

AN ECONOMIC ANALYSIS OF THE MISSISSIPPI SCHOOL TRUST PROGRAM

by

MATTHEW H. BONDS

(Under the Direction of Dwight R. Lee)

ABSTRACT

The process of statehood, as outlined by the General Land Ordinance of 1785 and the Northwest Ordinance, required western territories to set aside substantial stocks of land for the benefit of public schools. These lands are now managed under the trust doctrine in 31 states, and are accordingly referred to as school trust lands or state trust lands. The history of Mississippi's school lands begins over 200 years ago, and is laden with struggles over proper management. Local school boards became the trustees as a result of the Sixteenth Section and Liu Lands Act of 1978 and have since supervised substantial increases in surface lease rents and timber receipts. Surface leases are managed by the local Superintendents of Education, and the majority of the timber management services are contracted to the Mississippi Forestry Commission (MFC). The school districts and the MFC are legally required to maximize revenue from these lands. However, school districts are also legally permitted to outsource forestry services to private vendors and do so on a regular basis by recommendation from the MFC. This dissertation examines the legal precursors of the school trust lands and the obligations of their managers, as well as conducts ordinary least square regressions and stochastic frontier analyses of surface lease rents and timber production. Average technical efficiency of timber production on

the sixteenth section lands is 44%, and about 50% on surface rents. The impact of the 1978 Reform is estimated to have increased receipts between 30% and 40%. And there is a positive and statistically significant increase in total timber receipts when a higher proportion of management services are outsourced to private vendors.

INDEX WORDS: Stochastic frontier, Public land, Sixteenth section, Education funding, Timber, School trust, Trust law, Productivity analysis

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DEDICATION

To Meredith, Adam, Mom, and Grandanne

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CHAPTER 1:

HISTORY OF THE MISSISSIPPI SCHOOL TRUST PROGRAM

Introduction

There is an extensive economics literature on the management of U.S. federally owned lands, but little on state land management. Much of the focus has been on the Forest Service with the general conclusion that it operates inefficiently (Clawson, 1977; Hyde, 1981; Muraoka and Watson, 1986; Leal 1995; Gardner, 1997). Such inefficiency could create significant costs considering that the Forest Service controls about 192 million acres of land. But economic analysis of federal land is difficult, as Gardner (1997) points out: “because agency responsibilities mandated by Congress may be highly complex, comparing agency costs and revenues for a given activity, such as timber harvesting, may be somewhat misleading.” For example, the Multiple-Use Sustained Yield Act (1960) requires, “the management of all the various renewable surface resources of the national forests so that they are utilized in the combination that will best meet the needs of the American people.” Such an objective has been treated by some as nonsensical (McCloskey, 1961). As a result, despite substantial efforts to evaluate performance of public land management at the national level, only vague conclusions of inefficiency have been drawn. What are the precise barriers to better management?

To address this question, we turn to land management at the level of the state government. As federal lands were being acquired during the western expansion of the U.S., a portion of the land was being systematically converted to state property and for a

particular objective: to generate revenue to fund public schools. Such lands have been generally referred to as school trust lands.¹ Thirty-one states are currently involved in school trust programs, comprising over 135 million acres of the United States, and generating more than \$4.5 billion annually for the benefit of schoolchildren (Fairfax and Souder, 1996).² As Robert Nelson says, “In a sense there are three major public land systems [in the U.S.]: the national forests, the BLM lands, and the state trust lands” (Nelson, 1996).

In *Turning a Profit on Public Forests*, Leal (1995) compares national forests in Montana and Minnesota to comparable forests on school lands. His conclusion is that the national forests are managed significantly less efficiently and with greater environmental impact than the school lands. The reason, he claims, is because the school lands are maintained under land trusts, and the managers have a specific mission to maximize revenue for the sake of public school funding, and can be sued for malfeasance.

There is, on the other hand a law literature arguing that school lands in various states have historically not realized their revenue potential. In “Utah’s School Trust Lands: A Century of Unrealized Expectations,” Harmer (1990) argues that the primary reason school trust lands have, “failed to produce appreciable value,” is because the U.S. Department of Interior has blocked their efforts to consolidate the land into parcels that are economically more manageable. In particular, the problem is that much land is currently located within Indian reservations and national parks. While land conflicts represent an obstacle to revenue-maximization, it is not clear this is Utah’s sole barrier.

¹ Other common names are “state trust lands,” “school lands,” and “sixteenth section lands.”

² According to Souder and Fairfax (1996), these figures were provided by the Annual Directory of the Western State Lands Commissioners Association (1989-1994), but was not available to this author. Given that that proceeds from eastern states were likely excluded, these figures provide a lower bound in 1994, and are presumably higher. Information on eastern states appears to be completely absent from the literature on school lands.

Fairfax and Souder (1996) argue that few states, including those without much federal intervention, have had success managing their school lands.

Presented here is the case of the Mississippi School Trust Program (MSTP), which has a notably deplorable history of managing their lands – actually referred to as the “Legacy of Shame” within Mississippi (Biennial Report, 1978). However the MSTP has produced dramatic increases in revenue over the last quarter century, partly as a result of land reform in the 1970’s. Lack of returns from school lands have been generally attributed to inadequate compensation for generously long leases – as much as 99 years for a small one-time payments (LAC, 1978) – as well as mismanaged timber resources.

School lands in Mississippi were established in the late 19th century, and they have been legally protected under the trust doctrine since 1895 (Jones v. Madison County, 1895). But it appears that it was not until the Frasier-Hall Reform Act in 1978, when trusteeship and management rights of the lands were transferred from county Boards of Supervisors to the respective Boards of Education, did the lands begin to bear substantial fruit. Between 1977 and 1997 trust land revenues have increased from \$7 million to a record high of \$56 million (Annual Report, 1976-1977; Biennial Report 1996-1997).

Table 1.1 Receipts from School Lands in Sixteen States (1990)*

State	Acres	Total Revenue	Total Revenue/ Acres
Arizona	8,255,377	\$40,366,999	\$4.89
California	586,917	\$5,651,292	\$9.60
Colorado	2,635,589	\$17,420,601	\$6.61
Idaho	2,054,292	\$23,500,557	\$11.44
Mississippi	642,051	\$27,656,346	\$43.08
Montana	4,597,691	\$27,134,583	\$5.90
Nebraska	1,519,774	\$16,359,685	\$10.77
New Mexico[†]	7,004,959	\$127,704,615	\$18.23
North Dakota[†]	635,885	\$12,409,332	\$19.51
Oklahoma[†]	388,565	\$31,201,425	\$80.4
Oregon	785,868	\$20,522,022	\$26.11
South Dakota	666,375	\$2,177,289	\$3.27
Texas[†]	809,389	\$163,271,845	\$201.82
Utah[†]	3,590,236	\$11,454,424	\$3.19
Washington	21,836,986	\$329,808,426	\$15.10
Wyoming[†]	3,139,814	\$40,799,832	\$12.99

* Source: Fairfax and Souder (1996)
[†] Majority of revenues from oil and gas

Sixteenth Sections and the American Frontier

The history of school trust lands in the U.S. begins with the westward expansion of the original 13 colonies. Seven of the original colonies – Georgia, North Carolina, Virginia, Pennsylvania, New York, Connecticut and Massachusetts – had land charters

that extended to the Pacific Ocean (Davis, 1950). As part of the establishment and recognition of statehood these colonies were required to cede unsettled western territories in order to form a U.S. federal domain. The Land Ordinance of 1785 combined with the Northwest Ordinance in 1787 mapped out new settlers' specific requirements on the newly granted lands and the process by which these new territories would become American states (Souder and Fairfax, 1996).

Among the early states to cede their western lands were Connecticut, Virginia, and New York, which combined to form the Northwest Territories (Davis, 1950). The Land Ordinance of 1785 required that the land be surveyed and partitioned into a grid of townships, each 36 miles-squared. Each township was further divided into 36 one-mile-squared sections. The sixteenth section, which was near the center of the township was reserved, "for the maintenance of public schools within said township" (See Figure 1.1; General Land Ordinance of 1785). The Northwest Ordinance, written by Thomas Jefferson, mapped out the specific steps necessary for the Northwest Territories to establish statehood and that, "religion, morality, and knowledge being necessary to good government, the preservation of liberty and the happiness of mankind, schools and the means of education shall forever be encouraged" (Northwest Ordinance, 1787).

In accordance with the Northwest Ordinance, becoming a state required a minimum of 60,000 American inhabitants, a petition from the settlers requesting admission, and an enabling act by Congress, authorizing the formation of a constitutional convention. The constitutional convention was to draft a state constitution, which among other things outlined the management obligations for the lands of the proposing state. The state constitution effectively became a bartering mechanism between the U.S. federal

government and the proposing state, ultimately forming a binding contract for the duties of the state governments (Fairfax et al., 1992). The original thirteen colonies, of course, were never part of the “federal domain” and therefore were not part of this initial land grant program, and do not currently have sixteenth sections lands.

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

Figure 1.1 The Sixteenth Section of the Township

A cohesive, enforced strategy of state accession lagged behind Congressional initiatives, however, and the first recognition of school lands by states did not occur until 1802 with Ohio. New York, North Carolina, and Virginia granted Vermont, Tennessee, and Kentucky respectively before 1803, and were never a part of the school land grant system. In fact, an official federal policy recognizing the states educational authority was not enacted until 1803, when Congress assigned it to State Legislatures and required that the school land grants were to be “for schools and for no other use, intent or purpose whatsoever” (Moelman, 1940).

The specific arrangements for management of school lands have varied among states over time, but in nearly all cases, the Land Ordinance of 1785 and the Northwest Ordinance of 1787 were applied. The first state to establish a sixteenth section program was Ohio in 1802, where sixteenth sections were “granted to the inhabitants of each

township for the use of schools” (Davis, 1950; Souder and Fairfax, 1996). What has become known as the Ohio plan, which specifically designated the townships as the beneficiaries, was applied to subsequent state accessions until 1836, when Michigan was admitted. Louisiana, Indiana, Mississippi, Alabama, Missouri, and Illinois operate under the Ohio plan. However, Illinois’s enabling act of 1818 granted the lands, “to the state for the use of the inhabitants of such townships for the use of schools,” rather than to the townships themselves. This distinction of to whom the enabling acts delegated responsibility for school land management has turned out to be significant.

Michigan’s enabling act was drafted in 1836 and specified that sixteenth sections were granted, “to the state for the use of schools,” instead of to the townships. Every state accession agreement that involved the federal domain after the Michigan act (excluding Texas, West Virginia, and Maine that became states under different circumstances), has delegated authority of school lands to the state. However states admitted between 1859 and 1896 – including Oregon, Kansas, Nevada, Nebraska, Colorado, Montana, North and South Dakota, Idaho, and Washington – were also granted the 36th section. Utah, Arizona, and New Mexico, which were admitted in 1896, 1912, and 1912, respectively were granted sections 2, 16, 32, and 36. Oklahoma entered the union in 1907 and received the sixteenth and thirty-sixth sections.

Evolution of Sixteenth Section Land Policy in Mississippi

The territory of Mississippi was acquired in two stages, in 1802 and 1815. The Georgia Cession Agreement in 1802 required that the Mississippi Territory be governed in all respects according to the Northwest Ordinance (Annual Report, 1977). In 1812, the

Mississippi Territory was expanded in the south by land the U.S. annexed from Spain in 1810. The land was accordingly surveyed and sixteenth sections were reserved for schools. An 1815 congressional act placed the Mississippi Territory county courts in charge of the sixteenth sections lands, and required all leases to expire within the first year of Mississippi statehood (Davis, 1950). The constitution of Mississippi, which was written two years later, prohibited the sale of the school lands.

All indications suggest that sixteenth section lands quickly became battle grounds between special interests and the schools'. Through a variety of methods – particularly acquisition of cheap timber and the securing of 99-year leases – the special interests prevailed for most of the following two centuries.

The first legislative statute regarding sixteenth section lands came within the first year of statehood in 1818, allowing for leases up to 3 years (Clayton and Spencer, 1977). In 1820, the leases were extended to 5 years, and in 1823 the Legislature transferred jurisdiction of the school lands to the directors of the respective county literary funds without restrictions on terms of leases. The following year, the owner townships, consisting of elected five-man boards of trustees, accessed control of the lands and were required by the Legislature to limit leases to 5 years. The success of the school lands in the first twelve years of Mississippi statehood is unclear. However, the thirteenth year would prove the first of nearly two centuries of mismanagement.

In 1830, the Mississippi Legislature chartered Planters Bank. In order to generate the necessary three million dollars of start-up capital, terms of the leases of the sixteenth section lands were extended in 1833 to 99 years for one-time payments, with the

proceeds lent to Planters Bank (Davis, 1950).³ Due to local citizen resistance, the townships stopped issuing 99-year leases three years later. The Legislature then responded by allowing for the proceeds to be shared with township members through loans to individuals (MS Laws 1836). As a result, 99-year leases resumed again by the end of 1836. Such a provision proved little benefit to the schools however: “The lending of the money to individuals was in a large number of instance made to friends of the persons holding the office, and was never reimbursed” (W.R. Newman, 1947).

Planters Bank, which failed in 1840, did not pay back its debts to the schools. In 1841, the owner townships authorized by the Legislature auctioned off the bank loan collateral, which took the form of depreciated bank paper, but received “practically nothing” (Davis, 1950). An 1845 assessment by Governor A.G. Brown found that school land funds had been managed with, “inefficiency, criminal negligence, and downright dishonesty” (Weathersby, Mississippi College).

Governor Brown’s solution in 1846 was to transfer jurisdiction of the lands to the county boards of school commissioners from the respective owner townships, and lease out all remaining sixteenth section land for 99 years (MS Laws, 1846). The proceeds from such leases were to be invested or loaned, with the interest used to help cover expenses for public schools in the respective counties. Unfortunately, the Civil War subsequently resulted in destruction of many of these records, and many titles and leases were lost (Annual Report, 1977).

For reasons that are unclear but have been loosely attributed to Reconstruction (Clayton and Spencer, 1977), a statute was passed that allowed sale of sixteenth section

³ Clayton and Spencer (1977) claim that the Mississippi Legislature needed to generate \$10 million to charter Planters Bank.

lands in 1871, but was then repealed six years later. County Boards of Supervisors acquired control of the lands in 1880 from the Boards of School Commissioners. In 1886, for the first time, the Mississippi Legislature passed a statute requiring the County Boards of School Commissioners to maintain records of sixteenth section proceeds and expenditures. These semi-annual itemized accounts were to be given to the county Boards of Supervisors. Such an act allowed for the following prognosis by State Superintendent J.R. Preston in 1890, 55 years after Governor Brown's Assessment: "The only uniformity discernible at this distance is that manifested in the fact that lands went and no revenue came in return" (Biennial Survey, 1935). In 1890, the Mississippi Constitution was rewritten, which, in addition to prohibiting sales of sixteenth section lands, limited leases to a maximum of 10 years.

Nearly all of the original 99-year leases, issued beginning in the early 1830's, expired between 1932 and 1946. However, lobbying by leaseholders in Columbus, Terry, and Raymond counties, among others, resulted in a 1942 constitutional amendment that resumed leases with 99 year terms. The Legislature passed corresponding statutes in 1946. However, due to a 1942 State Auditing Department report that "many" individual loans had been uncollected, and the collateral in some cases lost, Section 6603 of the MS Code of 1942 prohibited lending to individuals from sixteenth section funds (Davis, 1950).

However, leases were not the only form of revenue from the lands. Much of the sixteenth section lands were also managed for timber production, although the results were no better. In 1947, the General Legislative Investigating Committee asked the Attorney General of Mississippi to file law suits against the Boards of Supervisors in

Hinds and Rankin counties for selling timber on sixteenth section lands “far below market value.” In 1945, “liquor-dealer”, Gus Dear purchased timber from the Hinds County Boards of Supervisors for \$500, then resold the timber two weeks later to Grief Brothers Cooperage Corporation for \$4,000. That same year, H. E. Wamsley, road foreman for the elected Supervisor of the First District of Rankin County, Mr. Walker, purchased a deed to timber within that district for \$200. The General Legislative Investigating Committee determined that the market value for the timber was over \$8,000, and included in its report that, “Mr. Walker was defeated for re-election, and from the information obtained by this committee, Mr. Walker has already constructed roads to this timber that would make it accessible” (Jackson Daily News Editorial, 1947).

The General Legislative Investigating Committee reported in 1948 that, among other things, timber on sixteenth section lands had been sold at, “such grossly inadequate prices as to shock the conscience and in some instances as to constitute nothing more nor less than a donation of this timber to private individuals” (Clayton and Spencer, 1977). The Legislature responded the same year by requiring that timber be publicly advertised and sold through competitive bidding. A follow-up State Department of Audit report found, however, that all saleable timber had already been removed before the statute was enacted (MS Laws of 1948).

Another stream of legislation flowed in 1958. The new statutes required the State Land Commissioner to classify all school lands into two categories: “Forest” and “Other”. Land classified as Forest was prohibited from being leased, and its management control was transferred away from the Boards of Supervisors to the Forestry

Commission. In addition, 1974 legislation further required that all surface leases be approved by their respective school districts.

Following a series of law suits over management of sixteenth section lands in 1975 (discussed in the next section), the General Legislative Audit Committee conducted an extensive evaluation in 1977 (Clayton and Spencer, 1977). The report discussed a wide range of management inefficiencies on the sixteenth section lands, and recommended a host of solutions, most notably, due to something “a kin to a profit motive,” school authorities be granted jurisdiction over the trust lands.

Consequently, the Frasier Hall Reform Act (also known as the Sixteenth Section and Liu Land Act) was passed in 1978 with a tie-breaking vote from Lieutenant Governor Evelyn Gandy. The act, which established the rules by which the lands are currently governed, gave jurisdiction of school lands to the school districts themselves, limiting the Board of Supervisors to a supervisory position with veto power (MS Code, Section 29-3-1). Statutes stipulated that the lands be managed to generate maximum revenue. Trust lands were therefore reclassified into 9 specific categories according to their “highest and best use” for producing maximum revenue, with specific regulations on lease terms and rents according to such categories. As a result, surface leases were limited to 10 years for gross sum (one time) payments and 25 years for annual rentals. Rental values were to be determined according to a combination of competitive bidding processes and appraisals depending on the land classification. As a part of a checks and balances system, the Forestry Commission continued its management role of forest lands.

