A Measure of History:
Cherokee Agricultural Productivity
in Comparative Perspective, 1835-1850

by

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(Under the direction of Dr. Fred Bateman)

Abstract

In the first essay, the technical efficiency and total elasticity of production of Cherokee farm households are estimated from information contained in the 1835 Cherokee census. It is determined that the most productive Cherokee farms can be best isolated by grouping households in terms of whether they sold their excess crops rather than in terms of racial or cultural differences across households. On the free Cherokee farms, after controlling for location and farm size, there was no significant relationship between various household racial compositions and the probability of selling crops to the market; therefore, the racial mix of a household, holding other factors constant, was not a determinant of the most productive Cherokee free farms.

In the second essay, differences in Cherokee agricultural productivity prior to removal are compared to those of white farmers who later cultivated the same land. This analysis hinges on a matched sample collected from the manuscripts of the 1850 population, slave, and agricultural federal censuses. This comparative analysis shows that the marginal contribution of adult males and females to farm output did not differ between these two societies. This change in traditional gender roles on Cherokee farms is consistent with the increase in the relative price of hunting, the high amount of weavers and spinsters in the 1835 Cherokee census, and the few work alternatives for Cherokee males other than farming. For example, on the few Cherokee households that operated mills and ferryboats, the marginal contribution of women to farm output was substantial.

In the last essay, the level of marketable surpluses on Cherokee and white farms located in western North Carolina in 1850 is estimated. White farms produced a far greater amount of marketable surpluses than did Cherokee farms. To ensure being above subsistence, these Cherokees adopted labor gangs, called the gadugi, which redistributed output on a need basis. Assuming identical risk preferences and

shirking levels, it is shown that Cherokee households would have adopted the gadugi under a large number of scenarios, while white farmers simultaneously would have avoided teams because the relative price of being above subsistence substantially differed on Cherokee and white farms.

INDEX WORDS: Native American Economic History, Productivity Analysis, Sampling.

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Dedication

I dedicate this dissertation to my late grandmother Katherine Berenson, who did not have a chance to see the completion of my graduate program, but her excitement of having a Ph.D. in the family inspired me to write this dissertation.

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Chapter 1

Introduction

The literature on Native American history has grown in scale and improved in quality over the last twenty years mainly through the efforts of social anthropologists, archeologists, and historians. A field in history, termed ethnohistory, has been developed primarily to study the culture of American Indians by merging anthropological theories and historical methods.[1] This wave of mainly corrective studies has been termed the "New" American Indian history as scholars have gleaned from scarce historical documents a more accurate view of the history of Native Americans. Native Americans no longer play marginal roles in the development of the colonial and United States economy. However, research on Native American history is still underdeveloped, especially in terms of economic studies.

The purpose of this research is to conduct a large-scale comparative study on Cherokee and white agriculture by merging the literature on each group's agricultural history, neoclassical economic theory, and two major sources of agriculture data, the 1835 Cherokee census and a matched sample from the 1850 manuscript federal censuses of the whites who occupied the same land. As the cause célèbre of the Indian removal, Cherokee Indians, occupying lands in parts of Alabama, Georgia, North Carolina, and Tennessee (see Figure 1.1), became the most visible Indian group

[1]For a discussion of the origins and development of ethnohistory, see James Axtell, *Native and Newcomers: The Cultural Origins of North America* (Oxford: Oxford University Press, 2001), 1-14.

subsumed in a political debate over the efficiency of Indian land use.[2] The debate at that time was characterized by self-interested behavior: on one hand, there were frontier politicians and land-hungry whites who spoke of Indians as savages, while missionaries and elite Cherokees, both who invested heavily in Cherokee Nation, countered with examples of peaceful, "civilized" Indian farmers. Over time, some stylized facts have been developed. It is commonly accepted that there existed a significant degree of heterogeneity among the Cherokees regarding the adoption of westernized institutions as converting Indian agricultural, political, and social traditions to the early American model was the main tenet of the federally sponsored "civilization" program of the early 1800s. The challenge bestowed on historians and others is to accurately explain the factors which led to either the adoption, rejection, or modification of Euro-American social and economic traditions within the stratified Cherokee Nation. Did race, in particular the influence of whites living among Indians, play the biggest role, or were Indian cultural traditions too rigid to mold to this new environment?[3] The rate of acculturation conceivably might have had an impact on the productivity of these Cherokee farmers. The goal of the first study of this dissertation is to determine whether the most productive Cherokee, holding all other factors constant, can be characterized as either "acculturated" or "traditional".

Another goal of this research is to estimate and identify how farm output and productivity varied between white and Cherokee farms. One of the most popular

[2]Removal refers to the federal government's Indian policy during Andrew Jackson's administration which aimed to remove all Indians along the eastern United States to areas west of the Mississippi River. The Cherokees were the last major Indian group to sign a removal treaty, which led to their infamous migration to present-day Oklahoma in 1838, now known as "The Trail of Tears."

[3]The newest chapter of revisionist Indian history questions the concept of race in Southeastern Indian societies. For two diverse views, see Claudio Saunt, *A New Order of Things: Property, Power, and the Transformation of the Creek Indians, 1733-1816* (Cambridge: Cambridge University Press, 1999), and Theda Perdue, *"Mixed Blood Indians": Racial Construction in the Early South* (Athens: The University of Georgia Press, 2003).

topics within this new line of research has been comparative studies on Indian agriculture.[4] Despite popular notions, a majority of Indians, especially in the Southeast, before contact practiced sedentary agriculture. In fact, certain farming methods, such as intercropping, and several types of vegetables, such as tomatoes, corn, and squash, were introduced to Europeans by Indians.[5] The most surprisingly similarity between Southeastern Indians and colonists was the use of African slaves; however, it is commonly suggested that the treatment of these slaves was vastly different, as Indian masters were generally kinder to their slaves, allowing some, for example, to enroll in local missionary schools.[6] On the other hand, differences in agricultural techniques, in particular on Southeastern Indian farms, included the use of inferior farm implements such as hoes made of fish bones, the reluctance to fence animals for livestock purposes, and, most interestingly, the role of women as the main cultivators of food crops.[7] The cultivation of crops was typically considered to be "women's work" by Southeastern Indian males, although there is ethnographic evidence that

[4]For a comprehensive study on the differences in agricultural methods among diverse Indian groups, see R. Douglas Hurt, *Indian Agriculture in America* (Lawrence: University Press of Kansas, 1987).

[5]William Cronon, *Changes in the Land: Indian, Colonists, and the Ecology of New England* (New York: Hill and Wang, 1983), 127. In *Changes*, Cronon writes, "One must not exaggerate the differences between English and Indian agricultures. The two in many ways resembled each other in the annual cycles by which they tracked the seasons of the year." For a richer account of the diffusion of farming practices from Southeastern Indians to colonists, see G. Melvin Herndon, "Indian Agriculture in the Southern Colonies," *The North Carolina Historical Review* 44 (1967): 283-97.

[6]This view is typically explained from the perspective of cultural differences between whites and Indians. For the Cherokees, in particular, see Theda Perdue, "Cherokee Planters: The Development of Plantation Slavery Before Removal" in *The Cherokee Indian Nation: A Troubled History*, ed. Duane H. King (Knoxville: The University of Tennessee Press, 1979), 110; Theda Perdue, *Slavery and the Evolution of Cherokee Society, 1540-1866* (Knoxville: The University of Tennessee Press, 1979). For an alternative perspective, see R. Halliburton Jr., *Red over Black: Black Slavery among the Cherokee Indians* (Westport: Greenwood Press, 1977).

[7]William Cronon, in his discussion of land use among Northeastern Indians, states that "domesticated grazing animals −− and the tool which they made possible, the plow −− were arguably the single most distinguishing characteristic of European agricultural practices." Cronon, *Changes in the Land*, 128.

males did not completely abstain from agriculture as they commonly helped clear the land and harvest the crops. Different methods, possible path dependence, and distinct institutional arrangements may have led to the differences in productivity; however, the precise differences have yet to be determined. However, differences in productivity may have simply resulted from differences in farm sizes and skill-levels among farmers, both of which are variables more likely to be emphasized by economists rather than historians. The goal of the second study in this dissertation is to identify through quantitative methods why crop output differed on Cherokee and white farms by measuring the impact of differences in both farm endowments and each input's marginal product on the Cherokee-white output gap.

An analysis of the relative performance of Indian farmers, especially Cherokee farmers, is motivated by other reasons as well; the performance of Indian agriculture became the most important criterion in the political battle for maintaining their ancestral land. The line of reasoning, illuminated by philosopher Emmerich de Vattel in his influential book *The Law of Nations*, which served as justification for removal, stated that the right to cultivate land, done by "civilized" men, was superior to the right of "savages" to use the land primarily to hunt.[8] Along with removal advocates such as Andrew Jackson, Wilson Lumpkin, and Lewis Cass, ethnographers, without the same political motivations, made similar yet "unbiased" claims about superior white techniques in farming. Historians often challenge these views by claiming that these first-hand observers, blinded by their own familiar, European customs, often mistakenly described Indian conditions: for example, historian Alice Kehoe claims,

[8]Anthony F.C. Wallace briefly discusses the role of this philosophy on early American opinions on Indian land rights in *The Long, Bitter Trail: Andrew Jackson and the Indians* (New York: Hill and Wang, 1993), 38. The literature on Native American history is replete with examples of the discourse of savagery. Interestingly, this discourse can be traced back to Herodotus, who described Egyptians as people who "urinate sitting down" like animals, whereas others, mainly Greeks, urinate standing up. Herodotus, *The Histories*, tr. Aubrey de Selincort (London: Penguin Books, 1996), II.35.

"The traditional [ethnographic] picture of the Plains Indian woman is really that of an Irish housemaid of the late Victorian era clothed in a buckskin dress."[9] The third study in this dissertation compares white and Cherokee agriculture using information collected in 1850 on tightknit, traditional Cherokee community located in Quallatown, North Carolina. Using manuscript census records collected on both these Cherokees as well as on their white neighbors, the role of traditional Indian team-based production can be compared with that of their more individualistic, white neighbors.

Despite this new wave of research, very little quantitative work has been accomplished. The dearth of quantitative studies is surprising given the glut of data on various Indian groups. This mass of records is primarily due to the role of the federal government in (1) removing Indians east of the Mississippi River by 1840, and (2) maintaining Indians as federal wards from the 1880s onwards.[10] The allocation of resources away from statistical studies can be explained by the inability of historians to move away from "proper" topics.[11] Another explanation is that ethnohistorians often make their subjects so unique, relying heavily on the role of culture in explaining human behavior, that any quantitative study would undoubtedly gloss over the intricacies of Indian behavior. Despite these views, statistical methods have been undertaken; however, the bulk of the studies estimate population trends and migration patterns, rather than test the implications of changes in relative prices on human behavior.

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[9] Alice Kehoe, "The Shackles of Tradition," in *The Hidden Half: Studies of Plains Indian Women*, ed. Patricia Albers and Beatrice Medicine (Washington, D.C: University Press of America, 1983), 53-77; Theda Perdue, *Cherokee Women: Gender and Culture Change, 1700-1835* (Lincoln: University of Nebraska Press, 1998), 5.

[10] Melissa L. Meyer and Russell Thornton, "Indians and the Numbers Game: Quantitative Methods in Native American History," in *New Directions in American Indian History*, ed. Colin G. Calloway (Norman: University of Oklahoma Press, 1988), 5.

[11] Ibid., 18.

Surprisingly, "new" economic historians or cliometricians have generally avoided research on Native American economic history, even though the tools and data are available. The small group of exceptions includes studies on the Great Lakes Indians fur trade behavior, the impact of land allotment legislation, such as the Dawes Act, on farm sizes, and the degree of Cherokee subsistence farming.[12] However, this small literature has not been well-received by other disciplines. In a recent review of quantitative studies on Native Americans, only one economist was mentioned even though an edited volume of work by economists on Native American history was in print well before the publication of the literature review.[13] Given the history of large-scale comprehensive works by economic historians, the reluctance to enter this subset of American history implies that economic historians also have their own list of proper topics. As previously mentioned, the scarcity of economic studies is not constrained by data limitations nor theoretical shortcomings, even though some might think culturally motivated behavior is irrational. As reflected in the following pages, neoclassical economic theory can clearly characterize variations in productivity, differences in marginal products, and developed of labor gangs in Cherokee Indian agriculture; in fact, the analysis in Chapter Four shows that economic categories distinguish differences in Cherokee farm productivity across households better than both cultural or race categories.

Without relying on a set of primary documents, a contribution to Cherokee history would be hard to write. However, the 1835 Cherokee census has not been fully

[12]Ann M. Carlos, and Frank D. Lewis, "Trade, Consumption, and the Native Economy: Lessons from York Factory, Hudson Bay," *The Journal of Economic History* 61 4 (2001): 1037-64. Leonard Carlson, "Land Allotment and the Decline of American Indian Farming," *Explorations in Economic History* 18 2 (1981), 128-54. David M. Wishart, "Evidence of Surplus Production in the Cherokee Nation Prior to Removal," *The Journal of Economic History* 55 1 (1995): 120-38.

[13]Meyer and Thornton, "Indians and the Numbers Game." Linda Barrington, ed. *The Other Side of the Frontier: Economic Explorations into Native American History* (Boulder: Westview Press, 1999).

exploited. This census, collected by the War Department in 1835, contains agricultural information on every Cherokee household living east of the Mississippi River. Often mentioned by historians but rarely analyzed, this data set provided the first attempt by the U.S. federal government to obtain household-level information on various agricultural inputs and outputs. It was not until the 1850 U.S. Census of Agriculture that the federal government obtained similar household-level agricultural data on white farms. Only two other studies have exploited this detailed data set: Historians William McLoughlin and Walter Conser, Jr., used the census to determine the degree of economic stratification in Cherokee Nation as well as the lack of acculturation in the North Carolina region of the Nation; and economist David Wishart estimated subsistence levels for each households to show that a majority of Cherokees were self-sufficient.[14] This study, by incorporating econometric techniques, historical evidence and economic theory, conducts a productivity analysis on these data as well as makes comparisons to white farmers using household-level data in an effort to extract more information on Cherokee agriculture than previously analyzed.

In its aftermath of "The Trail of Tears," state governments established counties and sold the land either in land lotteries or at land offices to fortunate whites as soon as it was surveyed. Households located in the counties which represented the majority of the former Cherokee Nation were sampled and information on these recently emigrated households was matched across the population, slave, and agricultural schedules, collected for the seventh Census of the United States. This sample is created from the original figures enumerated by census marshals who travelled to each household to collect this information. Since it is widely known that the

[14]William G. McLoughlin, and Walter H. Conser, Jr., "The Cherokee in Transition: A Statistical Analysis of the Federal Cherokee Census of 1835," *The Journal of American History* 64 3 (1977), 678-703; David Wishart, "Evidence of Surplus Production," 120-38.

manuscript censuses are far more accurate that the summaries of these data listed in the published censuses, these data provide a clearer depiction of individual farm production during the late antebellum period. This sample represents one of the few such data sets from this particular census, as the majority of historical census-oriented studies of Southern agriculture come from either the 1860 or 1880 U.S. Census. Furthermore, until recently, the upcountry, which roughly characterizes this region, has been relatively ignored by economists and historians of the South. Due to the dearth of agricultural studies of this region, this sampling was necessary to make appropriate comparisons of Cherokee and white farming techniques. Unfortunately, the Cherokee and white data are dissimilar in some important ways; mainly, physical capital and total crop output have to be uniquely specified. Thus, the comparisons will be judged in terms of the sensitivity of the results to different input and output specifications. Despite data limitations, these white data fill the void of studies using the Cherokee census by creating a comparable data set.[15]

The dissertation is structured in the following way. Chapters Two and Three will discuss the Cherokee and white data in detail as well as the definitions of variables used through the study. Non-slave, or free, and slave farms in Cherokee Nation are analyzed separately in Chapters Four, since the use of slaves reflect a different production process than that of free farms. Chapter Five analyzes the differences in grain output between Cherokee farms and the white farms who later cultivated the same land. Chapter Six estimates the level of self-sufficiency among Cherokees and white farmers who both lived in Haywood County, North Carolina in 1850. A large contingent of Cherokees were mistakenly counted by the assistant marshals enumerating the western portion of North Carolina because these Cherokees were not yet official U.S. citizens. This mistake allows a contemporaneous comparison of white and Cherokee agriculture.

[15]McLoughlin and Conser, Jr., "The Cherokee in Transition," 678.

The use of econometric techniques on Cherokee and white agriculture adds to the present literature in a number of ways. The problem of any social history is in determining how representative observations on a small group of people are of the Indian group as a whole. Given that the majority of records left behind by Cherokees were written by the elite Cherokees, the majority of poor farmers typically has received much less attention. Revisionist historians had augmented this by analyzing records by Indian agents, missionaries, or ethnographers. In this study, these Cherokee households receive a voice when the individual farm productivity of roughly 2,300 households is estimated. The long and well-known debate on antebellum slave efficiency had left in its path a host of improvements and revisions which help make estimated productivity measures less dubious. Since the publication of Robert Fogel and Stanley Engerman's *Time on the Cross*, the field of productivity analysis has developed its empirical methods to the point where the combinations of the two fields can improve the accuracy of productivity measures, especially given the lack of data on input prices.

Figure 1.1: Cherokees in the Southeast, 1835

Map drawn by Wendy Giminski, Campus Graphics and Photography, University of Georgia.

Chapter 2

The 1835 Cherokee Census

"I do not yet comprehend the necessity for a census."[1]

The enumeration of the Cherokee census, collected under the leadership of Major Benjamin F. Currey, Superintendent of Cherokee Emigration, took place during the summer and fall months of 1835. At the time, Cherokee Nation, which was contained within four Southeastern states (Alabama, Georgia, North Carolina, and Tennessee), represented a much smaller version of its prior territory.[2] The census contains household-level data on a variety of information such as the number of male and female slaves, the age and gender of each household member, and the number of bushels of wheat and corn produced. In all, there are thirty-three different census categories. Each state had a separate census taker, except for Georgia, which had two enumerators since it held roughly half of the Cherokee families living east of

[1]The statement was made by the Commissioner of Indian Affairs Elbert Herring in a letter sent to Major Benjamin F. Currey, who was in charge of the enumeration of the 1835 Cherokee census, as well as to each census taker. Even though Currey had verbal approval from the Secretary of War Lewis Cass, there was some concern by Herring, Cass, and the President of the United States about Currey's motivation to collect this information. However, their concerns came well into the census taking process and, using poor economic reasoning, these politicians decided the census should be completed because of the low marginal cost (even though, in their eyes, the marginal benefit was zero). Gaston Litton, "Enrollment Records of the Eastern Band of Cherokee Indians," *The North Carolina Historical Review*, XVII 3 (1940), 205fn31.

[2]It is estimated that at its height of power in the 17^{th} century the Cherokees claimed 40,000 square miles in areas of the Carolinas, Georgia, Tennessee, Kentucky, Alabama, and the Virginias. John R. Finger, *The Eastern Band of Cherokees 1819-1900* (Knoxville: The University of Tennessee Press, 1984), 4.

the Mississippi River.[3] In Currey's words, the purpose of the census was "to be fully possessed of a knowledge of their number, the number of each man's houses, the number of his farms, with the quantity of land under cultivation, the proportions of tillable land, the mineral resources and water privileges of the county, etc., the commissioners would be able to fix a true estimate upon the value of the country in case the whole title does not approve the gross sum fixed upon already."[4]

Currey, in mentioning the "sum fixed upon already," is referring to a "preliminary" treaty developed by the U.S. Senate, with the assistance of a small band of Cherokee removal advocates, led by Major Ridge, in February 1835. The terms of this treaty were set at $4.5 million for the entire Cherokee territory; however, the treaty held the provision that the Cherokee Nation would have to ratify the treaty. In October 1835, the Cherokee National Council, which included Major Ridge and other removal advocates, met in Red Clay, Tennessee, and unanimously rejected the terms of the treaty. The federal agents attending the meeting, who included Benjamin F. Currey and negotiator Reverend Schermerhorn (a retired New York minister), responded by setting another meeting in an effort to negotiate a new treaty, this time in New Echota, Georgia. In the eyes of Reverend Schermerhorn, "The Lord is able to overrule all things for good."[5] These negotiations led to the Treaty of New Echota, which was signed by a small number of Cherokees (called the "Treaty Party") on December 29, 1835, and which set the terms of total cession at "a sum not exceeding five million of [sic] dollars." However, by December, the census

[3]In the sorted sample, Georgia contained the most number of Cherokee households at 1177, followed by North Carolina (618 households), Tennessee (360 households), and Alabama (189 households).

[4]George Nixon, "Records Relating to Native American Research: The Five Civilized Tribes" in *The Source: A Guidebook of American Genealogy*, ed. Arlene Eakle and Johni Cerny (Salt Lake City, 1984), 535; Wishart, "Evidence of Surplus Production," 124.

[5]John P. Brown, *Old Frontiers: The Story of the Cherokee Indians from Earliest Times to the Date of Their Removal to the West* (Kingsport: Southern Publishers, Inc., 1938), 496-97.

was completed; therefore these figures reflect a period where some Cherokees held a flicker of hope that they still could live on their remaining ancestral land. However, the majority of these farmers had already reacted to the inevitable removal by adjusting their economic behavior. For example, as shown later, the accumulation of physical capital, in the form of slaves, and human capital, shown in their literacy rates, paralleled, if not surpassed that of their white neighbors, as investments in immobile forms of capital, such as land improvements, were far lowered.

To help mitigate the hostility between whites and Cherokees, the federal census takers were each assisted in their count by Cherokee interpreters. The enumerator for the North Carolina region of Cherokee Nation, Nathaniel Smith, was the only census taker to run into major difficulties. After arriving at John Christie's residence, Currey "found it impossible to proceed in consequence of evil disposed persons having preceded me and spread a report that I had been appointed to enroll them secretly for emigration."[6] In letters sent to Major Currey and Principal Chief John Ross, Smith complained of being chased off property. In response, John Ross, in a written statement which was read at a regional council meeting, discussed the census as an opportunity to enlighten the government on their progress in the "civilization" program: "I protest against his [John Christie's] refusal and insist that the President has a right to take your numbers in any manner that he may think proper to direct. I do not ask it as a favor but claim it as a right to proceed in taking your numbers and will view your refusal as a direct declaration that you have no friendship for the Government of the United States."[7] After this letter was read, there was no mention of any more problems with the enumeration of the North Carolina region.[8]

[6]Litton, "Enrollment Records of the Eastern Band of Cherokee Indians," 204.

[7]Ibid.

[8]Benjamin F. Currey to Lewis Cass, Sept 7, 1835, in *Letters Received by the Office of Indian Affairs 1824-1881.* Microcopy 234, Record Group 75, U.S. National Archives, Washington, D.C. Nathaniel Smith to B.F. Currey, in *Letters.* For the correspondence

2.1 A Selection from the Cherokee Census

A sample page from the 1835 Cherokee census of households living in McMinn and Hamilton County, Tennessee, is shown in Figure 2.2. This page includes the largest slaveholder in Cherokee Nation, Joseph Vann or "Rich Joe," son of a former Cherokee chief, James Vann. James Vann, himself a son of a Scottish trader who married a Cherokee women, was notorious for his alcohol-induced violence, which finally led to his assassination in 1809.[9] James Vann bequeathed his entire property, which at the time included many slaves, to his son. His bequest is evident in the size of Joseph's real property, although Joseph did expand his wealth as well. Although located in Hamilton County in 1835, this was not the original site of the Vann's family residence. After the 1832 Georgia Land Lottery, which gave winners the first right to Cherokee land upon removal, white encroachers, most of whom were lottery winners, forced Joseph Vann and his family −− along with other wealthy Cherokee households −− to relocate from their original home in Spring Place, Georgia (presently located near Calhoun, Georgia) to a safer environment just across the border in Red Clay, Tennessee.

Interestingly, this inheritance represented a major departure from the traditional methods of passing down farm property in the matrilineal Cherokee society. In the past, land improvements were owned by Cherokee women, as married males spent a significant amount of time away from their "home" residence, either hunting or living in large communal buildings along with other married men. When James Vann, a mixed-blood Cherokee, claimed rights to his real estate, the Cherokee tribal council stepped in and diverted some of his wealth to his wives, all five of them. However,

between John Ross and Nathaniel Smith, see *The Papers of Chief John Ross*, ed. Gary E. Moulton (Norman: University of Oklahoma Press, 1985).

[9]James Vann's epitaph reportedly reads: "Here lies the body of James Vann; He killed many a white man; At last by a rifle ball he fell; And devils dragged him off to hell." Halliburton, *Red Over Black*, 26.

most of the inheritance, as shown in this page, went to Joseph. Obviously, married white males put pressure on the stable foundations of the Cherokee matrilineal society.

This census page also illustrates the degree of heterogeneity that existed among Cherokee farmers. Joseph Vann, along with fellow slaveholders Ailsey Eldridge and William Blythe, embodied the elite Cherokees who owned a substantial amount of real property such as mills, ferry boats, and houses. On the other hand, there were Cherokees like Four Killer, Crow Mocks, and Akeney who held no slaves and lived in large full-blood households with little or no real property. Interestingly, the households who sold their surplus corn to the market are not a salient feature of this page or of the census as a whole. Of course, most slave farms on this page sold their crops, but even some of the Cherokees who could be characterized as "traditionalists" (ones who illustrated the persistence of cultural traditions) sold their crops. For example, Four Killer headed a family of ten full-blooded Cherokees that did not contain a married white or any readers of English, yet sold their corn surpluses, probably at a local trading post. Going Snake, with eight full-blood family members and no readers in English, cultivated an average-sized plot of land and managed to accumulate a fair amount of real property, as well as produce enough marketable surpluses to sell thirty bushels of corn to the market.

This sample page does not accurately reflect the number of married whites, mostly likely married males, in Cherokee Nation. Marriages between white males and Cherokee women were not as frequent as this page reflects, which is considered by some as one of the more surprising features on the census.[10] There was a total of 158 married whites in Cherokee Nation. This page alone contains twenty-one or 13.29% of the total number.

[10]McLoughlin and Conser, Jr., "The Cherokee in Transition," 678-703.

2.2 Summary Statistics from the Census

This census has been viewed as a "lower-bound" estimate for Cherokee progress, not because crop output was underestimated, but rather "until a means is found to extrapolate more complete estimates of family or farm income and the wealth generated from trade, timber, minerals, water power, and other resources."[11] There are still no feasible ways to estimate lumber production since unimproved acres were not listed in the census. Unlike early American farmers, Cherokee farmers did not hold the title to their land; it was held in common by the Cherokee National Council. But they did have usufructuary rights to their plots.[12] Therefore, uncultivated land, at least for long periods, would not have been considered personal property of an individual Cherokee. Therefore, the exclusion of unimproved acres is not completely the fault of the designers of the census. Dairy production was most likely minimal, or at least much lower than on white farms, given the historical evidence of the slow adoption of livestock on Indian farms. The economic reason for the low levels for livestock was that livestock was a normal good and a majority of the Cherokees were far poorer, which is reflected by the small average farm size, than their white neighbors; thus the demand for livestock would have been lower on Cherokee farms. Despite these data shortcomings, no historian has seriously questioned the integrity of the counts by these census takers. Most of the census figures correspond with the existing knowledge of Cherokee history.[13]

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[11]William G. McLoughlin, *Cherokee Renascence in the New Republic* (Princeton: Princeton University Press, 1986), 298.

[12]John Phillip Reid calls this form of property rights "communal in principle but private in practice." John Phillip Reid, *Law of Blood* (New York: New York University Press, 1970), 130-33; Kahled J. Bloom, "An American Tragedy of the Commons: Land and Labor in the Cherokee Nation, 1870-1900," *Agricultural History* 76 3 (2002), 499.

[13]McLoughlin and Conser, Jr., "The Cherokee in Transition," 678. There is no doubt that some of the figures may be inaccurate as evident in Georgia census taker C.H. Nelson's affidavit: "[T]he other times of information under their appropriate heads are as correctly

Of the 2,670 households contained in the Cherokee census, only the corn-producing households that held a positive amount of land and houses were included in this study. This represents 87.79% of the total observations, or 2,344 households. Of the households sampled, 190 households or 8.10% of the sample held slaves.[14] The majority of the observations left out of the study, where the census purports that Cherokee families neither held land nor produced crops, typically appear in large bunches. Therefore, there was no feasible way to aggregate the observations with "missing" information with other households that contained a full account of agricultural information. Instead of incorrectly aggregating specific households together, which would introduce measurement error, the households with incomplete information were purged. The exclusion of households with zero values in important categories has been done in the past, as the Parker and Gallman sample, the workhorse for economic historians in studies on the antebellum South, did omit households with zero values for either improved acres or crop output. Regardless, it is later shown that this sample is representative of the entire Cherokee census.

Free and slave farms are disaggregated and analyzed separately because of the different participation rates among the household labor on these farms as well as the different production processes on these two types of farms. Tables 2.1 and 2.2 reflect the different population characteristics on these types of Cherokee farms. One similarity between the two groups is that the large extended families, which used to be characteristic of traditional Cherokee household patterns, have been essentially eliminated from their society. The average number of household members corresponds with the average size of white households who later moved into this area. Other sim-

stated as practicable without a precise and thorough examination of each subject respectively." 1835 Census Roll of the Cherokee Indians East of the Mississippi and Index to the Roll, Records of the Bureau of Indian Affairs, Record Group 75.

[14]There is a total of 209 slaveholders in the entire census; however, some of the households apparently did not produce any output. The percentage of slaveholders in the population is 7.83%, which is roughly the same as the sample.

ilarities between free and slave farms include the number of farmers and mechanics over the age of 18, and the number of weavers and spinsters in a household.[15]

The number of weavers and spinsters is a vitally important category in this census, even though these totals are directly specified in the empirical analysis. 2,158 households, or 92.06% of the sample, contain at least one weaver or spinster. The adoption of the domestic arts by Cherokee women has been discussed at length in prior studies; however, the usage of looms in these households has never attempted to show a change of traditional gender roles in the household. Rather, historians show that this evidence supports the view that Cherokee women were more welcome to the "civilization" program than Cherokee men.[16] Another interpretation for the proliferation of weaving among Cherokee women is that Cherokee women were responding to changes in relative prices within the household. Through the annals of time, farm households have changed their division of labor in the face of changes in the relative price of farming. Since males were typically stronger than females, males have generally substituted towards farming when the relative price of working in the best alternative occupation −− typically hunting during a horticultural period −− increased. Likewise, women substituted away from farming and towards domestic arts when the relative price of farming (e.g. the amount of yarn spun per hour spent in the fields) increased. When both household members play off each other's comparative advantage, the resulting occupational decisions are reflected in these relative prices. The number of weavers and spinsters in Cherokee society provides *a priori* evidence of a change in traditional household gender roles, as one would expect when relative prices change.

[15]The number of weavers and spinsters reflects the number of women in the household who could operate a loom.

[16]Theda Perdue, "Women, Men, and American Indian Policy," in *Negotiators of Change: Historical Perspectives on Native American Women*, ed. Nancy Shoemaker (New York: Routledge, 1995), 90-114; Saunt, *A New Order of Things*, 140fn4.

Furthermore, the differences between slave and non-slave households are most apparent in the racial composition of the household. Mixed-blood Cherokee households, here defined as non-full-blooded members of the household, were more characteristic of slaveholders than traditional, full-blooded families.[17] Besides the race categories, which are not the only way or the best way to distinguish between traditionalists and assimilationists, the number of readers in Cherokee and English, and the number of married whites are clearly different on these two farms. The written Cherokee language was a recent invention, developed by Sequoyah, a Cherokee who could not read English, which was adopted by the Cherokee council in 1821.[18] The written language should have been adopted faster by full-bloods, who far outnumber mixed-bloods, because of their knowledge of the oral language. Take, for example, Alexander McGillivary, a mixed-blood Creek Indian who negotiated many land treaties on behalf of his fellow Creeks. He had no knowledge of the Creek language at all, relying on an interpreter to communicate with his fellow Creeks. Yet, the Cherokee language, along with the English language, was commonly taught in missionary schools, so the Cherokees who were more supportive of the "civilization" program would have been also more likely to learn the written language. Therefore, the determinants of readers in Cherokee is an empirical issue and the last section of Chapter Four addresses these issues through the estimation of a Probit model.

[17]The census separates race categories into six categories: full-bloods; halfbreeds; quadroons; mixed Catawba; mixed Spaniards; and mixed black. In other studies, mixed bloods are defined as the children from marriages between white males and Native women. See Perdue, *"Mixed Blood" Indians*, ix; Saunt, *A New Order of Things*, 2-3. Given the census categories, mixed-blooded Cherokees are classified as any household contains at least one halfbreed which most likely reflects a child from a mixed marriage.

[18]Sequoyah, who along with several other Cherokees, voluntarily moved to lands in Arkansas in 1817. There, he developed the 86 letter Cherokee syllabary. For biographies of Sequoyah, see Grant Foreman, *Sequoyah* (Norman: University of Oklahoma Press, 1938); Jack Frederick Kilpatrick, *Sequoyah of Earth and Intellect* (Austin: The Encino Press, 1965); Amy H. Sturgis, *From Aniyuwiya to Indian Territory: Cherokee Civilization, 1500-1839* (Ph.D. Dissertation: Vanderbilt University, 1998), Chapt. VI.

Tables 2.3 and 2.4 contain agricultural-specific information from this census on free and slave households. Each type of farming inputs and crop outputs is significantly different on slave and non-slave farms. Clearly, the slave farms were much larger than free farms. On average, slave farms cultivated six times more acres than free farms. The greater number of houses on slave farms reflects the higher demand for dwellings (i.e. slave cabins) on these farms. The use of slave cabins implies that the adoption of slaves into a Cherokee family, a characteristic of seventeenth and eighteenth century Cherokee society, was not very common on most slave farms. In fact, of the 39 Cherokee households that held only one slave, only two households shared their home with their slave. This is rough evidence that in these two households, slaves could have been adopted into the family. Although conventional wisdom states that Cherokee masters were typically kinder to their slaves than white masters, the large number of houses on slave farms implies that living arrangements on the surface appear quite similar to those of their white counterparts.

Since acres cultivated was higher on slave farms, total corn and wheat output was, on average, greater on slave farms; however, corn yields were not dramatically different. The wheat yields were higher on slave farms, reflecting more variation in their crop mix.[19] The greater level of bushels of corn and wheat raised implies higher levels of crops sold and thus, corn income levels are higher on slave farms. 123 slave households or 64.74% of all slaveholders who sold some crop output to the market, while only 31.10% of the free Cherokee farmers sold bushels of corn on the market. The high corn expenditures was reflected in the additional demand for food by slaves.

[19]In general, smaller farms were typically less diversified than larger farms. One explanation for this is that economies of scope only existed on large farms as cultivation of a variety of crops would have increased productivity, and lowered average costs. For example, the labor requirements for corn and cotton were similar. Another explanation is that larger farms sell a larger percentage of their crops to the market, and diversification allows for mitigating market risk.

The preceding discussion summarizes some of the key aspects of the Cherokee census. The data were segmented to capture the different methods of cultivating land on slave and free farms. The next section explains the specification of the output and input variables used throughout the study. One particular variable, household labor, will be uniquely specified, since gender roles and participation rates differed on these two types of farms.

2.3 Cherokee Output and Input Variables: Definitions

2.3.1 Crop Output

The output variable is computed by converting bushels of wheat into corn-equivalents units and then aggregating them together with the bushels of corn produced. Corn-equivalent units are based on the nutritional value of food crops relative to corn which is highly correlated with the relative weight of a bushel of wheat. The nineteenth-century conversion rate of wheat to bushel of corn was estimated at 1.104.[20] Seed requirements are subtracted from total output so as not to double-count the level of output. These requirements reflect the estimated amount of seed needed to obtain the same amount of crops in the next year. The seed requirements are given as 5% of the corn output and 12% of the wheat output.[21] Feed requirements will not be subtracted, since the individual levels of livestock for each Cherokee household are unknown. However, the feed requirements could not have been substantial, as the

[20]Roger L. Ransom and Richard Sutch, *One Kind of Freedom: The Economic Consequences of Emancipation* (Cambridge: Cambridge University Press, 1977), Table E.2, 247. This estimate corresponds closely to nutritional values published in the *Rural Carolinian* in 1870 as well as other sources. Lee Craig's conversion rate of 1.00 was taken from a different source, F.B. Morrison, *Feeds and Feeding: A Handbook for the Student and Stockman* (Ithaca: Morrison, 1955), Table II. The imputed conversion rate from the Rural Carolinian is closer to Ransom and Sutch's estimate, therefore their estimate will be adopted; however, the difference between the two are trivial.

[21]These seed requirements were listed in U.S. Patent Office reports on white farmers from the Upcountry shortly after removal. David F. Weiman, "Farmers and the Market in Antebellum America: A View from the Georgia Upcountry," *The Journal of Economic History*, 47 3 (1987), 634fn26.

use of livestock lagged well behind that of their white agricultural counterparts in the early nineteenth century. The data on the North Carolina Cherokees in 1850 in Haywood County, North Carolina prove evidence of the low supply of livestock on poor, subsistent Cherokee farms. The output variable is therefore specified as:

$$CROP\,OUTPUT = CORN * 0.95 + WHEAT * 0.88 * 1.104.$$

2.3.2 Household Labor

For both free and slave farms, the household field labor variable is converted into equivalent field hands by using labor force participation rates as weights. But first, the married white category needs to be gendered. The percentage of white males in this group can be estimated by incorporating information from two highly aggregated censuses taken in the mid-1820s which listed that 69.2% and 70.2% of the total married white population in Cherokee Nation were males.[22] Therefore, the adult male and female category is given as

$$ADULT\,MALES = (MALES\ \geq 18) + (0.7 * MARRIED\,WHITES),$$

$$ADULT\,FEMALES = (FEMALES\ \geq 16) + (0.3 * MARRIED\,WHITES).$$

The household labor variable is specified in two ways: (1) on slave farms, by adopting the labor force participation rate typically used on antebellum slave efficiency studies and testing this aggregation through econometric techniques; and (2) on free farms, by determining the labor force participation rates solely through econometric methods since Cherokee labor force estimates do not exist.[23] In past

[22]For further information on these national-level censuses, see Elias Boudinot, *An Address to the Whites. Delivered in the First Presbyterian Church, on the 26th of May, 1826* (Philadelphia: W.F. Geddes, 1826) and the *Cherokee Phoenix*, June 18, 1828.

