

**Input/Output Price.** While the TFP index captures the changes of quality in the agriculture input and output, the change of price elements have been left out. The latter is nevertheless important in that price and quality jointly determine the net farm income and the real capital gains from farm assets. Historically, farmland values were consistently linked to net farm income. However, after the 1950s, the gap between the rise in land prices and the rise in net farm income widened. Since 1973, real net farm income consistently declined while farmland values continued to rise. Studies that concentrate on

rent derived from agricultural income as the major land price determinant include Tweeten and Martin (1966), Shalit and Schmitz (1982), and Pope et al. (1979), among others. Shalit and Schmitz (1982) concluded that both savings (the difference between farm income and consumption) and the accumulated debt that farmland carries determine the price of farmland. The impact of input/output prices is captured in the ratio of the prices received index to that of the prices paid index to reflect the fluctuation of net farm income. The former is the measure of prices ranchers and growers receive for their products while the latter is the measure of the costs of the inputs necessary to realize saleable commodities. Both indexes are defined by the same period.

**Residential Housing Price.** The value of residential housing positively affects the value of farmland in that it raises the opportunity cost of land in non-agricultural uses. Urban economists Alonso (1964), Brueckner (1990), and Capozza and Helsley (1989) have developed several models indicating that the market valuation of farmland and residential housing is jointly determined, while there is a positive correlation between the house price and the farmland price. These models assume that equilibrium in the nonagricultural land market roughly equates the marginal value of land in all urban uses, so that those counties that have a high value of residential housing also have similar values of commercial real estate. This assumption provides justification for the exclusion of commercial real estate price. Hardie et al. (2001) extended the existing models by introducing the geographical element of real estate value and developed a simultaneous equation model of farm and house prices at a county level. They found that farm earnings and non-farm factors both play significant roles in determining farmland prices, while farmland value is more responsive to non-farm factors. Mean elasticities computed for

county quintile groupings indicate that a 1% change in house prices evokes a larger response in farmland prices than a 1% change in agricultural revenues.

**Government Support Program.** The increase in the value of assets used in agricultural production is considered to be one of the major consequences from government support payments. Capitalizing the full benefits of a support program will not affect net farm income in the short run. There are also negative distributional consequences associated with the capitalization of government support payments. Current asset owners obtain the present values of future income transfers while beginning farmers received little or no benefit from the transfers. A limited number of studies have empirically examined the effect of government programs on the price of land and agricultural assets with mixed results. Using a partial equilibrium model of the U.K. agricultural sector, Traill (1985) estimated a 1% increase in support prices would increase net farm income by 9%, but this increase in income was largely capitalized into land values. Using a recursive econometric model of past rents and land values, Featherstone and Barker (1988) estimated that a move to a more free market scenario from the 1985 farm program would reduce land prices in the United States by about 13% in five years. Veeman, Dong, and Veeman (1993) determined that the abolition of direct government transfer payments in Canada would reduce total farm cash receipts by 13%, and consequently lead to a decline in land prices of 5% in the short run and 18.5% in the long run.

**Other Factors.** There are several other factors that may affect the change of farmland value. Net export gains of U.S. agriculture products increase the profitability of the agriculture production and may increase the value of the farmland. The inflation rate has

an important effect on land prices and one of the more controversial topics in the economic literature on land prices. In general the effect of inflation on land prices depends on the relative effect of inflation on agricultural real output and input prices. During inflationary periods there is also a tendency to observe growing nominal prices of assets as the money supply increases (Reinsel and Reinsel, 1979). Also, the transaction costs (including but not limited to the costs of searching, bargaining, asset valuation and management cost) are likely to affect the farmland prices. The higher the transaction costs in the land market, the lower the incentives to do land transactions. Thus, the transaction costs reduce the demand for farmland and its value. However, it is difficult to measure the transaction costs by some kind of index. Therefore, although theoretically sound, the transaction cost is not included as an independent variable in the regression model.

### **III. Data and Methods**

The dependent variable farmland acreage was gathered from National Agricultural Statistics Service (NASS). We adjusted for state size using total federal and non-federal land (the measure excludes water surface area within states) from National Resources Inventory (NRI) data on the Department of Agriculture website.