A Sacred ‘Trust’

The first sentence of the Sixteenth Section and Liu Lands Act of 1978 provides that, “sixteenth section school lands, or lands granted in lieu thereof, constitute property held in trust for the benefit of the public schools and must be treated as such.” While this was the first statutory legislation in Mississippi establishing the school lands as trust property, Mississippi Courts had been ruling according to trust law since the late 19th century. Bogert and Bogert’s Law of Trusts (1973) defines a legal trust as a, “fiduciary relationship in which one person [the trustee] is the holder of the title to property subject to an equitable obligation to keep or use the property for the benefit of another... [the trustee] is to act with strict honesty and candor and solely in the interest of the beneficiary.” There has been, however, some debate on whether trust law has been properly applied to school lands generally.

Fairfax and Souder (1992, 1996) argue that the application of the trust doctrine to school lands is a relatively recent, and partially misguided, phenomenon in the United States. They point out that the term “trust” is not even used in state accession agreements until New Mexico and Arizona in the 1920’s. The current general treatment of school lands as trust property, they suggest, is due to a series of rights-of-way cases, starting with *Lassen v. Arizona Highway Department* in 1966: “The worm turned radically in 1966, when the U.S Supreme Court reviewed and overturned *State v. Lassen*. *Lassen v. Arizona Highway Department*, is the starting point for a series of modern cases that rely on trust principles to answer ancient issues about the granted lands.” The case involved the compensation for school lands used by the Arizona Highway Department. Overturning *State v. Lassen* (1965), the U.S. Supreme Court ruled: “The Enabling Act

unequivocally demands both that the trust receive the full value of any lands transferred from it and that any funds received be employed only for the purposes for which the lands were given.”

The fact that rulings in the 1920’s and 1930’s, such as *Ide v. United States* (1923) and *U.S. v. Fuller* (1937), allowed for use of school lands for rights-of-ways without compensation and without mention of trust law, is used as further evidence that school “trust” lands are simply a new interpretation of old provisions (Souder and Fairfax, 1996). For example, the *U.S. v. Fuller* ruling was based on a federal statute in 1866 and an Idaho state statute in 1905 that granted rights-of-ways on school lands without compensation.⁴

In 1803, Congress provided that the survey system required by the General Land Ordinance of 1785 must be enforced by the State Legislatures and that school land grants were to be “for schools and for no other use, intent or purpose whatsoever” (Moelman, 1940). This left little doubt, if ever there was, that school lands were to be used exclusively for the benefit of schools. As the U.S. Supreme Court declared in *Andrus vs. Utah* (1980) the early state accession laws constituted a, “binding and perpetual obligation to use the granted lands for the support of public education.” Whether this “binding and perpetual” obligation itself constitutes trust is debatable. Fairfax et al. (1992) point out, for example, that, “neither the absence nor the presence of the word trust in whatever language is alleged to have established a trust is dispositive of the issue.” The “trust” in Mississippi school lands however is not up for debate. Mississippi courts have treated these lands as trust property for over a century and have specifically

⁴ In *Covington County v. State Highway Commission*, 1942(?), the Court ruled that the State Highway Commission may construct a public highway on sixteenth section land without condemnation proceeding and without compensating the county.

ruled that legislative statutes regarding them in conflict with trust principles are unconstitutional.

The Mississippi Supreme Court declared that sixteenth section lands were protected under trust law for the first time in 1895. In *Jones v. Madison County* (1895), the Court ruled that, “the grant of sixteenth sections is in perpetuity to the inhabitants of the respective townships; that the legal title to the land is in the state, in trust for the inhabitants of the respective townships in which the land is situated.” Such a ruling indicates that the State of Mississippi was the trustee although that the lands had been managed at the local level since prior to statehood.

In the 1906 case, *Moss Point Lumber Company v. Board of Supervisors* (MS Laws, 1906), Moss Point Lumber company was sued for the rights to log the land that they were leasing. The Board of Supervisors defense was based on the premise that logging the land would devalue the inheritance, and was therefore prohibited. In Judge Calhoun’s opinion, logging and clearing did not devalue the property because, “fine brick buildings might be erected on the spot where the timber stood,” and the Court ruled in favor of Moss Point Lumber Company. However, the case was appealed to the Supreme Court of Mississippi, where Moss Point Lumber Company argued that logging on sixteenth section lands was permitted under common law, given that it had been practiced for nearly seventy-five years. This time the Court ruled in favor of the Board of Supervisors. Chief Justice A. H. Whitfield’s opinion may have been the most dramatic to date from a superior court on sixteenth section lands anywhere in the country (Mississippi Educational Advance, 1947):

It was in pursuance of the purpose this declared, this enlightened public policy, that sixteenth sections all over the United States have been set apart as a sacred

trust fund to be perpetually maintained for the education of the children in the various townships. The thought, the paramount controlling purpose, was that this fund should not be wasted, and not even consumed for any one decade of children, but preserved “forever” for the education of every succeeding generation of children in these townships all over the United States. This state, acting in its governmental capacity, has accepted this sacred trust according to its terms and in harmony with the spirit which created it. It is, in my judgment, a high and solemn trust which the state in its governmental capacity has accepted imaginable; and the state should see to it that this trust fund shall not be seized up on by arrogant timber trusts, demanding, for the first time in the history of this state that they can, under the guise of a lease, having paid only a leasehold consideration, take an absolute fee simple property in these sixteenth sections, and destroy the whole value of the inheritance. No greater trust can be committed to any state than that of the education of the children within its borders; and, if one such trust can be more sacred than another, it is that trust designed to bring home to the doors of the poorer children of the common-wealth the means of acquiring a reasonably good education. It is these helpless children the state’s faith is pledged to protect. There are 35 other sections in every township, the timber on which is open to absolute sale. There is but 1 section in every township, the sixteenth section, consecrated to the education of these children. Let it be sacredly preserved for every generation of Mississippians to come in the great future.

The people of Mississippi can well ask the question as to whether in the handling of these school lands we have violated and are violating the sacred trust imposed in us to handle these lands for the best interest of the school pupils of this State; whether we have violated our sacred duty to protect and administer these lands for the benefit for the poor and helpless children of the State, for this generation and the generations to come?

If we again permit these lands to be tied up for 99 years and the money received therefrom placed in a fund which is subject to investments at the pleasure of the Legislature yet to come, are we carrying out the trust upon us?

In *Pace v. State* (1941), the court wrote specifically that, “the State cannot abdicate its duty as trustee of... sixteenth section land.” And in *Coleman v. Dear* (1952), the Mississippi Court explicitly determined the nature of the trust relationship. The Court reiterated that the trustee was the state of Mississippi, further specified that the Boards of Supervisors were the agents of the State, and stated that the trust beneficiaries were the “educable children.” This relationship bound the State to operate according to specific trust principles, which were nearly identical to those listed at the beginning of this section.

But such a fiduciary relationship in which the State is the trustee, the agents are the county Boards of Supervisors, and the beneficiaries are children, proved to undermine the power of the trust relationship. After all, the entity accountable for proper management of the trust did not even manage it. On what grounds, and in what context, can the trustee be held legally liable for malfeasance? Who represents the school children? In the 1970’s, these questions were resolved for Mississippi by a series of court cases that resulted from schools accessing veto power in 1974: *Tally v. Board of Supervisors of Smith County* (1975); *Edwards v. Harper* (1975); and *Holmes v. Jones* (1975). In sum, it was determined that laws suits could be undertaken by a taxpayers’ petition, or by fathers of the schoolchildren, and that the trustees are required to obtain fair market value for the lands.

Similar cases were happening across the country and with similar results as Mississippi. One of the most frequently cited cases was *Oklahoma Education Association v. Nigh* (1982). The Oklahoma Education Association sued its State Land Board for subsidizing the agricultural community by granting school lands for low rents

and using the school permanent fund to lend money to farmers at low interest rates. The Court ruled in favor of the Oklahoma Education Association.

The Effect of the Sixteenth Section Reform Act of 1978

In 1977, the counties of Mississippi aggregately generated \$7.7 million, which is equivalent to approximately \$25 million in 2003. By 1983, this revenue more than doubled in real terms to over \$50 million, and peaked to nearly \$70 million in 1997 (Figure 1.2). Such a dramatic change is suggestive of the effectiveness of the 1978 Reform. To test this evidence, two ordinary least squares regression are conducted here. The dependent variable for the first regression is the natural log of the real value of total receipts in 2003 dollars. The independent variables for the first regression include time in years, and a dummy variable for whether the revenues were generated before or after the 1978 reform was enacted. One concern of this regression specification is that energy and timber prices constitute as much as 80% of total receipts in some years (MS Biennial Reports, 1970-1998). As a result, sixteenth section revenues are vulnerable to volatile energy and timber prices. Therefore, the dependent variable for the second regression holds timber and energy prices constant.⁵ The dependent variables in the second regression are the same as those in the first.

⁵ The real value of Mississippi timber and oil and gas revenues were deflated to 1983 prices, then inflated to 2003 dollars using the CPI, and then added to the school land receipts from other sources. Mississippi timber prices were provided by the Mississippi Agricultural and Forestry Experimentation Station at Mississippi State University. Energy prices are found in the disaggregated Consumer Price Index

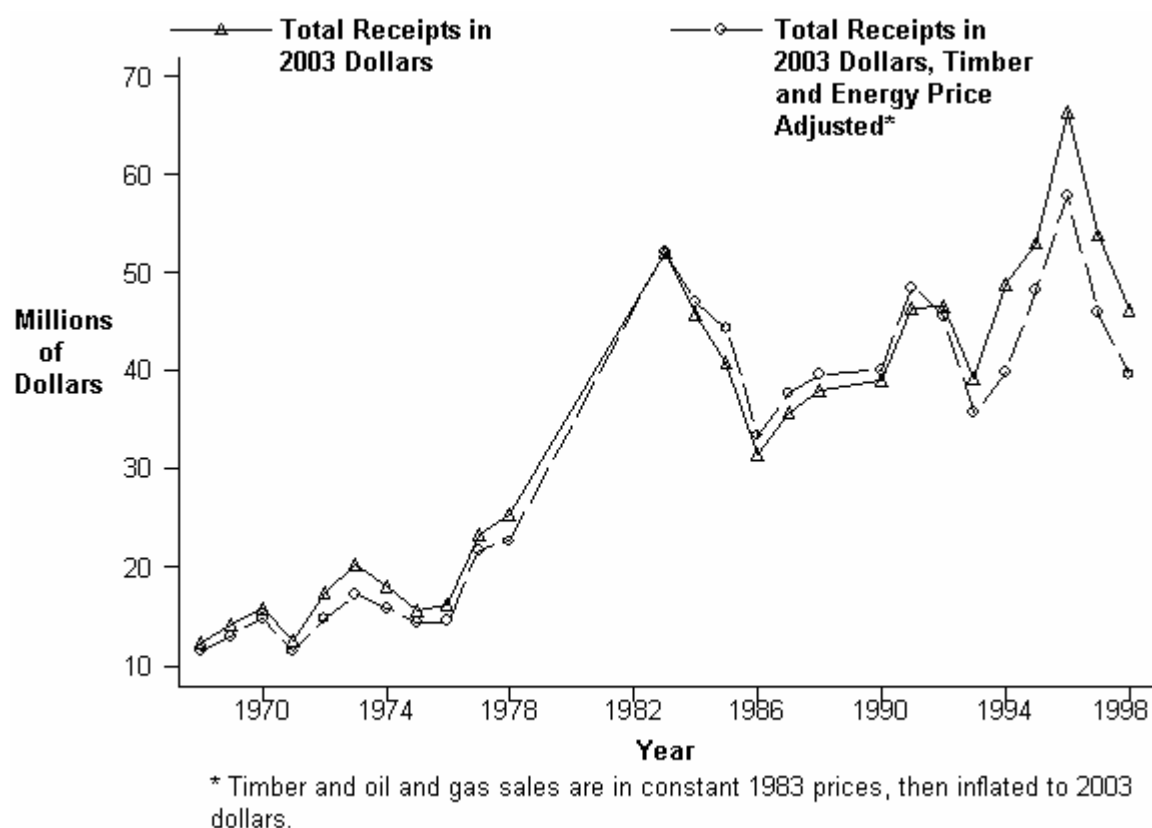


Figure 1.2: Mississippi School Land Receipts from 1968 to 1998

Table 1.2 Regression One Results: Total Real Receipts as Dependent Variable.

$$y_t = \beta_0 + \beta_1 x_t + \beta_2 x_{78} + \varepsilon_t$$

Variable	Coefficient Estimates
Intercept	-42.903** (16.908)
x_t - Year	0.030*** (0.009)
x_{78} - 1978: Equals 0 if the year is before 1978 and equals 1 if the year is equal to or greater than 1978	0.456** (0.181)
R^2	0.9081

Notes: The estimated standard errors are presented below the corresponding estimates.

*** Significant at the 1% level.

** Significant at the 5% level.

Table 1.3 Regression Two Results: Total Real Receipts as Dependent Variable, Timber and Energy Prices Adjusted

$$y_t = \beta_0 + \beta_1 x_t + \beta_2 x_{78} + \varepsilon_t$$

Variable	Coefficient Estimates
Constant	-22.334 (13.241)
X_T – Year	0.019*** (0.007)
X_{78} – 1978: Equals 0 if the year is before 1978 and equals 1 if the year is equal to or greater than 1978	0.426** (0.156)
R^2	0.885
Notes: The estimated standard errors are presented below the corresponding estimates. *** Significant at the 1% level. ** Significant at the 5% level.	

The considerable noise, small quantity of observations, and lack of detailed information on the sources of sixteenth section revenue and factors that influence them, confound interpretation of the impact of the 1978 Reform. However, irrespective of adjusting the dependent variable for changes in timber and energy prices, the results of both the OLS regressions allow for the rejection at the 5% confidence level of the null hypothesis that that Reform Act had no impact on receipts. Both regressions indicate that real receipts from school lands after the Reform are over 40% greater than what would have been predicted by the time trend.

Conclusion

A significant portion of all public lands in the United States are managed to produce revenues for public schools. In all cases, these lands are managed according to the trust doctrine, which requires undivided loyalty to the beneficiaries. The legal beneficiaries of the trust lands vary from citizens of the state to residents of the township

where the lands are located, to the educable children of the township – as is the case in Mississippi. In many states, including Mississippi, legislative statutes now mandate that school lands should maximize revenue. Evidence suggests that agents have struggled to fulfill these obligations everywhere and that they have been managed inefficiently. Mississippi is unique in that it has given jurisdiction of the lands to the recipients of their funds – the respective Boards of Education. The evidence suggests that this has had a significant positive affect on the receipts.

CHAPTER 2:

ANALYSIS OF SCHOOL LAND LEASES

Introduction

In 1992 Mississippi school land assets generated over \$55 million, and national trust lands generated over \$4.5 billion throughout the United States (Table 1.1). Returns on investments from permanent funds throughout the U.S. produced \$3 billion, and land management produced \$1.5 billion. On 135 million acres, this amounts to an average of only \$11 per acre per year, nationally. There are two reasons why the performance of the school lands is of interest: 1) public education is, by most accounts, under-funded and these lands represent a valuable asset for education in most states of the Union; 2) while economic analysis of government activity in general, and public land management in particular, is typically confounded by the multiple objectives of most government agencies, the school trust programs, which have the single economic objective of revenue maximization, offer a relatively clean opportunity for scrutiny.

There are four primary sources of revenue for the Mississippi School Trust Program: 1) Interest on investments from permanent school funds; 2) oil and gas royalties; 3) timber sales; and 4) surface lease rents. Although all land classified as Forest is managed by the Mississippi Forestry Commission for timber production, the land is often simultaneously leased to hunting and fishing clubs. Chapter Three investigates the performance of the Mississippi Forestry Commission in managing

timber production between 1997 and 2002, and this chapter examines surface lease rents.

Questions that motivate this study include: What explains the lease rents? Why have surface lease rents nearly tripled in real terms over the last 3 decades? What land classes have experienced the most growth and why? Do differences in policies for different land classes create different results? For example, is there a difference in Agricultural rents that can be attributed to the competitive bidding process? Does the amount of land managed by the school district affect per acre receipts? Do differences in Mississippi sixteenth section policy among land classes and over time reflect in any way different experiences with school lands across the nation? Given that Mississippi generated more revenue per acre than any other state in the country 1990 besides the oil producing states of Texas and Oklahoma (Table 1.1), are there lessons to be learned from Mississippi? And perhaps most importantly, what was the impact of the Sixteenth Section Reform Act of 1978 that gave jurisdiction of the lands to the recipients of the funds, the Boards of Education?

There exists very little literature on the economic performance of school lands in the United States. Souder and Fairfax (1996) provide the most detailed economic analysis.⁶ They discuss, among other things, the tradeoff between selling and leasing school lands and present some simple methods for considering the efficiency of the management of the lands. Under the criterion that a necessary condition for efficient land management is that the marginal product of labor must be equal across different outputs, they find that many school land management schemes are operating inefficiently. In

⁶ Portions of the analysis in Souder and Fairfax (1996) can also be found in Fairfax et al. (1992), and Souder et al. (1994).

particular, the output-labor input ratio between different land management programs differs substantially within states. For example, New Mexico generates fifty times as much revenue per employee in its mineral leasing than in surface leasing, and Montana generates twenty-six times as much revenue per employee in surfaces leasing than mineral leasing. However, because the employees may be involved in multiple activities, a one dimensional output-input ratio must be approached with some caution.

Two other analyses, both from the Political Economy Research Center's Policy Series, by Leal (1998) and Fretwell (2001) compare the U.S. Forest Service to forest production on school lands and conclude that the School Trust Programs, with their revenue incentives, and legal enforceability, are relatively effective ways of publicly managing lands. In particular, they generate profit, while the national forests do not.

This paper provides the first econometric analysis of individual surface leases of school lands, and the only analysis of school lands in the eastern United States. Four log-linear econometric models are estimated in this chapter: two ordinary least squares (OLS), and two stochastic frontiers (SF).