[23]For studies that use similar labor force participation rates on slave farms, see Robert W. Fogel and Stanley L. Engerman, *Time on the Cross: Evidence and Methods-A Supplement* (Boston: Little Brown and Co., 1974), 131; Elizabeth B. Field, "The Relative

studies, economic historians estimated that males 16 years old and over have a 100% participation rate on slave farms, while males aged 10 to 15 participate 17% of the time on slave farms. Over time, the latter participation rate has been shown to be underestimated.[24] For this study, the four-state average from Thomas Weiss's reestimation of the antebellum labor force for males between ten and fifteen is used and modified slightly for the under-eighteen Cherokee male category. The average participation rate in Georgia, Alabama, North Carolina, and Tennessee in 1850, the earliest estimate available, was 46%. The participation rate for Cherokee males under 18 is slightly adjusted upward to incorporate the males aged over fifteen who historically always work on slave farms, while noticing that males under ten, though there are some reports of children working on farms as early as seven, typically did not work on these farms. Therefore, the household field labor variable on slave farms is initially given as

$$FREE = (0.5 * MALES < 18) + (ADULT\ MALES)$$

This aggregation implies that both males under and over the age of 18 were substitutes; therefore, they were similar inputs. The aggregation can be tested with an OLS regression of output on each input variable. First, the output variable is logged to reduce the variance in the crop output data. Then, individual likelihood-ratio (LR) tests are conducted to determine which inputs significantly impacted grain output. Consistent with the previously-mentioned studies on Southern slavery, both

Efficiency of Slavery Revisited: A Translog Production Function Approach," *The American Economic Review* 78 3 (1988): 543-49.

[24]Fogel and Engerman obtain their participation rates from Stanley Lebergott's estimates of the antebellum labor force; however, Thomas Weiss has shown that there are some errors in those initial calculations. Stanley Lebergott, "Labor Force and Employment 1800-1960," in *Studies in Income and Wealth* (1966) Vol. 30, 117-204. Thomas Weiss, "U.S. Labor Force Estimates and Economic Growth, 1800-1860," in *American Economic Growth and Standards of Living before the Civil War*, ed. Robert E. Gallman and John J. Wallis (Chicago: The University of Chicago Press, 1992), 49.

Cherokee female variables are determined not to significantly impact grain output.[25] Once the insignificant inputs are omitted, the hypothesis that $\beta_{\geq 18} = .5\beta_{<18}$ is failed to be rejected at standard significance levels; therefore, the aggregation is appropriate in a statistical sense.[26]

Given this result, the conclusion that gender roles on white slave farms were the same as on Cherokee slave farms can certainly be questioned since the adoption of slaves has been viewed as an example of male substituting away from "women's work" by buying slaves and making them work for them. Yet, this interpretation appears dubious considering the rising slave prices which characterized the ante-bellum period. If the marginal benefit of holding a slave was equal to the marginal cost of a slave, which must occur in this scenario, then as slave prices rose, Cherokee males would have substituted out of holding slaves and towards either working on the farm or requiring the women and younger males of the household to work.[27]

The participation rates on free Cherokee farms involve more creativity, because the gender roles historically have been completely unlike Euro-American farms. Despite typically labelling agriculture "women's work," males did assist women in

[25]The joint hypotheses test that the marginal product of females under and over 16 is statistically significant generates a LR statistic of 3.148 with a critical value of 5.991 at the 5% level.

[26]The following regression conducts this hypothesis test:

$$\underset{}{\ln Q_i} = \underset{(0.14)}{5.310} + \underset{(0.06)}{0.048}\ Men_i + \underset{(0.04)}{0.083}\ HH_i + \underset{(0.00)}{0.008}\ L_i + \underset{(0.01)}{0.020}\ K_i + \underset{(0.13)}{0.335}\ Soil_3.$$

where $\ln Q_i$ is log output, Men_i is Cherokee males over 18, HH is $.5 * Men_i + Boys_i$, L_i is cultivated acres, K_i is the number of houses, and $Soil_3$ is a soil type dummy. The coefficient on $boys_i$ indicates whether the null hypotheses ($\beta_{\geq 18} = .5\beta_{<18}$) should be rejected, since this coefficient can be rewritten as $\beta_{boys} = \beta_{\geq 18} - .5\beta_{<18}$. Since the point estimate is statistically insignificant, the null hypothesis cannot be rejected.

[27]Formally, the necessary condition, given the claims that slaves were acquired to allow males to avoid farm work, is $\frac{MU_{la}}{MU_S} = \frac{p_{la}}{p_S}$ where MU_{la} is the marginal utility of working in the fields, MU_{le} is the marginal utility of holding a slave, p_{la} is the price of labor, and p_S is the price of a slave.

Figure 2.1: Joint Household Production on the Farm

Source: Stefan Lorant, ed., *The New World: The First Pictures of America* (New York: Deull, Sloan & Pearce, 1946), 77.

field work, in particular in clearing fields and harvesting crops. In an account of his exploration to Roanoke Island in 1585, Thomas Harriot wrote: "a fewe daies before they sowe or set, the men with wooden instruments, made almost in forme of mattockes or hoes with long handles; the women with short peckers or parers, because they use them sitting, of a foote long and about five inches in breadth; doe onely breake the upper part of the ground."[28] Roughly twenty years earlier, painter Jacques le Moyne, illustrated this division of labor in a painting of Timucuan Indians, who were located in East Florida (see Fig. 2.1). This picture shows males breaking up the soil with hoes made of fish bones, while the women were planting either corn or bean seeds. Furthermore, famous American anthropologist John Swanton wrote of 18^{th}-century Natchez women and males working on the farm in a similar manner. In terms of the Cherokee, the extent of male farmers is not

[28]Herndon, "Indian Agriculture in the Southern Colonies," 289-90.

completely known, but can be gleaned from the 1835 Cherokee census. There are numerous examples of males abstaining from farming and examples of males taking up the plow. Not all Cherokee households faced the same relative prices as Cherokee males substituted out of hunting and into other occupations listed in the census such as running mills, operating ferryboats, or farming. In fact, a proponent of the persistence of female gender roles throughout the nineteenth century, historian Theda Perdue, claims that "the novelty of the plow, its status as a gift of the federal government, the example of white men, and the association of the plow with horses may have led increasing numbers of Cherokee men to become directly involved in farming. More than likely, however, men adopted the new technology of plow agriculture while women continued to perform more traditional tasks, such as hoeing, associated with farming."[29] Prior censuses have shown a steady increase in the number of livestock in the country, which implies that the number of plows drawn by horses, and thus the participation of males in plow agriculture, increased as well.

To determine which gender and age groups contributed to grain output, a regression model is specified with a logged output as the dependent variable and males under and over 18, females under and over 16, capital, acres, and two soil type dummy variables are used as explanatory variables. Surprisingly, both coefficients on females above and under the age of 16 were statistically insignificant, yet the coefficients on both male age groups were statistically significant.[30] The male age groups are pooled together to determine whether aggregating these two groups is appropriate. The linear restriction $\beta_{boys} = \beta_{men}$ was tested and failed to be rejected at standard significance levels.[31] Assuming males over the age of 18 had a labor force

[29]Perdue, *Cherokee Women*, 126-27.

[30]The individual LR statistics for females above and below the age of 16 are 1.482 and 0.0071, respectively. The null hypothesis that the coefficients on males under 18 and males over 18 are individually zero is rejected as the LR statistic is 19.782 for males over 18 and 12.559 for males under 18.

[31]The following regression is specified to conduct this hypothesis test:

participation rate of 100%, a variety of possible weights for Cherokee males under 18 were used; however, all possible combinations were rejected at the 10% significance level. Therefore, the household labor variable used on free farms is specified as

$$FREE = (\ MALES < 18) + (ADULT\ MALES)$$

Prior works on Cherokee gender roles commonly claim that women held on to their obligation to farm during the "civilization" program; therefore, one would except a large percentage of adult women to participate in agriculture. Therefore, are these results simply a reflection of an inaccurate data set? The answer is an affirmative no. Most Cherokee males main alternative to farming was eliminated due in part to the selling of their hunting grounds as well as due to the general deterioration of the deer population in the Southeast. This increase in the relative price of hunting certainly would have increased the male's participation in agriculture. Even though precise records on Cherokee labor force participation rates do not exist prior to removal, in 1850, the community of Cherokee Indians in North Carolina, which avoided removal, had their occupations listed in the U.S. Census of Agriculture. In this community, 87.50% of the head of households listed in the census manuscripts were male farmers as 19.17% of these households contained additional male farmers as well. Only five households or just above 4% of the total number of Cherokee households held female heads of households who, although no occupation was listed for these women, cultivated crops on their farms. This high degree of male participation in agriculture is consistent with the regression results listed earlier and thus

$$\begin{array}{cccccccc} \ln Q_i = & 3.710 & - 0.39\ Men_i & + 0.094\ HH_i & + 0.032\ L_i & + 0.078\ K_i & - 0.119\ Soil_1. \\ & (0.07) & (0.03) & (0.02) & (0.01) & (0.03) & (0.04) & \end{array}$$

where $\ln Q_i$ is log output, Men_i is Cherokee males over 18, HH is $Men_i + Boys_i$, L_i is cultivated acres, K_i is the number of houses, and $Soil1$ is a soil type dummy. The coefficient on $boys_i$ indicates whether the null hypotheses ($\beta_{\geq 18} = \beta_{<18}$) should be rejected. The t-statistic of -1.581 on Men_i shows that the null hypothesis should not be rejected.

the specification of the household labor variable on free farms. Undoubtedly, some males did not farm, while the women in these households continued to farm. Some Cherokees, albeit a very small percentage (only 22 households), owned and operated mills and ferryboats. Therefore, within these households, the division of labor would have been between managing the mill or ferryboat and laboring in the fields. The optimal division of labor depends on the comparative advantage on males and females within the household. Since Cherokee males ran the mills and ferryboats in the Nation, the fieldwork would have accomplished by Cherokee women.

The impact of differences in comparative advantage of among household members in families that held mills and farms rather than only farms can be analyzed with the Cherokee data. By specifying an OLS regression of log grain output on all farm inputs along with interacting each input with a dummy variable which is 1 for the households that owned a mill or ferryboat and 0 otherwise, the difference in the marginal product of males and females between these two types of households can be determined. Using only data on free farms, the results from the OLS regression, once statistically insignificant regressors are dropped, are located in Table 2.5. These results show that, as in the earlier case, an additional female on the majority of Cherokee farms did not significantly generate greater output as males, both young and old, were the household members who contributed the most to grain output on non-mill households. However, on households containing either mills or ferryboats, as expected, the coefficient on the adult female interaction is highly significant and positive. Thus, the marginal product of an adult Cherokee women was 57.4% greater than the marginal product of adult Cherokee women in all other types of household. Even though the interaction term was slightly statistically insignificant, the sign on the interaction tern on adult males was negative which gives some evidence, albeit

imprecise, that the marginal productivity of males was lowered on these farms.[32] The lower land productivity on households with mills and ferries is due to the higher average levels of acres cultivated on these farms, 51.59 acres, than on the average level for free farms, which was 12.64 acres.

2.3.3 Slave Labor

Elizabeth Field determined through separability tests and estimates of elasticities of substitution that free and slave labor were dissimilar inputs on antebellum Southern farms.[33] Therefore, the free and slave labor variables are first disaggregated. Fogel and Engerman assume that all slaves, both male and female, over the age of ten worked on antebellum Southern farms. Weiss later estimated that roughly 75% of the rural slave population over the age of 10 was engaged in agricultural production prior to 1860. Since the census does not give the ages of the slaves, adjusting the slave variable by a suitable labor force participation rate will only rescale the variable. The high level of collinearity between male and female slaves limits the ability of using LR tests to determine reasonable aggregations. Therefore, the slave variable will simply be the total number slaves, both male and female, held by each Cherokee slaveholder. Thus,

$$SLAVE = (MALE\ SLAVES) + (FEMALE\ SLAVES).$$

2.3.4 Land

The land variable is specified as the number of acres cultivated, which is identical to the number of improved acres, a common category in U.S. agricultural schedules. In past farm productivity studies, improved acres, rather than also including

[32]The p-value on $MFD * (Men)$ was .220. When it is included, the marginal product of adult males do not change, but the marginal product of adult female increases while remaining highly statistical significant.

[33]Elizabeth B. Field, "Free and Slave Labor in the Antebellum South: Perfect Substitutes or Different Inputs?," *The Review of Economics and Statistics* 70 4 (1988): 654-59.

unimproved acres, is used to specify the land variable.[34] Other studies on total farm output, in particular studies on northern agriculture, use unimproved acres to determine estimated levels of lumber output; however, due to data limitations, lumber output will be not estimated and therefore an estimate for unimproved acres will not be taken.[35] However, a common criticism of Fogel and Engerman's work is not the omission of unimproved acres but rather the role of land quality in their productivity estimates. Field adjusted their land variable by multiplying improved acres by a soil quality index, which was computed by estimating mean crop yields of each soil type in the Parker-Gallman sample. This method, albeit creative, introduces unnecessary simultaneity since greater output levels would increase the adjusted land variable and vice versa. Therefore, three separate dummy variables, one for each soil type, will be used in this study. Cherokee Nation in 1835 was comprised of parts of the Piedmont Plateau, Appalachian Hills, and Cumberland Mountains and Plateau. Using soil characteristics first characterized by Eugene Hilgard and later adopted by Ransom and Sutch, the following soil types characterize the soil quality on Cherokee lands: soil type 1 (consisting of mainly the Piedmont counties) contains gray and red clay lands along with a hilly terrain; soil type 3 (consisting of Appalachian Hills region), contains siliceous and mountain lands in Tennessee and North Alabama; and soil type 8 (consisting of counties along the Cumberland Plateau) contains very fertile valley lands among the Blue Ridge, Smokey, and parts of the Cumberland Moun-

[34]Since unimproved acres were not used in the production of field crops, only improved acres are included. Although first used by Fogel and Engerman in *Time on the Cross*, unimproved acres were later dropped from their analysis. Fogel and Engerman, "Explaining the Relative Efficiency of Slave Agriculture in the Antebellum South: A Reply," *American Economic Review*, 70 4 (1980), 674; Field, "The Relative Efficiency of Slavery Revisited," 544-45.

[35]For applications of the U.S. Census of Agriculture on Northern antebellum farms, see Jeremy Atack and Fred Bateman, *To Their Own Soil: American Agriculture in the Antebellum North* (Ames: Iowa State University Press, 1987), and Lee Craig, *To Sow One Acre More: Childbearing and Farm Productivity in the Antebellum North* (Baltimore: Johns Hopkins University Press, 1993).

tains. [36] The land variable and the dummy variables accounting for soil differences are specified as

$$LAND = ACRES\ CULTIVATED,$$

$$SOIL_1 = \begin{cases} 1 & : \quad Household\ Located\ in\ Soil\ Type\ 1 \\ 0 & : \quad Otherwise, \end{cases}$$

$$SOIL_2 = \begin{cases} 1 & : \quad Household\ Located\ in\ Soil\ Type\ 3 \\ 0 & : \quad Otherwise, \end{cases}$$

$$SOIL_3 = \begin{cases} 1 & : \quad Household\ Located\ in\ Soil\ Type\ 8 \\ 0 & : \quad Otherwise. \end{cases}$$

2.3.5 Capital

The physical capital variable is often the most disputable and troublesome input to specify in any productivity analysis. It is common in historical census studies to include the value of livestock, buildings, implements and machinery in a physical capital variable. Unfortunately, this census does not contain information on levels of farming implements or livestock. Therefore, a proxy for physical capital, the number of houses, is used.[37] The farmer who invested heavily in structures probably also

[36] Eugene W. Hilgard, *Report on Cotton Production in the United States, Also Embracing Agricultural and Physico-Geographical Descriptions of the Several Cotton States and of California*, 2 volumes (Washington, D.C.: U.S. Government Printing Office, 1884). Roger Ransom and Richard Sutch, "Economic Regions of the South in 1880," Southern Economic History Project, working paper no. 3 (1971), 4, 7, 13.

[37] The number of houses should be correlated with acres cultivated; however, in an OLS regression of acres cultivated on number of houses (along with an intercept term), the coefficient on houses is positive and significant, but the R^2 was only 0.231 on free farms. Another there is no rule, since only 23% of the sample variation in acres cultivated is explained by the number of houses, collinearity problems should be important with these two variables. On slave farms, 51% of the sample variation in acres cultivated is explained by houses. Even though the two variables are more collinear on these farms, the R^2 is still low even not to worry about collinearity issues.

invested heavily in farm implements such as plows. A proxy is needed, not to determine the true impact of physical capital on output levels, but to avoid the problems of omitted variables on regression estimates. Thus, the capital proxy is

$$CAPITAL = NO.\,OF\,HOUSES.$$

In this case, physical capital is a latent variable. Prior studies have shown that the omission of a proxy variable, even if the variable contains a large amount of measurement error, generates a greater degree of inconsistency in the coefficient estimates than if the proxy was included.[38]

2.4 Sample Tests

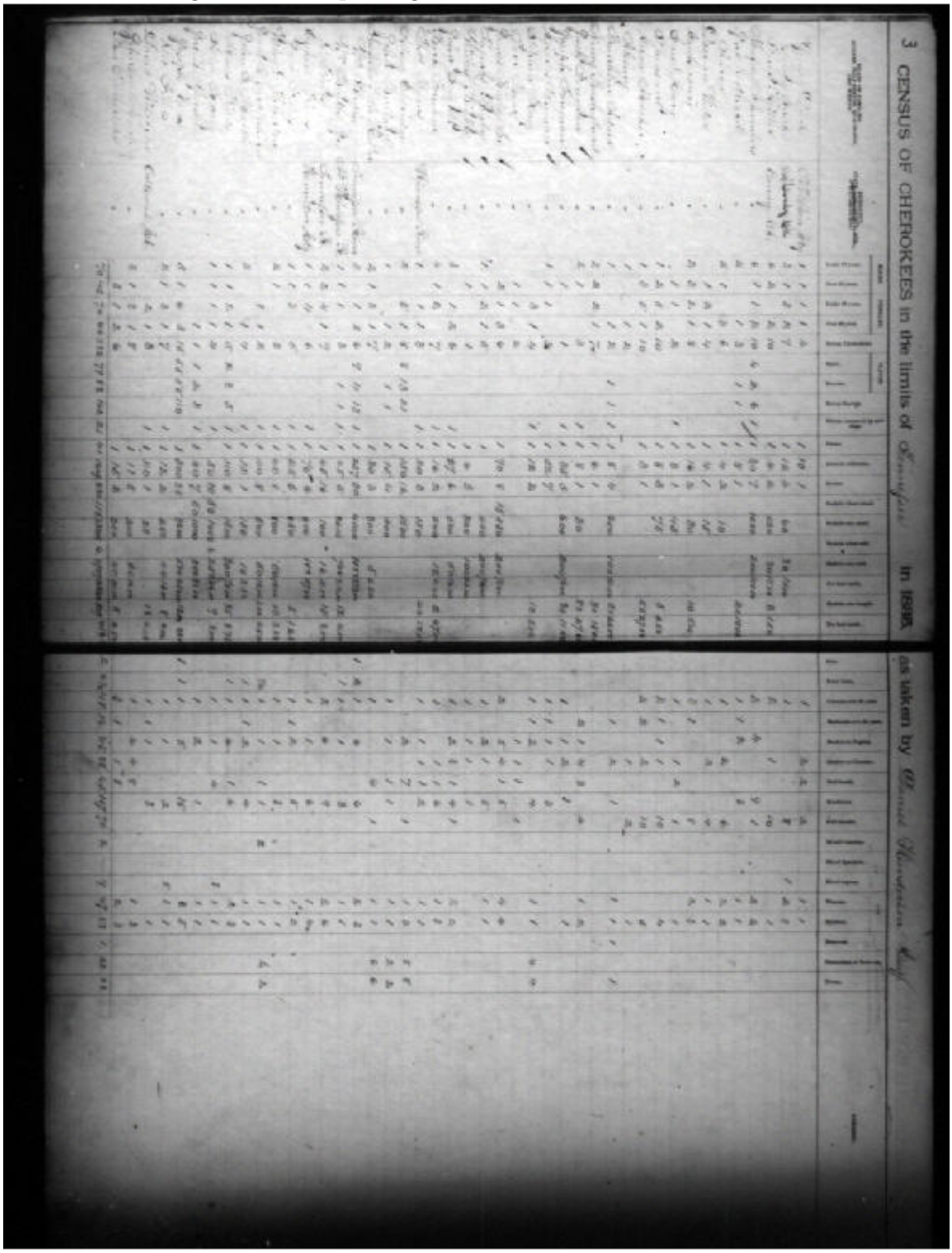
The non-random censoring method of eliminating some observations from the analysis can introduce biases in the results. In theory, if only certain types of farmers produced output, then there would be a sample selection bias which can lead to inconsistent parameter estimates. Unfortunately, as mentioned earlier, zero values can generate problems when specifying flexible functional forms. Also, some households contained only information on their population levels; therefore, these observations have to be removed as well. A test of how well this sample represents the entire population is one way to determine how biased or unbiased the censoring of the data was. Comparisons of means tests are done on a number of parameters from the census. Those parameters chosen to be tested are

1. Corn Output.
2. Wheat Output.
3. Total Household Labor.
4. Total Slaves.
5. Corn/Labor Ratio.
6. Capital/Labor Ratio.
7. Corn/Acre Ratio.

[38]William H. Greene, *Econometric Analysis* (Upper Saddle Creek, NJ: Prentice Hall, 1993), 442-43.

The results from these tests are located in Table 2.6. Households from each state are tested individually using a t-test where $t = (\mu - \bar{x})/(s/\sqrt{n})$. Of the 28 sample tests, only one test rejected the null hypothesis that there was no difference between the sample mean and the population mean. Given the high level of failures to reject the null hypothesis, I conclude that this sample is representative of the entire Cherokee population. This result is not surprising, since just under 90% of the households fit the censoring criteria.

Figure 2.2: Sample Page from the 1835 Cherokee Census



Returns from the 1835 Cherokee census, Hamilton and McMinn Counties, Tennessee. (*Source*: National Archives of the United States.)

Table 2.1: Cherokee Free Households: Population Characteristics

	Mean	Standard Deviation	Minimum	Maximum
Cherokee Males under 18	1.64	1.42	0.00	11.00
Cherokee Males over 18	1.57	1.05	0.00	9.00
Cherokee Females under 16	1.53	1.34	0.00	9.00
Cherokee Females over 16	1.69	1.04	0.00	11.00
Total Cherokees	6.43	3.25	1.00	28.00
Married Whites	0.04	0.20	0.00	2.00
Farmers over 18	1.49	0.98	0.00	9.00
Mechanics over 18	0.13	0.38	0.00	3.00
Readers in English	0.22	0.71	0.00	8.00
Readers in Cherokee	1.10	1.51	0.00	16.00
Full-bloods	5.53	3.64	0.00	27.00
Mixed-bloods	0.86	2.23	0.00	19.00
% of Full-bloods*	0.85	0.33	0.00	1.00
No. of Weavers	0.98	0.97	0.00	6.00
No. of Spinsters	1.63	1.27	0.00	18.00
No. of Reserves	0.02	0.20	0.00	4.00
Descendants of Reserves	0.10	0.74	0.00	10.00

Notes: N=2,154. * N=2,144. Some observations contained more full-blood members than total number of household members. These households were omitted from the calculation of the summary statistics for just this variable.

Source: 1835 Census Roll of the Cherokee Indians East of the Mississippi and Index to the Roll, Records of the Bureau of Indian Affairs, Record Group 75.

Table 2.2: Cherokee Slave Households: Population Characteristics

	Mean	Standard Deviation	Minimum	Maximum
Cherokee Males under 18	1.76	1.54	0.00	7.00
Cherokee Males over 18	1.43	1.12	0.00	5.00
Cherokee Females under 16	1.64	1.36	0.00	6.00
Cherokee Females over 16	1.52	0.94	0.00	4.00
Total Cherokees	6.34	3.17	1.00	18.00
Male Slaves	3.55	6.59	0.00	55.00
Female Slaves	3.93	6.53	0.00	55.00
Total Slaves	7.48	12.94	1.00	110.00
Married Whites	0.35	0.48	0.00	1.00
Farmers over 18	1.43	1.07	0.00	6.00
Mechanics over 18	0.18	0.42	0.00	2.00
Readers in English	2.53	2.42	0.00	11.00
Readers in Cherokee	0.84	1.28	0.00	8.00
Full-bloods	1.20	2.55	0.00	12.00
Mixed bloods	5.04	3.47	0.00	15.00
% of Full-bloods*	0.17	0.34	0.00	1.00
No. of Weavers	1.25	0.96	0.00	5.00
No. of Spinsters	1.77	1.25	0.00	7.00
No. of Reserves	0.30	0.76	0.00	6.00
Descendants of Reserves	1.70	2.94	0.00	14.00

Notes: N=190. * N=189. Some observations contained more full-blood members than total number of household members. These households were omitted from the calculation of the summary statistics for just this variable.
Source: 1835 Census Roll of the Cherokee Indians East of the Mississippi and Index to the Roll, Records of the Bureau of Indian Affairs, Record Group 75.

Table 2.3: Cherokee Free Households: Agricultural Characteristics

	Mean	Standard Deviation	Minimum	Maximum
No. of Farms	1.23	0.68	0.00	9.00
Acres Cultivated	12.65	16.04	0.25	351.00
Houses	2.75	2.42	1.00	50.00
Bushels of Wheat	0.24	2.91	0.00	75.00
Bushels of Corn	163.60	230.38	1.00	6000.00
Bushels of Wheat Sold	0.04	0.78	0.00	25.00
Bushels of Corn Sold	18.73	54.55	0.00	1000.00
Corn Income	$9.21	$27.07	$0.00	$500.00
Bushels of Corn Bought	1.84	9.73	0.00	200.00
Corn Expenditures	$0.86	$4.23	$0.00	$75.00

Notes: N=2,154.
Source: 1835 Census Roll of the Cherokee Indians East of the Mississippi and Index to the Roll, Records of the Bureau of Indian Affairs, Record Group 75.

Table 2.4: Cherokee Slave Households: Agricultural Characteristics

	Mean	Standard Deviation	Minimum	Maximum
No. of Farms	1.43	1.29	0.00	13.00
Acres Cultivated	78.98	80.63	2.00	450.00
Houses	9.43	7.91	1.00	44.00
Bushels of Wheat	10.04	27.83	0.00	220.00
Bushels of Corn	1128.53	1206.59	15.00	7000.00
Bushels of Wheat Sold	2.15	10.23	0.00	100.00
Bushels of Corn Sold	324.95	649.56	0.00	4000.00
Corn Income	$160.37	$313.43	$0.00	$2000.00
Bushels of Corn Bought	28.35	150.87	0.00	1500.00
Corn Expenditures	$8.92	$38.81	$0.00	$324.00

Notes: N=190.
Source: 1835 Census Roll of the Cherokee Indians East of the Mississippi and Index to the Roll, Records of the Bureau of Indian Affairs, Record Group 75.

Table 2.5: Interactions with Mill/Ferryboat Dummies

(Dependent Variable: ln Output)

Variable	(1)	(2)
Constant	3.668	3.664
	(0.064)	(0.062)***
MFD	-0.313	
	(1.071)	
Boys < 18	0.046	0.045
	(0.014)***	(0.014)***
Males ≥ 18	0.099	0.084
	(0.019)***	(0.020)***
Females < 16	0.012	
	(0.016)	
Females ≥ 16	-0.011	
	(0.023)	
Acres	0.034	0.042
	(0.005)***	(0.004)***
Houses	0.073	0.061
	(0.029)**	(0.025)**
Soil 1	-0.103	-0.122
	(0.048)	(0.041)***
Soil 3	0.134	
	(0.096)	
MFD* Males < 18	0.270	
	(0.326)	
MFD* Males ≥ 18	-0.293	
	(0.239)	
MFD* Females < 16	0.018	
	(0.252)	
MFD*Females ≥ 16	0.422	0.574
	(0.221)*	(0.152)***
MFD*Acres	-0.030	-0.031
	(0.007)***	(0.008)***
MFD* Houses	-0.021	
	(.067)	
R^2	0.406	0.403

Notes: N=2153. The mill and ferryboat dummy, MFD, represents 1 for Cherokee households that owned either a mill or a ferryboat and 0 otherwise. *, **, and *** represent statistical significance at the 10%, 5%, and 1% levels.

Table 2.6: Aggregate Mean Values of Sample Statistics and T-Tests, 1835

(Standard Deviations in Parenthesis)

State	Sample Mean	Population Mean	t-statistic
1. Corn Output			
Alabama	474.48 (826.66)	452.91	0.36
Georgia	222.01 (443.55)	211.47	0.77
North Carolina	126.70 (183.75)	125.21	0.20
Tennessee	382.16 (568.03)	346.56	1.19
2. Wheat Output.			
Alabama	1.32 (10.85)	1.26	0.08
Georgia	1.09 (8.60)	1.12	0.10
North Carolina	0.11 (1.90)	0.10	0.02
Tennessee	2.67 (14.79)	2.49	0.24
3. Total Household Labor			
Alabama	6.33 (3.24)	6.25	0.34
Georgia	6.96 (3.40)	6.85	0.99
North Carolina	5.69 (2.68)	5.66	0.22
Tennessee	6.31 (3.50)	6.05	1.39
4. Total Slaves			
Alabama	1.54 (4.90)	1.47	0.20
Georgia	0.57 (4.33)	0.57	0.01
North Carolina	0.06 (0.45)	0.06	0.05
Tennessee	1.13 (6.62)	1.09	0.11
5. Corn/Labor Ratio.			
Alabama	109.38 (283.08)	104.41	0.24
Georgia	38.96 (88.40)	37.36	0.58
North Carolina	24.56 (32.18)	24.27	0.22
Tennessee	82.68 (145.64)	75.19	0.98
6. Capital/Labor Ratio			
Alabama	0.65 (1.17)	0.64	0.07
Georgia	0.69 (1.11)	0.68	0.40
North Carolina	0.33 (0.23)	0.33	0.21
Tennessee	0.96 (1.17)	0.99	0.52
7. Corn/Acre Ratio			
Alabama	14.34 (11.84)	13.69	0.76
Georgia	17.67 (14.58)	16.57	2.44*
North Carolina	10.86 (4.69)	10.75	0.58
Tennessee	15.58 (23.29)	14.93	0.53

Notes: N=2,344. * Represents a statistically significant between the sample and the population mean at the 5% level.
Source: 1835 Census Roll of the Cherokee Indians East of the Mississippi and Index to the Roll, Records of the Bureau of Indian Affairs, Record Group 75.

Chapter 3

The 1850 Matched Sample of Southern Farmers

> "All I ask in this whole creation is a pretty little wife, and a big plantation, way up yonder in the Cherokee Nation."[1]

In addition to collecting data on Cherokee households, a sample was drawn from information contained in the manuscripts of the 1850 U.S. agriculture, population, and slave schedules. The sampled households lived in newly created counties formed by the acquisition of Southeastern Cherokee land (see Fig. 3.1). Some state governments distributed land at relatively high prices while others practically gave the land away free. The method of distributing land does not impact the efficient allocation of resources in these counties; however, some state governments, in particular Georgia's, lost out on extracting a large portion of economic rent yet probably generated a positive net transfer of wealth.[2] Regardless of the allotment method, whites quickly sought out the best land and in many cases, squatted on the land before it became a part of the state's legal domain. The purpose of the collection of the second data set used in this study is to obtain information on these replacement farmers.

This chapter is organized in the following way. First, each state's allotment process is discussed. Second, the sampling procedure is explained and these data are

[1] These is a lyric from a popular song in Georgia, prior to removal, during the 1820s and 1830s.

[2] In the Georgia Land Lottery, trades among participants occurred quickly, as some Southerners arranged prior to the draw to have winners turn over their draws for some nominal amount. Steven Hahn, *The Roots of Southern Populism: Yeoman Farmers and the Transformation of the Georgia Upcountry, 1850-1890* (Oxford: Oxford University Press, 1983), 19.

discussed and compared to similar data on Cherokee households. Last, the sample is compared against the population figures represented in the U.S. published census. These are not exact tests of representativeness, since it is well known that the published census contains many errors.[3] However, determining the differences between the sample and population mean of a host of variables should give a rough idea of the randomness of the sample.

3.1 Allotment of Southeastern Cherokee Land

Each state containing parts of former Cherokee Nation quickly dispensed land to its residents. In Georgia, Cherokee lands, which covered roughly 6,800 square miles, were allotted to whites through the 1832 land lotteries.[4] State surveyors first established four large sections from this new property, then split the sections into ninety-three land districts, each nine square miles, and further subdivided into either 160-acre land lots or 40-acre gold lots.[5] Lottery tickets, some with lot numbers and some blank, were drawn from a "lot drum," and the fortunate drawers were by law ordered to wait until the Cherokees were removed before possessing the land.[6] The lot fee was only $18.00, thus the price per acre set by the state government was a minuscule $0.11 for the land lots and $0.45 for the gold lots. This was by far the best value for Cherokee land; even the federal government, which at the time desired to set

[3]For an example of the errors in the published census, see Atack and Bateman's *To Their Own Soil*, Table 7.3, 115.

[4]Prior to these land lotteries of the early nineteenth century, the state distributed land along the eastern coast through a headright system, which allowed every head of household 200 acres with an additional 50 acres for each child and slave up to ten. This system aided in the development of large plantations along the Georgia coast. Ibid., 19.

[5]Gold was discovered in the southern part of Cherokee Nation in July 1829 near Auroria, Georgia. Douglas C. Wilms, "Cherokee Indian Land Use in Georgia, 1800-1838" (Ph.D. dissertation, University of Georgia, 1973), 71-72.

[6]There were 85,000 people registered for 18,309 land lots and 133,000 people registered for 35,000 gold lots. Some people were able to draw twice, such as a male wounded in a prior Indian War and a large family with a long history of Georgia residence. Douglas C. Wilms, "Cherokee Indian Land Use," 50fn12. For a list of the winners, see James F. Smith, *The Cherokee Land Lottery, containing a numerical list of the names of the fortunate drawers in said lottery* (New York, 1838).

policies to rapidly expand the population westward, set the price of western land at $1.25 per acre.[7] Even though parts of this area were mountainous and distant from roads or navigable rivers, a fair amount of Cherokee land in Georgia, in particular around New Echota, was prime farming land because it was already cleared, typically located close to rivers or creeks, and usually had improvements on it, such as corn cribs and fences.[8] Undoubtedly, the market value of the majority of Cherokee land far exceeded the state's rates; therefore, this lottery did create a net transfer of wealth. However, the social costs of this land giveaway were increased when, despite a Georgia legislative act, winners attempted to possess their land while it was still inhabited by Cherokees, so the state was forced to establish a police force, called the Georgia Guard. Thus, like most government's giveaways, this land giveaway was not free. Squatting was another characteristic, or possibly a by-product, of each state's allotment process, as well as of the entire federal land disposal effort in the United States.[9]

In Tennessee, the Ocoee District, which held newly created Bradley County and later Polk County as well as smaller portions of previously established Hamilton and Monroe counties, was formed from the ceded land.[10] The land in this district was divided into townships, each six square miles, then into thirty-six sections which were further cut into 640-acre land lots which could be sold in fractions. Ownership of

[7]Gary M. Walton and Hugh Rockoff, *History of the American Economy*, 8^{th} edition (Fort Worth: Harcourt Brace College Publishers, 1998), 165.

[8]Douglas Wilms merged information in the plats generated from the land surveys in Georgia prior to the land lotteries with that contained in the 1835 Cherokee census to show that the majority of Cherokee settlements in Georgia were located along the courses of rivers, such as the Etowah, Chattahoochee, Coosawattee, and Chickamauga. Wilms, "Cherokee Indian Land Use," Table 11, 98.

[9]*Acts of the General Assembly of the State of Georgia, 1830* (Milledgeville, 1831), 141-2; Wilms, "Cherokee Land Use," 72. The most notable case of encroachment was when Spencer Riley, an alleged winner in the lottery, entered Joseph Vann's plantation home and claimed it his. Col. Bishop, leader of the Georgia Guard which was established to maintain peace in the area after 1832, threw a smoldering log on the front steps which managed to smoke Riley out of the house.