To explain state-level farmland acreage, we select independent variables that capture the factors identified as causes of changes in farmland values: agricultural productivity, per-capita income, population density, agricultural subsidies, and net agricultural exports. We include two additional indicators that may capture the impact of urbanization: developed land and sprawl (per-capita developed land). Because technology may



generate a substitution toward capital and away from land (Blank, 2002), increases of agricultural productivity may explain the decline in acreage. For the full 1960-96 period, every state exhibits a positive and generally substantial average annual rate of productivity growth. On the other hand, increases in per-capita income may raise the per-capita food consumption and ultimately the amount of land under cultivation.

We initially included as independent variables net farm income, government subsidies to agriculture and government payments for conservation programs. These variables make agriculture more lucrative and thus may expand the number of acres in cultivation. Net farm income is defined by USDA as “that portion of the net value added by agriculture to the national economy earned by farm operators”. It is the residual of gross farm income minus total production expenses. Subsidies are identified as government spending in farm income stabilization. U.S. Census Bureau Classification Manual defines farm income stabilization as federal government programs to stabilize, support, and protect farm income and prices through commodity loans, purchases, and payments, production limits, and crop insurance. This category excludes conservation programs unrelated to price or income support and agricultural credit programs unrelated to farm income stabilization.

Data on subsidies at the federal level were collected from the Budget of the United States (various years). Government payment is defined as “direct cash payments received by the farm operators. It includes disaster payments, loan deficiency payments from prior participation, payments from Conservation Reserve Programs (CRP), the Wetlands Reserve Programs (WRP), other conservation programs, and all other federal farm programs under which payments were made directly to farm operators.” Commodity

Credit Corporation (CCC) proceeds and federal crop insurance payments were not tabulated in this category. However, agricultural subsidies and government payment for conservation programs are highly correlated (0.99), and we keep only subsidies for the final regression analysis.

Net export gains of U.S. agricultural products increase the profitability of the agriculture production. Overall, 25 percent of all cash receipts for agriculture come from export markets. Over the last few decades, total net export of U.S. agricultural commodities has fluctuated cyclically (mainly due to import fluctuation) but still exhibits a rising trend. Higher net export increases demand for U.S. agricultural products and consequently may expand the farmland acreage. Data for total net export is available at the national level.

The effect of population density on farmland acreage is ambiguous. Population growth increases demand for commodities that go into food production and drives farmland to expand. On the other hand, additional population calls for alternative uses of land such as residential development. Increases in developed land therefore may compete away the increase in farmland acreage.

Residential and commercial land development prevents agricultural uses and may decrease farmland acreage. Farmland protectors claim that over the past 20 years the acreage per person for new housing almost doubled and far more farmland is being converted than is necessary to provide housing for a growing population. To examine the impact of urbanization on farmland acreage, we include both the ratio of developed land to total non-federal land and the ratio of developed land to total population as independent variables in the regressions below. We include only non-federal land in the

denominator because only non-federal land is classified into developed and undeveloped by the NRI.

The data on productivity and balance of U.S. agricultural trade were collected from the Department of Agriculture website. The data on productivity are missing observations for Alaska, Hawaii, and District of Columbia (n=48 states). Data on per-capita income, population density are from The Statistical Abstract of the U.S. (US Bureau of the Census, various years). Data on net farm income and government subsidy payments are from the Census of Agriculture published by the Department of Agriculture (various years). The census did not compile the government subsidy payments until 1987 and therefore the available data on government payments starts from 1987. Real per-capita income, real net farm income, real government payments and net export are in 2000 dollars. In the results reported below, nominal values are converted using the GDP deflator. Converting the nominal values using the CPI had no effect on the results.

The measure of new land development was derived from the National Resource Inventory Summary Report that is compiled by the Department of Agriculture in cooperation with the Statistical Laboratory at Iowa State University.

The summary report surveys land using aerial photographs and classifies all land as federal land or nonfederal land. Land in nonfederal category is classified as either developed or rural. Developed land is defined as “residential, commercial and institutional land; construction sites; public administrative sites; railroad yards; cemeteries; airports; golf courses; sanitary landfills; sewage treatment plants; water control structures and spillways; other land used for such purposes; small parks (less than 10 acres) within urban and built up areas; and highways, railroads and other transport

facilities.” The data in the report are compiled every 5 years using the same sample sites located across the 50 states. The report does not provide data for Alaska (n=49 states).

The data contains annual observations on each variable across the 48 U.S. states for the years of 1982, 1987, 1992 and 1997 (4 years and 48 cross sections). Table 1 reports means, standard deviations, and definitions for the dependent and independent variables.