The Leasing Process

School lands in Mississippi are required by law to be classified according to their "highest and best use" (Biennial Report, 1998-99). There are nine classifications of sixteenth section lands in Mississippi: Agricultural, Farm Residential, Forest, Residential, Commercial, Industrial, Catfish Farming, Recreational, and Other. Land classifications across school districts are relatively, but not perfectly, consistent. For example, churches are often included in the Other category, but are sometimes considered Recreational or

even Commercial. Leases to public agencies are typically classified as Other as well, but sometimes, depending on the specific nature of the lease, are considered Recreational. Except for Agricultural, Hunting and Fishing, and Oil, Gas, and Mineral leases, school lands are let by application to the local Superintendent of Education upon approval of the Board of Education. The Superintendent of Education, who is either elected through local elections or is appointed by the elected Board of Education, is the sole manager of school lands, though the Boards of Education maintain legal responsibility.⁷ Leases granted upon application must also be submitted to the Board of Supervisors for approval of the rental amount (Biennial Report, 1997). These leases must be signed by the local Superintendent of Education, the President of the Board of Education, and the President of the Board of Supervisors.

Annual rent for all leases is required by law to be set at the “fair market rental” of the land, excluding buildings and improvements not owned by the school district (Biennial Report, 1997). The Board of Education (or effectively, the Superintendent of Education) must appoint an appraiser to determine the value of the land and must let the Commercial land at no less than 5% of the appraised value. The Boards of Education are not legally compelled to lease other land, such as Residential and Farm Residential, according to any fixed relationship with the appraised value, except to acquire fair market rent. Effective April, 1987, clauses requiring rents to be adjusted at least once every ten years were made mandatory for all leases except Residential and Farm Residential. However, as of March, 2003, fewer than 20% of all surface leases have been reviewed and adjusted.

⁷ In most cases, the Superintendent of Education has an assistant who shares this responsibility.

Three categories of leases are determined by competitive bids: Hunting and Fishing, Oil, Gas, and Mineral, and Agricultural (Biennial Report, 1998-99). Only land classified as Forest may be leased for hunting and fishing purposes (and nearly all of the Forests are leased for such purposes). In each case, an advertisement for bids must be posted for two consecutive weeks in a newspaper published in the county of the lease. Interested parties are required to submit sealed bids and provide proof of financial ability. The school districts then have three options: they may accept the highest bid and award the lease, call for an auction among those who submitted the sealed bids, or reject all bids and re-advertise. Current leaseholders are always given the option to match the highest bid, but may also request lease extension without bid advertisement. That request may be approved by the local Superintendent of Education no more than one time. The minimum rental for renewed leases without advertisement is 120% of the original rent, and the maximum term is 5 years. The maximum term for agricultural leases is ten years for rice and pasture, and five years for all other uses.

Proceeds of School Lands

Collection of annual rents from school land leases is the duty of the local Superintendents of Education. All proceeds in the form of annual rents are deemed “expendable funds” and are deposited into the maintenance or building fund of the school district. Expendable funds from school leases may be used for all of the same purposes as other available school funds in operating and maintaining the schools of the district. Permissible uses include expenditures on school building repairs, furniture, vehicles, teacher salaries, and a variety of other school district expenses. The proceeds may also

be used for management and improvement of sixteenth section lands, such as clearing and reforestation.

Lease Data

Data for over 7000 Mississippi school trust land leases for year 2003 have been collected from the Mississippi Secretary of State's Office, Public Lands Division. These leases account for approximately 440,000 of 670,000 school trust acres (Table 2.1 and 2.2). An additional 5000 leases for over 200,000 acres of Mississippi exist but are not accounted for in this data set. The majority of these absent 5000 leases were acquired by lumpsum (e.g. one-time) payment before 1978. The current annual payment for the 5000 missing leases is zero, and the one-time payment amounts are not available.

Table 2.1: Summary Statistics of Non-Forest Surface Leases for 2003 for which Annual Payments are Positive

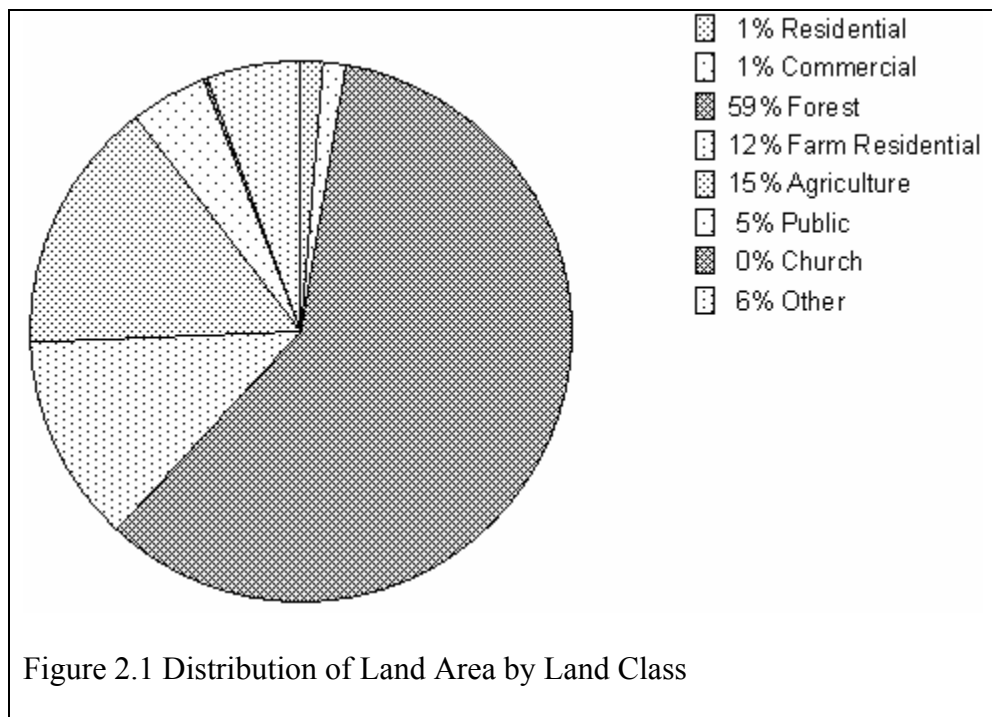
Quantity of Leases:	6196
Total Acres:	164,180.00
Total Rental Value:	\$7,863,379.00
Mean Annual Rent:	\$1269.11
Mean Land Area in Acres:	26.50
Total Rental Value / Total Acres:	\$47.90
Mean Rent per Acre:	\$345.74*
* The difference between the mean rent per acre and the total rent divided by total acres reflects the nonlinearity of rent per acre. In particular, many commercial and residential leases are for less than one acre and larger lots generally pay significantly lower rents per acre.	

In 2003, current annual rents for surface leases total nearly \$10 million. The average annual rent paid on school trust lands is approximately \$48.00 per acre per year for Non-forest land, and about \$7.50 per acre for Forest land (Table 2.2). The lease data

generally contain the following information: the name of the lessee; the school district in which the lease is located; the date the lease began; the expiration date; the land classification; acres leased; annual payment; lump sum payment. The leases, which range from 1-year to perpetuity in length, begin as early as 1945. Some leases do not expire until 2077, although some never expire.

Table 2.2: Summary Statistics of Forest Surface Leases for 2003*

Quantity of Leases:	895
Total Acres:	277,660.000
Total Rental Value:	\$2,078,735.000
Mean Annual Rent:	\$2322.609
Mean Land Area in Acres:	310.235
Total Rental Value / Total Acres:	\$7.487
Mean Rent per Acre:	\$8.284



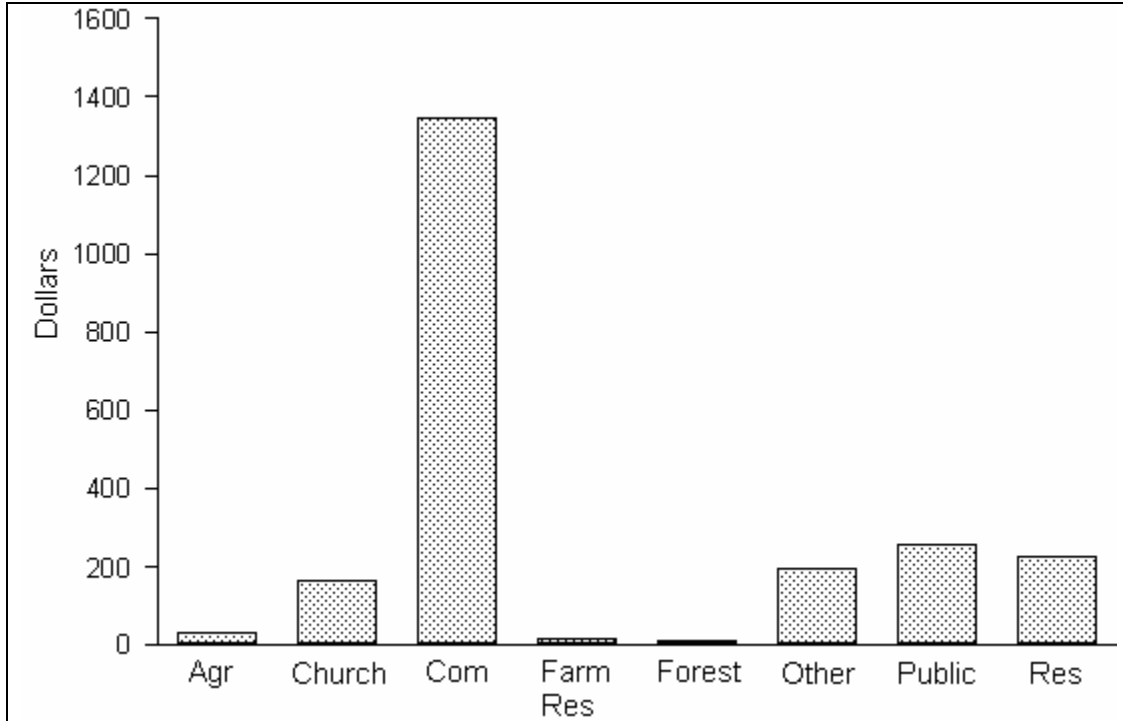


Figure 2.2 Average Rent per Acre in 2003 by Land Class

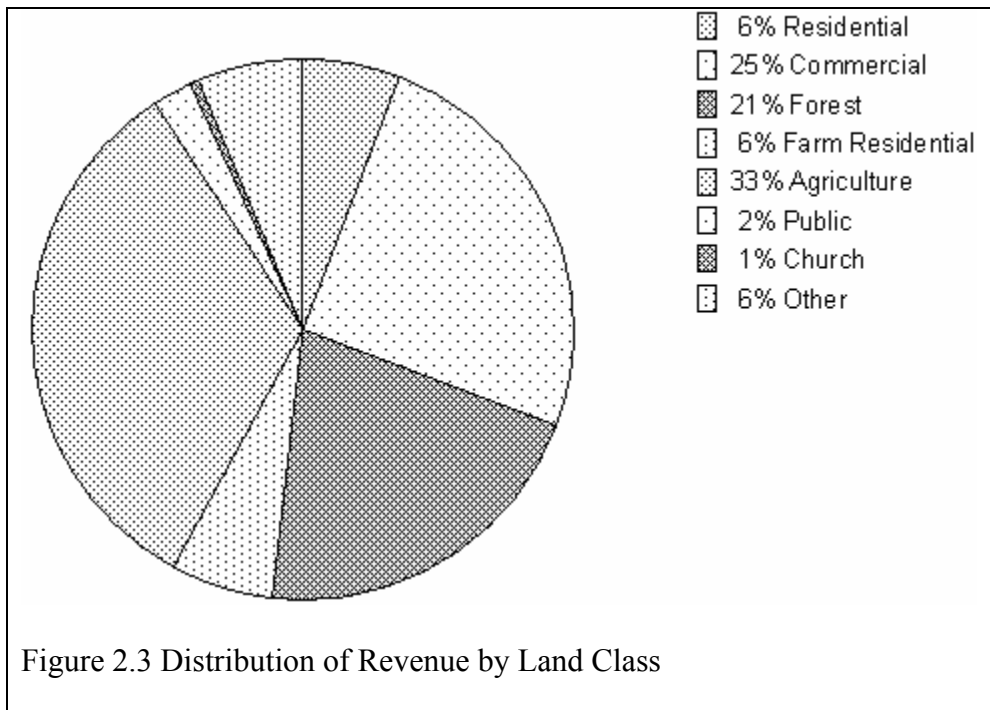
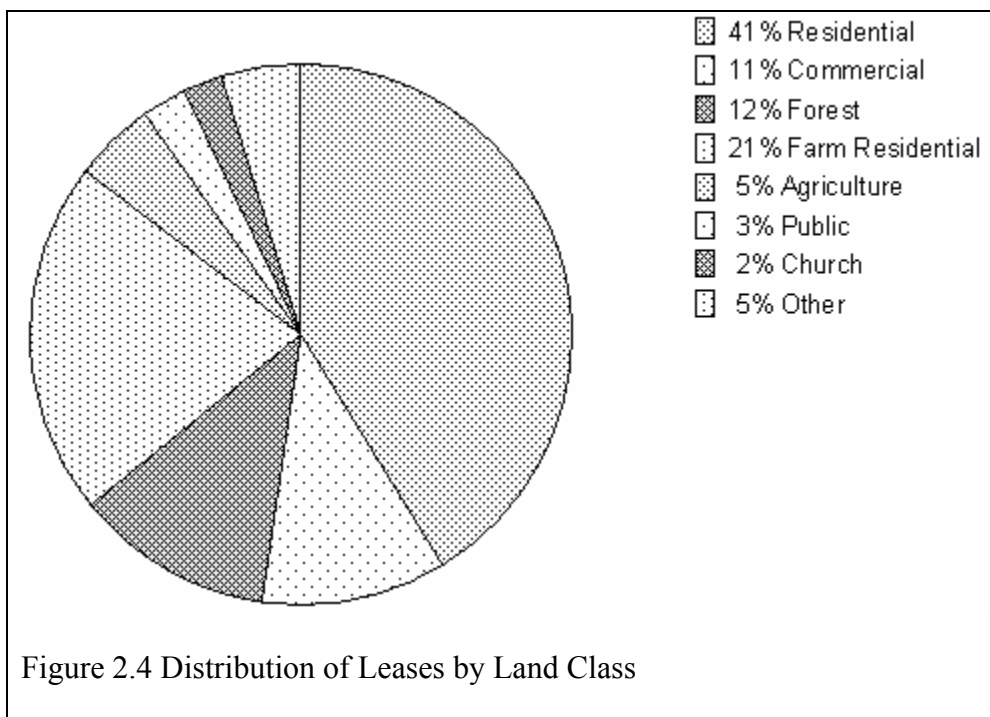


Figure 2.3 Distribution of Revenue by Land Class



Principals and Principles

School land rents are required by law to be set at the “fair market value,” which, given a competitive market, is the value that maximizes revenue from the lands.

Economic “incentive theory” (Sappington, 1991) would predict that these lands would be managed according to the interests of their managers, resulting in maximum revenue for schools to the degree that the managers’ interests coincide with those of the schoolchildren.

Trust law is designed to coordinate these interests by 1) requiring the mandate to be specific (which it now is), and 2) structuring a system for enforcing the fulfillment of the mandate.⁸ A violation of this mandate is grounds for a law suit against the trustee, creating, at least in principle, economic disincentives for malfeasance, thereby bridging

⁸ For a discussion of the legal history of the trust doctrine, see Chapter One.

the principal-agent relationship. Trust law has therefore been heralded by some property-rights advocates as an economically-sound alternative to outright privatization of public lands (Leal, 1995; Fretwell, 2001). As Kaplow and Shavell (1999) point out in the “Economic Analysis of Law,” that “the various benefits from property rights... could be enjoyed under a centrally planned economy.” Yet, there is reason to be skeptical of the effectiveness of the trust doctrine as is evidenced by the history of school lands across the United States (see Chapter One). Whether school land managers anywhere are fulfilling the legal mandate to maximize revenues has never been tested econometrically.

Pronounced asymmetrical information is a source of friction between the principals of school trust lands and their agents. Most school children and their families, in fact, are not even aware that school lands exist (Fairfax et al., 1996), let alone of their rights under the trust doctrine. In cases where these rights are known, trust law provides a legal framework for enforcing agent obligations, thereby decreasing enforcement costs. But even under trust law, enforcement is not free. Legal enforcement may be relatively expensive and concentrated, while the benefits may be great but diffused amongst the beneficiaries. In Mississippi, for example, the damage award of a law suit against the trustee would not be awarded to the plaintiff, but be placed into the principle fund of the land trusts.⁹ It is easy to imagine, therefore, that the existence of the trust doctrine in public land management may only be effective in specialized cases where the threat of legal retaliation is credible, from informed beneficiaries, who perceive their potential gains from retaliating to be greater than their costs. This would seldom, if ever, be the

⁹ From a conversation with William Cheney, Senior Attorney for Public Lands, Mississippi Secretary of State’s Office. Since the 1978 legislation, the new trustees of the sixteenth section lands (boards of education) have yet to be sued.

case. That is, school trust lands in Mississippi continue to rely on altruism on the part of at least one of the parties, a requirement that has failed the beneficiaries in the past.

To further confound matters, Boards of Education are elected officials whose constituents are the renters of the sixteenth section lands. This allows for an environment where the interests of the schoolchildren throughout the district are juxtaposed with the special interests of those who are actually renting the lands. Land managers must decide between maximizing revenue for the sake of all constituents or minimizing rents for the sake of the special interests. Either way, it is important to remember that though there is single stated legal objective for the sixteenth section lands, multiple objectives for the land managers persist, and therefore so does the principal-agent problem that the trust doctrine attempts to overcome.

This principal-agent friction can be thought of as having two components that can be modeled and estimated econometrically. The first component is discretionary and deterministic, and represents decisions the land manager exercises that are counter to the interests of the school children - namely, lower rents in order to satisfy the special interests of the lessees. The second component is nondiscretionary and nondeterministic and is best considered technical inefficiency. That is, there are three theoretical levels of rent the Superintendent of Education may charge for a lease.

1) The maximum (or market) rent is a function of the characteristics of the land:

$$y^* = y^*(x; \beta), \quad (2.1)$$

where β represents coefficients of x , which are traits of the lease.