[10]Bradley County was established well before removal on February 10, 1836, and later a section was removed from the county to establish most of Polk County in November 28, 1839. Roy G. Lillard, *The History of Bradley County* (Cleveland: 1976), 28, 32-33.

land in the district was not made legal until November 1838, when the entry taker's office in Cleveland (a town in Bradley County, Alabama) first began to operate. Of course, settlers squatted on this land and made improvements. The state government invoked preemption rights that gave these squatters the first right to buy 160 acres of land at $7.50 per acre, which was to be paid in full after three months. Thereafter, these squatters were allowed to purchase an additional 160 acres at the same price if the original plot was paid in full. If the squatters could not pay for the land, the improved land was open for purchase at the same price. Thus, for the first five months, the price per acre in the entire district was $7.50, much higher than the $0.11 per acre for land lots in Georgia. This undoubtedly slowed settlement and expansion, but people still arrived at the land office in Cleveland to purchase this land.[11] After this five-month period, the price of land fell, adjusting to the demand for poorer land, until the last plots of land in heavily mountainous areas were sold at one cent per acre.[12]

In Alabama, DeKalb and Cherokee Counties were both created from Cherokee land in the same legislative act on January 9, 1836.[13] Some Cherokees in 1835 lived in other counties in Alabama such as Jackson, Morgan, Blount, and St. Clair, but the land formerly occupied by Cherokees was cut from most of these counties and added to Cherokee and DeKalb counties when they were formed.[14] In both newly formed counties, as soon as the Treaty of New Echota was signed, land offices in Lebanon and Huntsville were erected, and surveyors rushed to survey the land as buyers eagerly awaited their purchase of their land.[15] Typically, the price per acre in Cherokee and DeKalb counties was $1.25, the same as the federal price per acre at that time, for as much as 160 acres, but terms of credit were far looser than the

[11]On the first day of opening, forty-seven land grants were issued at the entry taker's office in Cleveland. Grants were even issued on Christmas Day, 1838, as three settlers purchased 160-acre plots. Ibid., 42.

[12]Ibid., 40-42.

[13]Annie Koger Young, *Alabama's DeKalb County* (Centre, AL, 1980), 38.

[14]Mattie Lou Teague Crow, *History of St. Clair County (Alabama)* (Huntsville: The Strode Publishers, 1973), 13.

[15]Mrs. Frank Ross Stewart, *Cherokee County History* (Centre, AL, 1958), 42.

federal government's conditions. While the federal government at this time required western land to be paid in full with cash, an Alabama settler had to make a down payment of only ten cents per acre, plus pay a survey fee of $6, and then pay the remainder of the purchase in three years.[16]

Last, in North Carolina, Cherokees lived in the western portion of the state. Most of the Cherokees lived on land which became Cherokee County, while a small contingent lived in western parts of previously-established Macon County.[17] After removal, 1,112 square miles of land soon become the legal possession of North Carolina. The state similarly divided the land into land lots of 50 to 400 acres. The price of each lot was determined by a set of five categories used to describe the land quality, as the highest-quality land sold for $4 per acre and the lowest-quality for at $0.50 per acre. The credit terms were loose, as a down payment of only one-eighth the purchase price was needed. The land auctions began on September 3, 1838, and lasted three weeks. 1,202 out of the 1,400 lots were sold in this three-week period, as some individual buyers were able to possess over 350 acres of land.[18] Neither Macon nor Cherokee County was restructured until 1861, when Clay County was carved out of the southeastern portion of Cherokee County.

The counties chosen to be sampled were established from removal and thus had no reported populations in the 1830 U.S. published census. This ruled out, among others, Macon County, North Carolina, Hamilton County, Tennessee, and Jackson County, Alabama. These counties contained some Cherokees in 1835; however, they were established well before removal, and using census records made it hard to distinguish between new farmers and the farmers who had lived on the property for many years prior to removal. Given this rule, the counties sampled included the following: in Alabama, DeKalb and Cherokee counties; in Georgia, Cass, Chattooga,

[16]Young, *Alabama's DeKalb County*, 39.

[17]The Cherokees who lived outside the Nation in Quallatown, North Carolina are not discussed in this chapter, since their land was never allotted.

[18]Nathaniel C. Browder, *The Cherokee Indians and Those Who Came After* (Hayesville, N.C., 1973), 77-79; John Hill Wheeler, *Historical Sketches of North Carolina* (Baltimore: Regional Publishing Co., 1964), 87-88, 250.

Cherokee, Cobb, Dade, Floyd, Forsyth, Gilmer, Gordon, Lumpkin, Murray, and Paulding counties; in North Carolina, Cherokee County; and in Tennessee, Bradley and Polk Counties.[19] Some counties in Georgia, such as Dade and Chattooga, were created shortly after the land lotteries; however, they were completely contained within former Cherokee territory, and thus were included in the sample.

3.2 The 1850 Southern Sample

These data on roughly 3,200 farms were linked to the population and slave schedules, using the name of the farm operator as the key. Therefore, the matching process had to be done with extreme care since the names of heads of households within counties were often similar. Often, the assistant marshals for the population and slave schedule did not follow the same routes; therefore, the enumerations of a particular household may have been at the end of the population population schedule while at the start of the slave schedule. This dilemma was resolved by sampling in small blocks, while keeping the interval size small enough hopefully not to hurt the randomness of the sample.[20] Individual heads of household were more successfully matched when neighboring households were identified as well.

Each assistant marshal, the individual designated to collect this information, was directed to address a variety of questions for each census schedule. For the agricultural schedule, the assistant marshals asked each head of household forty-six questions including topics such as the number of acres improved, the value of his livestock, and the amount of field and root crops grown. The assistant marshals enumerating the population and slave schedules obtained information on the name, age, and gender of each family member, the occupation of males over the age of

[19]Union County and Walker County were not sampled because the fourth book of the Georgia manuscript agricultural censuses has been lost. The published census contains county-level agricultural figures for these two counties; but the book was unfortunately disposed of prior to the microfilming process.

[20]Richard Sutch, Roger Ransom, and George Boutin, *A Sample of Southern Farms in 1880: Sampling Procedures*, Southern Economic History Project (working paper no. 2, 1969), 1-13.

16, and the age and gender of their slaves, if they held any. The instructions given to each assistant marshal on the variables of interest for this study are located in Appendix A.

Since these agricultural data are the most crucial for this study, a sample page from the agricultural schedule of farmers located in Cherokee County, North Carolina, is shown in Figure 3.2. In this mountainous region of western North Carolina, as this sample page suggests, very little cotton was grown; in fact, no cotton was grown on any of the slave farms in this county. However, some farmers on this sample page used slaves in the fields. For example, the first person enumerated on this page, Abram Nearshaw owned 28 female and 22 male slaves. Joshua Hearhaus also owned a fair number of slaves, 14 male and 14 female slaves. This farm produced 3000 bushels of corn, 400 bushels of oats, 80 bushels of rye, and a variety of root crops and dairy products during the crop year of 1849 on 350 improved acres. Hearhaus's livestock was valued at $1,945, and $730 worth of the livestock was slaughtered during the year ending in June 1, 1850. This farm had a cash value of $6,000, and his farm implements, which most likely included plows given the amount of horses, and machines, possibly threshing machines given the level of grain production, were valued at $200.

This sample page characterizes the degree of heterogeneity across farms in the Old South. As opposed to Abram Nearshaw and Joshua Hearhaus, farmers such as Austin Mason, second from the top, and Hiram McClean, number 20 on the page, exemplify the poor yeomen farmers of this region. Austin Mason held only $8 in farm implements and owned only a milch cow (from which 50 pounds of butter were produced), one swine, and another type of cattle, all together valued at $20. The Mason household, on 45 acres of improved land, raised 700 bushels of corn, 100 bushels of oats, 12 bushels of rye. Hiram McClean, along with his six other family members, held only five acres of improved land. His livestock of two milch cows and two types of cattle were valued at $20, and together with $5 worth of farm implements show the low amount of capital accumulation on his farm. However,

there were either a significant amount of farm buildings or superior soil quality of his farm because the cash value of his farm is higher than others on this page with the same amount of improved acres. Most likely, the soil, which can vary substantially within counties, was superior on his farm, since his crop yields, 24 bushels of corn per acre, and 20 pounds of tobacco per acre, were much higher than those of his neighbors.

There was not a great degree of diversity in crop output on this page, as no farmers cultivated rye, cotton, barley, buckwheat, wine, orchard fruits, clover seed, other grass seeds, hops, hemp, silk cocoons, maple sugar, cane sugar, or molasses. Only one farmer grew wheat, the "civilized" crop suggested by Cherokee Indian agents to be raised; however, as in the Cherokee case, wheat production was never substantial on these farms, as by 1850, Northern farmers held such a cost advantage in raising this crop that their food surpluses were sold in the South.[21] The relatively high amount of home-manufactured products is reflected in this sample page as well as in the entire region. Since Southern plantations typically produced such items as alcohol distilling, food processing, and other animal by-product industries, internally, markets for these goods were not well-established in the South, unlike in the North where this type of production was transferred to factories.[22]

The agricultural schedule was first sampled under different methods for each county to roughly match the total number of Southern farms in each county to the total number of Cherokee farms formerly in that state. Therefore, the bulk of the sampling occurred in Georgia, where roughly 50% of the Cherokees east of the Mississippi River lived. For Georgia, 20% of the farms in the agricultural schedule were sampled by choosing a group of five contiguous farms and then using a skip interval of 20 farms. In Tennessee, 30% of the farms, picking six farms and then skipping the following 14 farms, were sampled from both Polk and Bradley Counties. In Alabama, 10%, 5 farms picked and then the next 45 farms skipped, of the farms

[21]For a quantitative estimate of crop surpluses on Northern farms, see Atack and Bateman, *To Their Own Soil*.

[22]Fogel and Engerman, *Time on the Cross: Evidence and Methods*, 133.

in Cherokee and DeKalb Counties were sampled. Lastly, in Cherokee County, North Carolina, because of the high number of Cherokees residing before removal, all of the farms were collected. This sampling technique kept roughly the same ratios of Cherokee farmers living in each state to the number of white farmers who moved in.[23]

Table 3.1 contains information about the success rate of matching households across schedules for each county. The proportion of failed matches ranged from zero in Cherokee County, North Carolina, and DeKalb County, Alabama to roughly 28% in Floyd County, Georgia. These unmatched farms are typically assumed to be operated by people living outside the county.[24] As in past census studies, some farms contained no household members who were farmers, yet their names are located in the agriculture schedule. Since the majority of these households had no listing for an occupation, it is assumed that this was a reporting error by the census taker.

The major problem with any agriculture schedule prior to 1880 is the exclusion of land tenure information. Typically, the combination of no improved acres, arable production, and an occupation of farmer implies a tenant of some sort.[25] As Table 3.1 depicts, some counties contained a high number of farms without improved acres; however, some of these farmers might not have been agriculturalists at all, e.g. horse breeders, or some were simply starting a farm. The sample page probably contains few to no tenant farmers. Every farmer had a positive amount of improved acres, yet some households held real estate which was valued less than the cash value of the farm. This is another way to isolate a form of tenant farmer.[26] The

[23]The percentage of total households in each state in both samples are

	Alabama	Georgia	North Carolina	Tennessee
Cherokee	0.08	0.50	0.26	0.16
White	0.08	0.64	0.14	0.14

[24]Atack and Bateman, *To Their Own Soil*, 105.

[25]This criterion has been used by Atack and Bateman, *To Their Own Soil*, 110; Hahn, *The Roots of Southern Populism*, 22fn19; Alan Bogue, *From Prairie to Corn Belt: Farming on the Illinois and Iowa Prairies in the Nineteenth Century* (Chicago, 1963), 64; Frederick A. Bode and Donald E. Ginter, *Farm Tenancy and the Census in Antebellum Georgia* (Athens: The University of Georgia Press, 1986), 13-26.

[26]Atack and Bateman, *To Their Own Soil*, 110.

inability to accurately distinguish tenants, as some have suggested, makes estimation of scale economies flawed, since assistant marshals sometimes aggregated all the inputs owned by the proprietor, namely improved acres, into his enumeration, while disaggregating the specific crops and livestock grown and owned by a tenant and listing these figures in the tenant's enumeration.[27] However, this problem may be overemphasized as Mark Schmitz and Donald Schaefer show that estimates for the scale economies on Southern farms did not significantly vary across sampling techniques.[28] However, on upcountry farms, the level of tenancy was higher than on Deep South farms −− the farms Schmitz and Schaefer analyze −− so the problem of matching tenants and farms may be more serious in this sample.

Take, for example, the enumeration of Chattooga County, Georgia. On page 377, Joshua Johnson, who held 70 improved acres and 90 unimproved acres, was listed *above* W. Johnson, a farmer who held livestock and grew corn, peas and beans, potatoes, and even some cotton yet had no cultivated acres. W. Johnson, who was 39 years old at the time, was possibly Joshua's son since Joshua was 71 years old. Therefore, it appears that Joshua allowed his son to work on his property. Thus, one might assume that census takers typically listed the owner first and the tenants under him. However, on page 369, the same census taker listed Lewis Vaughn, a 24-year-old male farmer, in the agriculture schedule as holding no improved acres but owning swine and raising various crops, a prime example of a tenant of some sort. Listed *below* Lewis is Benjamin Vaughn, an 45-year-old farmer, who might be Lewis's father, had 30 acres of improved acres and 300 of unimproved acres which generate a substantial amount of food and root crops. Therefore, Lewis was probably a tenant of his father's land; however, in this case the proprietor, Benjamin, was listed below Lewis's in the agriculture schedule, whereas, in the previous example, the proprietor was listed above the possible tenant.

[27]Bode and Ginter, *Farm Tenancy and the Census in Antebellum Georgia*, 6.

[28]Mark D. Schmitz and Donald F. Schaefer, "Using Manuscript Census Samples to Interpret Antebellum Southern Agriculture," *Journal of Interdisciplinary History*, 17 2 (1986): 399-414.

This example shows that the location of the tenant and the proprietor is not standardized. However, a rule needs to be set in place to systematically define a tenant and his proprietor. A farmer is identified as a tenant if the farm had no improved acres but crop production. If the cash value of the farm is greater than the value of the real estate owned by the farmer, then there is no doubt this farmer is a tenant of some sort; however, these tenant farmers typically have positive amounts of improved acres, so they will not be treated differently than owners. The rule established to link farmers without improved acres and possible owners is as follows: if a farm without improved acres is determined to be a farm run by tenant farmers, then the farm's crop information is aggregated by the closest farm above or below it in the agricultural schedule which contained information on improved acres. This general rule is adjusted under two situations: (1) when a farmer below the farm without improved acres has a possible relative below him (as in the above example) and (2) when the aggregated corn yield is significantly different from the neighbor's farms when tenant farm is matched with the farm above it in the agricultural schedule. In these cases, the tenant farm is aggregated with information below its entry in the agricultural schedule. Any farm which does not have improved acres and has no crop production will be omitted from the sample, as this farmer is probably not an agriculturalist, but rather someone incorrectly entered into the agricultural schedule.

The summary statistics of the agriculture, population and slave information of each state for both free and slave farms are given in Tables 3.2 and 3.3. The distribution of ages and gender for both household members and slaves across these four states is fairly homogenous. The sample average of household members, 6.51 across both types of farms, is essentially the same as the average size of a Cherokee household, which was 6.49. Regarding the slaveholding population, the average number of slaves, of all ages, in the sample is 6.97 per household, which is smaller than the Cherokee average slaveholdings (see Table 2.4); however, the two largest Cherokee slaveholders are driving these results, as once these two farmers are omitted, the

average size of a Southern slave farm is higher, albeit slightly, than the average Cherokee slave farm.[29]

The average improved and unimproved acres show that an adjustment of the initial distribution of land had occurred. The total number of improved and unimproved acres size of households that did not hold slaves averaged from 116.76 acres Alabama farms to 172.58 acres on Tennessee farms. On slave farms, the largest average farm size was in North Carolina at 607.34 acres, where Alabama was the smallest at 290.90 acres. In Georgia, the land lotteries, as shown in other studies, allowed for the accumulation of large slave farms, which were on average almost 350 total acres.[30] Both types of Southern white farms far exceeded the average sizes of Cherokee improved acres, which were 12 acres on free farms and 78 improved acres on slave farms.

As with Cherokees, Indian corn (zea mays) was the main food crop of the region. Cherokees, like these farmers, also produced peas and beans, sweet and Irish potatoes, and oats. The allocation of acreage to wheat production was higher on white farms than on Cherokee farms. Very little barley and absolutely no sugar were produced on any farm. Tobacco was produced on many farms, especially among farms located in the Blue Ridge Mountains (i.e. North Carolina and Tennessee). Finally, cotton production was not an important crop on both types of farms, as slave farms in Tennessee and North Carolina did not even grow the crop.

3.3 Definitions of Variables

3.3.1 Output

Due to the omission of a variety of field crops in the Cherokee census, the output variable must be defined in a similar manner to conduct this comparative anal-

[29]The average Cherokee slave farm, omitting these two farmers, contained 6.11 slaves, whereas on the average southern slave farm, omitting slave farms with over 60 slaves, was 6.82 slaves.

[30]Hahn, *The Roots of Southern Populism*, 19; David Weiman, "Peopling the Land by Lottery? The Market in Public Lands and the Regional Differentiation of Territory on the Georgia Frontier," *The Journal of Economic History*, 51 4 (1991): 835-60.

ysis. Therefore, the two grains listed in the Cherokee census, bushels of corn and wheat, are used in specifying the crop output variable. The two crops are aggregated together using the same conversion rates as used earlier. Therefore, differences in total output between whites and Cherokees are not due to differences in output prices but rather differences in the physical quantity of grain. The output variable is thus defined as

$$CROP\,OUTPUT = CORN * 0.95 + WHEAT * 0.88 * 1.104.$$

Since the white data contains a more complete listing of the field crops grown, the other cultivated crops will be added later to this output variable to determine the sensitivity of the results to the specification of the output variable. In this case, output will be defined using standard cliometric methods as *feed* requirements as well as *seed* requirements will be estimated and subtracted from total crop output.[31] The crops specified in the this output variable are corn, barley, buckwheat, oats, rye, wheat, peas, beans, Irish potatoes, sweet potatoes, hay, tobacco and ginned cotton. Since conversion factors into corn-equivalent units do not exist for cotton and tobacco, individual crop prices must be used to aggregate these crops. The crop prices are taken from constructed national averages of the year 1850.[32] The seed requirements are 5 percent for corn, 12 percent for wheat, 7 percent for oats, 11 percent for rye, 9 percent for peas and beans, 8 percent for buckwheat, 8 percent for barley, and 10 percent for Irish and sweet potatoes.[33]

[31]The crops used in this study are mainly the ones initially specified by Fogel and Engerman, with the exception that cane sugar was excluded because no farmer in the region produced sugar. Buckwheat was included because it was grown on some farms.

[32]Marvin W. Towne and Wayne D. Rasmussen, "Farm Gross Product and Gross Investment in the Nineteenth Century," in Conference on Research in Income and Wealth, *Trends in the American Economy in the Nineteenth Century*, Studies in Income and Wealth, Vol. 24 (Princeton: Princeton University Press, 1960), 294-99, 303, 305, 307.

[33]Each seed requirement, except buckwheat, barley, and potatoes, is taken from Weiman, "Farmers and the Market," 634fn26. The requirements for buckwheat, barley, Irish and sweet potatoes are from Atack and Bateman, *To Their Own Soil*, 214.

The output variable is further adjusted to account for feed requirements on non-swine livestock. The feed requirements for livestock are 35 bushels of corn for horses and oxen, 30 bushels for mules, 5 bushels for milch cows, and 0.25 bushels for sheep.[34] Cattle and swine, which mainly grazed in forests in this region, are assumed to have no feed requirements. In general, the output variable used to test for the sensitivity of the results is specified as

$$TOTAL\,OUTPUT = VALUE\,OF\,CROP\,OUTPUT - \ SEED - \ FEED.$$[35]

3.3.2 Household Field Labor

Even though the exact age of each family member is known, the age and gender groups have to be identical to the Cherokee census listings to make comparisons. Therefore, household labor is grouped into the following classifications: males under the age of 18, males 18 years old and older, females under the age of 16, and females 16 years old and older. Since the marginal product of each input is compared to that of each Cherokee inputs through a linear OLS regression, there is no need to aggregate the white household labor variables. The aggregation is necessary when specifying a flexible production function since the degrees of freedom will be notably conserved. Since second-order and interactions between inputs are not of significance in the Cherokee and white comparisons, these gender and age groups will be left disaggregated.[36]

3.3.3 Slave Labor

The slave labor variable is specified exactly as in the Cherokee case,

[34]Weiman, "Farmers and the Market," 634fn26; Ransom and Sutch, *One Kind of Freedom*, Table E.4, 250.

[36]Farm labor force estimates have been computed by Weiss, "U.S. Labor Force Estimates and Economic Growth, 1800-1860," 19-75. In his study, the participation rates of males aged 10 to 15 in each state were 0.534 in Alabama, 0.446 in Georgia, 0.506 in North Carolina, and 0.388 in Tennessee. The participation rate of females was derived by Weiss using the Bateman-Foust sample of rural northern households in 1860. Since each male and female age group participated in some way in fieldwork, each group will be tested to determine whether a marginal increase in each group impacted output.

$$SLAVE = (MALE\ SLAVES) + (FEMALE\ SLAVES).$$

3.3.4 Land

The land variable is specified as the number of improved acres on each farm, which is identical to the Cherokee land specification. Soil quality differences will also be included in the analysis through dummy variables, one for each soil type. Therefore, the variables which measure the amount and quality of the land used in production are

$$LAND = IMPROVED\ ACRES$$

$$SOIL_1 = \begin{cases} 1 & : \quad Household\ Located\ in\ Soil\ Type\ 1 \\ 0 & : \quad Otherwise, \end{cases}$$

$$SOIL_2 = \begin{cases} 1 & : \quad Household\ Located\ in\ Soil\ Type\ 3 \\ 0 & : \quad Otherwise, \end{cases}$$

$$SOIL_3 = \begin{cases} 1 & : \quad Household\ Located\ in\ Soil\ Type\ 8 \\ 0 & : \quad Otherwise. \end{cases}$$

3.3.5 Capital

The biggest difference between the Cherokee and white data is in the recording of physical capital. Typically, the capital stock is determined by summing the total value of livestock, the value of farming implements and machinery, and the imputed value of buildings on the farm.[37] The ratio of the cash value of the farm to value of buildings has been determined as 5.25 in this region of the South. However, unlike Fogel and Engerman, Elizabeth Field suggested annualizing the capital stock to

[37]Martin Primack, "Farm Formed Capital in American Agriculture, 1850 to 1910" (Ph.D. Dissertation, University of North Carolina, 1966).

create a flow variable by assuming a rate of return of 10% on the capital stock and depreciation rates of 2% on buildings, 10% of implements, and 0% on livestock. Such methods to compute either a flow or stock capital variable are infeasible with the Cherokee variable. Therefore, physical capital must be omitted from the comparative analysis of Cherokee and white production. Yet, when determining the robustness of the white estimates to the output specification, as mentioned above, the capital input variable will be specified as

$$\begin{aligned} CAPITAL &= (VALUE\,OF\,LIVESTOCK * 0.10) \\ &+ (VALUE\,OF\,BUILDINGS * 0.12) \\ &+ (VALUE\,OF\,IMPLEMENTS * 0.20), \end{aligned}$$

where

$$VALUE\,OF\,BUILDINGS = CASH\,VALUE\,OF\,FARM \div 5.25.$$

3.4 Sample Tests

Before discussing the comparative production aspects of Cherokees and whites, it is necessary to test whether the mean of the individual variables as well as the distribution of slaves on these farmers is significantly dissimilar to the averages in the published census summaries, which contain information on all the farms in each county sampled. These are not exact tests of representativeness, since the published census summaries contain measurement error; however, the tests are a statistical way to determine if the sample can be rejected as representative of the universe of farms.

The systematic sampling technique ensures that the percentage of white farms in each state matches the same percentage of former Cherokee farmers and the systematic way of taking blocks of farms at fixed intervals helped match heads of household across census schedules. In theory, a random sample should contain the same sizes, produce the same crops, and employ the same type of workers as do the farms contained in the entire universe. The representativeness of the sample

is tested by applying published census information on the counties contained in the sample. The 1850 published census contains information on crop levels and the age distribution of the slave and free population. The universe is defined as all the counties sampled in the study.

Two tests are employed for this sample. First, the comparison of average output of each crop per farm is compared to the average output of each crop per farm in the universe. The test is a comparison-of-means test; $t = (\bar{x}_i - \mu_i)/(s_i/\sqrt{n})$, where $\bar{x}_i$ is the average output of the i^{th} crop per sample farm, μ_i is the average output of i^{th} crop per universe farm, s_i is the standard error of the sample mean for the i^{th} crop, and n is the number of farms in the sample.[38] This comparison-of-means test has a t distribution with n-1 degrees of freedom. The other sample test compares the age distribution of male slaves and female slaves in the sample to the distribution of these groups in the universe.[39] The chi-square statistic is $\chi^2 = \sum_{i=1}^{k} \frac{(O_i - E_i)^2}{E_i}$, where k is the number of age classifications, O_i is the number of persons in the sample of the i^{th} age category, and E_i is the expected number of persons in the universe of the i^{th} age category.[40] Each test is computed for each state in the sample; therefore, there are four comparisons for each sample test.

[38]As pointed out by James Foust in his sample of cotton farms, this test does not determine representativeness of the sample but rather detects sampling errors, since the distribution of the sample is assumed to be identical to the distribution of the universe. James D. Foust, "The Yeoman Farmer and Westward Expansion of U.S. Cotton Production" (Ph.D. Dissertation, University of North Carolina, 1967), 33-34.

[39]The age distribution of free males and free females is not tested because the published census does not segment the population data into farm and non-farm families. Therefore, the distribution of ages on a farm family might be quite different from the distribution of an urban family; however, this difference cannot be gleaned from the published census. Therefore, the universe of farm households cannot be determined. Since a large majority of slaves in these counties were located on farms, the age distribution of slaves can be tested using the summaries in the published census.

[40]The expected number of persons in the universe is defined as $E_i = \frac{e_i}{N'} * n'$ where e_i is the number of persons in the i^{th} category in the universe, N' is the number of persons in the particular category in the universe, and n' is the number of persons in the particular category in the sample. Foust, "The Yeoman Farmer and Western Expansion of U.S. Cotton Production," 55-56.

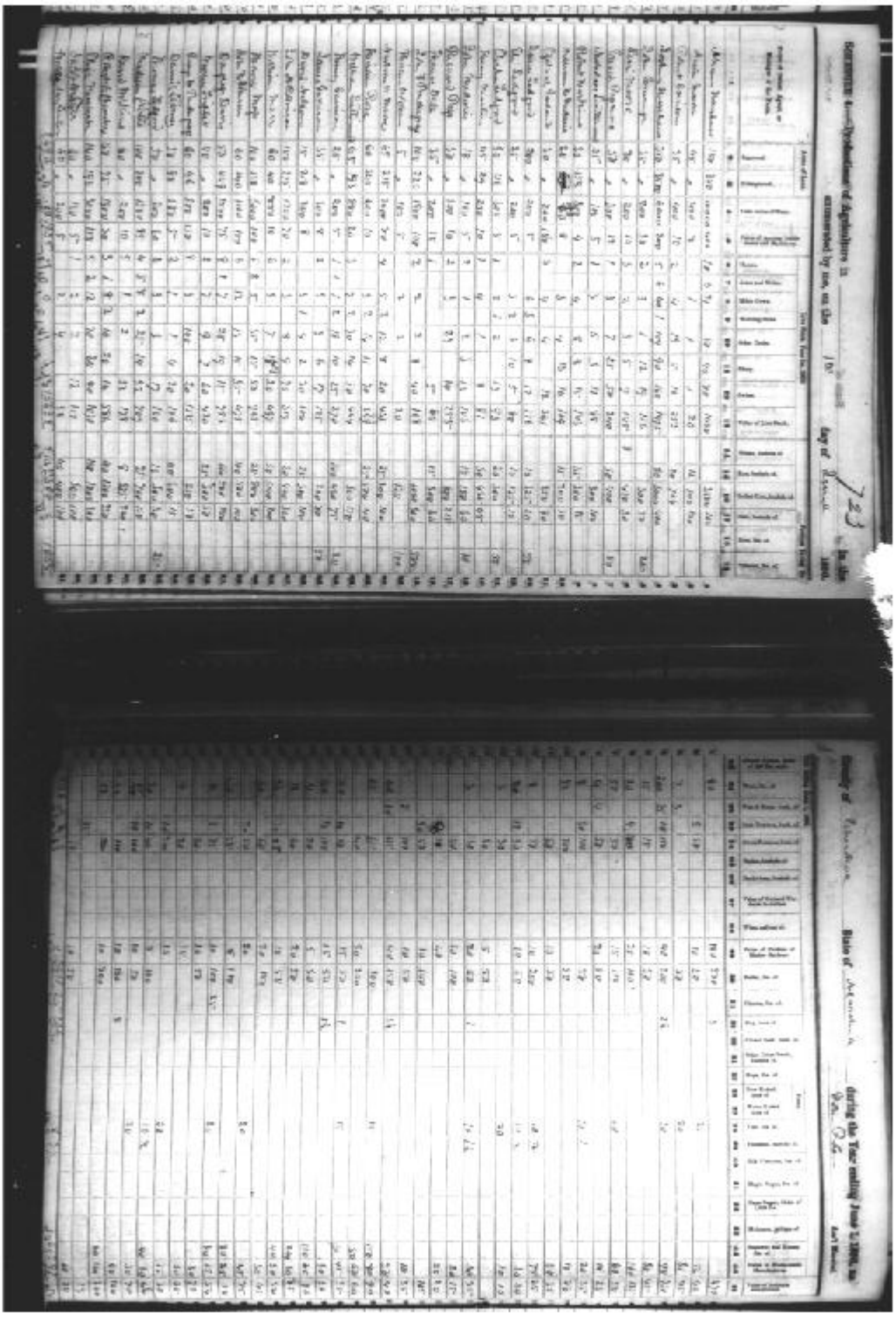
The results from the comparison-of-means test for each state are located in Tables 3.4-3.7. The mean of every crop listed in the agricultural schedule is tested; therefore, there are a total of 45 comparison-of-means tests for each state. In all four states, 160 out of the 180 comparisons-of-means tests show that the null hypothesis that there were no differences between population and sample means could not be rejected. Georgia failed the most tests, as the universe of farms was the largest of all for states, whereas North Carolina failed no tests. In Georgia, the majority of crops which failed the sample tests, such as the value of orchard products, wine, butter, and cheese, are not used in this analysis of field crop production.

The results from the other sample tests, those on the distribution of slave and free population, are located in Tables 3.8-3.11. The null hypothesis that the distribution in the sample was similar to that in the universe could not be rejected at the 5% significance level in any state. This implies that the distribution of slaves in those sampled farms was not significantly different from the distribution derived from the published census summaries. Considering that failures to reject a statistically significant difference between means were high in both tests, I find that there is no substantial evidence that this sample is not representative of the entire population. Differences between means were expected and they are a common characteristic of systematic sampling procedures using census data. A possible reason for the rejections could be errors made by the U.S. Census Bureau when computing the published figures. Therefore, these are not true sample tests since the population mean might be misreported. Regardless, most of the characteristics of the sample compared well with the published census figures; therefore this provides statistical evidence that there is little ground for rejecting this sample, and thus, for the analyzes that follows, the sample is accepted as a good approximation of the universe of farms in these counties.

Figure 3.1: Counties Established on Former Cherokee Land, 1850

Map drawn by Wendy Giminski, Campus Graphics and Photography, University of Georgia.

Figure 3.2: Sample Page from the U.S. Census of Agriculture



Agricultural schedule from the 1850 Census returns, Cherokee County, North Carolina. (*Source*: National Archives of the United States.

Table 3.1: Sampling Results

County, State	No. of farms Sampled	No. matched in Pop/Slave	Matching Rate	Farms w/o Imp. Acres	% Matched w/o Imp. Acres
Cherokee, AL	176	173	98.30%	55	31.79%
DeKalb, AL	85	85	100.00%	22	25.55%
Cass, GA	199	161	80.90%	33	20.49%
Chattooga, GA	166	159	95.78%	45	28.30%
Cherokee, GA	207	202	97.58%	1	0.50%
Cobb, GA	272	256	94.12%	61	23.83%
Dade, GA	74	69	93.24%	18	26.09%
Floyd, GA	93	67	72.04%	20	29.85%
Forsyth, GA	248	247	99.57%	72	29.15%
Gilmer, GA	120	118	98.33%	2	1.69%
Gordon, GA	137	135	9.54%	49	36.30%
Lumpkin, GA	220	200	90.91%	67	33.50%
Murray, GA	259	250	96.53%	32	12.80%
Paulding, GA	220	218	99.09%	92	42.20%
Cherokee, NC	459	459	100.00%	0	0.00%
Bradley, TN	275	251	91.27%	1	0.40%
Polk, TN	172	159	92.44%	0	0.00%
TOTAL	3382	3208	94.86%	570	17.77%

Source: Sample of the 1850 federal census manuscripts.

Table 3.2: Southern Free Farms, 1850 Sample

(Standard Deviations in Parenthesis)

Category	AL	GA	NC	TN
$Males < 10$	1.45 (1.52)	1.41 (1.40)	1.27 (1.23)	1.21 (1.21)
$10 \leq Males \leq 15$	0.62 (0.82)	0.64 (0.88)	0.67 (0.84)	0.56 (0.84)
$16 \leq Males \leq 64$	1.84 (1.26)	1.75 (1.19)	1.71 (1.06)	1.48 (0.85)
$Males \geq 65$	0.01 (0.11)	0.08 (0.27)	0.06 (0.24)	0.07 (0.25)
$Females < 10$	1.24 (1.41)	1.33 (1.31)	1.14 (1.12)	1.04 (1.02)
$10 \leq Females \leq 15$	0.65 (0.88)	0.63 (0.87)	0.63 (0.80)	0.58 (0.85)
$16 \leq Females \leq 64$	1.79 (1.45)	1.68 (1.15)	1.53 (0.88)	1.44 (0.78)
$Females \geq 65$	0.04 (0.20)	0.07 (0.26)	0.04 (0.20)	0.06 (0.24)
Acres (improved)	41.91	37.50	43.29	50.10
	(31.66)	(31.66)	(30.19)	(36.26)
Acres (unimproved)	74.85	112.12	126.26	122.48
	(71.65)	(171.89)	(177.56)	(154.93)
Cash Val. of Farm ($)	735.18	644.99	598.90	929.10
	(1090.06)	(1007.10)	(696.46)	(2131.88)
Val. of Impl. & Mach. ($)	52.07	38.00	32.01	43.35
	(154.14)	(65.56)	(39.55)	(42.58)
Val. of Livestock ($)	229.62	213.15	254.36	213.08
	(161.57)	(177.71)	(223.26)	(151.78)
Wheat (bu.)	9.30	17.27	2.16	27.40
	(17.90)	(28.79)	(7.49)	(35.40)
Rye (bu.)	0.04	1.20	21.31	0.30
	(0.50)	(6.27)	(29.52)	(2.13)
Corn (bu.)	462.24	356.72	390.48	484.24
	(344.91)	(310.71)	(234.43)	(336.13)
Oats (bu.)	58.51	42.92	68.93	110.65
	(93.18)	(73.60)	(76.00)	(104.09)
Rice (lbs.)	13.07	1.75	1.62	5.60
	(86.90)	(32.08)	(16.97)	(35.36)
Tobacco (lbs.)	8.79	17.60	16.63	16.82
	(47.45)	(114.12)	(49.99)	(81.19)
Cotton (ba.)	1.56	0.63	0.00	0.27
	(3.38)	(1.89)	(0.00)	(3.16)
Peas & Beans (bu.)	10.39	3.27	0.78	1.37
	(28.30)	(8.21)	(5.46)	(7.95)
Irish Potatoes (bu.)	8.82	5.58	8.78	9.13
	(18.70)	(19.31)	(14.43)	(16.74)
Sweet Potatoes (bu.)	72.50	62.10	50.61	31.87
	(120.34)	(78.18)	(57.07)	(34.24)

Source: Sample of the 1850 federal census manuscripts. N_{al}=143, N_{ga}=1208, N_{nc}=416, and N_{tn}=352.