#### **IV. Results**

While the amount of farmland declined steadily through the last half century, the rate of reduction by decade falls from 5.59% in 1960s to 3.73% in 1990s. Substantial differences of farmland acreage among the states remained. In 1997, the amount of farmland as percentage of total nonfederal land and federal land excluding water surface was highest in Nebraska (94.62), Iowa (92.83), Kansas (91.12), and South Dakota (90.76) and lowest in Nevada (9.81), Rhode Island (9.82), Massachusetts (11.47), and Connecticut (12.39).

A glimpse at the descriptive statistics in Table 1 generates some startling findings. Despite the popular perception that farmland is under the threat of development, overall 45.15 percent of the total land area excluding water surface is farmland. In 2002, farmland counts for 50.34 percent of the total land area while only 5.52 percent of the total land area is developed at the national level, inclusive of federally owned lands.

We estimate an equation in which the dependent variable, farmland acreage, is a function of agricultural productivity, per-capita income, net farm income, population density, subsidy, net export, and urbanization indicators. We use four fixed-effects panel-data models in attempt to draw the best results from the main variables in question. The

fixed-effects model is superior to the common intercept and random effects model in this case, based on *F-test* and Hausman test results. Each model maintains the independent variables representing productivity, per-capita income, net farm income, government subsidy, and the net export in agricultural section. The first three models include one variable that measures the nature/degree of urbanization, whether it is developed land, population density, or per-capita developed land (sprawl). The fourth model corrects for the first-order autocorrelation among independent variables in the third one. The results of these four regressions are presented in Table 2.

Table 2 shows fixed effects regression on farmland acreage. Columns 1-3 of Table 2 shows the results of three fixed-effects regression with common independent variables of productivity, per-capita income, net farm income, government subsidy, and the net export in agriculture. Each column also includes different urbanization indicators: developed land in Column 1, developed land and population density in Column 2, and sprawl in Column 3. Column 4 reports the results after correcting for the first-order autocorrelation in the third model.

The regressions show an ambiguous and insignificant relationship between agricultural productivity and farmland acreage. The regressions show significant relation between per-capita income and farmland acreage after correction for autocorrelation. The variables of agricultural subsidies and net export have the expected signs and all the estimates are significant. Among the indicators of urbanization, the effect of developed land is insignificant and ambiguous. The effect of population density is significant and negative. Surprisingly, the sprawl variable has a strong and positive relationship with farmland acreage, and its estimates are significant in both models.

Because agricultural products are likely a normal good, we expect increases in income to raise farmland acreage. Because environmental goods such as open space are likely luxury goods, they would be in higher demand by residents with high income levels. The results from the multiple regressions (column 4) clarify that the amount of farmland will indeed increase as per-capita income increases. However, per-capita income has a minimal effect on the percentage of land that is in agricultural use. For every one thousand dollar increase in real per-capita income, the percentage of farmland to total nonfederal land and federal land excluding water surface will rise roughly 0.000289 percentage points.

Among profit indicators, both net exports and net farm income (Revenue and Revenue<sup>2</sup>) are significant determinants of the farmland acreage in all four regressions. As net exports increase, farmland acreage will increase. Coefficient of net export in Column 4 indicates that a 100 million dollars increase in net export will raise the farmland percentage by 0.0488 points. While net export exerts only a modest effect on farmland acreage, net export decreased considerably from 1982-1997. The net export was \$34,166.52 million dollars in 1982 but by 1997 it decreased by 35.69% to \$23,971.43 million dollars. The decrease in net export is mainly due to the dramatic expansion in agricultural imports. Thus, the decrease in net export from 1982-1997 decreased farmland percentages by 5.95 points across 48 states.

On the other hand, the estimates in Table 2 throughout four columns show that net farm income has a negative effect on the farmland acreage. The positive coefficient of the square term (Revenue<sup>2</sup>) indicates the farmland acreage will decrease at an increasing rate as net farm income increases. The results are surprising because an increase of net farm

income makes farming more lucrative and thus may increase the amount of land under cultivation. Total U.S. net farm income increased from \$380.06 million dollars in 1982 by 41.48% to \$537.7 million dollars in 1997. This negative effect of net farm income may be explained by the more rapid growth of profitability in alternative land uses. If this is the case, the nominal positive profit in farming will be converted into real negative loss.