2) His/her optimal rent, $\hat{y}$, accounts for the maximum rent, and adjusts for the political pressure, P , associated with the beneficiaries and special interests:

$$\hat{y} = \hat{y}(y^*(x; \beta), P(z; \gamma)), \quad (2.2)$$

where γ represents coefficients of z , which are factors of political pressure.

3) The rent actually charged, y , is a function of y^* , $\hat{y}$, and technical inefficiency:

$$y = f(\hat{y}(y^*(x; \beta), P(z; \gamma))). \quad (2.3)$$

Let the ratio of optimal rent for the land manager to the maximum rent be equal to the parameter, P :

$$P(z; \gamma) = \frac{\hat{y}}{y^*(x; \beta)}. \quad (2.4)$$

P takes on a value between 0 and 1, inclusive, where 1 indicates the land manager's objective is to maximize rent, and 0 indicates that the land manager's objective is to not charge any rent. Technical efficiency is the ratio of rent charged by the land owner to the "optimal" rent of the land, given his/her P :

$$TE = \frac{y}{\hat{y}(y^*(x; \beta), P(z; \gamma))}, \quad (2.5)$$

where TE also takes on a value between 0 and 1, inclusive. Therefore,

$$y = \hat{y}(y^*(x; \beta), P(z; \gamma)) \cdot TE = y^*(x; \beta) \cdot P(z; \gamma) \cdot TE. \quad (2.6)$$

We may think of principal-agent friction as representing the barrier between maximum rent and the rent charged: $1 - P \cdot TE$; a portion of which is due to politics and a portion of which is due to technical inefficiency.

Econometric Model

Taking the natural log of the rent equation (2.6) gives:

$$\ln(y) = \ln(y^*) + \ln(P) + \ln(TE). \quad (2.7)$$

This equation has two deterministic components, y^* and P , and one random component, TE . In order to econometrically predict the observed rents, we must first specify y^* , P , and TE .

If we assume the maximum rent, y^* , is a function of complementary characteristics a la Cobb-Douglas, then,

$$y^* = \prod_i^I x_i^{\beta_i}, \quad (2.8)$$

where β_i represents the rent elasticity of characteristic x_i . Therefore, y^* is a loglinear function of the x_i 's:

$$\ln(y^*) = \beta_0 + \sum_{i=1}^I \beta_i \ln(x_i). \quad (2.9)$$

Given that the supply of land is fixed, the maximum rent is determined by its demand, which is a function of the general demand for land as well as specific characteristics of the lease. Such control variables are quantity of acres leased (x_S^i), per capita income in the respective counties in the year the lease was issued ($x_{I,t}^c$), population of the respective counties in the year the lease was issued ($x_{P,t}^c$), terms of the lease (x_T^i), whether the lease has been reviewed (x_R^i), and age of the lease (x_a^i):¹⁰

$$\ln(y_{i,t}^{c,d})^* = \beta_0 + \beta_1 \ln(x_S^i) + \beta_2 \ln(x_{I,t}^c) + \beta_3 \ln(x_{P,t}^c) + \beta_4 x_a^i + \beta_5 x_T^i + \beta_6 x_R^i; \quad 2.10$$

¹⁰ The age of the lease is not a function of the land and is therefore not technically a determinant of the market rent. However, the age of the lease is a determinant of the rent, given the market value of the land. This is also true for whether the lease is adjusted.

where $y_{i,t}^{c,d*}$ represents the maximum rent per acre on lease i , that began in year, in district d , in county c .¹¹

Given the rectangular survey system, sixteenth section lands represent a perfect sample of the land in each county, allowing for accurate estimation of the average value of the lands with county-wide data. However, the specific value of a lease is determined by some specific properties of the land for which information is unavailable. Thus an independently normally distributed error component, v_i , with a mean of zero and variance of σ_v^2 is warranted:

$$\ln(y_{i,t}^{c,d*}) = \beta_0 + \beta_1 \ln(x_S^i) + \beta_2 \ln(x_{I,t}^c) + \beta_3 \ln(x_{P,t}^c) + \beta_4 x_a^i + \beta_5 x_T^i + \beta_6 x_R^i + v_i. \quad 2.11$$

The equation above represents the estimation of the market price for the lease, and therefore what the land manager would charge if his/her objective was to maximize rent and if technical inefficiency were 0 (i.e. $TE=1$). But the land manager may be unaware of the precise market value of the lease and may randomly err by overshooting or undershooting the market rent. The most obvious explanation for this is that the Superintendents of Education are politicians (as emphasized above) and not experts of asset management. For example, the endowments of most universities and non-profits are managed by financial investment experts, whereas the Mississippi school lands are managed by politicians. This allows for a larger margin of error on the part of school land rents. However, given that the market price for land in Mississippi is determined competitively, we may observe leases priced under the market value, but we will never

¹¹ x_T^i , x_R^i , and x_a^i , are not logged. This assumes $y^* = \prod_{i=0}^3 x_i^{\beta_i} \cdot \exp\{\sum_{i=4}^6 \beta_i x_i\}$.

observe school land rents in excess of the market value. Therefore, technical efficiency may be less than one but cannot be greater.

To account for stochastic errors (or technical inefficiency) on the part of producers, Aigner, Lovell, and Schmidt (1977) and Meeusen and van den Broeck (1977) simultaneously proposed that a one-sided error component, u_i , be appended to the classical production function. Estimated via Maximum Likelihood, this technique has come to be known as stochastic frontier analysis (SFA). In the context of rents, a half-normally distributed u_i term with a mean of zero and variance, σ_u^2 , is reasonable, given that mistakes in pricing may realistically be normally distributed with a mean of zero, but positive mistakes never translate into actual rents (for details on SFA, see Kumbhakar and Lovell (2000)). Now our model has a deterministic component for estimating y^* as well as a two-part stochastic component; one part, v_i , that represents random noise and is normally distributed with a mean of zero and variance, σ_v^2 , and the other part, u_i , that represents technical inefficiency that has a normal distribution truncated at 0, with variance σ_u^2 :

$$\ln(y_{i,t}^{c,d})^* = \beta_0 + \beta_1 \ln(x_S^i) + \beta_2 \ln(x_{I,t}^c) + \beta_3 \ln(x_{P,t}^c) + \beta_4 x_a^i + \beta_5 x_T^i + \beta_6 x_R^i + v_i - u_i, \quad (2.12)$$

where $TE = \exp\{-u\}$.

If the objective of the land managers were to maximize rent, we would use the equation above to estimate actual rents, allowing for technical inefficiency. But the land managers on sixteenth section land are subject to another set of variables that we would not observe in the private sector and this is political pressure, P . Conversations with Mississippi's Senior Attorney for Public Lands has indicated that Superintendent's of

Education, who are either elected or appointed by elected Boards of Education, face persistent political pressure from lessees to lower rents on school lands. P essentially symbolizes the struggle between the beneficiaries, whose interests are diffused among the general school-attending public, and special interests who rent the lands. A P of one indicates that the school children have won the struggle, and a P of less than one is a violation of the Trust mandate, and is grounds for a law suit.

Consider P as a loglinear function of the population of the county (z_P^c), the number of renters (z_{DS}^d), the percentage of renters' fees that are given to the beneficiaries (z_{Sh}^d), the percent minority of the population of the county ($z_{M,t}^c$) when the lease began, and whether the lease began before or after the Reform Act of 1978 (z_{78}^i):

$$\ln(P_t^{c,d}) = \gamma_0 + \gamma_1 \ln(z_{P,t}^c) + \gamma_2 \ln(z_{DS}^d) + \gamma_3 \ln(z_{Sh}^d) + \gamma_4 (z_{M,t}^c) + \gamma_5 (z_{78}^i). \quad (2.13)$$

The first two of these dependent variables is the most easily interpreted. If γ_2 is negative, for example, then we can think of P as based partly on the ratio of the county population to the number of lessees – the ratio of beneficiaries to special interests.¹² The third variable, z_{Sh}^d , is based on the fact that a school district may not keep 100% of the proceeds of its lands. If a sixteenth section rests on the boundary of multiple school districts then it is managed by the district that harbors the greatest portion of the section, designated “controlling” district. The controlling district is required to share the proceeds in proportion to the number of students of the “sharing” districts. z_{Sh}^d equals the number of portions of sections that a controlling district must share divided by the total

¹² Population is a linear combination of student enrollment; a regression of population on students has an R^2 of 0.992. Complete data for number of lessees is not available, the total number of acres of leases is therefore a proxy.

number of sections it controls.¹³ The effect of the sharing is to lower the benefits of charging high rents but not the costs in terms of political pressure from special interests (i.e. foregone campaign contributions), and it would therefore be predicted to have a negative coefficient. The minority variable, $z_{M,t}^c$, seems important in a state which is laden with historical disputes over the inclusion of minorities in the joint consumption of public resources. It seems relevant that less than twenty years before this data set began, for example, African-Americans in Mississippi were not even permitted to share the schools with whites. The final variable, z_{78}^i , is necessary for determining the impact of the 1978 reform, which presumably enhanced the relationship between the land managers and the beneficiaries. Assuming the signs on the coefficients for minority, sharing, and district size, are negative, an alternative way of expressing the equation above is:

$$P_{i,t}^{c,d} = \gamma_0 \cdot \frac{(z_{P,t}^c)^{\gamma_1}}{(z_{DS}^d)^{\gamma_2} \cdot (z_{Sh}^d)^{\gamma_3}} \cdot (z_{W,t}^c)^{\gamma_4} \cdot (z_{78}^i)^{\gamma_5}, \quad (2.14)$$

where $z_{W,t}^c$ is the percentage of white people in the county. This equation suggests the political pressure to maximize rents is based on the proportion of white people in the county to the number of lessees, adjusting by the percentage of receipts that are retained, and whether the lease began before or after the Reform.

Factoring P into the rent equation results in the following model:

$$\begin{aligned} \ln(y_{i,t}^{c,d}) = & \beta_0 + \beta_1 \ln(x_S^i) + \beta_2 \ln(x_{I,t}^c) + \beta_3 \ln(x_{P,t}^c) + \beta_4 x_a^i + \beta_5 x_T^i + \beta_6 x_R^i \\ & + \gamma_1 \ln z_{DS}^d + \gamma_2 x_{Sh}^d + \gamma_3 x_{M,t}^c + \gamma_4 x_{78}^i + v_i - u_i. \end{aligned} \quad (2.15)$$

Other variables that were considered but are not included due to multicollinearity are average assessed property value, student enrollment, high school graduation rate, and

¹³ Each section is further divided into portions

population density.¹⁴ The population variable enters the equation only once, and unfortunately disentangling its effect on rents via greater property value and greater public pressure is not possible.

Finally, a discussion of the measurement of the dependent variable is warranted. The dependent variable for the model estimated is annual rent of each lease divided by the number of acres leased. The rents for each observation in this data set are in the year 2003, and are therefore current dollar values. Because this set is a cross section, and the rents are in 2003 dollars, adjusting the rent for inflation is arguably non-sensible. After all, even though some rents were determined in 1976, the annual payment is current. On the other hand, the majority of rents have not been adjusted since the time the leases were contracted. Changes in rents of different aged leases may be due to inflation. Suppose, for example, the rent was set every year according to the price level for that year, but was left unadjusted afterwards. An independent variable that represents passing of time, such as age or year of lease, would capture the changes in the price to the degree that those changes are linear or log-linear. But if the price level changes non-linearly, then changes in rent may also be ascribed to other variables that change over time. So, in the case that the rents are determined by the price level at the time the lease was issued, a price adjustment seems appropriate. For the reasons just mentioned, models with both measure of rent – one where the dependent variable is inflated, and the other where it is not – are estimated. In addition to the SF, OLS regressions with a one-part error component are

¹⁴ A regression with assessed property value as the dependent variable and population and per capita income as the independent variables produced an R^2 of 91.4%. Also, due to the near uniformity of county sizes in MS, variation in county population predicts 91.2% of the variation of population density. High school graduation rate regressed on age of lease, per capita income, percent minority, and population results in an R^2 of 90.1%.

also estimate for each specification of the dependent variable. Therefore, four models are estimated for each land class.

Table 2.3 Econometric Models and Explanation of Variables

OLS:	$\ln(y_{i,t}^{c,d}) = \beta_0 + \beta_1 \ln(x_S^i) + \beta_2 \ln(x_{I,t}^c) + \beta_3 \ln(x_{P,t}^c) + \beta_4 x_{M,t}^c + \beta_5 \ln x_{DS}^d + \beta_6 x_{78}^i + \beta_7 x_a^i + \beta_8 x_T^i + \beta_9 x_{Sh}^d + \beta_{10} x_R^i + \varepsilon_i.$
SF:	$\ln(y_{i,t}^{c,d}) = \beta_0 + \beta_1 \ln(x_S^i) + \beta_2 \ln(x_{I,t}^c) + \beta_3 \ln(x_{P,t}^c) + \beta_4 x_{M,t}^c + \beta_5 \ln x_{DS}^d + \beta_6 x_{78}^i + \beta_7 x_a^i + \beta_8 x_T^i + \beta_9 x_{Sh}^d + \beta_{10} x_R^i + v_i - u_i.$
$y_{i,t}^{c,d}$	- The present-day value of the annual rent of lease i, divided by the number of acres leased, issued by school district d, in county c, in year t, the year the rent was set.* [†]
x_S^i	- Number of acres in lease i.
$x_{I,t}^c$	- Inflation-adjusted Per capita income in county c at time t.
$x_{P,t}^c$	- Natural log of population of county c at time t.
$x_{M,t}^c$	- Percentage of nonwhite residents of county c at time t.
x_{DS}^d	- Number of acres managed by the school district, d, that issued the lease.
x_{78}^i	= 1 if the lease began in or after July 1, 1978; = 0 if the lease began before July 1, 1978.
x_R^i	= 1 if the annual rent has been adjusted since the lease began.; = 0 if the annual rent has not been adjusted.
x_a^i	- Age of the lease = 2003 - t.
x_{Sh}^d	- Percent of sixteenth sections that the district that issued the lease must share.
x_T^i	- Terms of lease
v_i	Error term $\sim \text{iid } N(0, \sigma_v^2)$
u_i	Error term $\sim \text{iid } N^+(0, \sigma_u^2)$
* The present-day value is inflated using the consumer price index for two of the estimations, and is not inflated for the other two.	
[†] If the rent has been adjusted, t is the year of the adjustment, otherwise t represents the year the lease was issued.	

Table 2.4 Summary Statistics for Leases with Positive Annual Payments after 1978 Reform

	Residential	Commerc.	Farm Res.	Agriculture	Church	Public
Rent per Acre	\$250.87 \$343.50 \$1.00 \$4670.00	\$1719.68 \$3538.840 \$1.00 \$31360.00	\$17.47 \$29.30 \$0.27 \$699.15	\$34.48 \$27.61 \$1.00 \$136.13	\$173.96 \$378.20 \$0.50 \$3020.00	\$312.48 \$1014.23 \$1.00 \$9964.29
Inflated Rent per Acre	\$316.81 \$443.64 \$1.02 \$4755.67	\$2043.47 \$4116.73 \$1.06 \$34698.23	\$22.87 \$36.34 \$0.68 \$785.80	\$37.02 \$29.27 \$1.20 \$140.82	\$210.79 \$425.76 \$0.52 \$3212.92	\$366.30 \$1078.67 \$1.03 \$10307.49
Income	\$12420.83 \$4998.44 \$3848.00 \$26903.70	\$13406.93 \$3924.14 \$4040.00 \$25758.80	\$10191.17 \$3263.77 \$3489.70 \$23469.00	\$13190.11 \$2480.34 \$4379.90 \$26903.70	\$10968.97 \$4221.95 \$4214.00 \$25758.80	\$12488.27 \$4171.35 \$3893.80 \$24613.90
Inflated Income	\$15094.11 \$4010.92 \$8651.00 \$26903.70	\$15969.06 \$3219.64 \$8982.14 \$26231.31	\$13358.18 \$2135.61 \$8339.60 \$24968.18	\$14279.25 \$2477.92 \$5752.13 \$26903.70	\$14041.25 \$3302.02 \$8511.12 \$26231.31	\$15234.18 \$3207.93 \$8738.12 \$25461.70
Acres	2.26 12.01 0.01 605.00	8.49 35.81 0.02 640.00	35.77 42.78 0.40 600.00	197.32 198.07 1.90 640.00	7.12 49.71 0.06 640.00	44.45 111.64 0.04 640
Population	46029.23 39219.64 8440.90 254096.70	83265.98 81038.56 9290.90 254441.00	30099.09 22986.77 8426.70 251528.20	45968.82 55696.68 8426.70 253348.70	56582.30 66435.38 90560.00 254076.90	73655.87 68288.55 10309.40 252984.60
Minority	35.83 14.97 9.73 79.53	38.86 17.49 9.80 79.53	36.96 12.85 9.73 85.29	56.06 16.59 9.80 86.94	39.29 16.18 9.81 87.00	38.33 17.90 9.80 80.21
District Acres	7891.41 3245.95 640.00 15084.00	7882.24 3267.72 633.00 15084.00	8983.00 2653.30 640.00 15084.00	8991.58 3979.10 640.00 16153.00	8379.47 3058.80 1199.00 16153.00	8242.53 3060.92 1028.00 16153.00
Age	8.925 6.358 0.000 25.000	7.83 5.22 0.00 25.00	11.06 6.34 0.00 25.00	3.65 3.02 0.00 24.00	10.62 6.44 1.00 24.00	8.79 6.08 1.00 25.00
Terms	30.713 12.342 0 Perpetual	34.43 13.412 1.00 Perpetual	29.45 12.72 3.00 Perpetual	6.50 5.52 1.00 51.00	39.20 25.14 5.00 99.00	28.33 15.30 1.00 Perpetual
Share	0.368 0.292	0.39 0.35	0.30 0.24	0.46 0.29	0.40 0.28	0.39 0.26

	0	0.00	0.00	0.00	0.00	0.00
	1.498	1.24	1.50	1.00	1.50	1.24
Adjusted	0.130	0.16	0.17	0.02	0.15	0.23
	0.336	0.36	0.38	0.13	0.36	0.42
	0.000	0.00	0.00	0.00	0.00	0.00
	1.000	1.00	1.00	1.00	1.00	1.00
N	2823	705	1589	356	165	151
Note:	The values in each cell represent the mean, standard deviation, minimum, and maximum, in descending order.					