Table 3.3: Southern Slave Farms, 1850 Sample

(Standard Deviations in Parenthesis)

Category	AL	GA	NC	TN
$Males < 10$	1.20 (1.55)	1.31 (1.51)	1.18 (1.41)	0.89 (0.88)
$10 \leq Males \leq 15$	0.56 (0.71)	0.69 (0.97)	0.55 (0.95)	0.50 (0.72)
$16 \leq Males \leq 64$	2.23 (1.54)	2.03 (1.52)	2.11 (1.54)	1.88 (1.57)
$Males \geq 65$	0.05 (0.22)	0.12 (0.33)	0.11 (0.32)	0.13 (0.39)
$Females < 10$	1.56 (1.72)	1.23 (1.43)	0.76 (1.06)	1.08 (1.07)
$10 \leq Females \leq 15$	0.84 (1.18)	0.57 (0.81)	0.44 (0.73)	0.45 (0.77)
$16 \leq Females \leq 64$	1.69 (1.32)	1.75 (1.26)	1.39 (0.76)	1.37 (0.66)
$Females \geq 65$	0.12 (0.33)	0.10 (0.31)	0.04 (0.21)	0.01 (0.13)
$Male\,Slaves < 10$	0.84 (1.32)	1.42 (2.11)	1.23 (1.65)	0.88 (1.13)
$10 \leq Male\,Slaves \leq 64$	1.84 (1.88)	2.34 (3.16)	2.16 (2.89)	1.25 (1.51)
$Male\,Slaves \geq 65$	0.00 (0.00)	0.05 (0.24)	0.07 (0.25)	0.00 (0.00)
$Female\,Slaves < 10$	1.64 (1.91)	1.30 (2.08)	1.39 (2.17)	0.59 (0.94)
$10 \leq Female\,Slaves \leq 64$	2.17 (2.10)	2.37 (3.06)	2.23 (2.81)	1.50 (1.65)
$Female\,Slaves \geq 65$	0.04 (0.20)	0.04 (0.22)	0.02 (0.15)	0.03 (0.18)
Acres (improved)	96.10	107.42	126.74	122.18
	(59.88)	(141.87)	(114.64)	(91.44)
Acres (unimproved)	194.89	341.01	480.60	214.23
	(139.67)	(1179.15)	(620.60)	(232.13)
Cash Val. of Farm ($)	2313.07	2971.40	3253.48	2667.28
	(2325.34)	(5268.84)	(4205.74)	(2587.37)
Val. of Imp. & Mach. ($)	158.84	126.69	111.81	114.66
	(202.17)	(169.43)	(83.94)	(97.44)
Val. of Livestock ($)	465.15	541.66	803.69	477.44
	(326.19)	(559.30)	(524.51)	(306.96)
Wheat (bu.)	20.30	54.78	7.16	83.50
	(28.78)	(82.75)	(21.58)	(99.21)
Rye (bu.)	0.12	1.48	50.16	0.00
	(0.80)	(6.37)	(53.58)	(0.00)
Corn (bu.)	895.38	825.62	985.69	1188.81
	(689.07)	(845.36)	(824.80)	(1193.77)
Oats (bu.)	105.61	129.42	165.46	269.23
	(130.85)	(250.66)	(157.41)	(433.09)
Rice (lbs.)	0.76	4.78	0.69	23.05
	(4.80)	(34.99)	(4.57)	(156.59)
Tobacco (lbs.)	5.12	13.92	28.18	13.06
	(18.33)	(111.95)	(109.75)	(45.89)
Cotton (ba.)	4.00	3.56	0.00	0.01
	(5.91)	(10.39)	(0.00)	(0.13)
Peas & Beans (bu.)	13.33	11.19	1.39	9.06
	(23.89)	(28.31)	(4.64)	(34.82)
Irish Potatoes (bu.)	9.58	13.13	13.51	17.74
	(11.06)	(29.72)	(17.88)	(27.93)
Sweet Potatoes (bu.)	70.51	116.18	82.32	51.50
	(59.32)	(132.49)	(72.62)	(67.19)

Source: Sample of the 1850 federal census manuscripts. N_{al}=39, N_{ga}=385, N_{nc}=43, and N_{tn}=59.

Table 3.4: Aggregate Mean Values of Sample Statistics and T-Tests, Alabama, 1850

	Sample Mean	Population Mean	t-test
Acres (improved)	37.621	34.169	1.246
Acres (unimproved)	70.912	67.965	0.493
Cash Val.of Farm	754.184	646.025	1.247
Val. of Impl. & Mach.	53.084	43.943	1.016
Horses	1.973	1.997	-0.010
Asses and Mules	0.291	0.318	-0.007
Milch Cows	2.728	2.743	0.108
Oxen	0.812	0.793	0.661
Cattle	4.329	4.318	0.110
Sheep	3.134	4.073	-2.333*
Swine	25.077	23.656	1.051
Val. of Livestock	206.517	215.473	-0.699
Wheat	8.287	7.662	0.596
Rye	0.099	0.133	-0.523
Indian Corn	388.831	356.945	1.146
Oats	47.934	56.560	-1.508
Rice	7.279	3.851	0.877
Tobacco	5.851	11.780	-2.659*
Ginned Cotton	1.540	1.167	1.618
Wools	5.686	6.943	-1.674
Pease & Beans	7.847	7.722	0.087
Irish Potatoes	6.517	5.729	0.860
Sweet Potatoes	50.839	44.714	1.069
Barley	0.095	0.004	0.961
Buckwheat	0.099	0.009	0.913
Val. of Orchard Prod.	0.103	0.008	0.926
Wine	0.107	0.00	1.001
Val. of Market Garden Prod.	0.716	0.447	1.242
Butter	73.096	70.582	0.549
Cheese	4.257	3.459	0.476
Hay	0.142	0.036	0.854
Clover Seed	0.138	0.002	1.073
Other Grass Seeds	0.229	0.039	1.314
Hops	0.134	0.005	0.964
Hemp (dew rotted)	0.138	0.00	1.002
Hemp (water rotted)	0.142	0.00	1.002
Flax	0.594	1.168	-2.168*
Flaxseed	0.161	0.022	0.933
Silk Cocoons	0.153	0.00	1.002
Maple Sugar	0.157	0.067	0.577
Can Sugar	0.161	0.000	1.002
Molasses	0.165	0.002	0.995
Beeswax and Honey	8.916	7.879	0.485
Val. of Home Manuf.	40.103	40.660	-0.263
Val. of Animals Slaught.	48.341	53.838	-0.412

$*$ Represents a statistical significance difference at the 5% level between the sample and population mean.

Table 3.5: Aggregate Mean Values of Sample Statistics and T-Tests, Georgia, 1850

	Sample Mean	Population Mean	t-test
Acres (improved)	43.077	44.661	-0.942
Acres (unimproved)	121.784	116.384	0.873
Cash Val. of Farm	951.475	1038.631	-1.637
Val. of Imp. & Mach.	46.186	47.416	-0.569
Horses	1.836	1.905	-1.841
Asses & Mules	0.406	0.405	0.0529
Milch Cows	2.484	2.592	-2.365*
Oxen	0.948	2.071	-36.653*
Other Cattle	4.491	4.669	-1.211
Sheep	6.198	6.739	-1.936
Swine	25.449	26.173	-1.053
Val. of Livestock	231.631	241.995	-1.589
Wheat	20.601	21.177	-0.524
Rye	1.062	1.039	0.177
Indian Corn	387.051	387.985	-0.046
Oats	50.620	50.118	0.180
Rice	2.000	6.919	-7.789*
Tobacco	13.328	15.069	-0.793
Cotton	1.094	1.043	0.482
Wools	10.375	10.580	-0.386
Peas & Beans	4.234	5.363	-3.616*
Irish Potatoes	5.981	5.874	0.248
Sweet Potatoes	58.548	60.785	-1.219
Barley	0.662	0.222	1.167
Buckwheat	0.023	0.011	0.843
Val. of Orchard Prod.	0.917	1.292	-2.344*
Wine	0.416	0.006	2.358*
Val. of Mkt. Garden Prod.	1.154	0.533	2.217*
Butter	63.478	68.605	-2.859*
Cheese	2.492	1.481	1.981*
Hay	0.186	0.215	-1.282
Clover Seed	0.009	0.009	-0.1823
Other Grass Seeds	0.011	0.012	-0.168
Hops	0.00	0.004	-
Hemp (dew rotted)	0.00	0.00	-
Hemp (water rotted)	0.000	0.000	-
Flax	0.131	0.224	-1.946
Flaxseed	0.002	0.008	-4.922*
Silk Cocoons	0.001	0.002	-1.166
Maple Sugar	0.000	0.000	-
Cane Sugar	0.000	0.000	-
Molasses	0.000	0.000	-
Beeswax & Honey	5.29	5.428	-0.272
Val. of Home Manuf.	32.296	32.620	-0.371
Val. of Animals Slaught.	66.676	70.797	-1.095

$*$ Represents a statistical significance difference at the 5% level between the sample and population mean.

Table 3.6: Aggregate Mean Values of Sample Statistics and T-Tests, North Carolina, 1850

	Sample Mean	Population Mean	t-test
Acres (improved)	51.339	52.411	-0.447
Acres (unimproved)	160.158	160.113	0.003
Cash Val. of Farm	851.301	848.457	0.037
Val. of Imp. & Mach.	39.658	39.658	0.000
Horses	2.466	2.466	0.000
Asses & Mules	0.424	0.424	0.000
Milch Cows	3.838	3.83	0.000
Oxen	0.757	0.757	0.000
Cattle	9.814	9.814	0.000
Sheep	11.102	11.102	0.000
Swine	27.301	27.301	0.000
Val. of Livestock	307.164	316.107	-0.616
Wheat	2.647	2.656	-0.009
Rye	24.122	24.122	0.000
Indian Corn	448.199	448.199	0.000
Oats	78.317	78.251	0.015
Rice	1.542	1.542	0.000
Tobacco	17.798	17.361	0.091
Cotton	0.000	0.000	-
Wools	21.682	21.682	0.000
Pease & Beans	0.843	0.842	0.001
Irish Potatoes	9.269	9.269	0.000
Sweet Potatoes	53.820	53.164	0.235
Barley	0.061	0.061	0.000
Buckwheat	0.196	0.196	0.000
Val. of Orchard Prod.	0.630	0.630	0.000
Wine	0.000	0.000	-
Val. of Mkt. Garden Prod.	9.761	9.761	0.000
Butter	95.807	96.026	-0.063
Cheese	1.251	1.251	0.000
Hay	0.484	0.479	0.033
Clover Seed	0.000	0.000	-
Other Grass Seeds	0.121	0.120	0.002
Hops	0.000	0.000	-
Hemp (dew rotted)	0.000	0.000	-
Hemp (water rotted)	0.000	0.000	-
Flax	7.610	7.610	0.000
Flaxseed	0.139	0.137	0.0250
Silk Cocoons	0.000	0.000	-
Maple Sugar	0.000	0.000	-
Cane Sugar	0.000	0.000	-
Molasses	0.000	0.000	-
Beeswax & Honey	14.083	14.085	0.000
Val. of Home Manuf.	40.021	40.056	-0.024
Val. of Animals Slaught.	57.354	58.170	-0.272

$*$ Represents a statistically significant difference between the sample and population mean.

Table 3.7: Aggregate Mean Values of Sample Statistics and T-Tests, Tennessee, 1850

	Sample Mean	Population Mean	t-test
Acres (improved)	60.255	59.571	0.272
Acres (unimproved)	141.881	173.903	-3.721
Cash Val. of Farm	1151.485	1087.787	0.608
Val. of Imp. & Mach.	53.469	54.556	-0.390
Horses	2.541	2.537	0.039
Asses and Mules	0.326	0.369	-0.818
Milch Cows	2.572	2.577	-0.068
Oxen	0.910	0.950	-0.637
Cattle	3.116	3.211	-0.623
Sheep	7.718	8.250	-1.305
Swine	26.346	27.627	-1.026
Val. of Livestock	246.659	258.994	0.1109
Wheat	33.939	33.666	0.110
Rye	0.362	0.497	-1.111
Indian Corn	566.487	595.783	-1.067
Oats	128.281	138.371	-1.118
Rice	7.516	5.596	0.625
Tobacco	15.055	26.599	-3.292*
Cotton	0.221	1.110	-6.689*
Wools	11.968	12.764	-0.972
Peas & Beans	2.501	2.923	-0.581
Irish Potatoes	10.536	10.117	0.463
Sweet Potatoes	34.626	35.364	-0.380
Barley	0.000	0.000	-
Buckwheat	0.055	0.058	-0.081
Val. of Orchard Prod.	0.055	0.017	0.695
Wine	0.000	0.000	-
Val. of Mkt. Garden Prod.	0.067	0.021	0.674
Butter	87.639	87.327	0.071
Cheese	1.214	1.304	-0.197
Hay	0.279	0.246	0.199
Clover Seed	0.006	0.023	-3.29*
Other Grass Seeds	0.022	0.078	-2.501*
Hops	0.033	0.010	0.933
Hemp (dew rotted)	0.000	0.000	-
Hemp (water rotted)	0.008	0.000	1.000
Flax	10.064	10.284	-0.107
Flaxseed	0.008	0.056	-6.737*
Silk Cocoons	0.002	0.001	0.692
Maple Sugar	0.011	0.003	0.692
Cane Sugar	0.000	0.000	-
Molasses	0.000	0.000	-
Beeswax & Honey	0.610	1.740	-4.105*
Val. of Home Manuf.	31.006	34.604	-2.763*
Val. of Animals Slaught.	72.785	81.881	-0.624

$*$ Represents a statistically significant difference between the sample and population mean.

Table 3.8: Age Distribution of Slaves by Gender, Sample Tests, Alabama, 1850

	Ages	Number in Sample	Expected Number	χ^2 statistic
Slave Males				
	Under 5	14	19.024	
	5-9	20	17.011	
	10-14	19	18.017	
	15-19	15	15.702	
	20-29	19	17.111	
	30-39	13	9.562	
	40-49	2	4.730	
	50-59	4	3.019	
	60 & over	1	2.818	
				χ^2 (df=9) = 6.448
Slave Females				
	Under 5	39	26.271	
	5-9	25	22.518	
	10-14	22	21.982	
	15-19	15	20.776	
	20-29	25	26.941	
	30-39	13	14.074	
	40-49	8	10.857	
	50-59	2	3.753	
	60 & over	3	4.825	
				χ^2 (df=9) = 10.529

Source: Sample of the 1850 federal census manuscripts. The 5% critical value with df=9 is 16.92.

Table 3.9: Age Distribution of Slaves by Gender, Sample Tests, Georgia, 1850

	Ages	Number in Sample	Expected Number	χ^2 statistic
Slave Males				
	Under 5	310	284.278	
	5-9	255	260.215	
	10-14	231	235.593	
	15-19	187	187.653	
	20-29	256	273.273	
	30-39	135	141.952	
	40-49	69	76.106	
	50-59	57	47.379	
	60 & over	46	39.545	
				χ^2 (df=9) = 7.626
Slave Females				
	Under 5	264	275.794	
	5-9	268	243.876	
	10-14	207	211.430	
	15-19	189	185.155	
	20-29	269	269.798	
	30-39	148	150.769	
	40-49	77	89.580	
	50-59	40	41.263	
	60 & over	36	40.381	
				χ^2 (df=9) = 5.397

Source: Sample of the 1850 federal census manuscripts. The 5% critical value with df=9 is 16.92.

Table 3.10: Age Distribution of Slaves by Gender, Sample Tests, North Carolina, 1850

	Ages	Number in Sample	Expected Number	χ^2 statistic
Slave Males				
	Under 5	26	25.624	
	5-9	27	27.522	
	10-14	28	29.420	
	15-19	24	22.777	
	20-29	14	14.235	
	30-39	15	14.235	
	40-49	6	5.694	
	50-59	6	5.694	
	60 & over	3	3.796	
				χ^2 (df=9) =0.3944
Slave Females				
	Under 5	33	30.788	
	5-9	27	25.355	
	10-14	24	21.733	
	15-19	23	27.166	
	20-29	27	25.355	
	30-39	13	12.677	
	40-49	7	8.150	
	50-59	8	10.866	
	60 & over	1	0.905	
				χ^2 (df=9) = 2.184

Source: Sample of the 1850 federal census manuscripts. The 5% critical value with df=9 is 16.92.

Table 3.11: Age Distribution of Slaves by Gender, Sample Tests, Tennessee, 1850

	Ages	Number in Sample	Expected Number	χ^2 statistic
Slave Males				
	Under 5	27	23.180	
	5-9	25	22.262	
	10-14	14	19.508	
	15-19	12	15.377	
	20-29	27	25.016	
	30-39	9	9.639	
	40-49	6	4.819	
	50-59	5	4.131	
	60 & over	1	2.065	
				χ^2 (df=9) = 4.484
Slave Females				
	Under 5	18	21.709	
	5-9	17	19.155	
	10-14	19	18.091	
	15-19	17	16.814	
	20-29	26	22.986	
	30-39	14	12.557	
	40-49	8	8.301	
	50-59	4	3.618	
	60 & over	3	2.766	
				χ^2 (df=9) = 1.555

Source: Sample of the 1850 federal census manuscripts. The 5% critical value with df=9 is 16.92.

Chapter 4

Race, Readers, and Rednecks: Identifying the Determinants of Cherokee Agricultural Productivity

How can we characterize the variation in productivity among Cherokee farmers? This issue, albeit couched in different terms, has been addressed by scholars in gleaning the historical record. The results have been inconclusive. Race, mainly emphasized by people in the more racially-charged early nineteenth century, and cultural traditions, promoted recently by historians, are commonly given as possible explanations for differential rates of performance among Cherokee farmers. In fact, these factors are often intermingled, as the racial composition of the household was considered to be highly correlated with the adoption of Euro-American cultural traditions; however, this generalization has been recently challenged.[1] By adopting techniques established by economists to estimate a flexible production function, the goal of this chapter is to determine the multi-factor productivity of farm households contained in the 1835 Cherokee census through the estimation of household-level scale elasticities and technical efficiencies. Two methods are used to estimate the Cherokee farm production function: the stochastic frontier approach which controls for random effects and the corrected ordinary least squares approach which avoids the *a priori* specification of the technical inefficiency effects. The benefit of using these two different techniques is that the sensitivity of the estimated coefficients to the model specification can be judged. Upon estimation, these productivity measures are grouped into general categories to determine how productivity varied across Cherokee classes. The two general categories are defined in terms of economic variables (defined as whether the

[1] See Perdue, *"Mixed Blood Indians."*

Cherokee household sold grain to the market) or sociological variables (defined as whether the household can be classified as a traditionalist or one that has accommodated to the "civilization" program).[2] The goal is to identify the factors which influenced Cherokee farm productivity.

The organization of this chapter is as follows. First, the history of the acculturation program is discussed to highlight the differing opinions among contemporaries and later historians regarding the Cherokee "civilization" progress. The economic theory of multi-factor productivity is then mentioned to explain why this measure is superior to other productivity measures as well as how this theory can be applied to the historical debate. The Cherokee farm production function is specified and estimated separately for free and slave farms; resulting technical efficiency measures are then estimated through different methods. The main conclusion of this chapter is that the racial composition of the household, controlling for all other factors, did influence productivity; however, the role of race differed on free and slave farms. Therefore, assimilated Cherokees were more productive than traditional Cherokees; however, only among assimilated households with a specific racial composition.

4.1 A Brief History of the "Civilization" Program

In the wake of American independence, the federal government adopted a "civilization" policy, which sought to acculturate Native American people.[3] In the Southeast,

[2]In recent years, the term "acculturation" has been typically abandoned by historians because of its vagueness. In this study, a salient feature of the Cherokee data, as emphasized by some historians, is that the Cherokee census contains glaring differences in wealth accumulation which are correlated with differences in the racial composition of the household. This paper adopts the definition of John Finger, who uses "acculturation" to "signify the changes among Indians that made them in the eyes of whites, more 'civilized.'" Finger, *The Eastern Band of Cherokees*, xiii.

[3]Henry Knox, the Secretary of War in Washington's administration, devised the first federal Indian policy. One part of the policy was that treaties from land cessions would furnish Indians with both farm implements and livestock as well as residential Indian agents to lead them in the adoption of Euro-American farming practices. The 1791 Treaty of Holston was the first Cherokee land cession which had these features. Perdue, *Cherokee Women*, 110-11; McLoughlin, *Cherokee Renaissance in the New Republic*, 34-37.

the program fell entirely into the hands of Benjamin Hawkins, the first U.S. superintendent of Southern tribes. He clearly stated his role in this federally-sponsored plan in an 1807 speech:

> The plan I persue [sic] is to lead the Indian from hunting to the pastoral life, to agriculture, household manufactures, a knowledge of weights and measures, money and figures, to be honest and true to themselves as well as to their neighbors, to protect innocence, to punish guilt, to fit them to be useful members of the planet they inhabit and lastly, letters.[4]

Upon arrival, Hawkins quickly started to adumbrate the different institutions of Southeastern Indians. For example, Cherokee legal and political institutions differed from whites, as each Cherokee town was to a large extent self-governed, as local councils, in which women had an important voice, became the legal entity for these villages. This type of government where the women played a powerful role was referred to by Europeans as a "petticoat government."[5] Another important factor in internal political issues was the clan, where membership depended on the mother's clan affiliation. Since Cherokee males never married into the same clan, any child from this union was not a blood relative of the husband. The child would have been only related to his mother because the child was a member of the mother's clan. This matrilineal descent pattern was a traditional aspect of Cherokee society which, in the eyes of the U.S. government, was an example of their savagery.[6]

Without a formal government, Cherokees policed themselves through blood vengeance, which required a clan member to seek revenge for another clan member's murder.[7] Revenge was always conducted because it was a "privileged" act: if not, Cherokees claimed that the spirit of the murdered clan member would haunt and create disorder in the life of the delinquent clan member.[8] This obligation typically

[4]Saunt, *A New Order of Things*, 139.

[5]Brown, *Old Frontiers*, 18.

[6]Perdue, *Slavery and the Evolution of Cherokee Society*, 61.

[7]This retaliation is sometimes considered irrational. Philosopher David Hume wrote, "Who sees not that vengeance, from the force alone of passion, may be so eagerly pursued as to make us knowingly neglect every consideration of ease, interest, or safety?" Jon Elster, "Social Norms and Economic Theory," *Journal of Economic Perspectives*, 3 4(1989): 101.

[8]McLoughlin, *Cherokee Renaissance in the New Republic*, 12.

fell upon the closest-related male relative on the mother's side, either the uncle or brother of the murdered Cherokee, as the murderer's clan could never prevent the execution of their own clan member.[9]

As suggested earlier, gender roles in Cherokee society were drastically different than in early American communities. Along with exercising political power, Cherokee women owned the property rights to any land improvement (i.e. log cabins, corn cribs, and the cultivated crops). A husband typically moved into his wife's residence; however, during the hunting off-season, men typically spent time with other men, often staying at communal buildings.[10] Women also controlled the food supply for the household as they were the chief cultivators of crops. The "children of nature," or Cherokee males, during the eighteenth century were mainly occupied with securing deerskins of a game population which was rapidly dwindling. Most white traders during the eighteenth century quickly learned that the only way to stay fed was to marry an Indian woman, since relying on gifts was not a secure way to obtain food.[11]

Redistribution was another glaring difference between Cherokee and white societies. This level of philanthropy made lasting impressions on early European travellers: naturalist Bernard Romans thought that "a savage will [would] share his last ounce of meat with a visitant stranger."[12] Traditionally, excess corn supplies were held in public granaries and distributed to Cherokees upon need. Redistribution cer-

[9]If the killer could not be found, retaliation could be taken against any other clan member. Often murderers simply gave themselves up, as the infliction of death was known with certainty. John Phillip Reid, "A Perilous Rule: The Law of International Homicide," in *The Cherokee Nation: A Troubled History*, ed. Duane H. King (Knoxville: The University of Tennessee Press, 1979), 43-44.

[10]Perdue, *Cherokee Women*, 46. In Creek society, males and females spoke different versions (either masculine or feminine) of their Muskogee language. This led ethnologist John R. Swanton to conclude, "in ancient times men and women were almost like two distinct peoples." Kathryn E. Holland Braund, *Deerskins & Duffels: The Creek Indian Trade with Anglo-America, 1685-1815* (Lincoln: University of Nebraska Press, 1993), 14; Saunt, *A New Order of Things*, 140-41.

[11]As traveller John Lawson stated in the early eighteenth century, "The English traders are seldom without an Indian female for his Bed-fellow." Perdue, *"Mixed Blood" Indians*, 15.

[12]Ibid., 12.

emonies such as the Green Corn Ceremony, which coincided with the maturing of the late corn crop, would, among other things, redistribute corn, and later, distribute the U.S. government's annuities.[13] All of these aspects of traditional Cherokee society (i.e. legal traditions, gender roles, and economic motivations) were focused on by Hawkins in his 1807 speech. These institutions would have to be altered to fulfill this program.

"Civilization" visited Cherokees in the form of federally subsidized missionaries and annuities such as plows, livestock, and looms.[14] The "master narrative" states that Cherokees were the most "successful" group, or at least the most eager to obtain the trappings of the acculturation program. Cursory evidence which justifies this claim includes the adoption of a federal government in 1827, complete with three branches of government and a written constitution.[15] Protestant missionaries who lived among the Cherokees converted many to Christianity. One mission station, Brainerd (located near present-day Chattanooga), established an agricultural school to help teach white farming methods and soon became one of the most successful missions in any Indian Nation.[16] Perhaps the most radical transformation among the Cherokees was their development of an intensive, surplus-oriented agricultural economy. Elias Boudinot highlighted some of the Cherokee progress in an 1826 address to whites: "In 1810 there were 19,500 cattle; 6,100 horses; 19,600 swine; 1,037 sheep; 467 looms; 1,600 spinning wheels; 30 wagons; 500 ploughs; 3 saw mills; 13 grist mills &c. At this time there are 22,000 cattle; 7,600 horses; 46,000 swine; 2,500 sheep; 762 looms; 2,488 spinning wheels; 172 wagons; 2,943 ploughs; 10 saw

[13]In this ceremony, Cherokees would wipe their slate clean of all the past year's injustices. Charles Hudson, *The Southeastern Indians* (Knoxville: The University of Tennessee Press, 1976), 366, 375.

[14]The Intercourse Act of 1802 appropriated $15,000, later reduced to $10,000, annually to a fund, which provided government agents to supply "useful domestic animals and implements of husbandry" to the Indians. Wallace, *The Long, Bitter Trail*, 34.

[15]Their constitution had some of the same restrictions as the U.S. version: for example, only free males over 18 could vote and only males over 25 could hold office. From Article 3, Section 4 from the 1827 Cherokee constitution.

[16]Hurt, *Indian Agriculture in America*, 101.

mills; 31 gristmills; 62 blacksmith-shops; 8 cotton machines."[17] The crops raised by Cherokees included corn, wheat, oats, potatoes, tobacco, indigo, and cotton, as surplus cotton was exported to port cities like Charleston and New Orleans. These improved farming practices have led some to state that the Cherokees achieved agricultural production that paralleled or surpassed that of their white neighbors.[18]

A closer look into the "civilization program" reveals a different picture, one which includes lags in the development of these new institutions and differences in agricultural practices across Cherokee families. Some, mainly politicians who represented advocates for Indian removal, adopted the discourse of scientific racism to explain their stance. For example, Georgia Governor George M. Troup stated,

> [As for Indian] incorporation and amalgamation with our [white] society [in Georgia]. . . the answer is that if such a scheme were practicable at all, the utmost rights and privileges which public opinion would concede to the Indians would fix them in a middle station between [blacks] and the white man, and that as long as they survived this degradation, without the possibility of attaining the elevation of the latter, they would gradually sink to the condition of the former -a point of degeneracy below which they could not fall.[19]

However, the most vocal removal advocate was Andrew Jackson, who often denied all forms of economic progress by the Cherokees, or for that matter all Indians: "Treachery of the Indian character will never justify the reposing of confidence in their professions."[20]

Other derisive comments specifically referred to full-blooded Cherokees, the large subset of their population perceived to rely on the dwindling game population for

[17]Perdue, *Slavery and the Evolution of Cherokee Society*, 54; McLoughlin, *Cherokee Renascence in the New Republic*, Table 7, 295.

[18]Wilma Dunaway, "Rethinking Cherokee Acculturation: Agrarian Capitalism and Women's Resistance to the Cult of Domesticity, 1800-1838," *American Indian Culture and Research Journal*, 21 1 (1997): 157.

[19]William G. McLoughlin, "Red Indians, Black Slavery, and White Racism: America's Slaveholding Indians," *American Quarterly*, 26 4 (1974): 377.

[20]This quote was contained in a letter from Andrew Jackson to General Henry Atkinson on May 15, 1819. General Atkinson later led U.S. forces against Sauk and Fox Indians in what is now known as "The Black Hawk War." John A. Andrew III, *From Revivals to Removal: Jeremiah Everts, the Cherokee Nation, and the Search for the Soul of America* (Athens: The University of Georgia Press, 1992), 97.

subsistence. Lewis Cass, who in 1830 anonymously wrote an influential article on total Indian removal in *The North American Review*, best summarized this stance:

> That individuals among the Cherokees have acquired property, and with it more enlarged views and juster notions of the value of our institutions, and the unprofitableness of their own, we have little doubt. And we have as little doubt, that this change of opinion and condition is confined, in a great measure, to some of the *half-breeds* and their immediate connexions. These are not sufficiently numerous to affect our general proportions; and the causes, which have led to this state of things, are too peculiar ever to produce an extensive result.[21]

Similar sentiments were expressed in the Report of the Indian Committee of the House, which was part of the 1830 Indian Removal bill. The report identified only 230 mixed-blood Cherokee families as achieving any level of "civilization." The report conveniently asserted that, due to their dire situation, the remainder of the population, who held no voice in the newly-created Cherokee federal government, preferred removal over their current situation.[22] Even some Cherokees believed that progress was not uniform. Charles Hicks, the second Principal Chief of the Nation, was critical of their own farming techniques: "Most families cultivate from ten, twenty, thirty to forty acres of land without the assistance of black people. The greatest number of whom might raise plentiful crops of corn where they do get into the habit of plucking out one or two stalks in a hill in old ground. It is believed that there is not more than one-eighth or ninth part of the families but has either horses or cattle, and perhaps there is none without a stock of hogs."[23]

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[21]Cass, "Removal of the Indians," 79. Lewis Cass was a very influential advocate of removal. He extensively studied and wrote on what he considered to be unstructured Native languages. He believed this implied that Indians maintained a savage lifestyle, incapable of assimilating into early American society. Interestingly, the state of Georgia named the territory around New Echota, the capital of Cherokee Nation before removal, Cass County prior to the land lottery of 1832. However, the county was renamed Bartow County −− after General Francis Bartow, the first Confederate General to die in the Civil War −− since Cass, a Michigan native, supported the abolitionist movement.

[22]This report quantified that twenty-five to thirty households ran the newly-formed federal government, while roughly 200 other families were part of the middle class, implying that there was no upper class in Cherokee Nation during the 1830s. Wallace, *The Long, Bitter Trail*, 67.

[23]McLoughlin, *Cherokee Renaissance in the New Republic*, 328.

Given this conflicting evidence, the degree of Cherokee economic progress is still debated. Employing dubious empirical methods, Stanley Lebergott estimated that the land requirement for Cherokees during the early nineteenth century was 1,900 acres per capita, as opposed to American antebellum land requirements, which were roughly 2 acres per capita.[24] In a subtle comment on this work, David Wishart later showed that the majority of Cherokee households in the Southeast prior to removal were in fact self-sufficient.[25] Furthermore, historian Mary Young asserted that Cherokees had achieved substantial economic progress in the acculturation program, and that removal was an issue of political pragmatism rather than economic inefficiency: "The young Republic's experiment in self-reproduction succeeded, in retrospect, better than either its authors or its beneficiaries could comfortably acknowledge."[26]

On the other hand, Cherokee historian William McLoughlin argued that many Cherokees were not wealth-seeking individuals who made efficient use of their land: "Although most full-bloods mastered the art of plowing, they did not really understand how to get the best yield from the land."[27] It has also been argued that the biggest failure of the "civilization" program was not the inability to convert full-blooded Cherokees but the inability to change traditional Cherokee gender roles, especially gender roles on the farm. Some white males who married Cherokee women claimed that only females were willing to change: for example, an intermarried white male told a visitor in the early nineteenth century, "The females have however made much greater advances in industry than the males, they now manufacture a great quantity of cloth; but the latter have not made proportionate progress in agriculture."[28] The problem, in the eyes of Indian agents, was that Cherokee males were unwilling to do "women's work." Benjamin Hawkins frustratingly expressed

[24]Stanley Lebergott, *The Americans* (New York: W.W. Norton & Co., 1984), Table 2.3, 16.

[25]Wishart, "Evidence of Surplus Production," 120-38.

[26]Mary Young, "The Cherokee Nation: Mirror of the Republic," *American Quarterly*, 33 5 (1981), 503-504.

[27]McLoughlin, *Cherokee Renaissance in the New Republic*, 301.

[28]Perdue, *Cherokee Women*, 120.

the avoidance of males in agriculture: "They told me they did not understand the plan, they could not work, they did not want ploughs, it did not comport with the ways of the red people, who were determined to preserve in the ways of their ancestors."[29] The transition into agriculture may have been slow but, as shown earlier, traditional gender roles were reversed by 1835. However, if adoption of farming was slow on households which attempted to "preserve the ways of their ancestors," then the accumulation of experience in agriculture would have differed across Cherokee farms, which, among other things, can influence productivity.

Most agree that beneath the elite class, there existed a "surprisingly durable stratum of traditionalism."[30] According to Cherokee historian Theda Perdue, "We will miss the opportunity to challenge the master narrative that Cherokee society abandoned its own values and institutions for those of Anglo-Americans. By constructing alternative narratives, we begin to make amends for the removal of Cherokee from their own history."[31] Thus, the current trend in Cherokee studies is to show that Anglo-American influences did not impact Cherokee society substantially. Therefore, Cherokee historians, especially Theda Perdue, consider differences in such things as the racial composition of households have been overemphasized in past studies. This particular study questions this new stance by first estimating the productivity of households contained in the 1835 Cherokee census and then group these productivity measures in terms of the racial composition, literacy levels, and market-orientation of these households. The goal is to identify the factors which affect productivity.

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[29]Braund, *Deerskins & Duffels*, 185.

[30]Finger, *The Eastern Band of Cherokees*, 9; Theda Perdue, "Clan and Court: Another Look at the Early Cherokee Republic," *American Indian Quarterly*, 24 4 (2000), 566.

[31]Perdue, "Clan and Court: Another Look at the Early Cherokee Republic," 568.

4.2 Multi-Factor Productivity: Theory

A multi-factor productivity (MFP) index reflects the ratio of an index of outputs to an index of inputs. Thus, it is commonly expressed as

$$TFP = \frac{Output\ Index}{Input\ Index}. \tag{4.1}$$

The advantage of this index over a partial productivity index, such as output per worker or output per acre, is that TFP distinguishes changes in output due to changes in efficiency or scale economies rather than merely changes in input levels. For example, output per worker might increase solely because the capital stock grew −− provided that they are complements −− while the multi-factor productivity index would only have changed if the change in output was greater than the weighted change in capital. Therefore, an output per labor measure does not isolate an increase in productivity from a ceteris paribus increase in labor. Therefore, farms with higher labor productivity do not necessarily mean the workers are more productive on these farms.

In theory, multi-factor productivity can vary across Cherokee households because of differences in scale economies and differences in technical efficiency. It is possible that the technology, defined as the process of turning inputs into outputs, between different groups of Cherokee farms may have differed; however, the public-good nature of farm technology would have made free farm technology common among all free farmers and the slave farm technology common among all slave farmers. For example, traditionalists and assimilationists used the same inputs (i.e. labor, land, and physical capital) to cultivate crops. Even if the production function was the same for all Cherokee farms, scale economies and technical efficiency may have differed. If a farm exploited the available scale economies and thereby produced at a constant returns to scale level, then larger Cherokee farms would have had a productivity advantage over smaller Cherokee farms. However, larger farms might not have been more technically efficient as coordination problems can arise as the scale of operation increases.

Differences in technical efficiency, defined as the ability to produce maximal output given a set of inputs, can arise from differences in competitive forces and differences in skill levels within the household. In theory, market forces drive technical inefficiency to zero in a long-run competitive equilibrium. Since some farms produced to the market while others did not, technical efficiency should play an important role in determining the differences in productivity. Yet, the most skilled and experienced farmers may have been the ones who were able to sell their excess crops; therefore, the exact cause of greater technical efficiency of market-oriented farms is theoretically unclear. In terms of the experience of Cherokee farmers, if the white agricultural method was the "best-practice" method of farming, then the technical efficiency of the assimilationists should be greater than that of traditionalists. However, given the history of the interchange of agricultural technology between whites and Indians, the traditional method might be superior to the method promoted by Indian agents such as Benjamin Hawkins; therefore, the technical efficiency of traditionalists would be greater than assimilationists. Furthermore, the recent debate regarding the role of race in Cherokee society implies that differences between assimilated Cherokee households and traditional Cherokee households may have been trivial, such that differences in technical efficiency would have been insignificant. These issues can be resolved empirically as the next two sections detail the methods to estimate multi-factor productivity.

4.3 Empirical Method: Stochastic Frontier Analysis

The first empirical method to determine multi-factor productivity is to estimate a production frontier for both free and slave farms where technical inefficiency effects are modelled as a one-sided error term and random effects, such as weather, are modelled as a two-sided error term. The resulting efficiency scores for each farm represent the maximum radial increase in output, holding input usage constant, which is feasible given the structure of the technology. This can be represented in

the following way:

$$TE_i = \frac{y_i}{f(x_i;\beta) * \exp(v_i)} \tag{4.2}$$

where TE_i represents the individual technical efficiency measures, y_i is an index of output, $f(x_i;\beta)$ is the deterministic production function, and $\exp(v_i)$ accounts for random noise. Provided that the technology is homogenous of degree one, the output elasticities are identical to cost shares assuming that Cherokee farmers cost minimized. In this case, the denominator would represent an index of inputs which is important because Eqs. 4.1 and 4.2 would be identical. The benefit of this approach is that input prices are not needed to estimate an input index. If the production function is non-homothetic, then the farm size as well as the technical efficiency of each household would impact multi-factor productivity.