From a theoretical perspective the effect of subsidies is positive. The estimates in Column 4 show that agricultural subsidies increase the percentage of land in agricultural use. For every 100 million dollars increase in the subsidy farmland percentage will increase about 0.0437 percentage points. From 1982-1997, subsidy also decrease dramatically. The agricultural subsidy was \$22,796.11 million dollars in 1982 but by 1997 it decreased by 71.16% to \$6,573.73 million dollars. Thus, the decrease in agricultural subsidy from 1982-1997 decreased farmland percentage by 7.09 percentage points across the 48 states. Interestingly, the coefficient of subsidy is almost identical to that of net exports, indicating that the force of one market section (the international one) is equivalent to the top-down planning. Nonetheless, while international trade of agricultural goods actually increases the total value of social production in the U.S., agricultural subsidies only produce a welfare transfer. The agriculture sector is better off at the expense of other sectors of society.

Another important findings center on the demographic and urbanization indicators. The estimates in Column 1 and 2 suggest that the relation between developed land and farmland acreage is both ambiguous and insignificant. Developed land alone does not affect farmland acreage. However, by combining total land area and population and

expressing them in terms of population density, we found that the increased level of population density depresses the percentage of farmland acreage. Among all indicators in Column 2, population density has the strongest effect on farmland acreage. For every one point increase in the population density the farmland acreage percentage falls around 27.64 points. The population density varies a great deal among states and has increased consistently from 1982-1997 for every single state in the analysis.

To further examine the impact of developed land and population, we include sprawl variable in regression 3 and 4. The estimates show a strong positive effect of sprawl on farmland acreage, indicating that an increase in per-capita developed land will raise the amount of land under cultivation. This positive effect is contradictory to the conventional wisdom which claims urbanization as the primary threat to farmland preservation. For every one point increase in the per-capita developed land the farmland percentage will increase around 19 points.

## **V. Conclusion**

The loss of farmland is of political, economic, and social significance. This issue not only drives much public concern but also consumes tremendous financial resources. While general perceptions hold that urbanization is the chief cause of the farmland loss in the states, this study demonstrates that the change of farmland acreage is driven by a series of complex forces.

Previously we hypothesized that agricultural productivity, per-capita income, net farm income, population density, per-capita developed land, government subsidy and agricultural net export all take partial blame in the change of farmland acreage, but we



were unsure of the significance and magnitude of these indicators. The regression demonstrated that per-capita income, net farm income, government subsidy and agricultural net export have significant effects on the change of farmland acreage. While the other three all positively relate to the farmland acreage, net farm income shows a puzzling negative effect. The minor effect of per-capita income again proves that agricultural goods are a necessity and its consumption barely varies as income changes. The negative effect of net farm income may be explained by the relatively higher profitability in alternative land uses. The magnitude of subsidies and net export effects are almost identical.

The regression also produces some startling results for the indicators which have been generally perceived as the major causes of farmland loss. Agricultural productivity simply does not have any impact on the farmland acreage. Developed land alone also has a bleak effect in changing farmland acreage. Per-capita developed land, while primarily takes the blame for encroaching the amount of land under cultivation, actually drives the increase of farmland acreage.

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Figure 1. Land in Farms vs. Land in Development