Table 2.5 Summary Statistics for Leases with Positive Annual Payments Before 1978 Reform						
	Resident.	Commerc.	Farm Res.	Agriculture	Church	Public
Rent Per Acre	\$51.91 \$107.89 \$4.17 \$466.67	\$53.30 \$66.04 \$6.60 \$100.00	\$14.75 \$24.42 \$3.13 \$75.00	\$4.41 \$2.87 \$0.70 \$8.00	\$4.13 \$1.19 \$2.67 \$5.00	\$131.24 \$245.98 \$1.00 \$50
Inflated Rent Per Acre	\$148.32 \$302.34 \$11.71 \$1311.25	\$149.76 \$185.57 \$18.55 \$280.98	\$44.10 \$67.98 \$8.78 \$210.74	\$13.32 \$8.67 \$2.12 \$24.19	\$11.61 \$3.35 \$7.49 \$14.05	\$370.66 \$689.86 \$2.81 \$1404.91
Income	\$3825.27 \$588.65 \$2407.50 \$4803.20	\$3758.50 \$358.50 \$3505.00 \$4012.00	\$3904.31 \$922.40 \$1780.00 \$4803.20	\$3777.95 \$407.17 \$3217.00 \$4159.80	\$3767.36 \$366.04 \$3143.80 \$4012.00	\$4043.93 \$627.62 \$3505.00 \$4733.00
Inflated Income	\$11275.39 \$1149.10 \$9848.41 \$13496.11	\$10560.69 \$1007.33 \$9848.41 \$11272.98	\$11864.54 \$1949.30 \$7801.34 \$13496.11	\$11313.35 \$1456.22 \$9039.18 \$13089.30	\$10585.59 \$1028.50 \$8833.50 \$11272.98	\$11362.71 \$1763.48 \$9848.41 \$13298.86
Acres	1.44 1.38 0.09 5.0	1.20 1.13 0.40 2.00	26.88 29.72 1.00 80.00	130.66 122.16 40.00 384.00	1.35 0.60 0.75 2.00	50.37 47.30 0.10 94.00
Population	26056.07 14143.42 14773.80 50460.40	30713.80 22542.56 14773.80 46653.80	19469.80 4638.35 14072.80 27340.00	17475.26 3471.41 13231.60 20376.20	15876.84 6035.91 10236.60 26152.20	42193.33 24724.72 15546.00 64384.20
Minority	31.29 18.17 11.70 62.74	42.07 29.25 21.39 62.74	26.04 21.06 11.70 65.83	32.86 17.32 12.09 65.05	41.43 19.83 21.39 67.26	41.37 18.85 27.12 62.74
District Acres	8489.09 3677.42 2542.00 16153.00	6703.00 5884.54 2542.00 10864.00	10231.38 3066.83 7803.00 16153.00	6817.00 3243.47 2558.00 12758.00	11198.80 1648.47 8822.00 13144.00	4046.67 3752.52 1280.00 8318.00
Age	25.82 2.06 25.00 32.00	25.00 0.00 25.00 25.00	26.38 2.00 25.00 31.00	25.88 0.84 25.00 27.00	25.00 0.00 25.00 25.00	25.00 0.00 25.00 25.00
Terms	35.09 25.99 25.00 99.00	25.00 0.00 25.00 25.00	26.88 5.30 25.00 40.00	25.00 0.00 25.00 25.00	25.00 0.00 25.00 25.00	25.00 0.00 25.00 25.00
Share	0.24	0.09	0.19	0.33	0.29	0.35

	0.26 0.00 0.99	0.13 0.00 0.18	0.27 0.00 0.83	0.24 0.00 0.55	0.33 0.05 0.87	0.30 0.00 0.54
Adjusted	0.00 0.00 0.00 0.00	0.00 0.00 0.00 0.00	0.00 0.00 0.00 0.00	0.00 0.00 0.00 0.00	0.00 0.00 0.00 0.00	0.00 0.00 0.00 0.00
N	22	2	8	8	5	4
Note:	The values in each cell represent the mean, standard deviation, minimum, and maximum, respectively in descending order.					

Table 2.6 Results of OLS Regression with Inflation-Adjusted Dependent Variable

	Residential	Commerc.	Farm Res.	Agricult. [‡]	Church [†]	Public ^{††}
Intercept	-29.697*** (8.619)	-16.710 (27.296)	-37.216*** (7.098)	13.237*** (2.766)	-1.366*** (1.863)	-3.407** (1.734)
x_S^i	-0.780*** (0.019)	-0.496*** (0.027)	-0.351*** (0.017)	0.175*** (0.030)	-0.621*** (0.095)	-0.305*** (0.061)
$x_{I,t}^c$	0.846*** (0.135)	1.566*** (0.554)	-0.166 (0.189)	-1.451*** (0.346)		
$x_{P,t}^c$	0.489*** (0.030)	0.678*** (0.084)	0.163*** (0.047)	0.155** (0.070)	0.670*** (0.117)	0.742*** (0.134)
$x_{M,t}^c$	0.010*** (0.001)	-0.006* (0.004)	-0.0034** (0.0016)			
x_{DS}^d	-0.189*** (0.014)	-0.717*** (0.110)	-0.112*** (0.046)		-0.390*** (0.171)	
x_{78}^i	0.633*** (0.217)	1.783*** (0.261)	-0.424 (0.398)	0.294 (0.532)	0.710** (0.286)	0.288 (1.11)
x_R^i	-0.361*** (0.046)	0.140 (0.136)	-0.293*** (0.049)		-0.307 (0.223)	
x_a^i	-0.012** (0.005)	-0.003 (0.015)	-.021*** (.004)	-.052*** (.018)	-0.058*** (0.017)	
x_T^i	0.003 (0.002)	-0.016*** (0.005)	-0.0011** (0.0006)			
x_{Sh}^d	-0.309*** (0.075)	-0.860*** (.244)	0.005 (0.076)	.401*** (.147)	-0.595 (0.421)	-.702 (0.513)
R ²	0.618	0.528	0.361	0.245	0.516	0.313
N	2843	707	1596	364	170	151

Notes: White robust standard errors are presented below the corresponding coefficient estimates.

* Significant at the 10% level

** Significant at the 5% level

*** Significant at the 1% level

[‡] Likelihood-ratio test on restricted model: $X^2(4) = 3.04$ Prob. $> X^2 = 0.5515$

[†] Likelihood ratio test on restricted model: $X^2(3) = 0.16$ Prob. $> X^2 = 0.9217$

^{††} Likelihood-ratio test on restricted model: $X^2(6) = 3.31$ Prob. $> X^2 = 0.7695$

Table 2.7 Results of OLS Regression with Unadjusted Dependent Variable

	Residential	Commerc.	Farm Res.	Agricult. [‡]	Church ^{†‡‡}	Public ^{††}
Intercept	-5.21*** (1.05)	-9.500** (4.325)	5.680*** (1.609)	12.611*** (2.552)	1.279 (1.893)	-2.066 (1.677)
x_S^i	-0.805*** (0.019)	-0.495*** (0.027)	-0.353*** (0.017)	0.174*** (0.030)	-0.618*** (0.095)	-0.286*** (0.068)
$x_{I,t}^c$	0.772*** (0.137)	1.557*** (0.557)	-0.242 (0.189)	-1.450*** (0.344)		
$x_{P,t}^c$	0.495*** (0.031)	0.683*** (0.084)	0.170*** (0.046)	0.157** (0.069)	0.668*** (0.119)	0.720*** (0.141)
$x_{M,t}^c$	0.010*** (0.001)	-0.006* (0.004)	-0.0033** (0.0016)			
x_{DS}^d	-0.325*** (0.036)	-0.716*** (0.111)	-0.098** (0.041)		-0.398** (0.178)	
x_{78}^i	0.883*** (0.219)	2.062*** (0.264)	-0.180 (0.396)	0.380 (0.510)	0.959*** (0.287)	
x_R^i	-0.368*** (0.047)	0.139 (0.136)	-0.302*** (0.049)		-0.314 (0.224)	
x_a^i	-0.047*** (0.005)	-0.035*** (0.015)	-0.057*** (0.004)	-0.082*** (0.017)	-0.092*** (0.017)	(-0.054)*** (0.020)
x_T^i	0.003* (0.002)	-0.016*** (0.005)	-0.0010** (0.0005)			
x_{Sh}^d	-0.308*** (0.076)	-0.862*** (0.246)	0.026 (0.075)	0.391 (0.147)	-0.616 (0.419)	-0.057* (0.031)
R ²	0.640	0.543	0.439	0.340	0.579	0.353
N	2843	707	1596	364	170	151

Notes: White robust standard errors are presented below coefficient estimates

* Significant at the 10% level

** Significant at the 5% level

*** Significant at the 1% level

[†] Likelihood-ratio test on restricted model: $X^2(3) = 0.13$ Prob. $> X^2 = 0.937$

[‡] Likelihood-ratio test on restricted model: $X^2(4) = 2.90$ Prob. $> X^2 = 0.5752$

^{††} Likelihood-ratio test on restricted model: $X^2(5) = 1.56$ Prob. $> X^2 = 0.9557$

Table 2.8 Results of SF Regression with Inflation-Adjusted Dependent Variable

	Residential	Commerc.	Farm Residential	Agricult. ^{†††}	Church [†]	Public ^{††}
Intercept	-5.746*** (1.007)	-9.985*** (3.810)	4.68*** (1.615)	13.552*** (2.473)	0.243 (1.654)	1.155 (2.259)
x_S^i	-0.742*** (0.015)	-0.493*** (0.028)	-0.349*** (0.013)	0.176*** (0.029)	-0.597*** (.0608)	-0.312*** (0.059)
$x_{I,t}^c$	0.893*** (0.131)	1.678*** (0.472)	-0.137 (0.190)	-1.402*** (0.306)		
$x_{P,t}^c$	0.496*** (0.032)	0.659*** (0.080)	0.159*** (0.040)	0.131* (0.069)	0.657*** (0.087)	0.720*** (0.117)
$x_{M,t}^c$	0.013*** (0.001)	-0.007 (0.004)	-0.003** (0.001)			
x_{DS}^d	-0.397*** (0.031)	-0.728*** (0.100)	-0.104*** (0.040)		-0.331*** (0.147)	-0.377* (0.221)
x_{78}^i	0.801*** (0.199)	1.872** (0.852)	-0.400* (0.236)	0.170 (0.409)	0.820* (0.473)	0.183 (0.674)
x_R^i	-0.321*** (0.049)	0.143 (0.141)	-0.283*** (0.046)		-0.453* (0.240)	
x_a^i	0.003 (0.004)	-0.000 (0.013)	-0.020*** (0.004)	-0.042*** (0.015)	-0.062*** (0.013)	
x_T^i	0.003*** (0.001)	-0.016** (0.004)	-0.004*** (0.001)		0.009*** (0.003)	0.019*** (0.008)
x_{Sh}^d	-0.229*** (0.058)	-0.876*** (0.211)	0.015 (0.076)	0.398*** (0.137)		-0.658* (0.388)
Log-Likelihood	-3593.597	-1122.242	-1468.292	-408.267	-241.513	-252.773
Mean TE	0.519	0.539	0.986	0.560	0.428	0.371
σ^2	1.433*** (0.063)	1.971*** (0.294)	0.369*** (0.013)	1.041*** (0.247)	2.336*** (0.457)	3.853*** (0.684)
N	2843	707	1596	364	170	151
LR Statistic $H_0 : \sigma_u = 0$	150.00 ^{†††}	2.33 [†]	0.00	3.02 ^{††}	9.38 ^{††}	12.92 ^{†††}

Notes: Standard errors are presented below the corresponding coefficient estimates

* Significant at the 10% level

** Significant at the 5% level

*** Significant at the 1% level

[†] Reject H_0 that technical inefficiency equals 0 at the 10% significance level

^{††} Reject H_0 that technical inefficiency is 0 at the 5% significance level

^{†††} Reject H_0 that technical inefficiency is 0 at the 1% significance level

^{†††} Likelihood-ratio test on restricted model: $X^2(4) = 2.43$ Prob. $> X^2 = 0.6564$

[†] Likelihood-ratio test on restricted model: $X^2(3) = 1.34$ Prob. $> X^2 = 0.7190$

^{††} Likelihood-ratio test on restricted model: $X^2(4) = 1.68$ Prob. $> X^2 = 0.7951$

Table 2.9 Results of SF Regression with Unadjusted Dependent Variable

	Residential	Commerc.	Farm Residential	Agricult. ^{†††}	Church [†]	Public ^{††}
Intercept	-4.350*** (0.942)	-8.680*** (3.571)	5.622*** 1.616	13.785*** (2.460)	1.274 (1.650)	3.479 (2.756)
x_S^i	-0.742*** (0.015)	-0.492*** (0.028)	-0.351*** (0.013)	0.175*** (0.029)	-0.594*** 0.061	-0.311*** (0.059)
$x_{I,t}^c$	0.830*** (0.132)	1.687*** (0.475)	-0.217 (0.189)	-1.395 *** (0.304)		
$x_{P,t}^c$	0.502*** (0.032)	0.662*** (0.080)	0.167*** (0.040)	0.132*** (0.069)	0.659*** (0.087)	0.686*** (0.119)
$x_{M,t}^c$	0.013*** (0.001)	-0.006 (-0.004)	-0.003** (0.001)			
x_{DS}^d	-0.395*** (0.031)	-0.730*** (0.101)	-0.351*** (0.013)		-0.334*** (0.147)	-0.500** (0.245)
x_{78}^i	1.053*** (0.200)	2.163** (0.855)	-0.159 (0.235)	0.508 (0.408)	1.069** (0.473)	0.174 (0.711)
x_R^i	-0.325*** (0.050)	0.142 (0.142)	-0.293*** (0.046)		-0.461* (0.239)	
x_a^i	-0.031*** (0.004)	-0.032** (0.013)	-0.056*** (0.004)	-0.072*** (0.015)	-0.096*** (0.013)	-0.055*** (.019)
x_T^i	0.004*** (0.001)	-0.015*** (0.004)	-0.004*** (0.001)		0.009*** (0.004)	0.020*** (0.008)
x_{Sh}^d	-0.230*** (0.058)	-0.880*** (0.212)	0.034 (0.076)	0.388*** (0.136)		-0.685* (0.385)
Log-Likelihood	-3602.487	-1125.178	-1462.615	-406.887	-241.608	-252.261
Mean TE	0.517	0.529	0.990	0.559	0.427	0.369
σ^2	1.449*** (0.064)	2.027*** (0.295)	0.366*** (0.013)	1.038*** (0.251)	2.345*** (0.477)	3.881*** (0.693)
N	2843	707	1596	364	170	151
LR Test Stat	160.00***	2.76**	0.00	3.02**	9.05***	13.48***
$H_0 : \sigma_u = 0$						

Notes: Standard errors are presented below coefficient estimates

* Significant at the 1% level

** Significant at the 5% level

*** Significant at the 10% level

† Reject H_0 that technical inefficiency is 0 at the 10% significance level†† Reject H_0 that technical inefficiency is 0 at the 5% significance level††† Reject H_0 that technical inefficiency is 0 at the 1% significance level† Likelihood-ratio test on restricted model: $X^2(3) = 1.68$ Prob. $> X^2 = 0.641$ ††† Likelihood-ratio test on restricted model: $X^2(4) = 2.25$ Prob. $> X^2 = 0.6898$ †† Likelihood-ratio test on restricted model: $X^2(3) = 0.45$ Prob. $> X^2 = 0.9298$

Discussion of Results – Control Variable

Acres, Population, and Income

Two regressors – acres and population – are statistically significant at the 10% level for all land types in all four regressions (Table 2.6 – 2.9). The coefficient on the acres variable is negative in all land classes except Agriculture, and ranged from -0.30 in Public land to -0.80 in Residential. This means that among Residential property, a 1% increase in land area results in a 0.8% decrease in rent per acre. The most obvious explanation for this is that people purchase more land when it is less expensive, which is where land is less scarce.

The exception to the negative relationship between land area and rent per acre is Agriculture, which is positive and significant at the 1% level in all four regressions. Agricultural land is the only land class discussed here which is leased via competitive bidding. The land area coefficient on agriculture is 0.18. This means that a 100% increase in farm size corresponds to a 118% increase in willingness-to-pay by the highest bidder, indicating an elasticity of scale of 1.18.

As predicted, the population coefficient is positive and significant at the 1% level for nearly all land classes in each of the four regressions, with the exception of Agriculture, in which case it is positive and significant at the 5% level. The coefficient ranges from approximately 0.50 to 0.68 in four of the six land classes, and is between 0.13 and 0.15 in Farm Residential and Agriculture. This means that a *ceteris paribus* doubling of population in a county would result in the average sixteenth section rent rising by at least 50% per year for Residential, Commercial, Public, and Church property, and approximately 14% for Agriculture and Farm Residential. There are two possible

explanations for the positive impact of population on rents. The first, and most obvious, is that a population increase causes demand for land to rise, thus increasing price.

Another possible explanation is that increases in the number of beneficiaries relative to special interests (given that the number of acres being managed is held constant) results in greater P . Asymmetric growth in population is the likely reason that the coefficient is lower in rural land classes. For example, population growth within a Mississippi county is likely to correspond to a migration from rural to urban areas over the last 30 years.¹⁵

Curiously, income is a statistically significant predictor of rents on sixteenth section lands in only three of the six land groups. In each of the three cases the significance is at the 1% level, but the coefficient is positive for only Residential and Commercial land, and is negative for Agricultural. What is more surprising is the magnitude of the coefficient, -1.4, on income among Agricultural land. This means that if county A is identical to county B except that it has 20% higher per capita income, then the average highest bid for sixteenth section farmland in county A will be approximately 28% (-1.4×20) less than that in county B. This accentuates the differences in the coefficients on population discussed above. Evidently, people in relatively populated and relatively wealthy areas of Mississippi will pay significantly less for farmland. This is despite the obvious positive effect on overall property value that results from greater ability to pay for land that is combined with intensified land scarcity. Apparently, if you want an inexpensive farm in Mississippi, you should move to the suburbs.