The production function for both slave and free Cherokee farms is specified by a translog function. This specification is commonly used in the productivity literature, since it eliminates the restrictive scale and substitution properties of a Cobb-Douglas production function. The substitution property is important for slave farms, since on large farms, slaves and free labor were probably complementary inputs.[32] This translog specification can be represented for both types of farms as

1. Free Farms

$$\ln y_i = \beta_0 + \sum_{i=1}^{3} \beta_i \ln x_i + \frac{1}{2} \sum_{i=1}^{3} \sum_{j=1}^{3} \beta_{ij} \ln x_i \ln x_j + \sum_{k=1}^{2} \delta_k SOIL_i + v_i - u_i, \tag{4.3}$$

$$\beta_{ij} = \beta_{ji} \; \forall \, i \neq j,$$

2. Slave Farms

$$\ln y_i = \beta_0 + \sum_{i=1}^{4} \beta_i \ln x_i + \frac{1}{2} \sum_{i=1}^{4} \sum_{j=1}^{4} \beta_{ij} \ln x_i \ln x_j + \sum_{k=1}^{2} \delta_k SOIL_i + v_i - u_i, \tag{4.4}$$

$$\beta_{ij} = \beta_{ji} \; \forall \, i \neq j,$$

[32]Free and slave labor on large slave farms, which is determined as farms with more than 15 slaves, in the Deep South in 1860 were complementary inputs, since free males often managed slaves while slaves did the field work. This implies that Fogel and Engerman's productivity results suffer from model specification bias since they used a Cobb-Douglas production function, which implies perfect substitutability between all inputs. Field, "Free and Slave Labor in the Antebellum South," 654-59.

where i is the i^{th} household, y_i is output, x_1 is household field labor, x_2 is improved acres, x_3 is capital, x_4 is slave labor, $SOIL_1$ and $SOIL_2$ are the soil type dummies.[33] The error term is specified by two components: v_i is defined as a two-sided random noise term, independently and identically distributed N(0, σ_v^2), and u_i is a one-sided technical inefficiency effect term, independently and identically distributed $N^+(0, \sigma_u^2)$.[34] The technical efficiency of each farmer is determined by $E(\exp(-u)) = \frac{y_i}{f(x_i;\beta)*\exp(v)}$, which is identical to Eq. 4.2.

Since the error term has two components, the estimation of Eqs. 4.3 and 4.4 should be computed by maximum likelihood, since in large samples, maximum likelihood estimates are consistent, asymptotically efficient, and asymptotically normal. Assuming the v_i's and u_i's are independent, the log likelihood function is specified as

$$\ln L = -\frac{N}{2}\ln(\frac{\pi}{2}) - \frac{N}{2}\ln(\sigma_s^2) + \sum_{i=1}^{N}\ln[1-\Phi(z_i)] - \frac{1}{2\sigma_s^2}\sum_{i=1}^{N}\varepsilon_i^2, \tag{4.5}$$

where N is the number of households, $\sigma_s^2 = \sigma_u^2 + \sigma_v^2$, $\gamma = \frac{\sigma_u^2}{\sigma_u^2+\sigma_v^2}$, $z_i = \frac{\varepsilon_i}{\sigma_s}\sqrt{\frac{\gamma}{1-\gamma}}$, and $\Phi(.)$ is the standard normal cumulative distribution function. Once the ML estimates of β, δ, γ, and σ_s^2 are obtained, each household's technical efficiency can be computed. Using a method developed by George Battese and Tim Coelli, one can determine the point estimator of $\exp(-u_i)$ by

$$E(\exp\{-u\}|\varepsilon_i) = \frac{1-\Phi(\sigma_* + \frac{\gamma\varepsilon_i}{\sigma_*})}{1-\Phi(\frac{\gamma\varepsilon_i}{\sigma_*})} * \exp(\gamma\varepsilon_i + \frac{1}{2}\sigma_*^2), \tag{4.6}$$

[33]The output and input variables are defined in Chapter Two.

[34]A number of nonnegative distributions could have been chosen besides the half-normal: such as exponential, truncated normal, and gamma to name a few. William Greene showed that the sample means of the cost efficiencies of U.S. electric utilities were largely unaffected by the specification of the one-sided distribution. William Greene, "Maximum Likelihood Estimation of Econometric Frontier Functions," *Journal of Econometrics*, 13 (1990): 37-56. Subal C. Kumbhakar and C.A. Knox Lovell, *Stochastic Frontier Analysis* (Cambridge: Cambridge University Press, 2000), 90. Furthermore, Christian Ritter and Léopold Simar showed that two-parameter distributions such as the truncated normal and gamma generate unreliable frontier estimates unless that sample size contains several thousand observations. Christian Ritter and Léopold Simar, "Pitfalls of Normal-Gamma Stochastic Frontier Models," *Journal of Productivity Analysis*, 9 2 (1997): 167-82.

where $\gamma = \frac{\sigma_u^2}{\sigma_u^2+\sigma_v^2}$, $\sigma_* = \sigma_u * (\frac{\sigma_v}{\sigma_v+\sigma_u})$, and $\Phi(.)$ is the standard normal cumulative distribution function.[35] This estimator is consistent with the original equation for technical efficiency: $TE_i = \exp(-u_i)$. Each estimate of household technical efficiency is restricted to be between 0 and 1; a 1 represents a household that is 100% technically efficient and 0 represents a household that is 100% technically inefficient.

The following restrictions on the free farm data are applied to determine if the function is homogenous:

$$\begin{aligned} \beta_{11} + \beta_{12} + \beta_{13} &= 0 \\ \beta_{21} + \beta_{22} + \beta_{23} &= 0 \\ \beta_{31} + \beta_{32} + \beta_{33} &= 0 \end{aligned}$$

Upon testing these restrictions, a further restriction is imposed to determine if the underlying production structure is linearly homogenous, which implies that every household faces a constant returns to scale technology regardless of the farm size. This restriction is

$$\beta_1 + \beta_2 + \beta_3 = 1$$

For the slave translog production function, there are four restrictions which impose homogeneity on the function and five restrictions which impose linear homogeneity. These restrictions are as follows:

$$\begin{aligned} \beta_{11} + \beta_{12} + \beta_{13} + \beta_{14} &= 0 \\ \beta_{21} + \beta_{22} + \beta_{23} + \beta_{24} &= 0 \\ \beta_{31} + \beta_{32} + \beta_{33} + \beta_{34} &= 0 \\ \beta_{41} + \beta_{42} + \beta_{43} + \beta_{44} &= 0 \\ \beta_1 + \beta_2 + \beta_3 + \beta_4 &= 1 \end{aligned}$$

[35] George E. Battese and Tim J. Coelli, "Prediction of Firm-Level Technical Efficiencies with a Generalized Frontier Production Function and Panel Data," *Journal of Econometrics* 38 (1988): 387-99.

If any of these restrictions are accepted, then they will be imposed on Eqs. 4.3 and 4.4, respectively. This will increase the efficiency of the point estimates.

4.4 Empirical Method: Corrected Ordinary Least Squares

The second empirical method avoids the possible misspecification of the one-sided technical inefficiency term. The corrected ordinary least squares (COLS) approach does not specify a distribution for the technical inefficiency effect, but rather, simply adjusts every residual by an appropriately-determined individual residual.

This approach contains two steps. In the first step, the translog production functions (Eqs. 4.3 and 4.4) are estimated by ordinary least squares. Even if technical inefficiency existed, the estimation of a production function by OLS would still produce consistent and unbiased estimates of the slope parameters; however, the intercept term will be biased. The intercept term, as well as the OLS residuals are then corrected in the second step by adjusting the intercept term upward by the largest residual. The residuals are simultaneously adjusted in the opposite direction by the largest residual. Therefore, the corrected residuals take the form -$\hat{u}_i^* = \hat{u}_i - \max_i\{\hat{u}_i\}$ and the individual technical efficiency terms are estimated in the typical fashion, $TE_i = \exp\{-\hat{u}_i^*\}$.

Due to the adjustment of the intercept term, the estimated production function lies above each observation except for the one household with the largest residual. Because the frontier is estimated using OLS, the curve initially goes through the mean of each input. This implies that the production technology is identical to the production structure of an average household. Since the production technology of the most efficient households at each input level may be quite different from the average household, this estimated frontier typically does not bound the data as closely as a stochastic production frontier. Therefore, the variance of the COLS technical efficiency measures will be larger than the ones estimated by ML.

4.5 Results

First, the restrictions of homogeneity and linear homogeneity are tested for both types of farms through the use of likelihood ratio tests. A likelihood ratio test determines if the set of linear restrictions on the beta coefficients can be rejected. The likelihood ratio test is determined as $LR = 2 * (L_{ur} - L_r)$, where L_{ur} is the log likelihood for the unrestricted model and L_r is the log likelihood of the restricted model. The results from these likelihood ratio tests are located in Table 4.1. On Cherokee slave farms, the null hypotheses of homogeneity and linear homogeneity are failed to be rejected, therefore implying that every Cherokee slave farm faced a constant returns to scale technology. Therefore, doubling all the inputs, regardless of the size of the farm, would led to a doubling of grain output. On Cherokee free farms, both null hypotheses were rejected, as the the LR statistic on the CRS restrictions is 63.361 with a critical value of 9.488 at the 5% significance level and the LR statistic on the homogeneity restrictions is 33.391 with a critical value of 7.814 at the 5% significance level. These two results imply that the scale economies on Cherokee free farms depended on the size of the operation. Doubling the inputs would have led to the doubling of output on some free farms, but it could have lead to a more than doubling of output on other free farms as well.

By imposing the linear homogenous restrictions only on the slave data, I estimate both models by maximum likelihood and corrected ordinary least squares, and the results are shown in Table 4.2. Before estimation, each input variable is divided by its respective mean; therefore, the first-order coefficients are mean output elasticities and thus mean cost shares *only* of the slave farms.

Each first-order coefficient is of the correct sign, and some of the cross products for both free and slave farms are highly significant. On free farms, both mean output elasticities of land and capital are highly significant. Since Cherokee free farms were small, the impact of additional capital and land should have had a bigger impact on output than additional labor. For example, an additional acre would have freed up labor resources. Since the amount of acres cultivated was higher on slave farms, land

Table 4.1: Testing for Both Homogeneity and Linear Homogeneity

Likelihood Ratio Tests

Category	Homogeneity Test	Reject at 5% Level	CRS Test	Reject at 5% Level	No. of Obs.
Free Farms	33.391	YES	63.361	YES	2110
Slave Farms	1.925	NO	2.550	NO	186

Notes: On free farms, the χ^2 critical value for the test for homogeneity (df=3) is 7.814 at the 5% significance level, and the critical value for the test of linear homogeneity (df=4) is 9.488. On slave farms, the χ^2 critical value for the test for homogeneity (df=4) is 9.488 at the 5% significance level, and the critical value for the test of linear homogeneity (df=5) is 11.071.
Source: See Chapter Two.

productivity should have been lowered than that on free farms. The relatively larger slave farms can also explain the higher household labor productivity. Although the estimates are insignificant, the contribution of an additional worker on a large farms should have been greater than the marginal contribution of labor on a small farm because the marginal benefit from cultivating – more grain output – is higher on large farms. Since the benefit from additional work is low on small farms, some eighteenth and nineteenth century countrymen observed their low labor productivity. An Alabama resident living among Creek Indians claimed, "it is notorious that in consequence of their habitual idleness all laborious pursuits tending to lucrative purposes are thought by them to be beyond their effect."[36] These farmers did not necessarily desire more leisure than white farmers. Rather, they farmed on smaller plots which reduced the benefit from working longer hours. However, these results show that the benefit from increasing the size of the farm did led Cherokee farmers to cultivate substantially more crops. Thus, on larger farms, Cherokee farmers substitute away from leisure and towards labor as the relative price of leisure differed across Cherokee

[36]Claudio Saunt, "What Can Economic Historians Tell Us about Native American History?," 3.

farms. The same statement would not have been true for the Indian agriculturalists holding large farms.

On slave farms, the mean output elasticity of slaves is low and insignificant. Their relatively low marginal productivity may be solely a function of the output variable which does not contain labor-intensive crops such as tobacco and cotton. Undoubtedly, the marginal product of slaves on the large Deep South farms was highly positive and statistically significant; however, those slave farms were much larger, therefore the benefit of working a slave an additional hour was higher. Yet, low slave productivity may also be due to shirking, as Cherokee slaves had in general more freedom than slaves on white farms. If slaves were treated differently on Cherokee farms, then free and slave labor should have been substitutes. Prior cliometric studies on the relationship between free and slave labor have used the Hicks elasticity of complementarity to estimate this relationship. The level of complementarity between inputs i and j is measured in this case as $h_{ij} = (\beta_{ij} + M_i M_j)/M_i M_j$ where β_{ij} is the coefficient on the interaction term of these inputs, and M_i and M_j are the logarithmic marginal products of each respective input. At the mean values for free and slave labor on Cherokee farms, the Hicks elasticity of substitution is -39.85 using the ML estimates and -7.29 using the COLS estimates. These elasticities imply that the two inputs were substitutes in grain production, which is dissimilar to Elizabeth Field's study on Deep South slave farms which showed that regardless of farm size, free and slave labor were complements on Deep South farms.[37]

Finally, the high levels of the γ parameter in both regressions suggest that the variance of the technical inefficiency effects outweighs the variance of the random effects. This provides some evidence that allowing for technical efficiency through the specified one-sided error term was advantageous, since there was a lot of variation in technical efficiency across both types of farms. Since the translog functions

[37]This level of substitutability far exceeds previously-measured elasticities of substitution between these two inputs, which were estimated as 0.30 on non-gang farms (i.e. slightly complementary) and 7.03 (i.e. more complementary) on gang slave farms. Field, "Free and Slave Labor in the Antebellum South," Table 1, 657.

for both farms are well-behaved and the output elasticities are consistent with economic theory, the resulting TE measures are considered consistent measures of the true productivity levels on these farms. However, before the factors of Cherokee productivity are determined, the technical efficiency and total elasticity of production of each household are grouped in terms of economic and sociological variables with the intended goal to identify the most productive Cherokees.

4.6 Sociological and Economic Forces among the Cherokees

To identify the spectrum of Cherokee Indians who lived in the Southeast, a number of variables are used to identify different groups among the Cherokee farm households. The economic variables are the easiest to define. The market-orientation of a Cherokee farm is determined by whether the farmer, either free or slave, sold any excess grain to the market. This represents 661 farmers or 31% of the free farms in the sample, and 123 or 66% of the slave farms in the sample. Typically, grain surpluses were not shipped outside the Nation; however, other crops such as cotton were shipped to port cities like New Orleans. The public roads (see Fig. 4.2) which crossed through the Nation provided access to cattle drovers who sold their excess cattle to Southern plantation farmers. For some Cherokees, the amount supplied to the market was not trivial; a few slaveholders sold over 3000 bushels of corn to local markets, generating $1500 in income.[38] This category is further specified to include only the households that sold 40 or more bushels of either corn or wheat.

The market-oriented households are grouped together to determine if there was a relationship between productivity and grain sellers. This classification is not so much an explanatory variable as a measure of the accuracy of the estimated multifactor productivity measures. This is because market-orientation is undoubtedly an

[38]Estimates of each farmer's marketable surpluses could have been done to determine whether the farmer could have supplied grain to the market. In fact, David Wishart estimated self-sufficiency levels for these Cherokees; however, relying on census records provides a more exact measure, since a fair amount of assumptions are needed to compute these self-sufficiency measures, since livestock and other food crops are not listed in the census.

endogenous variable: either the most productive Cherokees are able to sell their excess crops or to sell crops on the market, one had to be more productive. In the next section, the factors which influenced the market-orientation of the households are determined. This section will determine if the market-oriented households are at all related to higher multi-factor productivity levels.

Identifying traditionalists and assimilationists using the census categories is more challenging. The variables used to distinguish these groups are as follows: whether the household contained a reader in English, whether there was a married white in the household, whether the household contained at least one mixed-blooded family member, and whether the household contained at least one full-blooded family member.[39] Readers in English show the influence of higher education levels on productivity, while the married white category reflects the influence of white agricultural methods on relative productivity. The influence of married whites on productivity may have differed across free and slave farms. Married whites were typically males who held non-agricultural occupations, such as traders and government agents. However, a married white who owned slaves was probably a full-time farmer as Cherokee women did marry neighboring white farmers as well. Therefore, the influence of married whites on productivity may be different across farm types.

Readers in Cherokee were not used as a category because this dichotomy can be problematic, since there was a fairly even split between readership in full-blooded families and mixed-blood families. This is because "the syllabary appealed to the diverse ends of the Cherokee political spectrum: the assimilationists, who already knew and appreciated the convenience of a written language because of their familiarity with English, and the purists, who sought to preserve the Cherokee language

[39]The race categories are somewhat problematic because they were not clearly defined. The greatest influence on household behavior or traditions would have been mixed-blood Cherokees, or children from the white male and Cherokee woman marriage. In the 1830s, these Cherokees were referred to as "half-breeds"; therefore, in this study, the mixed-blood members of the household are determined by the number of "half-breeds" in the family. Since this term is now considered derogatory, the term "mixed-blood" is used.

from extinction in the face of the ever-present English."[40] Also, Willard Walker suggests that the census underestimates the number of Cherokee readers, stating that "the Cherokees were 90 percent literate in their native languages in the 1830s."[41]

Finally, the two race categories are used to determine the role of acculturation on productivity levels. Full-blooded Cherokees were on average more likely to reflect the traditional lifestyle than other Cherokees. Even though full-blooded Cherokee males substituted away from hunting, their farm-specific human capital was probably lowered than males that descended from generations of farmers. The opposite is expected with mixed-blood families, as the influence of white traditions conceivably would have been greater on these households than on the full-blooded ones. Therefore, the race categories attempt to determine the role of cultural or sociological factors in productivity.

4.7 Productivity Differences Across Groups

First, unlike on Cherokee slave farms, scale economies on the free farms depended on the scale of the farm operation. The calculation for the scale elasticity on each farm is determined by summing each individual output elasticity. This partial production elasticities is shown by

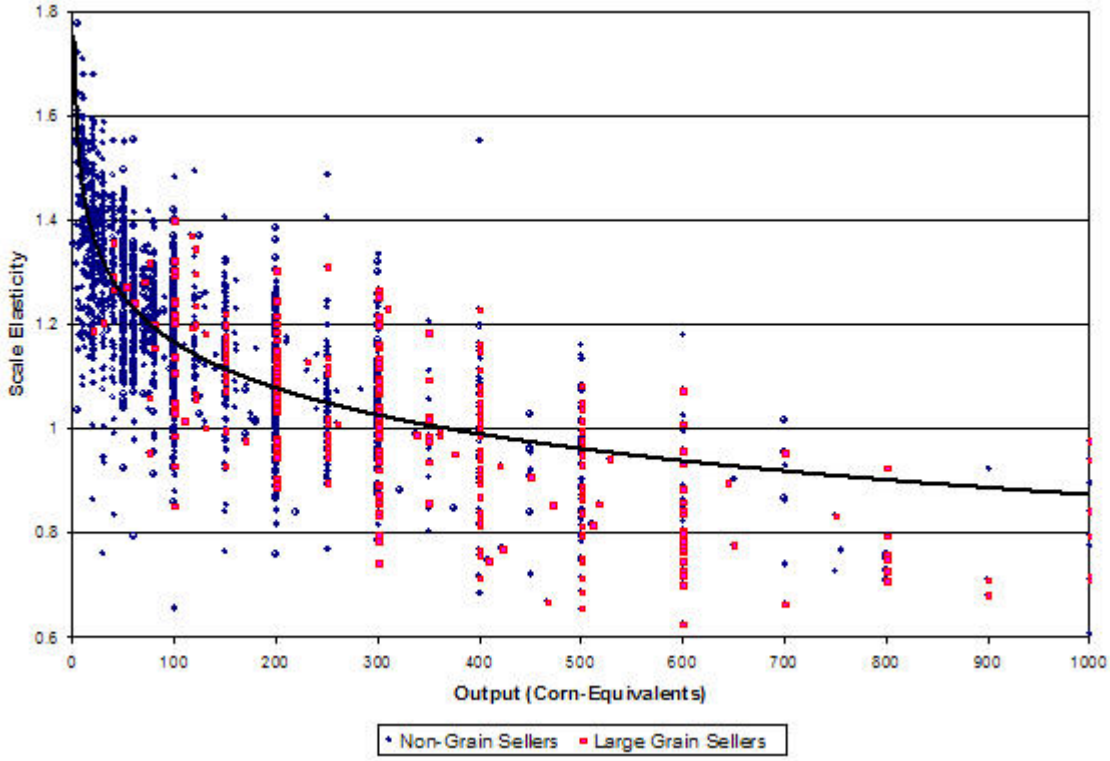
$$\epsilon_i = \beta_i + \sum_{j=1}^{J} \beta_{ij} \ln x_j \ \forall \ i. \tag{4.7}$$

Therefore, the returns to scale parameter is $\varepsilon = \sum_{i=1}^{3} \epsilon_i$ for each household. As shown in Table 4.3, the large grain sellers exploited all the available scale economies and produced at a constant returns to scale level. This is far different than the full-blooded families who, on average, were far more cost inefficient. The superior cost efficiency of the large grain sellers is also shown in Figure 4.1 which shows the majority of the small Cherokee free farms producing at a level far lower than optimal. All types of grain sellers, along with the readers in English, married whites,

[40]Sturgis, "From Aniyuwiya to Indian Territory," 118-19.

[41]Willard Walker, "Notes on Native Writing Systems and the Design of Native Literacy Programs," *Anthropological Linguistics*, 2 (1969): 151.

Figure 4.1: Returns to Scale on Cherokee Free Farms



and mixed-bloods groups, were producing near the optimal scale. In terms of scale economies, the only category which operated at a significantly different level than optimal was the full-blooded group. Therefore, in terms of elasticity of scale, the large grain sellers produced closest to the optimal scale. The differences between all types of grain sellers and the other groups are less clear. This issue will be addressed later at length.

Tables 4.4 and 4.5 contain the relative technical efficiency measures for these cultural and economic classifications. The most obvious result from these productivity measures is that the households who sold their excess crops generated the highest degree of technical efficiency. Market-oriented free farms were 16.4% more productive than non-market-oriented free farms, while market-oriented slave farms

were 32.4% more productive than non-market-oriented slave farms. The relative efficiency of large-scale sellers is even more transparent; large-scale sellers were 20.0% more efficient on free farms and 35.1% more efficient on slave farms than all other households. Regarding the sociological variables, households with married whites were roughly 10% more productive than all other types of households on free farms and 17.5% more productive on slave farms. Households with readers in English and mixed-blood members were also more productive on both types of farms.

Since groups such as grain sellers and married whites had similar returns to scale parameters, the CRS restriction was imposed on all free farms to determine if multi-factor productivity was in fact higher on *all* market-oriented farms. This imposition implies that the technical efficiency measures are identical to multi-factor productivity measures. The relative technical efficiency measures are listed in Table 4.6. When constant returns to scale is imposed on free farms, the most productive Cherokees can clearly to characterized as the market-oriented households. A household which sold any amount of grain to the market was 17.2% more productive than households that did not. No other sociological variable achieved this level of productivity.

Regarding the sociological groups, the three variables which are proxies for assimilationists all generate, on average, high efficiency levels than households viewed as traditionalists. The largest difference in productivity among these variables is determined by whether the household had a married white. The influence of married whites on slave productivity is so high because these farmers would have had more experienced at this particular type of agriculture than households without married whites. This would have generated higher technical efficiency measures and thus greater productivity. Cherokees had long held slaves; however, the role of slaves in intensive, market-oriented agriculture was a new aspect of their society. Also, some traditional Cherokee households could have adopted their slaves as members of their kin, an aspect of eighteenth-century Southeastern societies.

When one only analyzes the market-oriented households, the impact of differences in sociological traits becomes much less important. By analyzing only households that sold grain, one finds that the differences in productivity among the four sociological variables on free farms ranged from 1.2% to 5.4%, while on slave farms, the differences ranged from 3.0% to 11.7%. All of the differences in productivity among these variables decreased, except for readers in English on slave farms, which is consistent with the more homogenous market-oriented farm.

The profit-motive which allowed Cherokees to obtain high productivity levels is a new aspect of Southeastern Indian societies in general. The economic structure of Southeastern Indians prior to the early nineteenth century, in particular prior to contact, placed no value on wealth accumulation. Surpluses, e.g. European gifts from warfare, were shared with other Indians and even given to other European soldiers. These Indians compared market-oriented colonists to cougars: "The cougar, they said, is an animal that will sometimes kill two deer at one time, more than it can possibly eat, and yet it will lie between the two carcasses, too greedy to be willing to share its surplus."[42] Naturalist William Bartram wrote on Cherokee redistributive nature as well: " [the] public treasury supplied by a few and voluntary contributions and to which every citizen has the right of free and equal access."[43]

But these attitudes on marketable surpluses changed through the effects of Indian agents such as Benjamin Hawkins. Hawkins encouraged market participation by allowing Indians to purchase farm implements and supplies from his residence, which was located along the Chattahoochee River near present-day Columbus, Georgia. He observed as early as 1798 that "the women who are the labourers in the land experience the advantages of having corn for sale, as they have been many of them clothed by it this season."[44] Staples of the trade in the eighteenth century between whites and Southeastern Indians included guns (e.g. smooth-bore muskets called Birmingham guns), metal tools (e.g. iron hoes, axes, and knives), and cloth (e.g.

[42]Hudson, *Southeastern Indians*, 311-12.
[43]Perdue, *Slavery and the Evolution of Cherokee Society*, 14.
[44]Saunt, *A New Order of Things*, 155.

duffels, strouds, calico, and silk).[45] Of course, the development of large-scale farms along with the accumulation of experience in farming also would have influenced their desire and more importantly, their ability to become market-oriented.

In sum, the most productive Cherokees were able to sell their excess crops; however, this implied causation is not necessarily accurate. Selling crops to the market would have pressured the Cherokee household to become more productive. Therefore, the market-oriented farms are probably endogenous and the instrumental variable approach would be warranted to resolve this issue. Unfortunately, there are no valid instruments in the Cherokee census that solely isolate market-oriented farms from non-market-oriented farms. Therefore, the precise impact of market forces on the productivity of these Cherokees cannot be identified. However, competition on the Upcountry was probably not as severe as other parts of the South, since there were few navigable rivers, shorter growing seasons, and a poor inland transportation network. Therefore, market forces probably played a less important role in selling excess crops than simply being a more productive farmer. Therefore, the next section identifies the factors which led a household to sell its excess crops. Given the previous analysis, the factors that influenced a household to sell its excess crops were the determinants of productivity on Cherokee farms.

4.8 Who were the Sellers?

Each element along the spectrum of Cherokee farmers sold grain surpluses when possible. Mixed-bloods, full-bloods, readers in English, families with and without married whites sold their grain surpluses. For example, a full-blooded household, comprising of twelve members, located in the western portion of North Carolina, one of the more conservative areas of Cherokee Nation, sold 500 bushels of corn, which created $250 in income. Thus, corn-sellers were not restricted to the elite Cherokees, nor to the assimilated Cherokees. However, there is a more precise method to determine the characteristics of grain sellers in Cherokee Nation.

[45]Braund, *Deerskins & Duffels*, 122.

A Tobit regression model is estimated for the Cherokee free farms to determine the factors which influenced Cherokees to sell their excess crops. The Tobit model is used because the dependent variable, which is bushels of corn and wheat sold, is zero for a large majority of observations, while positive and continuous for the households that sold their excess grain crops.[46] The unrestricted model contains all the variables which theoretically could have influenced the productivity of the household. On free farms, these included readers in Cherokee, readers in English, and dummy variables reflecting differences in the racial mix of the household. Dummy variables were also created to distinguish between households with only quadroons, households with mixed-blooded and quadroons, and households with married white members. Thus, the quadroon dummy variable is 1 if the household held at least one quadroon, but did not hold a married white, mixed-blood, or full-blood Cherokee. The mixed-blood dummy variable is 1 for households that contained at least one half-breed, but did not contain a married white or a full-blooded Cherokee. The married white dummy is obviously then 1 for a household which contained a married white. These race variables most likely reflect differences in human capital accumulation, while the literacy variables reflect differences in educational levels, although literacy rates are probably poor indicators of farm-specific skills. Two location dummies were included to reflect the superior access to markets of certain households. A dummy variable was created for the households who lived in counties that contained the Federal Road, which joined Georgia and Tennessee and was a popular road for cattle drovers. Another dummy variable was created to identify the households that lived near navigable rivers.[47] Therefore, the unrestricted Tobit model contains 10 regressors.

Individual LR tests were calculated to isolate the statistically significant variables as the insignificant explanatory variables are removed from the model. On free farms, both readers in English and Cherokee, proximity to rivers, and the married white

[46]All the grain sellers are used in the sample in this analysis, because in the prior analysis, some observations had to be dropped because they contained no Cherokee males in the household.

[47]The rivers located in the Cherokee Nation were the Tennessee, Hiwassee, Coosawattee, Consasawga, Chatooga, and Coosa Rivers.

and mixed-blood dummy variables were not significant determinants of productivity. The statistically significant determinants of selling grain to the market included the number of acres cultivated, the number of houses, the proximity to the Federal Road, and whether a quadroon lived in the household. The results from the Tobit regression on free farm data is located in Table 4.7. Given the economies of scale on free farms, the positive and significant coefficients on acres and houses reflect the productivity advantages of having a large free farms. The positive coefficient on the proximity to the Federal Road variable reflects the cost advantage of being located near the most travelled road in the Cherokee Nation (see. Fig. 4.2).

Interestingly, when controlling for farm size and location, all the racial mix variables are statistically insignificant.[48] The insignificant signs on the dummy variables are robust to different variable definitions as well. This result means that all else constant, there was no specific racial composition of the household that was able to channel superior technical efficiency. Households with married whites did not generate higher technical efficiency levels because the majority of non-slaveholding whites were former traders, government agents, or soldiers. Therefore, they were not as more experienced farmers than any other group of Cherokee Indians.

On slave farms, the Tobit model is determined to be inappropriate, as certain variables and estimated probabilities differ substantially on Tobit and Probit models. Therefore, an alternative model was estimated: a two-part model. In the first part, a Probit model is specified and then in the second part, an OLS regression on the market-oriented farms is estimated. As on free farms, the battery of LR tests are used to omit the insignificant terms. The only significant terms in the Probit model are the number of houses and whether a household contained a married white. The results, along with the second stage, is shown in Table 4.8. Since the slave technology was homogenous of degree one, farm size did not have an impact on productivity.

[48]Two quadroon households sold over 500 bushels of corn. If these two households are included in the sample, the quadroon dummy variable becomes highly significant. However, once they are removed, the quadroon variable becomes highly insignificant. Therefore, these two households are determined to be outliers and are removed from the sample.

However, the number of houses, a proxy for capital, reflects the superior technical efficiency which existed on households that invested heavily in their operation. Since a large majority of slaveholders held under five slaves, the large slaveholders were the more skilled farm managers.

Even on capital-abundant slave farms, the influence of married whites on productivity was still significant. This result reflects the accumulation of superior farm management skills by whites rather than Cherokees. Unlike the married whites on non-slave farms, these males were most likely neighboring farmers who entered the Nation as a professional farmer, as opposed to a trader or a soldier. Therefore, their experience as farmers should have led them to obtain superior farm management skills. Other racial compositions on Cherokee farms, such as mixed-blood or quadroons, were not descendants of this particular type of farming, as slave-oriented agriculture was a recent development in the Cherokee Nation.

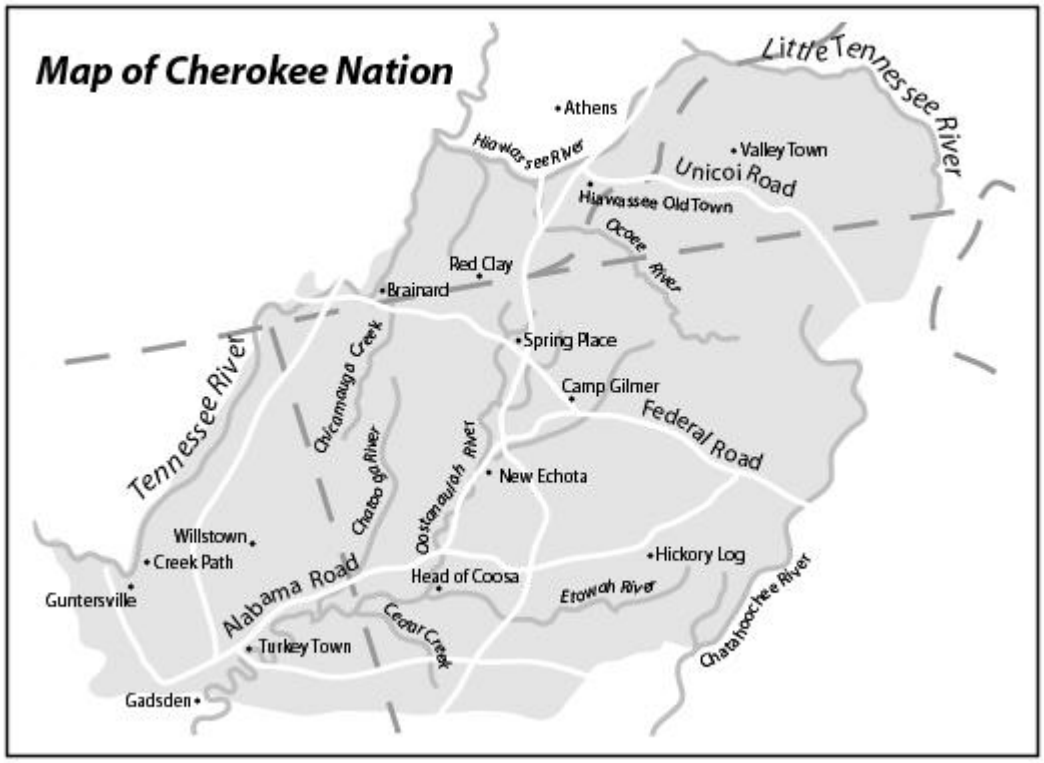
4.9 Summary

The role of the racial composition of Cherokee households, as often debated among Native American historians, did influence productivity but only on slave farms. The most productive Cherokees were the farmers who held large farm size and held where located near the Federal Road. Controlling for these factors, it is shown that there was no specific racial composition of a Cherokee household that exerted higher productivity. This results refutes claims made by biased nineteenth-century observers as well as later historians who have emphasized the lower productivity of full-blooded Cherokees. In this analysis, on free farms, the probability of a full-blooded Cherokee household being able to sell his excess crops, and thus being productive, was no different than the probability of a mixed-blood Cherokee household selling his crops to the market.

On slave farms, the racial composition of the household did factor in channelling higher productivity gains. In particular, households that contained a married white achieved greater technical efficiency levels than all other types of slave households.

It is suggested that the accumulation of human capital, mainly generated from their ascendants, influenced the married white household's technical efficiency, and therefore helped generate a productivity advantage.

Figure 4.2: Cherokee Nation, 1835



Map drawn by Wendy Giminski, Campus Graphics and Photography, University of Georgia.

Table 4.2: Translog Estimates: Cherokee Free and Slave Farms

(Dependent Variable: ln Output)

		ML Estimates		**COLS Estimates**	
Variable	Parameter	Free	Slave	Free	Slave
Constant	β_0	0.741	0.589	3.534***	1.309***
		(0.037)***	(0.095)***	(0.037)	(0.100)
lnFree Labor (x_1)	β_1	0.014	0.047	0.030	0.038
		(0.036)	(0.055)	(0.030)	(0.059)
lnLand (x_2)	β_2	0.745	0.689	0.791	0.701
		(0.020)***	(0.074)***	(0.027)***	(0.080)***
lnCapital (x_3)	β_3	0.312	0.214	0.274	0.190
		(0.029)***	(0.087)***	(0.032)***	(0.076)**
lnSlave (x_4)	β_4	*0.050*		*0.070*	
			(0.073)		(0.049)
$\ln x_1^2$	β_{11}	0.015	*0.004*	0.051	*0.045*
		(0.083)	(0.109)	(0.086)	(0.081)
$\ln x_1 \ln x_2$	β_{12}	-0.087	0.156	-0.066	0.144
		(0.034)**	(0.063)**	(0.037)*	(0.090)*
$\ln x_1 \ln x_3$	β_{13}	0.015	-0.064	0.004	-0.167
		(0.047)	(0.126)	(0.057)	(0.074)
$\ln x_1 \ln x_4$	β_{14}		-0.096		-0.022
			(0.068)		(0.064)
$\ln x_2^2$	β_{22}	0.047	*0.135*	0.008	*-0.041*
		(0.024)*	(0.081)*	(0.037)	(0.149)
$\ln x_2 \ln x_3$	β_{23}	-0.158	-0.213	-0.097	-0.070
		(0.028)***	(0.096)**	(0.041)**	(0.127)
$\ln x_2 \ln x_4$	β_{24}		-0.078		-0.034
			(0.079)		(0.070)
$\ln x_3^2$	β_{33}	-0.025	*0.054*	-0.095	*0.154*
		(0.054)	(0.213)	(0.105)	(0.120)
$\ln x_3 \ln x_4$	β_{34}		0.222		0.083
			(0.118)*		(0.067)
$\ln x_4^2$	β_{44}		*-0.048*		*-0.027*
			(0.114)		(0.079)
Soil_1	δ_1	-0.251	-0.137	-0.227	-0.025
		(0.030)***	(0.102)	(0.036)***	(0.107)
Soil_3	δ_2	-0.159	0.104	-0.143	0.093
		(0.062)***	(0.099)	(0.056)**	(0.110)
	σ^2	0.927	0.897		
		(0.044)***	(0.133)***		
	γ	0.809	0.962		
		(0.021)***	(0.030)***		
log-likelihood		-2149.963	-153.227	$R^2 = 0.617$	$R^2 = 0.682$

Notes: N=2110 for free farms and N=190 for slave farms. The standard errors are shown in parentheses. *, **, and *** represents statistically significant at the 10%, 5%, and 1% levels.