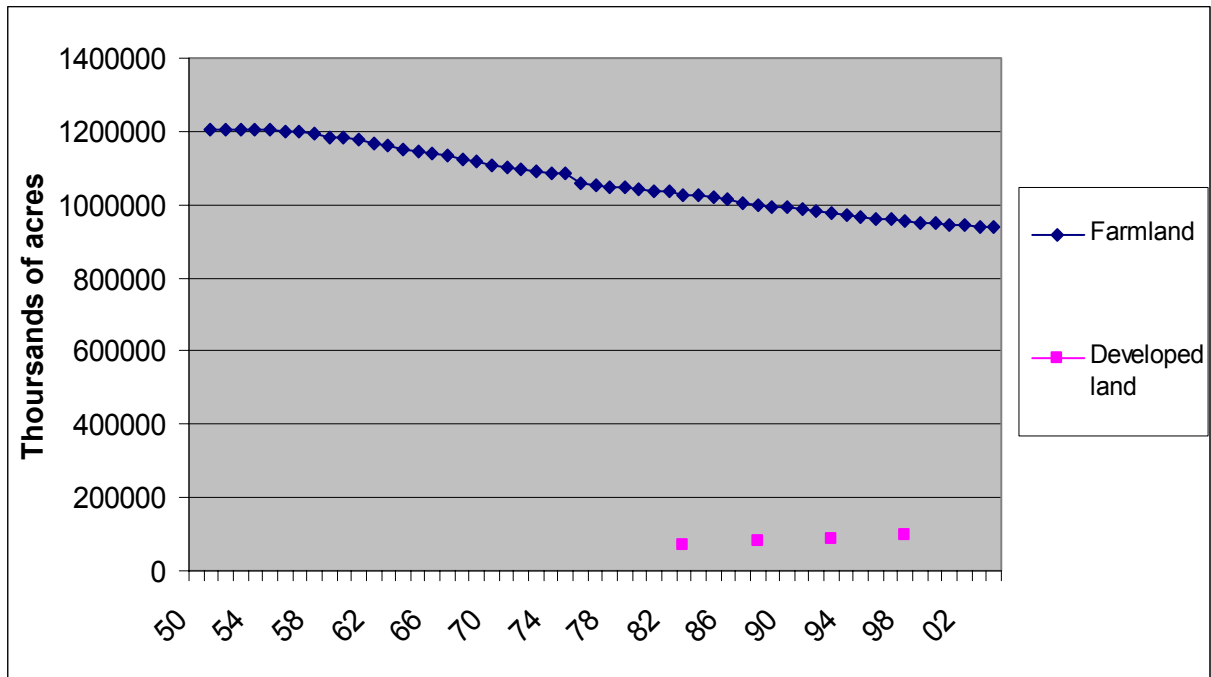


Figure 2. Reduction in Farmland by Decade

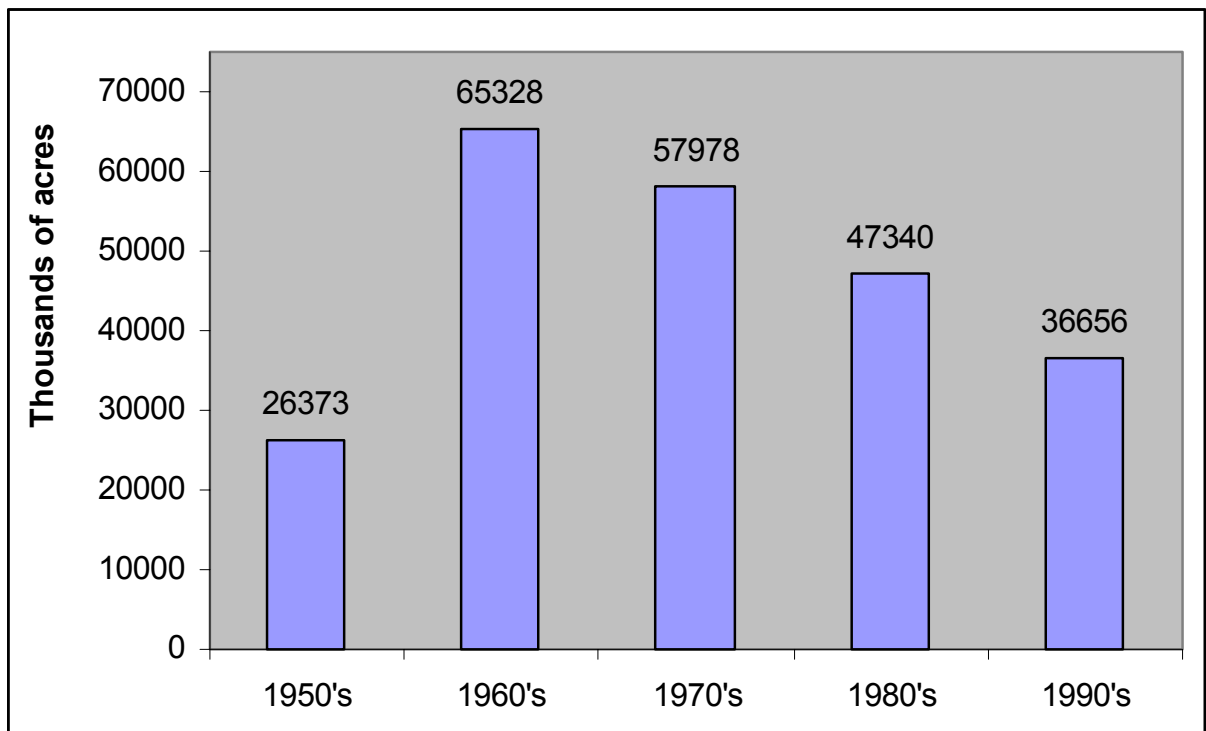


Table 1. Means and Standard Deviations

Variable	Mean	Standard Deviation	Minimum	Maximum
Acreage	45.15027	24.81388	6.493177	96.82989
Product	0.9403646	0.2016071	0.4	1.55
Income	21007.45	4451.475	12399.17	37588.3
Density	0.2669792	0.3727909	0.01	1.75
Devland	8.227656	7.292279	1.34	39.13
Sprawl	0.4638542	0.2797395	0.15	1.53
Revenue	78.77854	92.01968	-2.75	619.99
Subsidy	19443.18	10079.09	6573.73	33743.17
NetX	18183.63	4861.945	11348.22	22012.89

$Aceage_{it}$ : Farmland as percentage of total nonfederal land and federal land excluding water surface for state  $i$  in year  $t$ .

$Productivity_{it}$ : Level of total factor productivity in agriculture for state  $i$  in year  $t$  (relative to Alabama in 1996).

$Revenue_{it}$ : Real net farm income (in thousands of 2000 dollars) per thousand square miles of farmland for state  $i$  in year  $t$ .

$Density_{it}$ : Population (in thousand) per square mile of developed land in state  $i$  in year  $t$ .

$Income_{it}$ : Real per-capita income (in thousands of 2000 dollars) for state  $i$  in year  $t$ .

$Devland_{it}$ : Percentage of nonfederal land that is developed for state  $i$  in year  $t$ .

$Sprawl_{it}$ : Developed land per person for state  $i$  in year  $t$ .

$Subsidy_{it}$ : Real government spending in farm income stabilization (in millions of 2000 dollars) in year  $t$ .

$NetX_t$ : Real surplus of U.S. agricultural trade (in millions of 2000 dollars) in year  $t$ .

Table 2. Fixed-effects regression results for farmland acreage

Variable	Fixed Effects 1	Fixed Effects 2	Fixed Effects 3	Fixed Effects 4
Product	0.0127315 (0.007)	-0.0120599 (-0.007)	0.87385 (0.484)	0.36311 (-0.23)
Income	3.08e-06 (0.029)	0.0000361 (0.345)	-0.0000267 (-0.297)	0.000289 (2.15)*