The three land groups for which income is not a statistically significant predictor is Farm Residential, Church, and Public. Under the rule that rural property values are less affected or are negatively affected by income due to an apparent rural migration, the

¹⁵ This explanation cannot be tested with county-wide data.

negative but statistically insignificant coefficient estimate on Farm Residential is not surprising. The insignificance on the sign on Public property is also less surprising, given that the willingness to pay by state and federal governments may be less dependent on local income levels. However, local governments' willingness to pay would be a function of local income levels.¹⁶ What is more surprising is that the rent that churches pay is independent of the ability to pay of their parishioners.

Age

The age variable represents how many years have passed since the rent was last determined. It is no surprise then that the coefficient on age is negative for the majority of land classes in most of the estimations, and is positive in none of the cases. Unlike most variables here, the specific estimate of the effect of age on the rental value of leases depends strongly on whether rent is adjusted for inflation. . If current rents are inflated to account for their present-day value given the time passed since their inception (as in Table 2.6 and Table 2.8), then the age variable reflects the *ceteris paribus* change in real returns over time. The age coefficient is statistically significant at the 1% level for three of the six land groups in the SFA – Farm Residential, Agriculture, and Church – and significant at the 5% level for four of the groups in the OLS estimation – Farm Residential, Agriculture, Church, and Residential. The coefficient on age indicates that the present-day value of the rents have increased beyond what would have been predicted by changes in the other factors. Interestingly, Commercial and Public leases have experienced no discernible improvements in receipts over the past 30 years other than

¹⁶ Approximately one third of Public land is leased to local governments, the other two-thirds are leased to state and federal government agencies.

what can be attributed to the other control variables, while real Residential property rents have been rising by average annual rate of only 1%. The greatest growth has been experienced by the churches that are now paying, on average, 6% more each year in real terms, after also accounting for the other factors. The average church paid approximately \$12 per acre in real terms before the Reform, and about \$210 in real terms afterward – a near twenty-fold increase in about 25 years. The age coefficient indicates that about one fifth of those additional receipts can be attributed to the fact that the leases are younger. The coefficients for Agriculture and Churches are similar, and significantly smaller in absolute terms for Residential (-0.01) and Farm Residential (-0.02).

When rental value is not inflated, then it is no surprise that in both the OLS and SF approaches, age is negative and statistically significant at the 1% level for all land classes. Again, the coefficient on Churches is absolutely highest at close to -0.1, indicating that churches have been paying close to 10% more per acre in nominal terms as each year passed. Agricultural rents have risen by about 7% nominally each year after accounting for other factors, and Residential rents have risen by about 3% annually.

The age of the lease is the variable most capable of capturing the regular annual progress by the school districts in managing the lands, but it is imperfect. Notice, for example, that Commercial rents have grown from around \$150 in real terms from before the Reform to over \$2000 in 2003, yet its age coefficient is zero. This does not mean that all of the increase is exclusively the result of population growth, income growth, etc., and none of the increase is due to steady management improvement over time. It does mean however that any progress that is due to managements improvement can be predicted by changes in those other factors.

Terms

Besides age, the terms of the lease is the only variable for which rents depend on the model estimation and whether the rents are adjusted for inflation. Given that rents are not annually adjusted, and that they are typically under-adjusted if adjusted at all, one might predict renters would be willing to pay more for longer leases. After all, the real price falls as the lease ages. However, such an effect cannot be predicted unambiguously with economic theory. It is not uncommon, for example, for college students and other transients to pay higher rates for short-term rents, and even higher rates if no lease is arranged. One may be willing to pay more to avoid a legally-binding long-term contract. Nevertheless, given the dismally low rents that were charged in the past, and the rate by which rents on new leases have risen, it is surprising to see that the coefficient on commercial (-0.016) and farm residential (-0.004) leases is negative and statistically significant at the 5% level in all four regressions, and significant at the 1% level in three of the four regressions. This suggests that a commercial renter pays 1.6% less for each year added to the terms of the lease. The annual rent on a 60-year lease would be 48% lower than the rent for the same property that is leased for 30 years. There are two possible explanations for this. The first is that businesses fear the commitments associated with long leases and must be substantially compensated for engaging in them. This explanation makes less sense for living quarters such as in Farm Residential property, where tenants are presumably more likely to prefer the security of long-term contracts. Second because the terms of leases are endogenous: low rents may be

correlated with longer lease terms because both are the result of poor management decisions.¹⁷

Rental Adjustments

Managers have adjusted approximately 15% of the current surface leases. The dependent variable in all four sets of regressions is annual rent in 2003. Therefore, the null hypothesis that the adjusted coefficient equals zero is based on an assumption that there is no differentiation between a lease that started in, for example, year 2000, and a lease whose rent was last adjusted in 2000 but was issued previously. The coefficient on adjustment was negative and significant in the SF estimations for three of the six land classes, and two of the six land classes for the OLS estimations. These three land groups are Residential, Farm Residential, and Church. The coefficient is approximately 0.30 for Residential and Farm Residential and -0.45 for Churches. This indicates that when Residential and Farm Residential properties are adjusted, they are adjusted to approximately 70% of the rent of a new lease. Churches, however, only pay on average 55% the value of a new lease upon adjustment. Such discretion in the rent adjustments appear to be systematic. The coefficient on Agricultural land is not significant. This may be because the large majority of Agricultural leases are for five years, and therefore only a handful – 6 specifically – of them have been adjusted. It seems mildly significant that Commercial and Public lands are adjusted to their normal rental values, while Church and Residential are not. This may indicate purposeful discretion on the part of land managers

¹⁷ Endogeneity of the terms variable can be controlled via a two-stage regression analysis. Unfortunately, potential instrumental variables for the first stage of the regression that are correlated with the lease terms, but uncorrelated with the other regressors have escaped this author. However, White robust standard errors maintain efficient estimate despite endogenous regressors.

as to how much they will charge the lessee. Citizens, in the form of residents and churchgoers get a break, but citizens in the form of commercial businesses, do not. And neither does the government.

Discussion of Results – Principal-Agent Friction

Minority

Another perhaps surprising result is the near complete lack of correlation between racial composition of the counties and rental fees of their respective sixteenth sections in a state that is laden with historical racial conflict. After all, it was just in 2002 that Mississippi's most famous government official, Trent Lott, was forced to resign as Senate Majority Leader for what were considered to be implicitly racist comments.¹⁸ In three of the six land groups – Residential, Commercial, and Farm Residential – the coefficient on minority is statistically significant at the 10% level, but is of no practical (or economic) significance in any of the land groups. The coefficient on minority is approximately 0.01 for Residential property in all of the four estimates and is statistically significant at the 1% level. This indicates that the rent for residential property in a county that is 50% nonwhite will be approximately 0.1% higher than in a county that has 40% (10 percentage points lower than 50%) nonwhite population. This amounts to about \$0.25 per year for the average Residential property – a trivial amount by any standards. For Commercial and Farm Residential property, the coefficient is negative but even smaller, between -0.003 and -0.007. It should also be noted that the three land categories for which the race coefficient turned up significant are the three with the largest number of

¹⁸ Trent Lott suggested that the U.S. would be a better place if Strom Thurmond, who ran on a segregationist platform, would have won the presidential election.

observations. Whether race still plays a role in other market functions in Mississippi remains to be seen, but it is clear that sixteenth section land managers have been behaving at least as if they are color blind.

District Size

There are no *a priori* expectations of the effect on the land's rental value from the number of acres managed by the Board of Education. Each Board of Education devotes two people to manage sixteenth section land rents – the Superintendent of Education and an assistant. If determining the market rent for the land requires effort, and less effort is correlated with lower rents, then we might observe a negative sign on the district size coefficient due to what could be considered diminishing marginal productivity of labor.¹⁹ Another factor that the Mississippi Senior Attorney for Public Lands has emphasized in private conversation is the relationship between political pressure and the number of acres leased. After all, holding population of the district constant, more acres in the school district means larger special interests relative to beneficiaries, and therefore lower *P*.

The district size coefficient is negative and statistically significant at the 1% level for four of the six land groups – Residential, Commercial, Farm Residential, and Church – and is negative and significant at the 5% and 10% level for Public land. The only land group whose rent is apparently unaffected by the size of the district is Agriculture, the only group whose rent is determined by a competitive bidding process. The coefficient

¹⁹ A regression with probability of rental adjustment as the dependent variable and the natural log of the size of the district as a sole independent variable has a coefficient of -0.04. This indicates that a 100% increase in the size of the district results in a 40% decrease in the number of leases that have been adjusted. In other words, the land managers cannot keep up with their work.

on district size is approximately -0.38 for Residential, Church, and Public, -0.73 for Commercial and -0.10 for Farm Residential. Therefore, if district A has 100% more acres to manage than district B, according to the estimates above, district B will charge nearly three quarters less per acre for Commercial property, and over a third less for Residential, Church, and Public land, and about ten percent less for Farm Residential land. Given that these estimates are holding constant other control variables, such magnitudes may be the result of both diminishing marginal productivity of labor and larger special interests.

Share

Sections 29-3-119 through 29-3-127 of the Mississippi Code of 1972 require that in the case of a sixteenth section located on the boundary of multiple school districts, the district that harbors the largest area of the section is designated the controlling district, and must manage the land and share its revenue in proportion to the number of school children with the other districts, called the share districts. The models for P presented in equations (2.4), (2.13), and (2.14) predict that sharing would result in lower rents due to its negative effect on the benefits of rents and its lack of effect on the costs. The effect of sharing would be compounded if the productivity of school land managers diminishes as the quantity of land managed rises. In such a case, a substitution effect would cause the land manager to prioritize land for which potential revenues are higher, which is where, all other things being equal, the proceeds are not shared.

The coefficient on sharing is negative and significant at the 1% level for Commercial and Residential leases in all four estimations, and is negative and significant

for Public leases in the OLS methods, and is negative but statistically insignificant at the 10% level for the Church leases (test statistic is approximately 1.5). The fact that the share variable is positive and significant at the 1% level for Agricultural land in all regressions suggests an alternative possible explanation. The three land groups for which sharing is negatively correlated with rents are the land groups that generate the highest rent. In addition, the magnitude of the coefficient is greater for the most valuable property and lowest for the least valuable property. One possible explanation for this is that there is a larger substitution effect for more valuable land.²⁰

Sixteen Section and Liu Lands Act of 1978

In 1978, the Mississippi Legislature narrowly passed the Sixteenth Section Reform Act with a tie-breaking vote from the Mississippi Lieutenant-Governor. The principle change of the legislation was to give school districts management jurisdiction over the lands under the auspices of the Secretary of State's Office of Public Lands, reducing the Boards of Supervisors to an advisory position with veto power. Unfortunately, despite the thousands of 2003 leases that were established before the Reform, state-level data on most of these leases is virtually nonexistent due to their being acquired via one-time payment. Because many of these leases were for 99 years, no rents will be collected from these lands for many years to come, and little data on them is available. Their absence underscores the importance of an analysis of school lands, their proceeds, and possible improvements in policy. With a total of 44 pre-Reform leases, inference is more difficult. It is nevertheless apparent that average rents have risen

²⁰ A regression of sharing on population and income finds that sharing is negatively correlated with income and positively correlated with population; $R^2 = 10\%$

substantially in real terms. For example, the average present-day value of Commercial leases in this data set was equal to Residential leases at about \$150 per acre per year before 1978. Since, the Commercial leases have risen to an average of over \$2000 in present dollars, while the Residential leases have doubled in real terms. Church rents have risen from a meager \$11 to \$150 per acre annually. The question is where to attribute these changes? Despite the meager sample before 1977, inferences may nevertheless be made.

The coefficient on the Reform variable for Residential, Commercial, and Church land is positive and significant at varying levels depending on the model specification. The coefficient on Farm Residential is negative and significant at the 10% level for the SF method with inflation-adjusted rent. The coefficient for Church and Residential is approximately 0.8, and is 1.8 for Commercial. This means that after you account for regular annual rental increases, as well as population growth and income growth, in addition to changes in other variables, the effect of the 1978 Reform was to increase rental receipts by about 80% on Residential and Church property and nearly triple the receipts on Commercial property.

Discussion of Results – Technical Efficiency Estimates

The average technical efficiency score ranges from 0.37 for Public land and 0.98 for Farm Residential. There appears to be no obvious correlation between the efficiency score and the average rent per acre. Technical efficiency for Residential, Commercial, and Agricultural fall between 0.52 and 0.56, and Church lease efficiency is second lowest at 0.42. A likelihood ratio test on the null hypothesis that technical efficiency is equal to

1, is not rejected at the 10% significance level for Farm Residential, and is rejected for all other land groups at the 5% level. This means that there is no one-sided error component to the rent equation for Farm Residential. In other words, all variation around the deterministic variables in the log-linear Farm Residential rent model is normal with a mean of zero. This does not mean, however, that Farm Residential lessees are paying maximum rent. It simply means that the difference between the maximum rent and the actual rent is predicted by the deterministic variables in the model and not by technical inefficiency; that is, TE is 1 but P is not. The average technical efficiency for all other land groups is roughly 50%, suggesting that the land managers could double revenue from surface leases, even political pressure remained unchanged. This would correspond, for example, to an average annual rent per acre payment on residential property of around \$500 instead of the current \$250, or \$42 per month instead of \$21. Again, this only indicates that, holding P and other factors fixed, the average maximum rent on residential property is \$500 per year, not that charging \$500 per year would exonerate the Boards of Education from violation of their mandate.

Conclusion

The stock of capital that schools in Mississippi have in their sixteenth section land trusts constitutes a valuable endowment whose total worth is not perfectly known, but its current annual return amounts to approximately \$55 million, or \$48 per acre, per year for surface leases. Historically, the problem for the Mississippi Sixteenth Section Program (as well as for school land programs across the country) is one of bridging the interests of the principals – the school children – and the agents. Although in some

respects management of school lands is comparable to other forms of public management, there are two important differences: 1) There is a single stated objective that is easy to measure, and 2) the desirability for the fulfillment of the objective is generally less controversial than other government activities such as environmental policy or military action. This does not however eradicate the conflict between special interests and the beneficiaries' (i.e. between the principles and their agents).

This study has revealed that the school land program has observed significant improvements over the last quarter century, some of which can be attributed to the change of the agents to the Boards of Education. This adjustment alone has doubled total receipts from Residential land and Churches, and has tripled the receipts from Commercial land. The amount from these three sources is approximately \$1.95 million of the \$7.8 million collected annually from the surface leases considered here. This represents a 30% increase in surface lease receipts due to the Reform. This is comparable to the 42% predicted effect of the Reform on total receipts for total land activities found in Chapter One.

There are a handful of other policy implications from this study. The average sixteenth section lease is about 11 years old, with 15% of the rents having been adjusted since. It is not surprising that in all cases older leases are set at prices below the predicted value for 2003; the worst case being for Churches. The average Church lease began fourteen years ago in 1989. Fifteen percent of the Church leases have been adjusted since, with the average rent adjustment set at 54% of the rent of new Church leases of the same year. New Church rents however have been rising at a steadfast pace of nearly 10% a year after controlling for other factors. Unfortunately, because most of

the Church leases have at least 25-year terms, and many of them longer, schools in Mississippi will continue to be subsidizing Churches for the foreseeable future.

Residential and Farm Residential rent adjustments – at about 70% of the level of new rents – are also causing substantial losses of revenue.

There are two other factors that warrant greater scrutiny: sharing and district size. The district size coefficient is negative and significant at the 5% level for five land groups, four of which are significant at the 1% level. The only exception to this is Agriculture, whose rents are determined via competitive bidding. There are two reasons that have been proposed here for this trend: 1) decreasing marginal productivity of labor, and 2) special interests. The magnitude of the coefficient suggests possibly both. The rent, for example, in a district that manages 2000 acres would be 73% less for commercial businesses than the rent for those same businesses in a district that manages 1000 acres; it would be 30% to 50% less for other land groups.²¹ This implies significant foregone revenues, and possible solutions depending on the specific nature of the problem. If the problem is due to diminishing marginal productivity of labor, then hiring part-time staff workers to manage lands in larger districts may be a profitable investment. If the problem is due to special interest pressure – e.g. is discretionary – then disincentives, such as law suits, may be helpful. Sharing also poses a problem for three land groups, and, once again, the most valuable group – Commercial – is the most sensitive.

Finally, the stochastic frontiers analyses indicate that school lands are operating at about 50% technical efficiency, suggesting that surface lease receipts could double

²¹ An R^2 of regression of district size on population density is 0.007, negating an alternative explanation that district size is negatively correlated with land scarcity, and therefore with lower rents. Of course, population density is also controlled for in the regressions above.

even without, for example, updating the leases. This would correspond to an additional \$10 million each year.

In short, there is a large range of potential improvements that the families of Mississippi school children could look forward to if both special interests and technical inefficiency were overcome. The former problem touches on an interesting dynamic that has been conspicuously absent from this analysis. And that is the threat of legal retaliation from representatives of school children as sanctioned by the trust doctrine. The last time that managers were sued for insufficient recompense was nearly 30 years ago when the lands were given away for small one-time payments. Both issues would presumably be partly mitigated simply by allowing experts to manage the lands in the same manner a university would hire financial advisors to manage their stock portfolio. Such an advisor would need to be appointed and provided economic incentives to maximize revenue. In a state that has a relatively meager tax base and struggling educational system, but a rich stock of renewable resources, proper management of these lands could translate into many millions of dollars of additional funds for public schools, and a corresponding greater level of education for its citizens.

CHAPTER 3:
TWO-STAGE STOCHASTIC FRONTIER ANALYSIS OF THE MISSISSIPPI
FORESTRY COMMISSION

Introduction

There has developed an extensive literature on the efficiency of United States National Forest timber production, but very little work has been done on public timber management at the state level. The overwhelming conclusion has been that the Forest Service operates inefficiently (Clawson, 1977; Hyde, 1981; Muraoka and Watson, 1983; Leal 1995). In *Turning a Profit on Public Forests*, Leal (1995) compares national forests in Montana and Minnesota to comparable forests that are state and locally owned respectively. His conclusion is that the national forests are managed significantly less efficiently and with greater environmental impact than the state and local forests. The reason, Leal suggests, is because the state and local forests are maintained under land trusts, and the managers have a specific mission to maximize revenue for the sake of public school funding. In addition, they can be held legally accountable to the trust beneficiaries – the local school boards. But the question is begged, how efficient are the state forests managed relative to their potential?