Table 4.3: Mean Scale Elasticities: Free Farms

Category	$\bar{\varepsilon}$ (Group)	$\bar{\varepsilon}$ (Non-group)	Difference
a. Economic Variables			
Large Grain Sellers	1.000	1.204	0.204
All Grain Sellers	1.072	1.220	0.148
b. Sociological Variables			
Readers in English	1.035	1.195	0.160
Married Whites	0.992	1.182	0.190
Mixed-bloods	1.078	1.188	0.110
Full-bloods	1.190	1.027	-0.163

Notes: Large-scale sellers are characterized as the households that sold forty or more bushels of corn and wheat in 1835. This represented 47.8% of all the non-slaveholding households and 91.2% of the slaveholding households that sold grain in the 1835 Cherokee Census. $\bar{\varepsilon}$ (Group) reflects the average scale elasticity of each category; thus, $\bar{\varepsilon}$ (Non-group) is the average scale elasticity for the households not in the specified category. The difference between this the mean returns to scale, $\bar{\varepsilon}$ (Group) - $\bar{\varepsilon}$ (Non-group), is reflected in column 4. A large positive difference was a greater degree of cost efficiency within the group.
Source: See Chapter Two.

Table 4.4: Technical Efficiency Ratios Across Categories: Free Farms

ML Estimates	
Category	Free Farms
All Farms	
Large Sellers/Non-Large Sellers ($\frac{TE_{ls}}{TE_{nls}}$)	1.200
All Market-Oriented/Non-Market Cherokees ($\frac{TE_{m}}{TE_{nm}}$)	1.164
Readers in English/Non-readers in English ($\frac{TE_{re}}{TE_{nre}}$)	1.049
Married White/no Married Whites ($\frac{TE_{mw}}{TE_{nmw}}$)	1.102
Mixed-bloods/no Mixed-bloods ($\frac{TE_{mb}}{TE_{nmb}}$)	1.050
Full-bloods/no Full-bloods ($\frac{TE_{fb}}{TE_{nfb}}$)	0.917
Only Market-Oriented Cherokee Farms	
Readers in English/Non-readers in English	1.012 (-0.037)
Married White/no Married Whites	1.054 (-0.048)
Mixed-bloods/no Mixed-bloods	1.023 (-0.028)
Full-bloods/no Full-bloods	0.947 (-0.030)
COLS Estimates	
Category	Free Farms
All Farms	
Large Sellers/Non-Large Sellers ($\frac{TE_{ls}}{TE_{nls}}$)	1.351
All Market-Oriented/Non-Market Cherokees($\frac{TE_{m}}{TE_{nm}}$)	1.324
Readers in English/Non-readers in English ($\frac{TE_{re}}{TE_{nre}}$)	1.206
Married White/no Married Whites ($\frac{TE_{mw}}{TE_{nmw}}$)	1.219
Mixed-bloods/no Mixed-bloods ($\frac{TE_{mb}}{TE_{nmb}}$)	1.244
Full-bloods/no Full-bloods ($\frac{TE_{fb}}{TE_{nfb}}$)	0.789
Only Market-Oriented Cherokee Farms	
Readers in English/Non-readers in English	0.967 (-0.239)
Married White/no Married Whites	1.045 (-0.175)
Mixed-bloods/no Mixed-bloods	1.117 (-0.127)
Full-bloods/no Full-bloods	0.970 (-0.181)

Notes: The mean for each category's TE is first determined and then divided by the mean of all the observations which do not fall into the specified category. The number in parentheses shows the differences in the productivity figures between all farms and market-oriented farms. A negative sign reflects that the differences between productivity measures have decreased once one controls for market-orientation, whereas a positive sign reflects an increase in the differences in productivity. Since constant returns to scale is imposed on the slave data, then the TE measures are equivalent to TFP measures.
Source: See Chapter Two.

Table 4.5: Multi-Factor Productivity Ratios Across Categories: Slave Farms

ML Estimates	
Category	Slave Farms
All Farms	
Large Sellers/Non-Large Sellers ($\frac{TFP_{ls}}{TFP_{nls}}$)	1.234
All Market-Oriented/Non-Market Cherokees ($\frac{TFP_{m}}{TFP_{nm}}$)	1.223
Readers in English/Non-readers in English ($\frac{TFP_{re}}{TFP_{nre}}$)	1.111
Married White/no Married Whites ($\frac{TFP_{mw}}{TFP_{nmw}}$)	1.175
Mixed-bloods/no Mixed-bloods ($\frac{TFP_{mb}}{TFP_{nmb}}$)	1.085
Full-bloods/no Full-bloods ($\frac{TFP_{fb}}{TFP_{nfb}}$)	0.906
Only Market-Oriented Cherokee Farms	
Readers in English/Non-readers in English	1.150 (0.039)
Married White/no Married Whites	1.128 (-0.047)
Mixed-bloods/no Mixed-bloods	1.063 (-0.023)
Full-bloods/no Full-bloods	0.940 (-0.034)
COLS Estimates	
Category	Slave Farms
All Farms	
Large Sellers/Non-Large Sellers ($\frac{TFP_{ls}}{TFP_{nls}}$)	1.255
All Market-Oriented/Non-Market Cherokees($\frac{TFP_{m}}{TFP_{nm}}$)	1.242
Readers in English/Non-readers in English ($\frac{TFP_{re}}{TFP_{nre}}$)	1.132
Married White/no Married Whites ($\frac{TFP_{mw}}{TFP_{nmw}}$)	1.182
Mixed-bloods/no Mixed-bloods ($\frac{TFP_{mb}}{TFP_{nmb}}$)	1.061
Full-bloods/no Full-bloods ($\frac{TFP_{fb}}{TFP_{nfb}}$)	0.956
Only Market-Oriented Cherokee Farms	
Readers in English/Non-readers in English	1.130 (-0.002)
Married White/no Married Whites	1.137 (-0.045)
Mixed-bloods/no Mixed-bloods	1.045 (-0.016)
Full-bloods/no Full-bloods	0.996 (-0.040)

Notes: The mean for each category's TFP is first determined and then divided by the mean of all the observations that do not fall into the specified category. The number in parentheses shows the differences in the productivity figures between all farms and market-oriented farms. A negative sign reflects that the differences in productivity between group means has decreased when controlling for market-orientation, whereas a positive sign reflects an increase in the differences in productivity. Since constant returns to scale is imposed on the slave data, then the TE measures are equivalent to TFP measures.
Source: See Chapter Two.

Table 4.6: Multi-Factor Productivity on Free Farms with CRS Restriction

ML Estimates	
Variable	Relative Productivity
All Farms	
Large Sellers/Non-Large Sellers ($\frac{TFP_{ls}}{TFP_{nls}}$)	1.204
All Market-Oriented/Non-Market Cherokees ($\frac{TFP_{m}}{TFP_{nm}}$)	1.172
Readers in English/Non-readers in English ($\frac{TFP_{re}}{TFP_{nre}}$)	1.085
Married White/no Married Whites ($\frac{TFP_{mw}}{TFP_{nmw}}$)	1.117
Mixed-bloods/no Mixed-bloods ($\frac{TFP_{mb}}{TFP_{nmb}}$)	1.074
Full-bloods/no Full-bloods ($\frac{TFP_{fb}}{TFP_{nfb}}$)	0.902
Only Market-Oriented Cherokee Farms	
Readers in English/Non-readers in English	1.043 (-0.042)
Married White/no Married Whites	1.062 (-0.055)
Mixed-bloods/no Mixed-bloods	1.034 (-0.040)
Full-bloods/no Full-bloods	0.937 (-0.035)
COLS Estimates	
Variable	Free
All Farms	
Large Sellers/Non-Large Sellers ($\frac{TFP_{ls}}{TFP_{nls}}$)	1.389
All Market-Oriented/Non-Market Cherokees ($\frac{TFP_{m}}{TFP_{nm}}$)	1.370
Readers in English/Non-readers in English ($\frac{TFP_{re}}{TFP_{nre}}$)	1.187
Married White/no Married Whites ($\frac{TFP_{mw}}{TFP_{nmw}}$)	1.211
Mixed-bloods/no Mixed-bloods ($\frac{TFP_{mb}}{TFP_{nmb}}$)	1.223
Full-bloods/no Full-bloods ($\frac{TFP_{fb}}{TFP_{nfb}}$)	0.819
Only Market-Oriented Cherokee Farms	
Readers in English/Non-readers in English	0.961 (-0.226)
Married White/no Married Whites	1.011 (-0.199)
Mixed-bloods/no Mixed-bloods	1.109 (-0.114)
Full-bloods/no Full-bloods	1.007 (-0.188)

Notes: Since constant returns to scale is imposed, the estimated technical efficiency measures are equivalent to multi-factor productivity measures.
Source: 1835 Cherokee Census.

Table 4.7: Tobit Estimates on Free Farms: Determinants of Cherokee Grain Sellers

(Dependent Variable: Bushels of Corn and Wheat Sold)

Variable	Tobit (unrestricted)	$\frac{\partial P(y>0\|x)}{\partial x_i}$	Tobit (restricted)	$\frac{\partial P(y>0\|x)}{\partial x_i}$
Constant	-124.519	-0.392	-122.828	-0.387
	(6.053)***		(5.761)***	
Married Whites	11.411	0.035	11.24	0.035
	(12.880)		(12.081)	
Quad.	21.147	0.067	20.99	0.066
	(17.654)		(17.593)	
Half.	6.292	0.019	7.073	0.022
	(12.398)		(11.998)	
Acres	2.394	0.008	2.413	0.007
	(0.171)***		(0.165)***	
Houses	7.295	0.023	7.343	0.023
	(1.113)***		(1.107)***	
Fed. Road	35.590	0.112	37.40	0.118
	(5.782)***		(5.495)***	
Rivers	9.052	0.028		
	(9.824)			
Read. Cherokee	1.694	0.005		
	(1.723)			
Read. English	0.836	0.003		
	(3.815)			
$\hat{\sigma}$	95.298		95.329	
	(2.835)***		(2.837)***	

Notes: N=2153. *, **, and *** represents statistically significant at the 10%, 5%, and 1% levels. The number of positive observations was 669 which represents 31.1% of the total observations.

Table 4.8: Two-Part Estimates on Slave Farms

(1^{st} Stage Dependent Variable: 1 if Sold Grain to Output, 0 otherwise)				
Variable	Probit (unrestricted)	$\frac{\partial P(y>0\|x)}{\partial x_i}$	Probit (restricted)	$\frac{\partial P(y>0\|x)}{\partial x_i}$
Constant	-0.699	-0.215	-0.502	-0.160
	(0.266)***		(0.227)**	
Married Whites	0.586	0.180	0.477	0.152
	(0.305)*		(0.261)*	
Quad.	0.016	0.005	0.078	0.024
	(0.360)		(0.340)	
Half.	0.047	0.014	0.001	0.000
	(0.272)		(0.265)	
Houses	0.099	0.030	0.090	0.028
	(0.029)***		(0.020)***	
Acres	-0.001	0.000		
	(0.002)			
Fed. Road	0.306	0.094		
	(0.238)			
Rivers	0.400	0.123		
	(0.364)			
Read. Cherokee	0.039	0.012		
	(0.087)			
Read. English	-0.029	-0.009		
	(0.049)			
Pseudo R^2	0.172		0.159	
(2^{nd} Stage Dependent Variable: ln Output)				
Variable	OLS (unrestricted)		OLS (restricted)	
Constant	4.302		4.126	
	(0.263)		(0.205)***	
Married Whites	0.617		0.706	
	(0.268)**		(0.243)***	
Quad.	0.607		0.552	
	(0.341)*		(0.321)*	
Half.	0.843		0.895	
	(0.279)***		(0.274)***	
Houses	-0.006			
	(0.016)			
Acres	0.008		0.008	
	(0.002)***		(0.001)***	
Fed. Road	-0.155			
	(0.239)			
Rivers	-0.356			
	(0.276)			
Read. Cherokee	-0.044			
	(0.081)			
Read. English	0.055			
	(0.043)			
R^2	0.415		0.393	

Notes: In the first stage, N=190. In the second stage, N=124. *, **, and *** represents statistically significant at the 10%, 5%, and 1% levels.

Chapter 5

"Indianizing" American Agriculture: A Comparative Analysis of Cherokee-White Farm Production

The interchange of agricultural methods between Indians and whites has only recently become well-documented.[1] Besides embracing New World food staples such as corn and potatoes, colonists quickly adopted Indian farming methods such as row planting and field rotation. Likewise, Indians incorporated iron farm implements, livestock, and African slaves into crop production. Despite the technical diffusion, differences in agriculture persisted throughout the colonial and antebellum periods, as adoption of either Euro-American or Indian methods was not uniform across the U.S. rural landscape. Surprisingly, economic historians have not attempted to determine differences in agricultural practices between whites and Indians through quantitative methods. The main reason for this is the lack of comparative data between these groups; however, the collection of data on Cherokee households in the 1835 Cherokee census and the sample of farms taken from the 1850 federal manuscripts censuses on farmers contained within the former region of the Cherokee Nation allows for such comparisons. The goal of the chapter is to incorporate these data on Cherokee and white households to precisely estimate these differences, provided any exist at all.

As discussed in the last chapter, the most productive Cherokee farmers were able to sell their excess crops. In this chapter, the agricultural performance of these Cherokee market-oriented households will be further analyzed by estimating the

[1]See Hurt, *Indian Agriculture in America*, for an comprehensive history of Native agriculture. For a discussion solely on the farming methods of Cherokee and other Southeastern Indian groups, see Hudson, *The Southeastern Indians*, 289-300.

difference in the marginal product of each input on these farms to that of white farms. Where the last chapter compared the productivity of different types of Cherokee households to a common production frontier, this chapter will compare the difference in the marginal productivity of each input across groups within the Cherokee Nation. Finally, the output-gap is decomposed to determine how differences in input levels and marginal products generated the observed difference in output. Stealing a phrase from the literature on the reciprocity between Indian and white cultural influences, analyzing how output on white farms would have changed if they used estimated Cherokee production methods is similar to "indianizing" early American agriculture, and likewise measuring the impact of white technology on Cherokee production is akin to "americanizing" Indian agriculture.[2]

This chapter is organized in the following way. First, a variety of partial productivity indices, such as crop yields or crop output per worker, are computed to show how these relative productivity measures differed across farm sizes. Then, semi-log regressions are used to determine differences in the marginal product of each input on Cherokee and white farms as well as between market-oriented Cherokee farms and white farms. Finally, using Oaxaca decompositions, the role of differences in factor levels and factor productivity on differences in mean output between Cherokee and white farms is estimated.[3]

5.1 General Trends in the Cherokee and White Data

First, the Cherokee and white data are segmented to estimate the production of free and slave farms. To incorporate these data, two field crops, bushels of wheat and corn, have to be used to specify the crop output variable. This is due to the fact that the 1835 Cherokee census did not report the other field crops. These crops, however, do represent a large percentage of the total market value of field production: roughly 65% of the value of field crops on slave farms and 70% on free farms in the 1850

[2]Axtell, *Natives and Newcomers*, 309-35.

[3]See Ronald Oaxaca, "Male-Female Wage Differentials in Urban Labor Markets," *International Economic Review*, 14 3 (1973): 693-709.

sample, as Indian corn was certainly the most widely grown crop in this Southern region before and after removal. These crops are aggregated together by converting bushels of wheat into corn-equivalent units. Seed requirements are then subtracted for both corn and wheat from total crop output.[4] Later in the study, a more complete specification of total field output is used to compare the sensitivity of the white results to this particular output specification.

The role of each household member on crop output is determined through the disaggregation of the household labor variable used in the previous chapter. The age and gender groups of each household, as listed in the 1835 Cherokee census, were males under 18, males over 18, females under 16, and females over 16. To make comparisons, these age and gender groups are used for the white farms as well.[5] These variables cannot be further specified, for example by eliminating family members under and over a certain age, because the white household variables must match the Cherokee household variables to conduct this decomposition. The land variable is defined as the number of cultivated acres per farm. This variable is similarly defined in both the Cherokee and white censuses. Three dummy variables are used to account for differences in soil types across this region of the Southeast.

The physical capital variable, because of the dissimilarities between the two censuses, needs to be omitted from these empirical models. In the last chapter, the number of houses was used as a proxy for physical capital. Unfortunately, there is no equivalent measure in the U.S. Census of Agriculture. There are methods to estimate the value of farm buildings on each farm; however, there is no similar method to extract this type of information from the Cherokee census. There are also no other proxies to use in place of a capital variable. In theory, the direction of the omitted variable bias depends on the relationship between capital and output, as well as the

[4]A longer discussion of this output specification is contained in Chapter Two.

[5]During busy times, every household member over a certain age was used in field work; therefore each age and gender group should be at least initially considered to be included in the empirical model. Donald L. Winters, *Tennessee Farming, Tennessee Farmers: Antebellum Agriculture in the Upper South* (Knoxville: The University of Tennessee Press, 1994), 117.

correlation between capital and the other inputs. The marginal product of physical capital must be positive, and using the white data, correlation coefficients on capital and each input variable were positive as well.[6] Thus, each estimate will be biased upward, and the direction of the bias will be the same for each input. However, considering the high degree of labor intensity on most farms during the antebellum period, the omission of this variable should not greatly bias the results.

Tables 5.1 and 5.2 contain the summary statistics of the variables used in this analysis on both free and slave farms. Both types of Cherokee farms, on average, were noticeably smaller than white farms, as the number of acres cultivated on white free farms was over three times as large as Cherokee free farms. The other input variables, namely each type of household field labor, were similar on both Cherokee and white farms, although the average white household contained more members than the average Cherokee household. This difference was not attributed to a larger number of hired hands on white farms, since the number of males over 18, who would have represented either family members or hired hands, was similar on Cherokee and white farms.[7] Cherokee farmers did face a more severe labor shortage of hired hands than white farmers because, under Cherokee law, land was only property of a Cherokee if cultivated. Therefore a Cherokee hired hand would in theory lose the privilege to farm a specific plot of land if these people farmed elsewhere.

To estimate a partial productivity index, conceptually, the computation is trivial: one only has to determine an output for the numerator and a specific input for the denominator. The slave and free farms are segmented to display the differences in the relative productivity among Cherokee and white farms. For free farms, the following ratios are computed: corn output per capita, wheat output per capita,

[6]The correlation coefficient of capital and males under 18, males over 18, females under 16, females over 16, slaves, and land is 0.087, 0.198, 0.043, 0.063, 0.560, and 0.607, respectively.

[7]Some farm hands could have been hired periodically throughout the year as their names were probably not listed under the household in the population manuscript census. Often these hired hands are termed "farmers without farms"; however, laborers with different last names, which probably reflected hired hands, were listed under the household where they worked.

corn output per acre, and wheat output per acre. For slave farms, two more measures are calculated: corn and wheat output per slave. Each Cherokee productivity index is computed at its mean and then divided by the same white mean productivity measure. Therefore, a relative productivity index greater than one shows that Cherokee productivity was higher than that of their white counterparts. Similarly, if the measure is below one, the white partial productivity, on average, is greater than the Cherokee partial productivity. Partial productivity measures are computed for all the households in both data sets as well as for each state within the Cherokee boundary.

Tables 5.3, 5.4, and 5.5 display the partial productivity measures, evaluated at the mean of each individual ratio, for free and slave farms. These measures clearly display a dramatic difference in the productivity of free and slave Cherokee farms. On free farms, each Cherokee productivity measure, evaluated for the entire Cherokee Nation, as shown in the bottom row of Table 5.3, is lower than each white measure except for corn yields. This is especially true for any measure which used bushels of wheat as the output variable. Although the level of wheat production was not substantial in this region, as the white wheat yields were far lower than the 1850 U.S. national average, the white levels were far greater than the Cherokee levels.[8] Wheat, termed a "civilized" crop because of its European origin, was emphasized by federal authorities during the acculturation program. President George Washington isolated wheat in an address to the Cherokees regarding the "civilization" program: "You can also grow wheat (which makes the best of bread) as well as other useful grain."[9] Wheat production was being phased out of Southern and Eastern farms by

[8]The national average of wheat output per acre was 15 bushels in 1850. In replying to a circular sent by the U.S. government, a farmer from Milledgeville, GA, claimed that the average yield was "from 3 to 5 bushels" in 1850. Even three bushels per acre exceeds the average in the Cherokee sample for either free (0.48 bushels per acre) or slave (0.52 bushels per acre) farms. U.S. Bureau of the Census, *Historical Statistics of the US: Colonial Times to 1970, Part 1: Bicentennial Edition* (Washington, DC 1975), 500; "Report of the Commissioners of Patents for the Year 1850," *The New American State Papers. Agriculture*, Vol. 9 (Scholarly Resources Inc., Wilmington, Delaware, 1973), 414.

[9]Perdue, *Slavery and the Evolution of Cherokee Society*, 54-55.

1850, as the newly established Midwestern farms held a comparative advantage in most grain production. Therefore, the relative size of the wheat crop in the 1830s would have been higher on southern farms than in 1850, yet the Cherokee yields in 1835 were much lower. Smaller farms are typically less diversified than larger farms for two reasons: (1) there are economies of scope in crop production which occurs on large farms and (2) large farms migrate market risk by diversifying their crops. Therefore, the slow adoption of wheat is more characteristic of the size of the average Cherokee farm as opposed to their opposition to the "civilization" program.

On both free and slave farms, corn yields on Cherokee farms were higher than the yields on white farms.[10] A commonly used measure of farm performance, crop yields are deceptively misleading. The higher corn yields have led some to determine that Cherokee farmers were more productive than their white neighbors.[11] However, higher yields are more reflective of their smaller farms then their superior ability to extract the best yields from the ground. As mentioned earlier, it is advantageous for large farms to diversify to lessen idiosyncratic market risk. Since the number of household members do not vary significantly with farm size, the lower average per capita corn output on Cherokee free farms also reflects the small-scale nature of Cherokee free agriculture.

The distribution of free farms among Cherokees and whites was quite disparate. 90% of all Cherokee free farms were under 25 acres, whereas only 38% of white free farms were of the same size. However, the distribution of slaves among Cherokee and slave farms were more alike. Unlike the large slave plantations in the Deep South, these Southeastern slave farms, both Cherokee and white, typically held between one and five slaves. This similarity in each group's frequency distribution has been overlooked in past studies. In comparing Cherokee to white slaveholders, scholars typically use only the Deep South cotton and sugar plantations to make

[10]There are numerous factors, often working simultaneously, which can impact crop yields. A list of these factors includes weather, quality of seed and soil, land maintenance, timing of the planting, spacing of the plants, and insects and other crop enemies. Stephen V. Visher, "Weather Influences on Crop Yields," *Economic Geography*, 16 4 (1940): 437.

[11]Dunaway, "Rethinking Cherokee Acculturation," 157.

comparisons: "The moon probably shone as bright and the magnolias smelled as sweet in the Cherokee Nation as anywhere else in the South, and a few mansions with white columns dotted the landscape, but no one in the Nation owned vast numbers of slaves."[12] While this statement is accurate, a more appropriate comparison is between farmers in the same region, since this region is characterized by shorter growing season and a poorer transportation network. The large-scale slave farms were seldom used in the Upcountry.

On slave farms, the relative productivity of the Cherokees looked quite different than their performance on free farms. Corn output per capita was higher on Cherokee farms in every slaveholding category. Also, corn yields were essentially higher on Cherokee slave farms, except for the smallest category of farm size. The superior corn yields were consistently higher as the farm size, defined as either number of slaves or number of acres, increased. This is not true for wheat yields as, in general, the difference in wheat yields increased as the number of slaves increased. Although the wheat yields were still lower on Cherokee farms, the relative difference in yields was less than on free farms.

The differences in these partial productivity measures were most disparate on Cherokee and white farms in North Carolina. Even corn yields, which were higher on most types of Cherokee farms, were lower than the corn yields on white North Carolina farms. This empirical evidence supports past studies which isolated the North Carolina region as lagging behind the rest of the Nation. In a prior analysis of the 1835 Cherokee census, it was concluded that "the most salient feature of the [1835 Cherokee] census is the eccentric aspect of North Carolina's figures. The smaller size of its farms and the smaller yield of its crops (particularly its low wheat yield) are evidence both of the mountainous area, the poor soil, the lack of money to invest in slaves or plows, and consequently of the general poverty of the Cherokees in this region. Possibly isolation from white settlements, adherence to traditional life-style,

[12]Perdue, "Cherokee Planters," 118.

and deliberate resistance to change contributed to these differences."[13] In fact, the North Carolina census taker in 1835, Nathaniel Smith, noticed these differences while enumerating in 1835 Cherokee census: "I found in Macon and Haywood counties [North Carolina] the balance of those families consisting of 233 souls who have left their country and settled among the whites near where they was raised those families do not appear to be progressing in the art of civilization as much as those in the hart [sic] of the Nation to their credit and their neighbors."[14] If these partial productivity measures are good indicators of acculturation, then these claims appear valid.

These partial productivity measures provided a mixed story regarding Cherokee relative productivity. Some measures show the Cherokee farms were more "productive" than white farms, certainly when corn is used as a measure of crop output. However, wheat production was far lower on Cherokee farms; therefore white farms appear more productive than Cherokee farms when wheat is the measure of crop output. Aggregating corn and wheat together will help further explain differences in productivity as well as controlling for all other factors that can influence output. This is accomplished in the next section by estimating Cherokee and white farm production functions.

5.2 Oaxaca Decompositions: Methodology

While partial productivity measures allow for the discussion of the performance of the distribution of farms within both groups, the Oaxaca decompositions help refine our understanding of differences in crop output by decomposing the output gap into differences in average farm sizes and differences in the marginal productivity of each factor of production as well as differences in their respective intercepts (which reflects technical differences). The following discussion describes this technique in detail. The decomposition of crop output is computed by first estimating an ordinary

[13]William McLoughlin and Walter Conser, Jr., "The Cherokee Censuses of 1809, 1825, and 1835," in *Ghost Dance*, ed. William G. McLoughlin (Macon: Mercer University Press, 1984), 223.

[14]1835 Cherokee Census, 32.

least squares (OLS) regression for both Cherokee and white free farms of log output on farm inputs and dummy variables which represent differences in soil types across this region. The regression models are specified as

$$\ln Q_{ci} = \beta_0 + \sum_{i=1}^{I} \beta_{ci} x_i + \epsilon_{ci}, \tag{5.1}$$

$$\ln Q_{wi} = \beta_0 + \sum_{i=1}^{I} \beta_{wi} x_i + \epsilon_{wi}, \tag{5.2}$$

where c represents Cherokee households, w represents white households, i represents the i^{th} household, Q_i is grain output, x_i represents the inputs into the production process, and ϵ_i is the random error term distributed N(0, σ^2). The Oaxaca decompositions rest on the fact that these OLS regression run through the mean of the dependent and independent variables. The difference in log output can be expressed in two ways: either using Cherokee estimated coefficients as weights or using the white estimated coefficients as weights. The relationship between the two groups' output levels is given as

$$\ln \bar{Q}_w - \ln \bar{Q}_c = (\bar{x}'_w - \bar{x}'_c)\hat{\beta}_w + \bar{x}'_c(\hat{\beta}_w - \hat{\beta}_c), \tag{5.3}$$

$$\ln \bar{Q}_w - \ln \bar{Q}_c = (\bar{x}'_w - \bar{x}'_c)\hat{\beta}_c + \bar{x}'_w(\hat{\beta}_w - \hat{\beta}_c), \tag{5.4}$$

where $\bar{x}_w$ and $\bar{x}_c$ are vectors of mean input levels for white and Cherokee households respectively, and $\hat{\beta}_w$ and $\hat{\beta}_c$ are vectors of estimated coefficients for white and Cherokee households. The interpretation of the first expression on the right-hand side of both equations shows the difference in log output due solely to differences in mean input levels between whites and Cherokees. The second term on the right-hand side reflects differences in log output due solely to differences in each estimated coefficients.

Provided that the estimated coefficients differ, the use of either Eq. 5.3 or Eq. 5.4 will lead to different results since each equation depends on a different weighting vector. This represents an index number problem, and a proposed way to deal with

this problem is to find the arithmetic mean of the two different results. Therefore, the results from Eq. 5.3 or Eq. 5.4 along with the arithmetic mean of the two equations will be presented.

To determine which variables are included in the analysis of free farms, various LR tests were conducted by pooling the data to determine the statistical significance of each input. On free farms, the results from the semi-log OLS regression are contained in Table 5.6. The only differences in the marginal products between Cherokees and white inputs were among males under 18 and land. In each case, the marginal product of these inputs were higher on Cherokee farms. The higher land productivity reflects the smaller average farm sizes on Cherokee farms. Holding all else constant, an additional acre should have had a greater impact on total output than an additional acre on a large (white) farm. This is consistent with many other studies on farm productivity which typically show this negative relationship between land size and land productivity. The higher marginal product of Cherokee young males is surprisingly given the long tradition of claims that Cherokee males avoided agriculture. However, as shown earlier, these claims are dubious given the changes in the relative price of farming. The difference in marginal products is small in an economic sense yet significant. Since Cherokee boys had far less work alternatives than white boys, an additional Cherokee male under 18 should have a larger impact on output since these young males would be used more frequently on Cherokee farms. For example, younger white males often worked multiple jobs such as on the farm as well in blacksmith shops; however, there existed few blacksmith shops in Cherokee Nation prior to removal. According to a census conducted by Elias Boundinot, there were only 62 blacksmith shops in Cherokee Nation in 1828.

The pooled regression also shows that there was no difference in the marginal product of adult females on Cherokee and white farms.[15] As mentioned earlier, comparative Cherokee-white studies never describe Cherokee women households roles as

[15]The LR test of females over 16 on both Cherokee and white free farms is 2.032. Given this estimate, the null hypothesis that the coefficients on females over 16 were jointly insignificant cannot be rejected.

being similar to that of white household roles. However, these studies often neglect the late 1820s and 1830s as well as the salient feature of the Cherokee census which showed that over 90% of the households held at least one weaver or spinster. Since the opportunity costs of adult women on both Cherokee and white would have been similar, their contribution to farm output should have been similar and these results verify that. The positive, statistically significant marginal product on females under 16 on both Cherokee and white farms reflects the occasion use of young adults on both types of farms. As with younger males, the alternatives to farm work were low for young females and often, especially on harvesting and planting, women were used; however, on both white and Cherokee farms.

The estimated coefficient on adult males provides evidence that an additional male farmers contribute significantly to grain output −− as was expected −− and differences between Cherokee and white productivity measures were not significant. This provides further evidence that Cherokee males, just like white males, responded to relative price changes by mainly working on farms. It is a well-known fact that white adult males mainly operated in the fields; however, this same cannot be said for Cherokee males.

Furthermore, the estimated intercept differ substantially on both farms. The higher intercept term has intuitive appeal: it reflects that the white production function lies above that of the Cherokee production function. This implies that unknown factors that impact productivity, generally considered technological factors, such that the white total product curve has in a sense been shifted above the Cherokee total product curve.

Before discussing the Oaxaca decompositions, the difference between the market-oriented Cherokee farms and white farms is determined. This is accomplished by including two dummy variables, 1 if the Cherokee household was market-oriented and 0 otherwise, and 1 if the Cherokee household was not market-oriented and 0 otherwise, with each input. Through various LR tests, the statistically insignificant terms were dropped and the regression results with the remaining regressors are

located in Table 5.7. On the few Cherokee free farms which sold their excess crops, there was no difference in the marginal product of each household member to that on white farms. The only differences between white and market-oriented free Cherokee farms was in the marginal product of land and with one of the soil type dummy variables. The difference in the estimate on the soil type dummy possibly reflects some soil erosion that has occurred over the fifteen years between the collection of the two data sets. The higher marginal product of land on both types of Cherokee farms reflect the much smaller size of Cherokee farms in general, especially on the non-market free farms. The estimate of the Cherokee dummy variables show that much of the difference in the intercept term between Cherokees and whites is due to non-market oriented Cherokees. Since the estimated intercept term acts as a shifter of the production function, both Cherokee groups' production function lied below the white product curve; however, the market-oriented production function was much closer to that of the white farm production function.

5.3 Oaxaca Decompositions: Empirical Findings (Free Farms)

Now that the statistically significant variables have been isolated, Table 5.8 displays the OLS estimates of Eq. 5.1 and Eq. 5.2 for both Cherokee and white free farms. The advantage of the Oaxaca decomposition is that the differences in average endowments, such as farm size, can be accounted for when determining differences in output. The earlier semi-log OLS regression can determine differences in marginal products but the regression cannot decompose the output-gap into these two effects. The OLS estimates of Eqs. 5.1 and 5.2 are used to determine the role of differences of input usage as well as technological differences in the Cherokee-white output gap.

Table 5.9 shows the role of differences in means and estimated coefficients of each variable. The observed difference in the mean level of log grain output is substantial, 1.251. The top panel of Table 5.9 decomposes the output gap using Eq. 5.3, while the bottom panel decomposes the output gap using Eq. 5.4. Focussing on the last panel of Table 5.9, the first component of the right-hand side shows the amount of

the observed output gap explained by differences in observed characteristics. 0.714 (or 57.0%) of the output gap can be accounted for from differences in mean input levels. Most of this difference (0.682 of the 0.714 or 95.5%) is determined by the larger amounts of acres cultivated on white farms. On the other hand, the second component of Eq. 5.4 and 5.3 provides a measure of how differences in estimated coefficient on each input variable impact the output gap. Again, focussing on the last panel, the differences in coefficients account for 0.536 or 43.0% of the output gap. There are two estimates that generate the bulk of this difference: differences in the intercept term and land productivity. According to the bottom panel of Table 5.9, the differences only in the intercept term increased the output-gap substantially. On the other hand, if the superior land productivity by Cherokee farmers reduced the gap so much, that if the only difference between Cherokees and whites was their land productivity, Cherokee free farmers would have produced 70.7% more grain than whites.

These Oaxaca decompositions show that the observed output-gap was essentially due equally in part to differences in endowments and differences in productivity. Even if Cherokee farms held exactly the same endowments as that of the white farms, white farms would still have produced over 71% more output than Cherokee farms. Similarly, if both types of farmers held the same production technology, white would have produced over 53% more output than that of Cherokee farmers.

5.4 Understanding Differences in Free Farm Technology

In Table 5.9, differences in the intercept terms generated substantial differences in the output gap. Since the data on white farms were collected roughly 15 years after the Cherokee data collection, the higher intercept term, and thus a major reason for the total differences in coefficients between the two farms, might simply reflect technical change. However, anecdotal evidence does not support that there was a significant amount of technical change from 1835 to 1850 in agricultural production. The U.S. agricultural revolution has been pushed backwards by historians in recent

years, as now there is consensus that technological advances could not have occurred much earlier than 1840.[16] Estimates of output per worker show a rapid advance in productivity after 1850 but not before.[17] In fact, total factor productivity was estimated to fall slightly from 1840 to 1860.[18] By analyzing farms located on former Cherokee land, we find that county-level data from the 1840 and 1850 published censuses show that in 1840, corn output per capita was 47.91 bushels in 1850 whereas in 1850, it fell slightly to 44.17 bushels per capita. The general slowness of technical progress implies that the significant difference in intercepts involves the differences in Cherokee and white technology rather than general technical improvements in agriculture from 1835 to 1850.

5.5 Oaxaca Decompositions: Slave Farms

On slave farms, the first step in determining the impact of differences in output due to differences in endowments and productivity is to estimate the statistical significance of each input. This is accomplished by pooling the data together and computing a host of LR tests. From these tests, the following inputs were excluded from the empirical model: females under and over 16 and slaves. The insignificance of slaves in production might seem dubious; however, the slave farms typically grew labor-intensive crops such as tobacco and cotton, which when entered into the output variable for white farms, the slave variable becomes highly significant.

The results from the semi-log OLS regression on pooled slave data are located in Table 5.10. As on Cherokee free farms, the marginal product on Cherokee males under 18 was higher than white young males. The limited work alternatives in

[16]Clarence Danhof, *Change in Agriculture: The Northern United States, 1830-1870* (Cambridge: Harvard University Press, 1969), 140-44; William Cochrane, *The Development of American Agriculture* (Minneapolis: University of Minnesota Press, 1979), 69.

[17]Thomas Weiss, "Long-Term Changes in U.S. Agricultural Output per Worker, 1800-1900," *Economic History Review*, XLVI 2 (1993), Fig. 1.

[18]Lee A. Craig and Thomas Weiss, "Hours at Work and Total Factor Productivity Growth in Nineteenth-Century U.S. Agriculture," in *New Frontiers in Agricultural History* ed. Kyle D. Kauffman vol. 1 (Stamford, CT: JAI Press, Inc., 2000), Table 3, 17.

Cherokee Nation, as suggested earlier, would have influenced the production of crops. The marginal product of land is again greater on Cherokee farms, as the average size of the Cherokee slave farm was smaller than that of the white slave farm.

The analysis of slave farms is furthered by decomposing the Cherokee dummy into Cherokee households that sold grain and those that did not. The results from this variant of the original regression is located in Table 5.11. The marginal product of each input between whites and market-oriented Cherokee slave farms were essentially indistinguishable. The only differences was in the marginal product of land; however, market-oriented Cherokees generated greater land productivity over whites by only 0.36%. Since non-market oriented slave farms were smaller than market-oriented ones, the marginal product of land was the highest on non-market farms. The largest difference between these three groups (whites, market and non-market Cherokees) was that only non-market Cherokee farms had a lower intercept term. In essence, the productivity of market-oriented Cherokee slave farms, which represented the majority of slave farms, were similar to the productivity of white slave farms in every sense.