Density		-27.63527 (-2.810)**		
Devland	-0.1732284 (-1.332)	0.2181249 (1.158)		
Sprawl			8.850089 (2.181)*	18.99626 (3.41)**
Revenue2	0.000251 (2.506)**	0.000027 (2.762)**	0.0000282 (2.868)**	0.0000188 (2.08)*
Revenue	-0.0201052 (-2.967)**	-0.0213154 (-3.217)**	-0.0229585 (-3.492)**	-0.01555 (-2.44)**
Subsidy	0.0001028 (3.320)**	0.0001136 (3.730)**	0.00013333 (3.869)**	0.000437 (4.38)**
NetX	0.0001047 (3.512)**	0.0001144 (3.905)**	0.0001307 (3.99)**	0.000488 (4.14)**
R-Square within	0.6660	0.6843	0.6730	0.3171
R-Square overall	0.1741	0.1789	0.3186	0.2895
n	192	192	192	144

Dependent variable: Acreage<sub>it</sub>, the amount of farmland as percentage of total nonfederal land and federal land excluding water surface for state i in year t.

t-value in parentheses. \*\* = significant at 0.01 level, \* = significant at 0.05 level.

Productivity<sub>it</sub>: Level of total factor productivity in agriculture for state i in year t (relative to Alabama in 1996).

Revenue<sub>it</sub>: Real net farm income (in thousands of 2000 dollars) per thousand square miles of farmland for state i in year t.

Revenue2<sub>it</sub>: Square of real net farm income (in thousands of 2000 dollars) per thousand square miles of farmland for state i in year t.

Density<sub>it</sub>: Population (in thousand) per square mile of developed land in state i in year t.

Income<sub>it</sub>: Real per-capita income (in thousands of 2000 dollars) for state i in year t.

Devland<sub>it</sub>: Percentage of nonfederal land that is developed for state i in year t.

Sprawl<sub>it</sub>: Developed land per person for state i in year t.

Subsidy<sub>it</sub>: Real government spending in farm income stabilization (in millions of 2000 dollars) in year t.

NetX<sub>t</sub>: Real surplus of U.S. agricultural trade (in millions of 2000 dollars) in year t.