This paper investigates the case of the Mississippi sixteenth section program, otherwise known as the School Trust Program. The efficiency of timber management under public school land trust programs is critical for two reasons: (1) the revenues are used for purchasing scarce materials necessary for public education (e.g. books, teacher salaries, facilities, etc...) (MS Code, Sec. 29-3-115); (2) the trustees have a legal mandate

to maximize revenue - an objective for which efficiency is a necessary condition - and can be held legally liable for fulfilling this mission (MS Code, Sec. 49-19-201).

The sixteenth section lands in Mississippi have a more than 200-year history of being managed with the objective to generate revenues for public schools, and offer an interesting experiment in institutional economics. A stochastic frontiers analysis is implemented here to test timber productive efficiency of the Mississippi School Trust Program and measure the returns to privatizing forest management activities. The revenue gains that could result from improved efficiency are then predicted.

There have been few attempts using productivity analysis to measure efficiency of forest management, and only one other than this that has considered public forests in the United States. Rhodes (1986) investigated the efficiency of U.S. national parks using data envelopment analysis (DEA). Kao and Yang (1991, 1992, 1993, 2000) applied DEA to measure the efficiency of forest districts in Taiwan. Viitala and Hanninen (1998) also employ DEA to measure the efficiency of 19 state-funded forestry organizations in Finland. A general criticism of DEA is that the production and cost frontier are generated deterministically (Coelli et al, 1998). Due to weather variability and other factors, output and costs cannot be considered deterministic in forestry. Grebner and Amacher (2000) use a stochastic frontiers cost function, which account for such random noise, to measure the effect of privatization on the efficiency of forestry in New Zealand. The only application of stochastic frontier analysis (SFA) to timber production within the United States was done by Carter and Cubbage (1994, 1995). They consider two years of private pulpwood producers in 12 Southern U.S. states and find that the average level of technical efficiency is 60%. This means that the average private southern pulpwood firm

could increase its output by two-thirds without incurring greater costs, if it operated efficiently.

Siry and Newman (2001) applied SFA to measure the impact of privatization on forest production efficiency in Poland. They found that the average Polish forest district was producing at fifty percent technical efficiency. The most significant source of inefficiency was administrative employment which was the only input that demonstrated a statistically significant negative production elasticity. Second to the growing stock of timber, privatization had the largest impact on production.

This paper is the first productivity analysis of state timber production in the United States.

The Mississippi School Trust Program

The sixteenth section program is rooted in American colonial policies. The General Land Ordinance of 1785 designated townships as 6 mile-by-6 mile square tracts of land, composed of 36 one-square-mile sections. The sixteenth section is approximately in the middle of the township - in the third row and third column of the square. The Ordinance "...reserved the lot no. 16, of every township, for the maintenance of public schools within said township" (General Land Ordinance of 1785). These provisions were maintained under the Northwest Ordinance and into Mississippi statehood.²²

The record for fulfilling the state mandate of managing the land to fund public education is dismal (See Chapter 1). Frequently, 99-year leases of the land were awarded for one-time small payments. After 70 years of minimal revenue generation, the U.S.

²² For details of the history of the school lands see Chapter One.

Supreme Court ruled in 1890 that the laws reserving the sixteenth section lands were a “binding and perpetual obligation to use the granted lands for the support of public education” (MS Biennial Report, 1994-95). The Mississippi Constitution was rewritten the same year prohibiting leases on the sixteenth section lands in excess of ten years.

An 1895 Mississippi Supreme Court decision in *Jones vs. Madison County* determined that sixteenth section land was trust property – the state being the trustee and the inhabitants of the townships being the beneficiaries (MS Biennial report, 1997-98). The 1895 case led to numerous litigation cases over management of the lands.

The earliest case involving timber production was *Moss Point Lumber Company vs. Board of Supervisors* in 1906 (Mississippi State Law, 1906, in Davis, 1950 p.55), where Moss Point Lumber company was suing for the rights to log the land that they were leasing. The Board of Supervisors defense was based on the premise that logging the land would devalue the inheritance, and was therefore prohibited. According to Judge Calhoun the Court ruled in favor of Moss Point because logging and clearing does not devalue the property because “fine brick buildings might be erected on the spot where the timber stood.” However, the case was appealed and brought to the Supreme Court of Mississippi, where Moss Point Lumber Company argued that logging on sixteenth section lands was permitted under common law, given that it had been practiced for nearly seventy-five years. This time the Court ruled in favor of the Board of Supervisors. Judge Whitfield’s opinion was the most dramatic to date from a superior court.

It was in pursuance of the purpose this declared, this enlightened public policy, that sixteenth sections all over the United States have been set apart as a sacred trust fund to be perpetually maintained for the education of the children in the various townships. The thought, the paramount controlling purpose, was that this fund should not be wasted, and not even consumed for any one decade of children, but preserved “forever” for the

education of every succeeding generation of children in these townships all over the United States. This state, acting in its governmental capacity, has accepted this sacred trust according to its terms and in harmony with the spirit which created it. It is, in my judgment, a high and solemn trust which the state in its governmental capacity has accepted, the most sacred imaginable; and the state should see to it that this trust fund shall not be seized up on by arrogant timer trusts, demanding, for the first time in the history of this state that they can, under the guise of a lease, having paid only a leasehold consideration, take an absolute fee simple property in these sixteenth sections, and destroy the whole value of the inheritance. No greater trust can be committed to any state than that of the education of the children within its borders; and, if one such trust can be more sacred than another, it is that trust designed to bring home to the doors of the poorer children of the common-wealth the means of acquiring a reasonably good education.

Jurisdiction over the sixteenth section lands has changed at least fourteen times since their creation (Clayton, 1977). Though the counties of Mississippi had always legally operated under a revenue incentive to manage the lands productively, the source of some of the inefficiencies can be largely attributed to the difference between the principals - the local school districts - and the agents. The trustees appear to have had incentives to manage these lands in conflict with the interests of the schools (e.g. allocating the land to special interests).

In 1947, the Attorney General of MS was asked by the General Legislative Investigating Committee to take action to sue the Boards of Supervisors in Hinds and Rankin counties for selling timber on sixteenth section lands “far below market value.” For example, in 1945, “liquor-dealer”, Gus Dear purchased timber from the Hinds County Boards of Supervisors for \$500, then resold the timber two weeks later to Grief Brothers Cooperage Corporation for \$4,000. That same year, H. E. Wamsley, road foreman for the elected Supervisor of the First District of Rankin County, H.R. Walker,

purchased a deed to timber within that district for \$200. The General Legislative Committee determined that the market value for the timber was over \$8,000, and included in its report that, “Mr. Walker was defeated for re-election, and from the information obtained by this committee Mr. Walker has already constructed roads to this timber that would make it accessible” (Jackson Daily News, 1947, in Davis, p. 153).

In 1948, the General Legislative Investigating Committee reported that the timber from sixteenth section lands had been sold, “at such grossly inadequate prices as to shock the conscience and, in some instances, as to constitute nothing more or less than a donation of this timber to private individuals” (MS Laws, 1948). In an effort to solve this principal-agent problem, the Fraiser-Hall Reform Act of 1978 transferred the jurisdiction of the lands from the county boards of supervisors to the school boards where it rests now (MS Code, Sec. 29-3-1).

The county school boards are now required by law to classify the lands according to a finding of their highest and best use for producing the maximum revenue (MS Code, Sec 29-3-33). Management of land classified as forest is supervised by the Mississippi Forestry Commission (MFC) (MS Code, Sec. 29-3-45). Each school district is required to contract with the MFC, which then schedules timber harvesting and sales. Both the MFC and the respective school boards must authorize all timber management activities.

The district school boards are responsible for compensating the MFC for the costs of the timber management (MS Code, Sec. 29-3-47). Fifteen percent of timber receipts for each district are placed into an escrow fund that is used to cover the costs of managing the respective forests. Excess money that has accumulated in the escrow funds may be released to the respective school boards after authorization from the

secretary of state and the MFC. Those funds may be directed to cover a large variety of public school expenditures. In case of insufficient funds for timber management, school boards may deposit money directly into the escrow fund, defer payments to the MFC until sale of timber at a later date, or seek assistance via the Forest Resource Development Law of 1974 (MS Code, Sec. 49-19-201). In addition to providing need-based grants for timber management to school districts, the Forest Resource Development Law requires that, “the Mississippi Forestry Commission brings all Sixteenth Section Forest Lands to maximum productivity.”

The MFC is responsible for forest management decisions in all of the participating districts, but school boards are legally permitted to outsource the activities to private vendors (MS Code, Sec. 29-3-49). In practice, the MFC is involved in all forest management activities and recommends outsourcing in cases when they cannot accommodate the demand. For projects estimated to exceed \$10,000, the MFC must publicly advertise the project and accept the highest bid over a three week period. For projects less than \$10,000, a public advertisement is not required, and vendors are contacted directly for bid submission.

After a long and tumultuous history, the sixteenth section forest lands in Mississippi, are now legally being managed to maximize revenue through joint cooperation between their trustees – the boards of education – and the MFC. Total timber receipts from sixteenth section lands have improved from a real value of about \$7 million in 1979 to \$22 million in 2001.²³ Despite this marked improvement, the question still remains, how well are the lands managed relative to their potential? On one hand, profits go to the school boards’ budgets, providing an incentive for efficiency. On the

²³ Deflated with the GDP deflator, base year = 1996.

other hand, the MFC can increase its budget through higher timber management costs, for which the school boards are required to compensate, providing a disincentive for efficiency. Which of these forces is dominant? These are questions that no productivity analysis has attempted to answer – neither for Mississippi nor for any other state in the Union. How much additional revenue could be generated under an efficient management regime? What is the opportunity cost to the public schools of employing a monopolistic MFC instead of competitive private vendors?

Timber Production Data

To analyze the productivity of the sixteenth section forests in Mississippi and measure the returns to privatizing timber management, data on total forestland acres, expenditures, and timber receipts from 1997 to 2001 of every participating school district has been collected from the Mississippi Forestry Commission. The expenditures included in this analysis are: fertilization, pruning, release, fire-break/road maintenance, firelane control, site preparation, planting, vegetation and animal control, silvicultural burning, timber marking and technical assistance. MFC overhead expenses are not included. In addition, data on the value of the escrow fund in the 1995-1996 was collected for use as an instrumental variable. The expenditures and receipts were averaged over the five year period with the GDP deflator, and the remaining cross-section includes the 71 districts in Mississippi for which complete data was available.²⁴ The average real expenditures outsourced to private vendors were divided by the average real

²⁴ The GDP deflator was chosen over a timber price index for two reasons: a) The objective of revenue maximization is not conditional on the source of the revenue; b) Data on timber classification was not available. It should be noted that the efficiency scores determined from SFA are unit-invariant.

total expenditures paid to the MFC and the private vendors to yield the average cost-share privatized in each district.

Table 3.1: Summary Statistics of School Trust Timber Production				
	Mean	Standard Deviation	Minimum	Maximum
Avg. Real Sales 1997-2001	\$295,219.40	\$283,320.8	\$1700.28	\$1,368,338
Avg. Real Total Expenditures 1997-2001	\$6700.17	\$6,679.366	\$132.88	\$40,749.82
Average Cost Share Privatized 1997-2001	0.349618	0.304615	0	0.974297
Total Forestland Acres	5210.41	3033.49	533	13450
Real Escrow Fund 1995-1996	\$92,601.82	\$84,791.13	\$463.23	\$380,773.1

Methodology

Productive efficiency refers to the complete minimization of economic waste such that either, for some observed level of output, inputs are minimized, or for some observed level of inputs, outputs are maximized, or some combination of the two (Coelli et al. 1998). There are two components of productive efficiency: allocative and technical efficiency. In a single output case, allocative efficiency requires equating the marginal rate of technical substitution with the price ratio of inputs. Technical efficiency refers to the maximization of outputs given the input combinations. A firm could be employing inputs in efficient proportions (allocative efficiency) without extracting the most from the inputs (technical inefficiency). Alternatively, a firm could be using those inputs at inefficient proportions (allocative inefficiency) but could maximize outputs subject to that input combination (technical efficiency). Because allocative efficiency is concerned with the proportions of inputs, and the efficient proportion of inputs depends on their respective costs, data on input prices is necessary to test for allocative efficiency. Testing

for allocative efficiency would therefore be a significantly more difficult problem. This project concentrates on technical efficiency.

The stochastic frontiers production function was first proposed in independent papers by Aigner, Lovell, and Schmidt (1977) and Meeusen and van den Broeck (1977). Since, it has been used extensively to measure the productive efficiency of airlines, utilities, and other regulated industries where data has been available. For an overview of the literature see Kumbhakar and Lovell (2000).

The stochastic frontiers analysis converts the input-output observations to a production frontier, accounting for technical inefficiency and random noise, such as weather (Coelli, et al., 1998). A typical least squares regression consists of a deterministic component and a random noise component. The stochastic frontiers model is based on the premise that a production frontier cannot be generated from the deterministic component of a least squares linear regression because not all firms operate efficiently. It therefore assumes a distribution of technical inefficiency – often a truncated normal distribution – in addition to the random noise. This approach allows for the estimation of parameters accounting for these differences in the firms' efficiencies.

The production function that has been most commonly employed in timber productivity analysis is Cobb-Douglas (Siry and Newman, 2001). The Cobb-Douglas function has been implemented primarily because it is easy to estimate and manipulate and requires fewer observations than alternative functional forms. Unfortunately, it imposes restrictive properties on the production structure such as an elasticity of substitution equal to one, and fixed returns to scale (Coelli et al., 1998). One popular alternative production function is the translog, which is more complex, consumes more

degrees of freedom, and may suffer from multicollinearity problems, but is more flexible than the Cobb-Douglas. The Cobb-Douglas function is used here.

Due to data constraints, many econometric analyses of timber production regress output from a given year on input in that year (Siry and Newman, 2001; Carter and Cubbage, 1995), assuming the following production function:

$$Y_T = f\left(\sum_{h=0}^H x_T^h\right), \quad (3.1)$$

where the subscript on each variable represents the year of activity and the superscript represents the age-class. Y_T is units of output in year T , x_T^h is units of inputs in year T into stands of age-class h .

In reality, forests require many years for inputs to be converted to outputs. A “true” model would have output in year T as a function of inputs into the same stand over the course of the harvest cycle,

$$Y_T = f\left(\sum_{h=0}^H x_{T-H+h}^h\right), \quad (3.2)$$

where x_{T-H+h}^h represents units of inputs into the stands of age-class h in year $T-H+h$, and H is the length of the harvest cycle in years. For example, if the harvest cycle is 35 years, the timber yield in 1999 is a function of the inputs into the seedling stand (age class 0) in 1964, the yearling stand (age class 1) in 1965, the two year old stand in 1966, etc...

The specification in equation (3.1) implicitly assumes that inputs in year T into stands of age-class h are equal to inputs in year $T - H + h$ into stands of age-class h : $x_T^h = x_{T-H+h}^h$, for all h . That is, the inputs into each age-class are constant over time.

Inputs can be decomposed, $x_T^h = c_T^h a_T^h = c_{T-H+h}^h a_{T-H+h}^h = x_{T-H+h}^h$, for all h . Where c_T^h represents inputs per acre of age-class h at time T , and a_T^h represents acres of age-class h at time T . For simplicity, we can assume inputs per acre of each age-class are constant over time, $c_T^h = c_{T-H+h}^h = \bar{c}^h$, for all h , implying that the area allocated to each age-class must also be constant over time, $a_T^h = a_{T-H+h}^h = \bar{a}^h$ for all h . That is, the area of the seedling stand in 1964, a_{64}^0 , is equal to the area of the seedling stand in 1965, a_{65}^0 , as well as that of 1999, a_{99}^0 . But, it is also the case that, $a_T^h = a_{T-H+t}^{h+t} = \hat{a}_{T-H+t}^{h+t}$, for all h and t . For example, the area of seedling stand in 1964, a_{64}^0 , is equal to the area of the yearling stand in 1965, a_{65}^1 , and the two year old stand in 1966, a_{66}^2 , because they are the same stand. Therefore, we can conclude, $\bar{a}^h = \hat{a}_{T-H+t}^{h+t} = \bar{a}$, for all h and t . That is, $a_{64}^0 = a_{65}^0 = a_{99}^0 = a_{65}^1 = a_{66}^2$; the area of all age-class stands at all time periods are equal. And because the cost per acre is constant for each age-class over time, expenditures in each year are implicitly assumed to be constant. That is, the model that is implicitly implemented is:

$$Y_T = f\left(\sum_{h=0}^H \bar{c}^h \bar{a}\right). \quad (3.3)$$

The inputs may vary among age-classes in a particular year, but there is no variation between years. Therefore, using a panel set with output and inputs that vary across years violates the assumptions necessary to regress outputs of a given year on inputs of that year.

In other words, the model used in other timber productivity analyses assumes the area of a stand of a given age-class in a given time period must also be equal to the area

of the stand of that age-class plus one in the next time period, because they are the same stand, and therefore implicitly assumes that the area of all age-class stands is equal at all times. Such an assumption negates the use of a panel set where output for different years are regressed on the inputs for those respective years, because the differences are implicitly assumed to be attributed to noise.

An alternative approach that mitigates the inter-temporal effects of random noise but relies on less restrictive assumptions of firm activities, is simply to average the panel over time into a single cross section. This technique is implemented here and only assumes that the average inputs and outputs for a given district in the years observed equal the average inputs and outputs over the harvest cycle within that district.

It is also worth noting that most state and all national forests in the United States have multiple objectives (outputs) in addition to timber production (e.g. wildlife habitat, recreational use, grazing space, etc...). A stochastic production frontiers analysis cannot be conducted on agencies with multiple objectives, and other measures of technical efficiency, such as DEA and stochastic cost frontiers, require reliable data on all outputs (Coelli, et al. 1998). The Mississippi School Trust Program is unique in that it has a single objective for its forests – to maximize revenue – and therefore technical efficiency can be measured using stochastic production frontiers.

Regressing timber sales receipts on expenditures over the same time period is also subject to an endogeneity problem. This model assumes that average timber receipts are a function of average expenditures on inputs. Unfortunately, it is also the case here that expenditures are derived from the forestry escrow funds that are composed of a portion of

the timber receipts. That is, the inputs here (and likely in other studies of public forests) are also a function of the output.