5.6 Oaxaca Decompositions: Empirical Findings (Slave Farms)

The individual OLS regression estimates for Cherokee and white slave farms are shown in Table 5.12. As expected, the estimated intercept term is higher on white slave farms. The coefficients on all household labor variables have the expected sign. As with free farms, the land productivity on Cherokee farms was greater than that of white farms, which is consistent with Table 5.8. Table 5.13 lists the Oaxaca decompositions for slave farms. If the output gap was solely due to differences in input levels, then white slave farms would have produced 17.6% more output than Cherokee slave farms. Since the observed output gap was so small, differences in productivity imply that, all else constant, Cherokee slave farms would have produced 17.5% more output than white slave farms. In other words, Cherokee slave farms would have produced far more output than white slave farms if they both held the

same input levels. This is mainly due to the higher land productivity on Cherokee slave farms.

5.7 Summary

In this chapter, conclusions regarding differences in Indian-white agriculture are analyzed with the use of micro-level data from the 1835 Cherokee census and a sample from the returns on the 1850 manuscript censuses. These micro-level data provide evidence which supports historical evidence as well as provides new interpretations regarding their differences. The similarities in Cherokee-white agriculture depends heavily on whether the discussion is in regards to free or slave agriculture. On free farms, the marginal product on adult males and adult females on Cherokee and white farms were identical. Such a findings reflect a dramatic reinterpretation of gender roles on Cherokee farms; however, much of the "conventional wisdom" on Indian gender roles rarely isolates the late removal period as well as emphasizes traditional household gender roles during a period when the relative price of farming was substantially different. Similar marginal products of adult family members on farm output is consistent with earlier findings (see Chapter Two) on marginal contributions to output, as well as the increased relative price of hunting, and the high number of spinsters and weavers in the 1835 Cherokee census.

Besides estimating similar gender roles on Cherokee and white farms, the Oaxaca decompositions showed that the majority of the output-gap was due to differences in input levels, especially differences in acres cultivated. When comparing only the market-oriented free farms, differences between Cherokee and white agriculture become even less disparate; however, technological differences even between market-oriented Cherokees and whites still existed. Even though fifteen years separated these two data sets, prior works has shown that almost no technical change occurred from 1835 to 1850 in agricultural production. Therefore, differences in "technology" between Cherokee and whites cannot be considered simply general technical change.

Regarding slave farms, differences between Cherokee and white agriculture were more subtle. The biggest difference between Cherokee and white slave farms was in land productivity, as the smaller Cherokee farms achieved a higher marginal product of land. When comparing the market-oriented slave farms to white slave farms, there was essentially no difference in the productivity between these two farms. This result is consistent with an earlier finding which showed that the Cherokee households with a married white were far more technically efficient than other Cherokee slaveholders. This study showed that their superior efficiency matched that of white slaveholders farming outside the Nation.

Table 5.1: Summary Statistics: Free Farms

	Alabama		**Georgia**		**North Carolina**		**Tennessee**		**All**	
Variable	Cherokee	White	Cherokee	White	Cherokee	White	Cherokee	White	Cherokee	White
Corn	270.24	474.20	153.99	364.11	111.83	391.63	245.43	486.36	163.53	397.73
Wheat	0.00	9.34	0.20	17.88	0.04	2.18	0.86	27.72	0.24	15.82
Males <18	1.64	2.33	1.73	2.25	1.46	2.17	1.65	1.95	1.64	2.19
Males ≥18	1.62	1.68	1.69	1.65	1.41	1.58	1.61	1.50	1.60	1.61
Females <16	1.53	1.98	1.66	1.99	1.26	1.79	1.63	1.63	1.53	1.89
Females ≥16	1.72	1.83	1.82	1.76	1.52	1.58	1.63	1.51	1.70	1.69
Land	19.93	42.85	11.09	38.01	9.98	43.38	19.73	50.04	12.65	41.46
Soil_1	0.00	0.00	0.59	0.67	1.00	1.00	0.00	0.00	0.58	0.58
Soil_2	0.72	0.63	0.41	0.33	0.00	0.00	0.59	0.59	0.34	0.33
Soil_3	0.28	0.37	0.00	0.00	0.00	0.00	0.41	0.41	0.08	0.09
N	152	134	1090	1147	602	413	309	348	2153	2042

Table 5.2: Summary Statistics: Slave Farms

	Alabama		**Georgia**		**North Carolina**		**Tennessee**		**All**	
Variable	Cherokee	White	Cherokee	White	Cherokee	White	Cherokee	White	Cherokee	White
Corn	1313.51	892.63	1073.56	857.85	686.25	999.64	1228.80	1192.07	1128.53	910.86
Wheat	6.76	20.58	10.59	57.44	2.50	7.33	13.92	83.22	10.04	53.45
Males <18	1.46	2.18	1.79	2.24	2.44	2.14	1.72	1.60	1.76	2.16
Males ≥18	1.74	1.95	1.81	2.00	1.81	1.90	1.34	1.97	1.67	1.98
Females <16	1.57	2.45	1.49	1.84	2.44	1.24	1.68	1.57	1.64	1.80
Females ≥16	1.53	1.84	1.68	1.88	1.69	1.45	1.56	1.41	1.62	1.79
Male Slaves	3.73	2.74	3.72	3.85	0.81	3.48	4.00	2.10	3.55	3.53
Females Slaves	4.14	3.76	4.18	3.78	1.50	3.64	4.12	2.16	3.93	3.58
Land	109.76	96.92	72.93	104.38	48.00	128.57	76.66	119.98	78.98	107.63
Soil_1	0.00	0.00	0.54	0.51	1.00	1.00	0.00	0.00	0.33	0.45
Soil_2	0.49	0.76	0.46	0.49	0.00	0.00	0.52	0.72	0.44	0.50
Soil_3	0.51	0.24	0.00	0.00	0.00	0.00	0.48	0.28	0.23	0.05
N	37	38	87	365	16	42	50	58	190	503

Table 5.3: Partial Productivity Indices: Free Farms

Cherokee Free Farms						
No. of Acres	Per capita Corn	Per Capita Wheat	Corn per Acre	Wheat per Acre	N	% of total
1-25	23.589	0.020	15.259	0.014	1951	0.906
26-50	72.270	0.193	11.822	0.034	148	0.069
51-100	122.876	0.363	9.751	0.035	50	0.023
101-200	460.000	0.000	13.868	0.000	2	0.001
>200	850.000	0.000	18.227	0.000	2	0.001
ALL	30.415	0.040	14.896	0.016	2153	1.000
White Free Farms						
No. of Acres	Per capita Corn	Per Capita Wheat	Corn per Acre	Wheat per Acre	N	% of total
1-25	47.588	1.321	17.961	0.528	788	0.386
26-50	64.310	2.353	10.408	0.377	768	0.376
51-100	88.929	4.139	7.688	0.367	419	0.205
101-200	115.851	6.850	6.456	0.381	58	0.028
>200	295.612	26.443	7.450	0.452	9	0.004
All	65.392	2.555	12.639	0.433	2042	1.000
Relative Productivity						
No. of Acres	Per capita Corn	Per Capita Wheat	Corn per Acre	Wheat per Acre		
1-25	0.496	0.015	0.850	0.027		
26-50	1.124	0.082	1.136	0.089		
51-100	1.382	0.088	1.268	0.094		
101-200	3.971	0.000	2.148	0.000		
>200	2.875	0.000	2.446	0.000		
All	0.465	0.015	1.179	0.037		

Table 5.4: Partial Productivity Indices: Distribution of Slave Farms

No. of Acres	Per capita Corn	Per Capita Wheat	Corn per Acre	Wheat per Acre	Corn Per Slave	Wheat Per Slave	N	% of total
Cherokee Slave Farms								
1-25	76.512	0.229	20.543	0.073	157.159	1.141	52	0.274
26-50	105.792	0.808	15.104	0.149	256.766	1.289	46	0.242
51-100	239.912	2.791	16.119	0.147	414.909	3.705	52	0.274
101-200	414.961	3.062	13.497	0.149	335.862	4.185	23	0.121
>200	475.425	2.708	12.254	0.086	263.002	3.519	17	0.089
all	204.983	1.635	16.421	0.122	282.919	2.460	190	1.000
White Slave Farms								
No. of Acres	Per capita Corn	Per Capita Wheat	Corn per Acre	Wheat per Acre	Corn Per Slave	Wheat Per Slave	N	% of total
1-25	57.457	2.964	22.048	0.812	171.875	6.710	50	0.099
26-50	78.697	4.142	11.460	0.658	225.416	13.405	102	0.203
51-100	135.099	7.686	9.372	0.529	298.812	18.029	184	0.366
101-200	238.675	15.767	8.130	0.460	292.559	18.333	116	0.231
>200	345.458	23.782	6.923	0.439	271.127	18.141	51	0.101
all	161.159	9.993	10.581	0.558	267.061	16.048	503	1.000
Relative Productivity								
No. of Acres	Per capita Corn	Per Capita Wheat	Corn per Acre	Wheat per Acre	Corn Per Slave	Wheat Per Slave		
1-25	1.332	0.077	0.932	0.090	0.914	0.170		
26-50	1.344	0.195	1.318	0.227	1.139	0.096		
51-100	1.776	0.363	1.720	0.278	1.389	0.205		
101-200	1.739	0.194	1.660	0.324	1.148	0.228		
>200	1.376	0.114	1.770	0.196	0.970	0.194		
all	1.272	0.164	1.552	0.219	1.059	0.153		

Table 5.5: Partial Productivity Indices: By Number of Slaves

No. of Slaves	Per capita Corn	Per Capita Wheat	Corn per Acre	Wheat per Acre	Corn Per Slave	Wheat Per Slave	N	% of total
Cherokee Slave Farms								
1-5	148.593	1.085	16.464	0.090	369.734	2.910	119	0.626
6-10	174.398	3.070	15.969	0.213	141.259	2.430	38	0.200
11-15	354.309	1.120	16.086	0.094	154.013	0.788	14	0.074
16-30	436.448	2.988	17.207	0.199	127.405	1.142	15	0.079
>30	782.500	1.094	17.667	0.029	80.296	0.127	4	0.021
all	204.983	1.635	16.421	0.122	282.919	2.460	190	1.000
White Slave Farms								
No. of Slaves	Per capita Corn	Per Capita Wheat	Corn per Acre	Wheat per Acre	Corn Per Slave	Wheat Per Slave	N	% of total
1-5	107.622	7.683	11.362	0.634	382.755	23.542	295	0.586
6-10	194.082	11.583	9.569	0.463	125.376	6.741	108	0.215
11-15	164.919	7.907	8.037	0.384	78.754	4.122	45	0.089
16-30	294.338	12.206	10.754	0.442	82.789	3.748	43	0.085
>30	680.766	51.915	9.400	0.629	64.552	4.363	12	0.024
all	160.947	9.982	10.581	0.558	267.061	16.048	503	1.000
Relative Productivity								
No. of Slaves	Per capita Corn	Per Capita Wheat	Corn per Acre	Wheat per Acre	Corn Per Slave	Wheat Per Slave		
1-5	1.381	0.141	1.449	0.142	0.966	0.124		
6-10	0.899	0.265	1.669	0.461	1.127	0.360		
11-15	2.148	0.142	2.001	0.244	1.956	0.191		
16-30	1.483	0.245	1.600	0.450	1.539	0.305		
>30	1.149	0.021	1.879	0.046	1.244	0.029		
All	1.274	0.164	1.552	0.219	1.059	0.153		

Table 5.6: Semi-Log Regression: Free Farms

(Dependent Variable: ln Output)

Variable	(OLS - unrestricted)	(OLS - restricted)
Constant	5.173	5.186
	(0.037)***	(0.038)***
CH dummy	-1.394	-1.389
	(0.072)***	(0.083)***
Males < 18	0.015	0.015
	(0.007)**	(0.007)**
Males ≥ 18	0.0101	0.110
	(0.016)***	(0.012)***
Females < 16	0.016	0.022
	(0.008)**	(0.009)***
Females ≥ 16	0.017	
	(0.013)	
Land	0.010	0.011
	(0.001)***	(0.001)***
Soil_1	-0.236	-0.243
	(0.026)***	(0.027)**
Soil_3	0.118	0.093
	(0.034)***	(0.050)*
CH*(Males < 18)	0.039	0.044
	(0.016)**	(0.018)**
CH*(Males ≥ 18)	0.003	
	(0.024)	
CH*(Females < 16)	0.010	
	(0.018)	
CH*(Females ≥ 16)	0.001	
	(0.027)	
CH*(Land)	0.026	0.026
	(0.007)***	(0.007)***
CH*(Soil_1)	0.093	0.105
	(0.052)*	(0.046)**
CH*(Soil_3)	-0.049	
	(0.103)	
R^2	0.549	0.549

Notes: N=4195. The Cherokee dummy, CH, represents 1 for all Cherokee households and 0 for all other households. *, **, and *** represent statistical significance at the 10%, 5%, and 1% levels.

Table 5.7: Semi-Log Regression: Market-Orientation Dummies

(Dependent Variable: ln Output)

Variable	(OLS - unrestricted)	(OLS - restricted)
Constant	5.173	5.198
	(0.037)***	(0.036)***
Non-Market Dummy	-1.746	-1.792
	(0.083)***	(0.081)***
Market Dummy	-0.653	-0.636
	(0.091)***	(0.105)***
Males < 18	0.015	0.018***
	(0.007)**	(0.007)***
Males ≥ 18	0.101	0.104
	(0.016)***	(0.011)***
Females < 16	0.016	0.015
	(0.008)**	(0.008)**
Females ≥ 18	0.017	
	(0.013)	
Land	0.010	0.010
	(0.001)***	(0.001)***
Soil_1	-0.236	-0.242
	(0.026)***	(0.026)***
Soil_3	0.118	0.093
	(0.034)***	(0.038)**
NMD*(Males < 18)	0.054	0.047
	(0.018)***	(0.018)***
NMD*(Males ≥ 18)	-0.004	
	(0.027)	
NMD*(Females < 16)	-0.023	
	(0.021)	
NMD*(Females ≥ 18)	-0.002	
	(0.028)	
NMD*(Land)	0.039	0.039
	(0.008)***	(0.008)***
NMD*(Soil_1)	0.187	0.205
	(0.059)***	(0.054)***
NMD*(Soil_3)	-0.089	
	(0.098)	
MD*(Males < 18)	0.001	
	(0.023)	
MD*(Males ≥ 18)	-0.011	
	(0.029)	
MD*(Females < 16)	0.026	
	(0.022)	
MD*(Females ≥ 18)	-0.006	
	(0.031)	
MD*(Land)	0.010	0.010
	(0.006)*	(0.006)*
MD*(Soil_1)	0.265 *	0.268
	(0.070)**	(0.061)**
MD*(Soil_3)	0.001	
	(0.119)	
R^2	0.611	0.609

Notes: N=4195. The non-market dummy, NMD, represents 1 for Cherokee households that did not sell any grain to the market. The market dummy, MD, assigns a 1 for the Cherokee market-oriented households and 0 for all other households. Therefore, the control group is white households. *, **, and *** represent statistical significance at the 10%, 5%, and 1% levels.

Table 5.8: OLS Estimates of Free Farms

(Dependent Variable: ln Output)

	Cherokee Farms		White Farms	
Variables	Coefficient	Std. Error	Coefficient	Std. Error
Constant	3.79	0.064	5.18	0.036
Males < 18	0.057	0.015	0.016	0.007
Males ≥ 18	0.110	0.018	0.109	0.014
Females < 16	0.029	0.016	0.017	0.008
Land	0.036	0.007	0.010	0.001
Soil_1	-0.141	0.045	-0.238	0.026
Soil_3	0.068	0.097	0.114	0.034
# of obs.	2153		2042	
Mean log output	4.495	1.110	5.745	0.703
R^2	0.344		0.354	

Notes: *, **, and *** represent statistical significance at the 10%, 5%, and 1% levels.

Table 5.9: Oaxaca Decompositions: Free Farms

$\ln \bar{Q}_w - \ln \bar{Q}_c = (\bar{x}'_w - \bar{x}'_c)\hat{\beta}_w + \bar{x}'_c(\hat{\beta}_w - \hat{\beta}_c)$		
Variable	Differences in Means	Differences in Coefficients
Constant	0.000	1.394
Males < 18	0.009	-0.066
Males ≥ 18	0.001	0.000
Females < 16	0.006	-0.018
Land	0.305	-0.330
Soil_1	0.001	-0.055
Soil_3	0.002	0.003
Diff. in Log Output = 1.251	0.325	0.925
	(0.19)	(0.20)
$\ln \bar{Q}_w - \ln \bar{Q}_c = (\bar{x}'_w - \bar{x}'_c)\hat{\beta}_c + \bar{x}'_w(\hat{\beta}_w - \hat{\beta}_c)$		
Variable	Differences in Means	Differences in Coefficients
Constant	0.000	1.394
Males < 18	0.031	-0.089
Males ≥ 18	0.002	0.000
Females < 16	0.010	-0.023
Land	1.058	-1.083
Soil_1	0.001	-0.055
Soil_3	0.001	0.004
Diff. in Log Output = 1.251	1.104	0.147
	(0.201)	(0.195)
Arithmetic Mean		
Variable	Differences in Means	Differences in Coefficients
Constant	0.000	1.394
Males < 18	0.020	-0.077
Males ≥ 18	0.001	0.000
Females < 16	0.008	-0.021
Land	0.68	-0.706
Soil_1	0.000	-0.055
Soil_3	0.001	0.003
Diff. in Log Output = 1.251	0.714	0.536
	(0.198)	(0.198)

Notes: The standard errors are in parentheses.

Table 5.10: Semi-Log Regression: Slave Farms

(Dependent Variable: ln Output)

Variable	(OLS - unrestricted)	(OLS - restricted)
Constant	5.853	5.885
	(0.094)***	(0.091)***
Cherokee	-0.345	-0.394
	(0.179)*	(0.143)***
Males < 18	0.011	
	(0.016)	
Males ≥ 18	0.030	0.056
	(0.024)	(0.020)***
Females < 16	0.014	
	(0.021)	
Females ≥ 16	0.017	
	(0.026)	
Slaves	0.007	
	(0.534)	
Land	0.004	0.005
	(0.001)***	(0.001)***
Soil_1	-0.175	-0.136
	(0.061)***	(0.055)**
Soil_3	0.298	0.275
	(0.118)**	(0.092)***
CH*(Males < 18)	0.077	0.086
	(0.045)*	(0.039)**
CH*(Males ≥ 18)	0.089	
	(0.058)	
CH*(Females < 16)	-0.019	
	(0.046)	
CH*(Females ≥ 16)	-0.127	
	(0.073)*	
CH*(Slaves)	-0.004	
	(0.008)	
CH*(Land)	0.004	0.004
	(0.001)***	(0.001)***
CH*(Soil_1)	0.174	
	(0.141)	
CH*(Soil_3)	0.006	
	(0.182)	
R^2	0.456	0.447

Notes: N=693. The Cherokee dummy, CH, represents 1 for all Cherokee households and 0 for all other households. *, **, and *** represent statistical significance at the 10%, 5%, and 1% levels.

Table 5.11: Semi-Log Regression: Market-Oriented Slave Farms

(Dependent Variable: ln Output)		
Variable	(OLS - unrestricted)	(OLS - restricted)
Constant	5.85	5.908
	(0.094)***	(0.076)***
Non-Market Dummy	-0.991	-0.799
	(0.310)***	(0.189)***
Market Dummy	0.137	
	(0.173)	
Males < 18	0.011	
	(0.016)	
Males ≥ 18	0.030	0.056
	(0.024)	(0.021)***
Females < 16	0.014	
	(0.021)	
Females ≥ 16	0.017	
	(0.026)	
Slaves	0.007	
	(0.005)	
Land	0.004	0.005
	(0.001)***	(0.001)***
Soil_1	-0.175	-0.123
	(0.061)***	(0.055)**
Soil_3	0.298	0.275
	(0.118)**	(0.083)***
NMD*(Males < 18)	0.075	
	(0.127)	
NMD*(Males ≥ 18)	0.098	
	(0.153)	
NMD*(Females < 16)	0.001	
	(0.110)	
NMD*(Females ≥ 18)	-0.183	
	(0.178)	
NMD*(Slaves)	0.015	
	(0.034)	
NMD*(Land)	0.004	0.006
	(0.003)	(0.003)*
NMD*(Soil_1)	0.435	
	(0.271)	
NMD*(Soil_3)	0.173	
	(0.310)	
MD*(Males < 18)	0.052	
	(0.034)	
MD*(Males ≥ 18)	0.054	
	(0.043)	
MD*(Females < 16)	-0.039	
	(0.046)	
MD*(Females ≥ 18)	-0.082	
	(0.057)	
MD*(Slaves)	-0.004	
	(0.007)	
MD*(Land)	0.003	0.004
	(0.001)**	(0.001)**
MD*(Soil_1)	0.172	
	(0.124)	
MD*(Soil_3)	-0.065	
	(0.177)	
R^2	0.500	0.481

Notes: N=693. The Cherokee dummy, CH, represents 1 for all Cherokee households and 0 for all other households. *, **, and *** represent statistical significance at the 10%, 5%, and 1% levels.

Table 5.12: OLS Estimates of Slave Farms

(Dependent Variable: ln Output)

Variables	Cherokee Farms		White Farms	
	Coefficient	Std. Error	Coefficient	Std. Error
Constant	5.402***	0.151	5.903***	0.091
Males <18	0.084**	0.039	0.014	0.015
Males ≥18	0.083*	0.047	0.041*	0.022
Land	0.009***	0.001	0.005***	0.008
$Soil_1$	-0.010	0.126	-0.181***	0.061
$Soil_3$	0.312**	0.142	0.283**	0.116
# of obs.	190		503	
mean log output	6.477	1.108	6.478	0.852
R^2	0.525		0.401	

Notes: *, **, and *** represent significance at the 10%, 5%, and 1% levels.

Table 5.13: Oaxaca Decompositions: Slave Farms

$\ln \bar{Q}_w - \ln \bar{Q}_c = (\bar{x}'_w - \bar{x}'_c)\hat{\beta}_w + \bar{x}'_c(\hat{\beta}_w - \hat{\beta}_c)$		
Variable	Differences in Means	Differences in Coefficients
Constant	0.000	0.502
Males <18	0.006	-0.122
Males ≥18	0.013	-0.069
Land	0.140	-0.333
Soil_1	-0.021	-0.056
Soil_3	-0.049	-0.007
Diff. in Log Output = 0.0001	0.087	-0.087
	(0.047)	(0.070)
$\ln \bar{Q}_w - \ln \bar{Q}_c = (\bar{x}'_w - \bar{x}'_c)\hat{\beta}_c + \bar{x}'_w(\hat{\beta}_w - \hat{\beta}_c)$		
Variable	Differences in Means	Differences in Coefficients
Constant	0.000	0.502
Males <18	0.033	-0.149
Males ≥18	0.025	-0.082
Land	0.261	-0.454
Soil_1	-0.001	-0.077
Soil_3	-0.055	-0.001
Diff. in Log Output = 0.0001	0.263	-0.263
	(0.070)	(0.047)
Arithmetic Mean		
Variable	Differences in Means	Differences in Coefficients
Constant	0.000	0.501
Males <18	0.019	-0.136
Males ≥18	0.019	-0.075
Land	0.201	-0.394
Soil_1	-0.011	-0.066
Soil_3	-0.052	-0.004
Diff. in Log Output = 0.0001	0.175	-0.175
	(0.059)	(0.059)

Chapter 6

"Traditional" Cherokee Agriculture, the Gadugi, and the Marketable Surplus in Antebellum North Carolina

In western North Carolina, white settlements sprang up in the valleys and along the rivers of this mountainous region after the Trail of Tears in 1838.[1] However, there were already occupants on some of these lands. Through the permission of the federal government, after removal, some Cherokees remained on their North Carolina homesteads nestled in the valleys of the Smoky Mountains. The majority of Cherokees lived in Quallatown, North Carolina, at the time in Haywood County, one of the western-most counties of North Carolina (see map 6.1).[2] Their settlement, located along the Oconaluftee River and its tributaries, was established back in 1819 when roughly fifty Cherokee families decided to remain on ceded land, thereby removing themselves from the Cherokee Nation as a whole.[3] Interestingly, despite being located outside the boundary of the Nation, these people, while merging some Euro-American economic influences into their society, were considered the most "traditional" of the Southeastern Cherokees, since they held onto economic institutions

[1]From 1830 to 1850, the three most-western North Carolina counties were Cherokee (formed after removal), Macon, and Haywood. Whites did live in Macon and Haywood Counties prior to 1838, as these lands were part of the North Carolina state public domain. However, Cherokee removal led to a massive increase in population in these counties. From 1830 to 1850, the population in these counties increased by 70%, whereas the population growth rate in the remainder of the state was 17% during these years.

[2]In documents written in the nineteenth century, these Cherokees were referred to as Oconaluftee, Lufty, Quallatown, and Qualla Indians or simply as North Carolina Cherokees. Later, most anthropologists referred to them as Eastern Cherokees. Sharlotte Neely, *Snowbird Cherokees: People of Persistence* (Athens: The University of Georgia Press, 1991), 22-23.

[3]Ibid. The boundary of Cherokee Nation in North Carolina was incrementally moved westward in the treaties of 1791, 1798, and 1819. Fred B. Bauer, *Land of the North Carolina Cherokees* (Brevard: George E. Buchanan, printer, 1970), 10.

which were subsequently replaced in the larger Cherokee settlement just west of their North Carolina locale.[4] One of the most unique features of this settlement, one hardly practiced on neighboring white farms, was the system of collective labor, called the gadugi, where farmers would work on each individual member's plot together to help seed, cultivate, and harvest all the crops of the gadugi.[5] This study will quantitatively determine the impact of traditional Cherokee agriculture on the degree of self-sufficiency and thus the level of marketable surpluses by comparing their farm production to that of their more individualistic white neighbors. One finding from this study which contradicts prior claims by historians is that Cherokee and white farm production were truly distinct: low wealth levels led Cherokee households to hold smaller acreage, fewer farm implements and livestock, and fewer slaves than whites, which, along with the shirking behavior associated with collectives, generated a relatively small amount of food surpluses for the entire community despite the central role of food production on these farms. Another finding is that the Cherokee collective system of sharing output was established in response to the substantial risk of falling below the subsistence level, as on neighboring white farmers, the probability of falling below subsistence was less, so they preferred to work on separate family farms which in turn generated higher output.

At the same time these Qualla Cherokees farmed the valleys and hillsides of the Smoky Mountains, most western North Carolina farmers, some of whom resided in this region as early as 1810 and some of whom moved into ceded Cherokee land after the 1838 state land sales, were engaged in yeoman agriculture.[6] A few farmers dealt in

[4]After removal, the Qualla Indians were merged with about 1,000 Cherokees barely surviving in the hills of North Carolina. McLoughlin and Conser, Jr., "The Cherokee Censuses," 218. Mooney reported the exact figure of 1,046 Cherokees hiding in the hills. James Mooney, *Myths of the Cherokee* (New York: Dover Publications, 1995), 159.

[5]The gadugi existed until the early twentieth century, when William H. Gilbert, Jr. did fieldwork in Quallatown in 1931-32 and noticed the importance and persistence of the gadugi. See William H. Gilbert, Jr., "The Eastern Cherokees," Anthropology Paper #23, Bureau of American Ethnology Bulletin 133 (1943).

[6]Farm tenancy did exist in Haywood County during the antebellum period. Through extracting information from personal records of pre-Civil War farmers, Joseph D. Reid, Jr., showed, using Haywood County as an example, that the forms of tenant contracts

commercial agriculture, as by 1840, 10,628 pounds of tobacco were gathered through the work of 304 slaves, representing about 6% of the total population; however, no farm in either Haywood, Macon, or Cherokee County (the three western-most counties) cultivated any cotton. Although they were well removed from the large-scale commercial agriculture of the Lower South, the opportunities to market their food surpluses and sell their cash crops to local markets existed and provided an powerful incentive to produce such goods. As reflected in the 1835 Cherokee census, the lure of European goods provided enough incentive for some Cherokee farmers to sell their excess grain surpluses to local markets, while some Cherokee slaveholders engaged in long-distance trade by transporting their cotton to Southern port cities such as New Orleans, Mobile, and Charleston. Thus, a fair amount of pre-removal Cherokees were responding to market-based incentives as did white farmers; however, the North Carolina Cherokees differed from their countrymen in many respects. Since these North Carolina Cherokees still held on to their traditional ways, traditions commonly described as non-capitalistic, their degree of self-sufficiency could have been negatively impacted.[7]

In this chapter, the level of self-sufficiency among white and Cherokee farmers is estimated from data from the manuscript censuses of 1850. Any level of farm output above a self-sufficiency level is a measure of potential marketable food surpluses which could be used to protect against future crop failures, to redistribute to other members of their society, or to sell in local markets. Unlike past studies on Cherokee agriculture, the degree of self-sufficiency at the level of the farm can be determined and compared with that of white farms using a complete set of agricultural goods. Also, as so often suggested by contemporary opinions, if the level of "conservative" or

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were similar to the better-known postbellum contracts. Joseph D. Reid, Jr., "Antebellum Southern Rental Contracts," *Explorations in Economic History*, 13 (1976): 69-83.

[7]Reciprocity governed their economic system, especially of early pre-contact Cherokees, where wealth accumulation was not pursued. Wealth was often redistributed to others in the forms of gifts. Jewelry and other forms of personal property were buried along with its owner as well. Hudson, *The Southeastern Indians*, 310-12. This appears to be consistent with the loosely-defined system of property rights established in these non-state societies.

"savage" methods of agriculture were in fact less productive, then the North Carolina Cherokee data would represent the best test of the role of this traditional economic organization in production, since the ability to isolate cultural conservatism with the 1835 Cherokee census is inexact.[8]

Studies of the antebellum South have shown that Southern farmers were mainly self-sufficient as a whole, as the largest slave farmers typically produced the largest marketable surpluses.[9] The only study of Cherokee self-sufficiency using quantitative methods showed a majority of pre-removal Cherokee farmers were in fact self-sufficient as well.[10] However, the lack of comparable white data made contemporaneous comparisons of white agriculture infeasible. Fortunately, through the mistake of federal marshals in the western portion of North Carolina, the Cherokees who lived in Quallatown, Haywood County, although not official U.S. citizens and therefore not taxpayers, were enumerated along with their white neighbors in both the agricultural and population schedules.

Considered a prominent feature of this society, the gadugi was a collective labor system where individual farmers worked together on each farm in the community in an effort to maximize social good. Farms were worked in teams, and services rendered on a family's farm would be given in the form of crops and services like seeding or harvesting on the other member's family farm.[11] Interestingly, although often mentioned in histories of the Eastern Cherokees, especially in the written documents by ethnographers in the late nineteenth and early twentieth centuries, the explanation for the continued use of this "traditional" institution has been largely ignored in

[8]See Chapter Four for a review of the opinions on traditional Cherokee farming methods.

[9]In chronological order, see Robert E. Gallman, "Self-Sufficiency in the Cotton Economy of the Antebellum South," *Agricultural History* 44 1 (1970): 5-23; Raymond C. Battalio and John Kagel, "The Structure of Antebellum Southern Agriculture: South Carolina," *Agricultural History* 44 1 (1970): 25-37; William K. Hutchinson and Samuel H. Williamson, "The Self-Sufficiency of the Antebellum South: Estimates of the Food Supply," *The Journal of Economic History*, 31 3 (1971): 591-612; Lacy K. Ford, "Self-Sufficiency, Cotton, and Economic Development in the South Carolina Upcountry, 1800-1860," *The Journal of Economic History*, 45 2 (1985): 261-67; Weiman, "Farmers and the Market," 627-47.

[10]Wishart, "Evidence of Surplus Production," Table 4, 129.

[11]Gilbert, "The Eastern Cherokees," 212.

these studies. Data constraints do not allow a precise estimate of the productivity of the gadugi itself; however, an explanation for the use of this organizational form can be gleaned from the estimates of marketable surpluses and other measures contained in the manuscript censuses on the Cherokee farmers in Quallatown.[12]

6.1 The Formation of the Quallatown Settlement

There are two different explanations of how the Cherokees in North Carolina were allowed to stay after 1838. One is a romanticized myth involving Tsali, referred to as Charley by whites, who was an elderly man who revolted against U.S. soldiers while marching towards a holding camp in western North Carolina. In this myth, which is currently performed by the Eastern Band of Cherokees in the nightly summer outdoor pageant *Unto These Hills*, Tsali became outraged by the mistreatment of his wife by U.S. soldiers. In the heat of the moment, Tsali killed two U.S. soldiers and escaped with his family into the Smoky Mountains, teaming up with other Cherokees hiding there. General Winfield Scott maintained that if Tsali and his family were captured, the remaining Cherokees in the state, mainly the ones hiding out in the hills, could remain in North Carolina. When word reached Tsali, he decided to sacrifice his life and surrendered himself to the troops. The troops then ordered fellow Cherokees to execute him and two of his sons. According to this myth, the remaining fugitive Cherokees were then allow to remain in the state.[13]

However, historical documents do not suggest that Tsali played the crucial role in the formation of what is now the Eastern Band of Cherokees. The true story did involve murdered U.S. soldiers; however, the major players were not the elderly Tsali, but his oldest sons, Nantayalee Jake, and Nantayalee (or Big) George. The exact role of Tsali is not known, for he probably had a minor role, given his age, in

[12]In 1900, according to ethnographer William H. Gilbert, Jr., "about one-fourth of the people in Big Cove [a town held within the boundary of Quallatown] belonged to a gadugi." Unfortunately, there are no membership records in 1850 to determine which Cherokees were a part of the gadugi. Gilbert, "The Eastern Cherokees," 212.

[13]Mooney, *Myths*, 131; Finger, *Eastern Band*, 21-22.

the murder. These Indians were in fact captured and returned to the holding camp not only by U.S. troops, but by Qualla Indians, led by William Holland Thomas, an adopted white man who played the most crucial role in the persistence of the Eastern Cherokees, and Euchella's band of Indians, who hid to avoid removal. Euchella had lived in the caves and mountains of North Carolina, losing his wife and brother while hiding from removal. When William Holland Thomas met up with Euchella, he described him as being "in a state of desperation," as Euchella even stated that "he had but little to make life desirable," which then made Thomas feel endangered.[14] Euchella gave the location of these fugitive Cherokees just a few days prior to Thomas's visit, and soon thereafter they were found. These Cherokees were tried and executed upon capture, but not at the suggestion of U.S. army officials; rather, Cherokees committed the executions either as an example of clan revenge, which is doubtful, or in an attempt to gain solidarity with the U.S. effort in removal, since Qualla Indians were already given tacit permission to stay before the execution of Tsali.[15]

Called "Wil-Usdi" or "Little Wil" as a child by Cherokees, William Thomas labored prior to 1838 to obtain citizenship and thus legal residence for Qualla Indians in North Carolina. Outside the Nation for roughly sixteen years before the Treaty of New Echota was ratified, he, along with the rest of the community, felt the treaty did not apply to these people. Thomas made many trips to Washington, D.C., using the 1835 Cherokee Treaty as a device to defend their rights to North Carolina lands, citing Article 12, which stated,

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[14]Letter from William H. Thomas to Gen. Winfield Scott, March 6, 1846. The William H. Thomas Papers, 1:7:2.

[15]Finger, *Eastern Band*, 26. Euchella, before the execution, stated "They must die for their offense, as the ancient custom existing between the whites and Cherokee required life for life." However, this is not entirely accurate, as the "ancient custom" called blood vengeance required a life for a life only if a clan member was murdered by another Cherokee from a different clan. This rule did not traditionally apply to cases when another tribe or even whites murdered a Cherokee clan member, as retaliation would occur, and often the number of deaths did not equal the number of slain clan members. See Reid, "A Perilous Rule," for more on the difference between clan revenge or blood vengeance and the international code of homicide.

> Those individuals and families of the Cherokee Nation that are averse to a removal to the Cherokee country west of the Mississippi and are desirous to become citizens of the States where they reside and such as are qualified to take care of themselves and their property shall be entitled to receive their due portion of all the personal benefits accruing under this treaty for their claims, improvements and per capita; as soon as an appropriation is made for this treaty.
>
> Such heads of Cherokee families that are desirous to reside within the States of No. Carolina Tennessee and Alabama subject to the laws of the same; and who are qualified or calculated to become useful citizens shall be entitled, on the certificate of the commissioners to a preemption right to one hundred and sixty acres of land or one quarter section at the minimum Congress price.[16]

Representing Qualla Indians, as well as some of the smaller groups of Indians living near Quallatown, Thomas informed federal authorities that these Indians were not planning to leave.[17] Official recognition as North Carolina citizens was slow, as the only acknowledgement of their status by the prior to 1840 can be gleaned from an Act passed by the state General Assembly, which "set up means to protect the Indians from fraud and which was to go into effect after the expected removal of most of the tribe."[18] The state's indifference towards these Indians on marginal state lands proved to be an another important factor in the persisting Cherokee presence in North Carolina. It was not until the twentieth century that these Cherokees obtained official status as U.S. citizens.[19]

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[16]This passage is contained in Finger, *Eastern Band*, 17.

[17]Thomas in the fall of 1836 assembled Qualla Indians in an effort to gauge the current opinion over removal. He directed two men to stand a few feet apart and asked anyone who wanted to rejoin their fellow Cherokees in Indian Territory (present-day Oklahoma) to walk between the two men. Evidently, no Qualla Indians walked between the two. Finger, *Eastern Band*, 18; Mooney, *Myths*, 163.

[18]Finger, *Eastern Band*, 18.

[19]In one only case was a Cherokee granted citizenship prior to 1850. Junaluska, an elderly man by the late 1840s who helped save Andrew Jackson's life during the Battle of Horsebend, was granted citizenship in Graham County, North Carolina, by the General Assembly. Bauer, *Land of the North Carolina Cherokees*, 13.