To solve this problem, the real value of the 1995-1996 escrow fund is used as an instrumental variable and a two-stage regression is implemented. The escrow fund accumulates in value over time in accordance with annual injections that are typically much greater than the annual expenditures. The escrow fund in the year previous to 1997 provides a useful instrumental variable because its value is completely independent of subsequent timber sales, yet constitutes the bulk of the source from which management expenditures are withdrawn from 1997-2001. The model for the first stage is:

$$X_{EX,i} = \gamma_0 + \gamma_1 X_{EF,i} + \varepsilon, \quad (3.4)$$

where,

$X_{EX,i}$ is the natural log of the average real value of expenditures for district i from 1997-2001.

$X_{EF,i}$ is the natural log of the real value of the escrow fund for district i in the 1995-1996 academic calendar year.

The first stage yields $\hat{X}_{EX,i}$, which is the predicted value of $X_{EX,i}$.

Table 3.2. Results of First Stage OLS Regression; Generating $\hat{X}_{EX,i}$.

$$X_{EX,i} = \gamma_0 + \gamma_1 X_{EF,i} + \varepsilon$$

Variable	Coefficient Estimates
Constant	1.190 (1.121)
X_{EF} - natural log of the real value of the escrow fund for district in the 1995-1996 academic calendar year.	0.675* (0.102)
R ²	0.341
Adj. R ²	0.333

Notes: The estimated standard errors are presented below the corresponding estimates.

* Significant at the 1% level.

The model for the second stage is:

$$Y_i = \beta_0 + \beta_1 \hat{X}_{EX,i} + \beta_2 X_{A,i} + \beta_3 X_{PV,i} + v_i - u_i, \quad (3.5)$$

where,

Y_i is the natural log of the average real timber sales from 1997-2001 for district i .

$X_{A,i}$ is the natural log of the total forestland acres for district i .

$X_{PV,i}$ is the average cost-share from 1997 – 2001 outsourced to private vendors for district i .

v_i is random disturbance that is i.i.d. $N(0, \sigma_v^2)$, independent of u_i ;

u_i is technical inefficiency that is an i.i.d. truncation at 0 of $N(0, \sigma_u^2)$.

Discussion of Results

Table 3.3. Results of the Second Stage SF Regression

$$Y_i = \beta_0 + \beta_1 \hat{X}_{EX,i} + \beta_2 X_{A,i} + \beta_3 X_{PV,i} + v_i - u_i$$

Variable	OLS	ML
Constant	0.900** (1.40)	4.913** (1.390)
$\hat{X}_{EX}$ - predicted value of the natural log of the average real value of expenditures from 1997-2001.	0.742** (0.255) [†]	0.641** (0.269) [†]
X_{PV} - average real cost-share privatized from 1997-2001.	0.771* (0.380)	0.564* (0.283)
X_A - natural log of forestland acres.	0.521** (0.160)	0.284* (0.141)
σ^2		2.098** (0.498)
R ²	0.5311	—
Adj. R ²	0.5104	—
Log-likelihood		-89.327
Mean technical efficiency	—	0.443
Elasticity of scale	1.263	0.925

Notes: The estimated standard errors are presented below the corresponding estimates.

[†] Adjusted standard error = the original standard error divided by the R² of the first-stage regression.

* Significant at the 5% level.

** Significant at the 1 % level.

A Hausman test indicates that the coefficient estimates of the second stage of the two-stage regression are significantly different from those of the one-stage regression, justifying the use of the two-stage approach.²⁵ A likelihood ratio test indicates that the null hypothesis that the u term = 0 can be rejected with 99% confidence.²⁶

The results of the stochastic frontiers test indicates that the average district in Mississippi is operating at 43% technical efficiency. That is, they could more than double their timber production on the same land without increasing costs. These results are comparable with Carter and Cubbage (1995) and Siry and Newman (2001), who estimated the technical efficiency of private southern pulpwood producers at 60% and Polish federal timber production at 49%, respectively.²⁷ In addition, the coefficient for returns to scale here is 1.09, which is comparable to the findings by Carter and Cubbage (1995), and Siry and Newman (2001), that have returns to scale estimates of 1.13 and 1.15, respectively. Though these figures have been interpreted to reveal increasing returns to scale, an F-test reveals that the elasticity of scale coefficient presented here is not significantly different from 1.²⁸ One implication of this is that there may not be advantages from pooling resources through a single agency, such as the MFC.

All parameter estimates for the production of timber on sixteenth section lands are positive and significant at the 5% level. The variable with the greatest coefficient is X_{PV} , the cost share spent on private vendors. This indicates that the average school district can increase output by 25% on their current forestland without increasing expenditures, by

²⁵ $\chi^2 = 7.46$.

²⁶ $\chi^2 (01) = 13$.

²⁷ The efficiency estimates are based on the dispersion of the observations within the respective samples. A conclusion cannot be drawn about the relative technical efficiency between the different samples.

²⁸ F-statistic = 0.115.

simply bidding out twice as many projects²⁹ on a competitive basis to private vendors, in accordance with MS Code 29-3-49, instead of paying the MFC.

There are several possible explanations for the inefficiency of the School Trust Program and the apparent advantages of outsourcing. Private vendors keep their revenues and therefore have an incentive to minimize the costs of operation for a given set of activities. In addition, their receipts are based on the services they sell, which are determined by their ability to under-bid their competitors. In short, private vendors have an incentive to behave efficiently. In a perfectly competitive market with perfect information, private vendors would sell their services at marginal cost. School boards would then be able to have their timber managed at the marginal cost of the most efficient vendor in the state.

Alternatively, the Mississippi Forestry Commission has a monopoly of forest management services on School Trust lands. Payment to the MFC for any services provided to the school districts is guaranteed regardless of price or quality of service. But they are paid only for their cost of production, and therefore have no economic incentives to lower costs or improve services. Arano and Munn (2003) determined that industrial timber producers in Mississippi manage their land six times as intensively as the sixteenth section lands. In fact, School Trust land management closely resembles that of nonindustrial timber producers in Mississippi who are not considered to be profit maximizers.

Outsourcing to private vendors only appears to be part of a solution for efficiency improvements. As part of a checks and balances system, the MFC is legally responsible for all management recommendations, even those that become outsourced. While the

²⁹ From the current average cost-share privatized of 35%.

intention of this law is to prevent the local school boards from unscrupulous practices, it appears that the MFC may not have the proper incentives for completely scrupulous behavior itself.

Other possible explanations for the positive relationship between contracting with private vendors and timber sales have to do with the decision process to outsource. It is possible that forests that are managed more productively, and hence generate greater timber receipts, are more likely to be aggressively regenerated. In addition, because private vendors are sought to absorb excess-activities that the MFC cannot accommodate, it may be the case that the vendors systematically receive larger projects in forests that are more productive due to causes not captured in the data. That is, by virtue of being productive and therefore active for reasons unobserved here (total expenditures and size of the district are controlled for), a district maybe more likely to have their forests served by private vendors. In short, there may be omitted variables that explain output and are correlated with outsourcing that bias the empirical results. It should be added however, that there is no evidence that the MFC is less likely to manage the productive districts than the unproductive districts.

Conclusion

The state of Mississippi has a troubled record of managing lands on behalf of its public schools. One important conclusion that can be drawn from this study is that the institutional setting for a particular objective is decisive in its determination. Since before the creation of the state, the purpose of sixteenth section lands has been unchanged - to generate funds for public education. Yet it was not until a full two centuries later,

when effective ownership of the lands was assigned to the school boards - direct beneficiaries of the land management - has this objective resembled realization.

Incentives have mattered and real progress has been made in managing these assets. But it may still be feasible for the school boards to more than double their profit from the lands by, among other changes, outsourcing more of the operations to competitive bids instead of to the MFC. This study has demonstrated that the objectives for the school lands have not yet been fully reached, and that the institutions that incorporate them continue to present barriers to better management.

CHAPTER 4:

CONCLUSIONS

The History of school lands throughout the United States can be traced back to the General Land Ordinance of 1785 and the Northwest Ordinance. These ordinances required that in order for western territories to become states their land was to be surveyed and partitioned into one-mile-squared townships, each with 36 square sections. The General Land Ordinance of 1785 required that the sixteenth section be reserved for educational purposes, but as states were later added, more sections were devoted to education (i.e. the 36th section in Oregon, Kansas, Nevada, Nebraska, Colorado, Montana, North and South Dakota, Idaho, and Washington, and the 2nd 32nd and 36 sections in Utah, Arizona, and New Mexico). Such a mandate was to ensure that some funding for education would be available irrespective of how remote that location was. Exploring the inefficiency of this original allocation is a topic of further research.

Because accurate information on the historical real value of school lands and their receipts is difficult to find, an accurate account of the performance of the land managers and their services on behalf of schools is near impossible to determine. However, the combination between historical anecdotes and recent econometric analysis provides a consistent story: school lands have been, and in all likelihood still are, not realizing their revenue potential, and probably had been falling far short of it. This appears to be true for Mississippi, but no less true for other states given that Mississippi's school land

revenue per acre exceeds that of most states despite its lower average income (Chapter One, Table 1.1). This assertion begs two important questions: what is the evidence, and what is the explanation?

This dissertation has attempted to lay down as much evidence as is readily available. It does not appear disputable that Mississippi has suffered loss of potential revenues from the school lands at least in the past. Many long term leases are known to have been issued for small one-time payments. Timber has been considered to be sold at such grossly inadequate prices as to “shock the conscience” (Clayton and Spencer). Mississippi, itself has considered its legacy of school lands to be one of “Shame.” This is not to say that the lands and their potential proceeds have been ignored. Throughout their history many Legislative Audit Committees have investigated the performance of the lands and have time-and-again made the same conclusions: potential proceeds are being squandered. Court cases that go back to the late nineteenth century have determined that these lands are to be managed under trust, requiring undivided loyalty to the schoolchildren. State educational authorities have attempted to gather statewide information on the revenues from the lands, yet with little cooperation from local school land managers, little information was revealed. It was in the early twentieth century that the Secretary of States Office required all school districts to acquire deeds for their trust lands; but fulfilling this mandate occupied another several decades (Chapter One).

Again, Mississippi appears to be not alone in the struggle over the management of its school lands. As recently as 1982, the Oklahoma Education Association sued the State Land Board for leasing school lands to farmers for meager recompense: about \$5 per acre per year. And, for example, in “Utah’s School Trust Lands: A Century of

Unrealized Expectations,” Harmer (1990) also finds that Utah’s school lands have failed to produce appreciable value.”

Mississippi’s recent progress can be traced back to *Tally v. Board of Supervisors of Smith County* (1975), when a Superintendent of Education, Joe Tally sued for malfeasance and won. Four more law suits for insufficient recompense of school lands were filed in 1976. In 1977, another major investigation by the Legislative Audit Committee concluded that the school lands would best be served if managed by the recipients of the lands’ proceeds – the respective Boards of Education (Clayton and Spencer, 1977). At the very least, this would preclude the Boards of Education from suing the land managers. Since then, real revenues from school lands have quadrupled. But what do we know?

Even now, after substantial efforts to improve the productivity of school lands in Mississippi have been made, a combination of residual problems from past decisions and current practices persist. There are about 4000 current surface leases in Mississippi that do not generate annual payments due to lumpsum payment prior to the 1978 Reform. For the majority of these leases, information on the original lumpsum payment, and amount of land leased is not centrally available at the Secretary of States Office. The average current lease for which annual payments are received began 12 years ago, without rental adjustments since. The managers of these lands, who have been elected, seem to be confounded by a combination of political pressure from the renters, and contractual obligations from former management regimes. Legal precedent, however, has revealed that if rents are set below fair market value, these contracts can be updated.

It is quite clear that despite historical constraints, the Mississippi School Trust Program has made major improvements in the past thirty years. These improvements may be attributable to a large combination of factors, but the most notable seems to be the acquisition of control of the lands by the Boards of Education. However, this arrangement may continue to suffer from institutional barriers.

The reason why school land managers have historically poorly served the schoolchildren is in all likelihood the result of the classic principal-agent problem; that is, they did not have proper incentives to do so. Is this principal-agent problem resolved? The answer is unquestionably no. The Boards of Education appear to have at least one major institutional incentive for generating revenue on school lands – reelection. Unfortunately the reelection game is three-pronged. On the one hand, greater revenue results in greater education spending, and presumably greater likelihood of being reelected. On the other hand, higher rents would result in some lost votes, and certainly decreased campaign contributions, decreasing likelihood of reelection. Thirdly, if total revenues are sufficiently low, and a law suit is induced, then the subsequent cost to the budget would presumably decrease the chance for reelection. This last disincentive is one invoked by the trust doctrine, and appears to be the weakest. After all, the economic incentives to sue the Boards of Education are lacking: the cost to the plaintiffs would be large and the benefits small. Either way, the interplay between these incentives ultimately determine the effort of the managers, and the subsequent school land receipts.

Before the 1978 Reform Act, school land managers were also elected, and their reelection would appear to have been affected by the prudence with which they managed the lands. The effect of the Reform was to give the responsibilities to managers who

additionally benefited from the proceeds. Clearly, the incentives remain imperfect, and shy of giving the lands directly to the schoolchildren (which would be unconstitutional), will forever be imperfect.

Chapter Two examines current surface leases under the premise that, given the temporal nature of the leases – there is much variation of when the leases began – they represent a combination of past and current practices, and therefore reveal the change in the management of the leases over time and with respect to a host of relevant variables. There are two conclusions that can be drawn with relative certainty for all land groups: old leases are, on average, generating less rent than new ones, and higher populations are strongly correlated with higher rents. But the coefficients on the other variables for most land classes also generally tell a consistent story. The following is an attempt to tell that story.

Such as would be expected for profit-maximizing firms, the rent for sixteenth section surface leases can be at least partly predicted by the supply – which is constant – and the demand for land in Mississippi. The demand is primarily represented by a few factors – the income of the citizens, the population, and the land use. The econometric results reveal a story where rents from Residential and Commercial properties in wealthy and populated areas are especially high. There are two land groups that more or less consistently prove an exception: Farm Residential and Agriculture. There are two possible explanations for this: they are either buffered from market forces due to other (say, cultural) mechanisms, or their value simply responds to changes in demographics differently than other lands groups. Any combination of these scenarios is plausible. Both land groups pay significantly less rent per acre than any of the other groups. They

pay especially less in wealthy areas, either because, other factors held constant, wealthier areas are more willing to subsidize such lands, or because in wealthier areas, such lands are considered less desirable. The case of *Oklahoma Education Association v. Nigh* (1982) reveals that school lands have been used to subsidize farmers elsewhere. But the fact that Farm Residential and Agriculture rents are the least changed over time is also consistent with a rural migration story. People simply may see greater economic opportunities in populated, wealthier, areas. The more wealth, the higher the opportunity cost of living in a rural area and operating a farm.

Another relatively consistent result is the negative relationship between number of acres managed by the district and rent per acre. It is important to note that because there is only a mild negative correlation between population density and size of the district, and because population is controlled for in the regressions, such a relationship cannot be considered to be due to relationship between rural areas with more land and lower land values. The magnitudes of the coefficients on population and district size are consistent with an explanation that expands into a world of supply and demand of a different sort: politics. Could it be that the larger population – which is a linear approximation of student enrollment – represents greater pressure from the beneficiaries, and the larger district size represents greater special interest to lower rents? If this were true, then the greatest rent per acre would be found in a district with very few lessees and very high population. Of course, the alternative explanation is simply that higher population represents higher demand and larger districts are confounded by diminishing marginal productivity of labor. There is a combination of econometric and circumstantial evidence that supports the political explanation.

The negative and significant sign on the sharing coefficient is consistent with the political explanation. Sharing occurs when a sixteenth section rests in multiple school districts. In such cases, one district manages the lands and shares the proceeds with the other districts. Sharing lowers the political benefits of charging high rents, but not the political costs. For example, if 100% of the proceeds were to be given away to other districts then there would be no reason at all for an elected Superintendent of Education, who receives campaign contributions from renters, to charge any rent. In such a case, there would be little incentive for beneficiaries to enforce the manager's obligations of generating maximum revenue. It seems relevant that the coefficient is most strongly negative for commercial businesses. In other words, a commercial business is very likely to pay lower rents if the renter does not keep all of the proceeds. For example, perhaps business have more influence through campaign contributions, and their rents are therefore more sensitive the incentives of the Boards of Education.

The circumstantial evidence is two-fold. The first is historical. There have been dozens of court cases over proper rents on sixteenth sections lands. The Sixteenth Section and Reform Act, which is generally considered in Mississippi to be a highly effective reform, required a tie-breaking vote from the lieutenant governor. Consider the following statement in the 1998-1999 Biennial Report: "bold and courageous steps were taken to correct the abuses of the past and to institute sound management practices under the Sixteenth Section Lands Reform Act of 1978." To this day, legislation is proposed every year that would appear to benefit the renters at the expense of the school children. For example, in the 2003 session, there was a proposal to re-extend leases to 99 year

terms. There is no doubt that politics have been a determining force of the productivity of school lands historically, and little doubt currently.

Another major source of revenue from school lands is timber production, coordinated by the Mississippi Forestry Commission. Chapter Three demonstrates the results of a stochastic frontier estimation of technical efficiency of timber production on school lands, and finds that the average school district is producing timber at 43% technical efficiency. This indicates that the average district could produce just as much revenue at the 43% the current cost if it operated efficiently. Furthermore, school districts that privately outsource their timber production generate more revenue per input than ones that do not. There is an obvious explanation for this: private vendors have an incentive to operate efficiently, and the MFC does not.

To conclude, there remain many unanswered questions regarding school lands and their performance across the United States. This dissertation is now a contribution to a small but growing literature. Fairfax, Souder, and others have painted a landscape of school lands and their general legal foundations across the country and over time. This paper has attempted delve into the legal, historical, and economic details of a particular state with the hopes of shedding light on the impact of policy throughout its history, and on understanding exactly what the status of school lands in this particular state is. Furthermore, this analysis has been conducted through the lens of political economics, and has attempted to push forward explanations that are consistent with economic theory. Much more work needs to be done, and many questions need to be answered that have general political economic implications. For example, is there a qualitative difference between the performance of school lands in the east, where lands are managed locally,

and those in west where they are managed by the state? A significant amount of work has been already done on western school lands; this is the first to intensely explore lands in the east.

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