6.2 The Gadugi

Collective labor on a large scale was not conducted within Cherokee Nation. However, the Qualla Cherokees still operated a collective labor system. Sometimes called a free labor company, "a typical gadugi had about a dozen members who annually elected officers, including one person who served as director."[20] The gadugi also acted as a financial intermediary by allowing members to take out loans from its treasury, often using land, livestock, or dwellings as collateral.[21] The organization of the gadugi was very formal, as the company included a chief, sheriff (who collected the member's money when a loan was taken), secretary, and warner, whose purpose was to monitor work effort and "catch the laggards." The chief and the warner were the most important positions in the gadugi, as the warner "commands the operations of the company, tells them how long to work,and regulates the labor in general."[22]

The gadugi worked four days a week in rotation with other members' farms, which given a 52 week year, equaled 208 days a year, which was far less than the average number of days adult males (268-298 days) and adult females (261-284 days) worked in their farms in 1850.[23] The tasks of the gadugi included "ordinary agricultural activities, such as hoeing corn, topping corn for fodder, and clearing land for cultivation."[24] These teams also helped spread the flow of information within this community, as ethnographer Frans S. Olbrechts claimed that these Cherokee knew

[20]Wendell H. Oswalt, *This Land Was Theirs: A Study of North American Indians*, 4^{th} Edition (Mountain View: Mayfield Publishing Company, 1988), 422.

[21]Gilbert, *The Eastern Cherokees*, 212.

[22]Raymond D. Fogelson and Paul Kutsche, "Cherokee Economic Cooperatives: The Gadugi" in *Symposium on Cherokee and Iroquois Culture*, ed. William N. Fenton and John Gulick (Washington, D.C.: U.S. Government Printing Office, 1961), 87. Daniel S. Butrick, a American Board missionary, and Frederick Starr, an anthropologist, were others who saw the gadugi at work. Gilbert, *The Eastern Cherokees*, 362; Frederick Starr, *American Indians* (Boston: D.C. Heath & Co., Publishers, 1898), 144.

[23]Ransom and Sutch, *One Kind of Freedom*, Table C.1, 233.

[24]F.G. Speck and C.E. Schaeffer, "The Mutual-Aid Volunteer Company of the Eastern Cherokee: as recorded in a book of minutes in the Sequoyah syllabary, compared with mutual-aid societies of the norther Iroquois," *Journal of the Washington Academy of Sciences* 35 5 (1945), 170.

"all that happens in the valley."[25] By the late nineteenth century, the gadugi was hiring its services out to neighboring white farms. In the 1900s, the gadugi rates were $2 a day for the entire team, as profits were divided annually among its members. The gadugi remained in place until the state of North Carolina taxed the company in the early nineteenth century, an act which apparently led to its disbandment.[26]

The most similar groups in white agriculture were the working "bees" of colonial America.[27] In fact, Carrington, while collecting information for the Interior Department, described the teams of Cherokee working together as follows: "On one of the slopes a 'working bee' of 30 men, women, and children were uniting their forces to help a neighbor put in his corn."[28] Even in the antebellum period, surpluses were sometimes distributed to neighbors, often relatives, a result "consistent with the reciprocal web of communal relations among self-sufficient households."[29] However, this form of reciprocity was hardly as formal as the Cherokee institution nor as pervasive in the regional historical literature as there is no mention of such an institution on western North Carolina white communities.

6.3 Contemporary Observations and Generalizations

Opinions of the degree of Cherokee self-sufficiency in this North Carolina society varied. A vague reference in the Mullay Roll of 1848 described the workforce of Eastern Cherokees as "moral and comparatively industrious people −− sober and orderly to a market degree −− and although almost wholly ignorant of our language (not a single full-blood and but a few of the half-breeds speaking English)

[25]Finger, *Cherokee Americans*, 57.

[26]Oswalt, *This Land Was Theirs*, 422-23.

[27]Leonard Bloom, "The Acculturation of the Eastern Cherokee: Historical Aspects," *The North Carolina Historical Review* 19 4 (1942), 326.

[28]Fogelson and Kutsche, "Cherokee Economic Cooperatives," 104.

[29]David Freeman Weiman, "Petty Commodity Production in the Cotton South: Upcountry Farmers in the Georgia Cotton Economy," (Ph.D. Disseration, Stanford University, 1983), 317.

advancing encouragingly in the acquirement of a knowledge of agriculture, the ordinary mechanical branches, and in spinning, weaving, etc."[30] Years later, just after the Civil War, S. H. Swetland, a United States special agent, reported to E.S. Parker, the commissioner of Indian affairs, on the condition of North Carolina Cherokees, that "the general condition of the Cherokees, when compared in the light of opportunity, is favorable and not much inferior to the white settlers among whom they live. . . those mountain lands suit them, and are only suitable for them."[31]

Other accounts refer to these Cherokees as "temperate, orderly, and industrious."[32] In a written statement presented to the North Carolina General Assembly in 1850, neighbors of the North Carolina Cherokees spoke of the fast and improving understanding of agricultural methods and the mechanic arts.[33] On a journey though Quallatown in May 1848, journalist Charles Lanman described their farming practices as similar to those of their neighbors: "They pratise, to a considerable extent, the science of agriculture. . . for they manufacture their own ploughs, and other farming utensils. They keep the same domestic animals that are kept by their white neighbors, and cultivate all the common grains of the country."[34]

On the other hand, George Barber Davis in 1808 described these conservative Indians as "at least twenty years behind other Cherokees."[35] Historians have also painted a less rosy picture of their situation. In their analysis of the 1835 Cherokee Census, William McLoughlin and Walter Conser, Jr., identified the North Carolina Cherokees as the most poverty-stricken Cherokees by isolating their low corn and wheat yields and smaller farm sizes. Their explanation for this state was the combination of "isolation from white settlements, adherence to traditional life-style, and

[30]Neely, *Snowbird Cherokee*, 19-20.

[31]Executive House Doc 41. Congress 2 session no. 1. Serial Set #1414, 901.

[32]These were the words of State Congressman William Graham speaking before the House of Representatives in North Carolina in May 1838. Bauer, *Land of the North Carolina Cherokees*, 11.

[33]Ibid., 16.

[34]Charles Lanman, *Letters from the Alleghany Mountains* (New York: Geo. P. Putnam, 1849), 94-95.

[35]Finger, *Eastern Band*, 13.

deliberate resistance to change."[36] Fellow historian John Finger reached a similar conclusion; however, he explains that compared to their poor, white neighbors, agriculture was not much different: "The Indians made no pretense of scientific farming, and even after the Civil War knowledgeable visitors were appalled by their methods; they were usually quick to note, however, that poor whites of the area were no more proficient."[37] Despite Finger's claims of the relative performance of Qualla Indian agriculture, no comparative agricultural productivity estimates were determined.

6.4 Data

The data source is the collection of farmers, Cherokees and whites, drawn from the manuscripts of the federal censuses of population (schedule I), slave (schedule II), and agriculture (schedule IV) for 1850.[38] According to historical records, only a portion of Cherokee households were enumerated in the agriculture and population census schedule. A total of 710 Cherokees in 152 separate households was contained in the 1850 population schedule. However, only one year later, a population roll taken by David Siler listed the Quallatown Cherokee population at 883.[39] This is consistent with journalist Charles Lanman's figures: in 1848 he claimed that roughly eight hundred Cherokees and one hundred Catawbas lived on seventy-two thousand acres of land in Quallatown.[40] In the agricultural schedule, 120 individual farms were listed, each with 12 improved acres and 133 unimproved acres, totalling 17,400 acres owned. The uniformity of acreage across all Cherokee farms might appear dubious, but in a report submitted to the Attorney General of the United States, William Thomas did not dispute these figures; rather he emphasized that they represented

[36]McLoughlin and Conser, Jr., "The Cherokee Censuses," 223.

[37]Finger, *Eastern Band*, 61.

[38]There were few free blacks, 15 or 0.23% of the total free population, in Haywood County in 1850. Therefore, the use of the term "white" agriculture, which refers to non-Cherokee agriculture, is used throughout the discussion since the large majority of the free population was white.

[39]Finger, *Eastern Band*, 71, where he noted, "This was a significant and unexplained increase over the number listed in the 1850 census."

[40]Lanman, *Letters from the Alleghany Mountains*, 93.

a share of the total property: "The census shows that those Indians. . . own 17,300 [actual number 17,400] acres of land −− which does not embrace half of the land they own −− the other portion was left out by reason of the deeds not being recorded."[41]

Since these enumerated Cherokees represented only a portion of the total population, the information for all 120 farms in the agricultural schedule was recorded and the head of household of each farm was matched with the population schedule to obtain the labor force for each farm. All 120 farms were successfully matched with the family in the population schedule, as the inability to match farms (in Schedule IV) with farmers (in Schedule I) is a common problem with manuscript census sampling, as it was in the 1850 matched sample used in Chapter Five. For the white sample, according to the published census, there were 7,074 people, including the free (white and black) and slave population, listed in the county's population schedule, comprising 1,137 different families under 1,110 different dwellings. 653 households or 57% of the families held farms listed in the agriculture schedule. To obtain a similar sample size of the Cherokees, 20% of the farm households were recorded. After setting a random start to the sampling, two farms were recorded while skipping the next eight farms in the schedule. This generated 129 farms in the sample of white North Carolina farms.

Unlike in the Cherokee data, the census enumerator overestimated the number of farms in the county by listing farms that produced no arable production or, in one case, no arable production and no livestock. The instructions specified for schedule IV should have excluded all farms whose "produce" was at least $100; thus clearly these farms would have fallen under this limit. To make meaningful comparisons between white and Cherokee farmers, I sampled only "genuine" farmers, who lived on any farm with arable production or, if no arable production, a substantial amount

[41]Bauer, *Land of the North Carolina Cherokees*, 13-14; *Explanations of the Rights of the North Carolina Cherokee Indians*. Submitted to the Attorney General of the U.S. by Wm. H. Thomas (Washington, D.C., 1851), 14.

Table 6.1: Output per Capita

	Cherokee	White
Corn	27.8	45.9
Grain Crops	29.3	53.7
Butter	1.8	9.4
Cheese	0.0	0.1
Animals, slaughtered	1.5	7.1
Domestic Manufacturing	1.4	5.7
Number of farms	120	123

Notes: Corn is measured in bushels. Food crops is measured in corn-equivalents, which are determined by the nutritional value of each of the following crops: corn, rye, wheat, oats, peas and beans, Irish and sweet potatoes, barley, and buckwheat. Butter and cheese are measured in pounds. The value of animals slaughtered and domestic manufacturing are measured in dollars. The farm population is the total number of household members and slaves in each household.
Source: Manuscript Census, North Carolina, Haywood County, Schedules I, II, IV.

of livestock.[42] Therefore, six farms were omitted from the sample.[43] Therefore, the Cherokee sample contains 120 farms, and the white sample contains 123 farms.

One final point needs clarification. Unlike with North Carolina Cherokees, farm tenancy existed on North Carolina farms; however, in every federal census prior to

[42]These are the same requirements Frederick Bode and Donald Ginter used to define their agricultural producers. The significant number of livestock is determined by more than five animals in any livestock category, where cows, oxen, and "other cattle" are aggregated together. Bode and Ginter, *Farm Tenancy and the Census in Antebellum Georgia*, 13-26.

[43]Five farms, or 3.9% of the sample, held, using Bode and Ginter's terms, only minor livestock levels. One farm, or 0.8% of the sample, whose operator was a mechanic, had no arable production and no livestock. This percentage of non-producers contained in the agriculture schedule is similar to the northern-most county in Bode and Ginter's study on antebellum tenancy in Georgia, where 3.3% of the Towns County's enumerations were farmers had only minor livestock levels, and 1.4% had no arable production and no livestock. Ibid., Table 2.1, 16.

1880, these types of farmers, except for a few cases, were never explicitly stated. Therefore, an identification procedure needs to be made. A tenant farmer is defined as any "genuine" producer who held no improved and unimproved acres (listed in schedule IV) and had no personal property (listed in schedule I). According to this requirement, 37 or 30.1% of the sample consists of "certain" tenants. This amount might be considered high given the long-standing literature of low levels of antebellum farm tenancy; however, recent studies have shown a high rate of tenancy, especially in the mountainous regions of the South, during the antebellum period. In particular, two Georgia counties, Towns and Habersham, located in the Blue Ridge Mountains, have estimated tenancy rates of 42.6 and 41.6% respectively.[44]

Table 6.1 provides an overview of the per capita farm production on both types of farms. While the per capita Cherokee corn and food crop production are far lower than white levels, the percentage of corn in total food crops is far higher, 95%, as compared to white farms, 85%. The less-diversified Cherokee farmer suggests a revision of prior claims of the level of Cherokee crop diversification. Higher Cherokee crop diversification has been suggested: "Because white tenant farmers would have been under the pressure to specialize in crops for sale in the market in order to generate cash income to pay rent, it seems reasonable that Cherokee farmers, who were under no similar pressure, would have been included to push diversification further in order to insure against specific crop failures."[45] While some tenant contracts were in terms of monetary allowances, others were not. Some contracts maintained the sharing of the corn crop, some for a fixed rate of corn, and others required clearing land as rent. This would not have added pressure to these tenant farmers to manipulate their crop diversity, since corn would have been the chief crop anyway. Regardless of the type of contract, farm tenancy was not characteristic of most antebellum Southern farms. In a study of antebellum Georgia agriculture, sampling counties in various physiographic regions, the highest number of tenant farmers in one county was 46.2%.

[44]Ibid., 4, 114-46.

[45]Wishart, "Evidence of Surplus Production," 131.

The higher levels of per capita butter, cheese, and value of animals slaughtered is consistent with the long-standing opinion that Southeastern Indians in general had a low levels of livestock productivity. Traditionally, Cherokees were not concerned with animal husbandry.[46] Even by 1818, European visitors to this region during the "civilization" program were shocked by the treatment of livestock by Cherokee males. In one case, a Cherokee family produced a beef stew for a European visitor by first shooting a cow, as if it was wild game, in their fenced-in yard, which his slaves then butchered immediately, as the visitors watched in shock.[47]

6.5 Estimation of Marketable Surpluses

To measure the degree of marketable surpluses on each farm, one must account for the following measures: seed requirements, feed requirements, and household diet requirements. Seed requirements are the amount of a crop which is set aside for next year's crop. Feed requirements are the amount of food annually fed to each type of livestock. These requirements are then deducted from the total amount of food crops cultivated on a farm to determine the amount of food available for the family. Household diet requirements are then used to estimate the level of marketable surpluses on each farm. The remaining amount of food, if any, is considered a marketable surplus. The estimates for each requirement are described in the following paragraphs.

In the only self-sufficiency study on antebellum Upcountry agriculture, three food requirements are used to determine lower, mid-range, and upper bounds of self-sufficiency.[48] The lower bound of 20 bushels of corn-equivalents, after deducting for a portion of the crop to pay hired hands, was initially determined by Robert Ransom and Richard Sutch on postbellum Southern farms. The mid-level of food requirements, 26.4 corn-equivalents was extracted from Raymond Battalio and John Kagel's estimate of the common diet of male slaves, which they assumed was the same diet for adult (free) males, 182 pounds of meat and 16.25 pounds of corn meal.

[46]Perdue, *Cherokee Women*, 78.
[47]Ibid., 121.
[48]See David F. Weiman, "Farmers and the Market."

The highest requirement on Southern farms was determined by Robert Gallman, who desired to create an upper bound for marketable surpluses to bias against his thesis on the high level of self-sufficiency in the Deep South. The highest requirement of human consumption in antebellum America was used by Jeremy Atack and Fred Bateman's study on northern farms, which assumed a common free diet composed of 771 pounds of milk, 200 pounds of meat, and 13.5 bushels of grain (measured in corn-equivalents), which amounts to over 5,000 calories a day. For this study, the Battalio and Kagel food estimates are used since these provided a mid-point on the above studies. The lower bound of 20 bushels of corn-equivalents requires a deduction for hired hands which cannot be easily gleaned from the manuscript census. If a family of four hired a farm hand throughout the year, then adding the assumed level of pay meant that the food requirements were essentially 25 bushels of corn-equivalents, roughly the same as Battalio and Kagel's estimate. The upper bounds appear too high for these small-scale, relatively poor yeoman farmers. The adult equivalents are determined through Battalio and Kagel's method as well.[49]

In general, livestock was fed poorly by both Cherokees and whites in the antebellum period, especially in this mountainous region, where the hogs were typically fattened by the mast of the forests: "Hogs were fattened on the nuts, in unlimited numbers −− thus furnishing every variety of necessitous support."[50] The livestock requirements used in this study are borrowed from Weiman's study of Upcountry antebellum farmers, which adopted the requirements from Ransom and Sutch. These requirements (located in Table 6.2) are lower than Battalio and Kagel's and Gallman's and far lower than Atack and Bateman's feeding standards. However, the low standards appear to be consistent with contemporary accounts.

[49]The household members are converted into adult male equivalents by using the using weights which reflect the amount of a standard male diet that each age group consumes: males over 14, 100%; females over 14, 100%; children 11-14, 90%; children 7-10, 75%; children 4-6, 40%; and children under 4, 15%. Battalio and Kagel, "The Structure of Antebellum Southern Agriculture," 29.

[50]Executive House Doc 41. Congress 2 session no. 1. Serial Set #1414, 901.

Table 6.2: Feed Requirements on Both Cherokee and White Farms

(Measured in Corn-equivalent Units)

	This Study	Gallman	Battalio & Kagel	Atack & Bateman
Horses	35.0	38.11	21.6	25.0
Mules	30.0	38.11	14.4	17.0
Milch Cows	5.0	8.99	2.25	2.0 per 1,000 lbs. milk
Working Oxen	35.0	38.11	14.4	17.0
Other Cattle	0.0	2.60	2.25	3.0
Sheep	0.25	0.60	.50	0.5
Swine	0.0	0.0	5.0	10.0

Notes: Gallman, "Self-Sufficiency in the Cotton Economy of the Antebellum South," 10fn13; Battalio and Kagel, "The Structure of Antebellum Southern Agriculture: South Carolina, A Case Study," 29. Jeremy Atack and Fred Bateman, "Self-Sufficiency and the Marketable Surplus in the Rural North, 1860," *Agricultural History*, 58 (1984), Table 1, 303.

The seed requirements are used for the following crops: corn, 5%; wheat, 12%; oats, 7%; rye, 11%; peas and beans, 9%; potatoes, 10%, barley 9%, buckwheat, 8%.[51] After these deductions, these crops are converted into corn-equivalent bushels, which are determined from the nutritional value, relative to a bushel of corn, of each feed crop.[52] The food surpluses are calculated as the residual food supplies on the farm after these requirements are deducted.

The estimated food surpluses and deficits per capita are listed in Table 6.3 and showed in levels across farm sizes in Table 6.4. Dairy and pork estimates are not

[51]All the seed requirements, except barley and buckwheat, are taken from Weiman, "Farmers and the Market," 634fn26. He determined these seed requirements by gleaning the Patent Office Reports from 1848-1855 in counties located in the Upper South. The seed requirements for barley and buckwheat, both minor crops which were left out of Weiman's study, are taken from Atack and Bateman, *To Their Own Soil*, 214.

[52]The following conversion factors are used: corn, 1.00; barley, .866; buckwheat, .620; oats, 0.433; rye, 1.05; wheat, 1.104; peas and beans, .946; Irish potatoes, .22; sweet potatoes, .262. Ransom and Sutch, *One Kind of Freedom*, Table E.2, 247.

Table 6.3: Average Food Surpluses per Adult Equivalent

(Standard Deviation in Parenthesis)

Cherokee (all)	0.83	(26.33)
White (all)	21.75	(50.45)
Tenants (white)	-3.58	(24.58)
1-25 acres (white)	16.52	(26.82)
26-50 acres (white)	31.23	(56.79)
51-99 acres (white)	49.31	(31.48)
100+ acres (white)	55.04	(94.56)

Notes: Acres is determined by the amount of improved acres listed in the manuscript census. Tenant farms are determined, using Bode and Ginter's "certain" tenant category, as the farms who did not have personal property, nor were improved acres listed by their farm, but produced food crops.
Source: see Table 6.1.

estimated, as using the logic of Ransom and Sutch, "grain was not lost as food, but merely consumed in a different form. The same argument applies with respect to 'other cattle' on the farm and to any poultry. We allocate no grain to them on the assumption that such feed would eventually appear as meat (or eggs) for the farm family."[53] However, these food estimates will be later included to show if the role of these food items represented further differences in self-sufficiency patterns among these groups. Therefore, these estimates probably represent a lower bound of marketable surpluses on both types of farms.

As reflected in Table 6.3, per capita Cherokee food surpluses show that this community was self-sufficient, a notion rarely doubted by even the most critical

[53]Ibid., 250.

contemporary account. In an article published in Philadelphia's *Friends' Weekly Intelligencer*, these Quallatown Indians were stated to have a birth rate of four per cent per year, which was indirect evidence of a fair degree of self-sufficiency.[54] Charles Lanman, the likely writer of a *Friends' Weekly Intelligencer* article on Quallatown Indians, claimed in a separate essay that they "have everything they need or desire in the way of food."[55]

6.6 Explanations for Low Cherokee Food Surpluses

The per capita marketable surpluses are far lower on Cherokee farms than on white farms. There are a number of possible explanations for the relative farm performance among these two groups. Unfortunately, data limitations do not allow the use of econometric methods to isolate each effect on the level of marketable surpluses. Therefore, possible explanations for the differential in marketable surpluses will be discussed in detail in the following few paragraphs.

Farm size, defined as the number of improved acres, can account for differences in marketable surpluses, since prior studies on antebellum Southern agriculture have shown an increasing linear relationship between food surpluses and farm size. This same upward trend in marketable surpluses as farm size increases exists as well on the white farms, and since the Cherokee farms all contained 12 improved acres, the larger white farms should have produced more surpluses per acre. A reason for the higher per capita food surpluses on larger farms is that the per acre subsistence requirements are typically higher on smaller farms. On white farms, the labor-to-improved acres ratio is 0.181, whereas on Cherokee farms, the ratio is 0.385. Since

[54]From the *Weekly*, "The aggregate number was 669, in 1840, agreeable to the census of the Cherokees east, who, with a few exceptions, were full-blooded Cherokees. In the fall of 1844, a period of four years, the total number of deaths, including those among the old and infirm, who were permitted to remain, in consequence of their being unable to remove, amounted to 53. The number of births in the same period was 166; making, as the aggregate number of the town, in the fall of 1844, 728, besides the remainder of the Catawba tribe now residing with them, not included in the estimate, which would increase the number to upwards of 800." "Quallatown Indians," *Friends' Weekly Intelligencer*, Vol. VI, No. 1 (Philadelphia: Wm. D. Parrish & Co.).

[55]Lanman, *Letters*, 95.

Table 6.4: Distribution of Farm Surpluses (and Deficits) Across Households

(Measured in Corn-equivalent Bushels)

Surplus (bushels)	Cherokee (% of total)	White (% of total)
Deficits	66 (55.0%)	44 (35.8%)
0-20	11 (9.2%)	6 (4.9%)
21-40	15 (12.5%)	6 (4.9%)
41-60	12 (10.0%)	10 (8.1%)
61-80	8 (6.7%)	6 (4.9%)
81-100	5 (4.2%)	6 (4.9%)
over 100	3 (2.5%)	45 (36.6%)

Source: see Table 6.1.

the critical yield per acre increases when farm sizes fall, one would expect, all else constant, that Cherokee farmers would have lower per capita marketable surpluses.

However, it does not appear that farm size is the only determining factor for these Haywood County farmers. White farmers who held between one and twenty-five improved acres still generated more marketable surpluses than the Cherokees. Even if the food deficits of tenant farmers, who did not own any land, were deducted from the surpluses of the white farmers between 1 and 25 improved acres, the average per capita marketable surpluses, 12.94 corn-equivalents, would still be far greater than the average Cherokee level.[56] Also, on the twelve white farms which held between 10 and 13 tilled acres, six of these households also produced some tobacco as well as enough food crops to comfortably feed their cattle with their household members.

[56]Per capita food deficits were not uncommon on tenant farms, as the same degree of self-sufficiency was estimated for tenant farmers in the Upcountry in 1860 using the same dietary requirements. See Weiman, "Farmers and the Market," Table 2, 636.

The ability to produce surpluses may have also been a result of Cherokees' farming on poorer land, as soil quality does often differ within county boundaries. However, the countryside within Quallatown has been described as follows: "Valleys and slopes are quite fertile, and the lower mountains are well adapted to grazing" furnished with a "dense forest of walnut, mulberry, hickory, poplar, dogwood, elm, ash, chestnut, sugar-maple, white pine, spruce, pine, fir, and cedar trees."[57] William Thomas described the settlement as holding "rich pasturage for their cattle, both winter and summer, and where game is plenty their lands are productive, their orchards supply them with fruit."[58] Historian John Finger also finds little evidence of poorer soil quality: "As for their low agricultural productivity, one might question the assumption that it was partly due to poor soil. Most Cherokee farms were in river and creek valleys where the arable land, though limited in extent, was quite fertile."[59] The lack of bottomland was not necessarily a hindrance to Cherokees: "The Eastern Cherokees' lands may very well have been adequate for them when they first occupied them and for some time thereafter. It seems that whether or not they would have preferred to farm bottom lands, they tended not to do so."[60] Bottomlands in the North Carolina were previously used only as ceremonial sites.

A slightly more quantitative method can help us infer differences in land quality by computing the cash value of the farm-to-improved acre ratio for both types of farms. On Cherokee farms, this ratio on average was 6.0, where on white farms, the ratio was 10.9. Since the value of buildings, which was not enumerated by census marshals, is correlated with the value of farm implements, which was much higher on white farms, the higher farm value-to-improved acres might reflect differences in values of the farm buildings. An OLS regression of the cash value of a farm on improved and unimproved acres on white farms can help resolve this issue. After controlling for unimproved acres and the value of farm buildings, we see that the value

[57]Lanman, *Letters*, 93; *Friends' Weekly Intelligencer*, 2.

[58]*Explanations of the Rights*, 15.

[59]Finger, *Eastern Band*, 61.

[60]John Gulick, *Cherokees at the Crossroads*, Institute for Research in Social Science (Chapel Hill: University of North Carolina Press, 1960), 20.

of improved acres is statistically significant and is still higher than the Cherokees' value-added to improved acres.[61] Since there was no variation in the farm values or improved acres across Cherokee farms, such a regression on Cherokee data is infeasible. The greater value of improved acreage on white farms can be attributed to three factors: superior soil quality, greater initial wealth of the farm population, and capital gains from closer proximity to the transportation network.[62] Assuming the above claims are accurate about soil quality, and since the transportation network was underdeveloped in this area, most of the differences in the value of improved acres between Cherokees and whites should be attributed to greater wealth accumulation of white farms.

The relatively poor transportation network in this county helped eliminate, among other things, the cultivation of cotton, and may have lessened the demand for marketable surpluses. In fact, a short trip from Asheville, North Carolina, to Quallatown frustrated a federal official who in 1875, twenty-five years after the enumeration of these data, spent two days in transit, claiming that Quallatown's "remoteness. . . would be sufficient to render them [their lands] comparatively valueless. The nearest railroad is. . . forty miles. . . over rugged mountain roads."[63] However, within this county, there was a demand for foodstuffs as industrialization, albeit growing at a far slower pace than in the North, did exist: "The principal industrial installation near the Oconaluftee was the Mingus Creek Mill; it used an overshot water wheel and was employed principally for grinding corn."[64] When the Oconaluftee Turnpike Company planed to create a turnpike in the 1830s over an early Indian path, William

[61]The regression was in the form of $V_i = \beta_0 + \beta_1 IMP_i + \beta_2 UNIMP_i + \epsilon_i$, where IMP_i is improved acres, $UNIMP_i$ is unimproved acres. The results, correcting for heteroskedasticity, are

$$\begin{array}{cccc} \ln V_i = & 12.43 + 9.78\ IMP_i + & 0.38\ UNIMP_i, & R^2 = 0.660, \\ & (72.42)\ (1.59) & (0.44) & \end{array}$$

[62]All of these factors are listed in Weiman, "Farmers and the Market," 646.

[63]Bloom, "The Acculturation of the Eastern Cherokee," 357.

[64]Robert S. Lambert, "The Oconaluftee Valley, 1800-1860: A Study of the Sources for Mountain History," *The North Carolina Historical Review*, 45 4 (1958), 423.

H. Thomas was one of its biggest supporters. Assuming Thomas reflected the interests of most Cherokees, an expanding transportation network would not have been to their disadvantage.

John Finger and other historians who have written on the Eastern Cherokees believe the lower productivity, leading to lower marketable surpluses, was due to resistance to change. The resistance to change is in direct relation with the use of the gadugi, an organization form used in pre-contact Cherokee communities. However, if these Cherokees were a self-selected group of traditional cultural zealots, then most likely they would not have attempted through the help of William Thomas to become citizens of the United States. In fact, a group of Cherokee called Chickamaguans, who are also considered traditionalists, continued to revolt against American forces long after the War of Independence ended. During the nativist movement of the early nineteenth-century, this same group joined a Pan-Indian revolt against the United States in effort to restore pre-contact traditions. Also, and probably more importantly, according to the 1850 census, the large percentage of males were farmers in Quallatown which represents a distinct differences in traditional farming practices which is quite opposite of "traditional" gender roles in Cherokee households. Therefore, an explanation relying on cultural persistence cannot only can characterize some aspects of the community, which gives some doubt on the validity of these claims.

Since soil qualities, transportation access, and cultural explanations do not give adequate reasons for disparate levels of marketable surpluses among Cherokee and whites, differences in income or wealth levels can help explain differences in food surpluses between the two groups. Differences in wealth levels can explain differences in acreage, farm implements and machinery, livestock, and slave levels. As shown in Appendix 1, each of these inputs into the production of marketable surpluses increased when wealth increased, which caused higher food surpluses. Each Cherokee household did not owe any real estate property. If the value of implements and machinery and livestock are included in the estimate of wealth per household, then

on average, Cherokee households held $57.03 in wealth. On the other hand, the white farmers in Haywood County on average owned $380.25 in real estate. Adding the value of farming implements, machinery, and livestock, the level of real and personal property grew to $635.72 per farm. The greater levels of wealth can explain the greater investment in farm implements and machinery, as well as the higher value-added on improved acres. On average, the value of farm machinery and implements was $4.81 on Cherokee farms, while $35.59 on white farms. This difference in the quality and amount of farm equipment would have unquestionably increased food crop output and might have impacted the productivity as well.

Although the exact number of Cherokees enrolled in a gadugi in 1850 is unknown, given the homogeneity of these data, the number was probably higher than the William Gilbert's estimate of 25% of the community in the early nineteenth century. Since there is a long-standing opinion among economists that, given asymmetric information, shirking is likely in cooperatives, the reduced work effect would have generated lower farm output as well. The warner was obviously supposed to prevent this free-rider problem; however, when a gadugi grew to be as big as 30 members, the ability to accurately observe each member's work effect had to be constrained. As shown in Appendix 2, these Cherokees were willing to tolerate a very high level of shirking just to satisfy the desire to guaranteed minimum which is a characteristic of the gadugi.[65]

Another interesting result, completely consistent with economic theory on collectivism, is that the variance of marketable surpluses across white farmers, working as small collective groups, was far greater than that of Cherokee farmers. This is also reflected in Table 6.4. Most Cherokee farmers had food deficits, although they

[65]A caveat is needed. The organization form may not have been the most important reason for lower output. Commonly, certain types of farmers sort themselves into teams, especially a low-quality worker who gets paid an average marginal product, which would be higher that if the farmer worked alone. This outcome is feasible if the low-quality worker's contribution to total output is not clearly viewed. In this case, part of the difference in farm output is due to self-selection rather than organization form. In this study, the quality of Cherokee worker is assumed to be identical.

were offset by the few farmers who held over 60 corn-equivalent bushels of food surpluses, leading to a positive, albeit close to zero, level of marketable surpluses. On white farms, the spread of marketable surpluses is much higher, shown by the standard deviation of all farms, and is very apparent with the 44 farms having food deficits and 45 farms holding substantial food surpluses, over 100 corn-equivalent bushels, while the highest white farmer, a slave owner with 10 slaves, producing a marketable surplus of 1,086 corn-equivalent bushels. The Cherokee farmer with the highest level of marketable surpluses pales in comparison to the white farmer with 228 corn-equivalent bushels.

The low measure of marketable surpluses for Cherokee farmers is a sign that interaction in local markets was sporadic at best. This refutes the claim made in the chirpy article in the *Friends' Weekly Intelligencer*: "They not only raise plenty for themselves, but make a surplus which they sell to the whites engaged in working gold mines adjacent to the Indian settlement."[66] These results are more consistent with the less biased, more scientific views of anthropologist John Gulick, who maintained that "the use of the edges of bottoms and steep, cleared slopes appears to have been a adequate base for true subsistence (and completely non-commercial) agriculture from the 1840s until the end of the century."[67]

If the gadugi, along with low wealth levels, helped generate low food crop output, why was this institution developed? As modelled in Appendix 2, given highly probable shirking levels, households with identical risk preferences would have formed teams in the Cherokee community and farmed individually in the white community. This is because of most peasant agricultural communities, households trade off expanding total output in order to maintain a guaranteed minimum. Since the probability of falling below subsistence was very high each Cherokee individual household, the gadugi was a way to offset that risk by creating a guaranteed minimum output

[66] *Friends' Weekly Intelligencer*, 2.

[67] Gulick, *Cherokees at the Crossroads*, 20. Charles Lanman had his reasons for exaggerating Cherokee life. He was a member of the Whig party, which fought against the Democratic Indian removal policy. Finger, *Eastern Band*, 70.

at the cost of lowering total farm output from shirking. On white farms, guaranteeing this minimum output is not necessarily since the probability of falling below subsistence was low. Therefore, even that low shirking level, white households would prefer not sharing output. This result does not depend on differential shirking levels as well: if both groups shirked equally as much, under a range of shirking levels, this conclusion which is consistent with historical descriptions and the census data would still hold.

6.7 Model of Team Production

The demand for a guaranteed minimum is common in low-income agricultural communities. Southeastern Asian countries, such as Tonkin, Annma, Java, and Upper Burma, have developed institutions which provide this this need. These institutions are involve pooling risks and pooling resources as the village and not the individual members controls the allocation of resources. When a family falls well below a tolerable subsistence level, these villagers can receives gifts in the form of extra crops from households with surplus crops.

This similar response to the risk of falling below subsistence was embodied in these institutions developed by North Carolina Cherokees. As shown below, the establishment of a gadugi is in response to the risks of individualized farming. It will be shown that the gains from pooling risk together and sharing crops, even if there was a high level of shirking, outweighed the gains from not cooperating. Interestingly, this same model can explain why neighboring white farmers did not engage in collective agriculture.

The objective of this model is to consider the tradeoff between the probability of falling below subsistence and the average level of marketable surpluses per person. Sharing output will undoubtedly cause shirking which will lower surpluses levels; however, sharing decreases the probability of falling below subsistence. On the other hand, individualized agriculture is riskier yet, the surpluses levels would be higher.

Given these tradeoffs, the goal of each individual farm is to

$$\max_{Prob[y \geq L^o], E[y]} U(Prob[y \geq L^o], E[y]) \tag{6.1}$$

where U is individual i's utility function, x is the probability of being over the subsistence level, and y is the average level of marketable surpluses. Since the risk of falling below subsistence was greater for Cherokees than white and since the average output was greater on white farms, they faced different relative prices. The goal of this model is to show under which conditions would have Cherokees shared food surpluses while whites farmed separately.

To compute expected payoffs from both types of farmers, the utility function is specified as a Cobb-Douglas function where both elements are equal weights, $U(x, y) = (Prob[y \geq L^o])^{\alpha} E[y]^{\alpha}$. Given this utility function, Cherokees would prefer sharing output when U(sharing)$\geq$ U(not sharing). Given the earlier result which showed that the per capita marketable surplus was 0.82, the probability of being above subsistence when sharing was 1.00, while mean output will be called Q. The probability of being above subsistence when not sharing is extracted from the census data as well. According to standard feed and dietary requirements, the number of households above subsistence was 45%. Since the majority of Cherokees did not share, at least according to anthropological reports, I assume this percentage is the same is if every Cherokee did not share. Therefore, Cherokee would prefer to same if $Q \geq \alpha * Q * z$ where $\alpha = .45$, and z is the amount which mean output, Q, increases by when there was no sharing. Other way to write is looking at the amount of shirking tolerated under the sharing regime, which can be written as $s * Q \geq \alpha Q$ where $s = \frac{1}{z}$. Therefore, s must be greater than or equal to α to ensure sharing is preferred to not sharing. In other words, as long as the mean output under sharing was more than 45% of the nonsharing mean output, Cherokees would have shared. Thus, the Cherokees would have tolerate a high level of shirking to ensure a higher probability of not falling above subsistence. It is highly probably that the level of shirking falls in this bound, therefore, the model predicts that sharing would have occurred on Cherokee farms.

On white farms, it must be shown that the U(not sharing) $\geq$ U(sharing). Like Cherokee farms, the probability of being above subsistence was 1.00 if output was shared. In reality, white farmers worked separately, therefore the probability of falling below subsistence can be computed from the census data as well. Unlike Cherokee farms, some white farms will food deficits produced other crops which could be sold for bushels of corn, which would have pushed these households over the subsistence level. Furthermore, unlike Cherokee farms, some white farmers owned real estate which, in times of need, could have sold their own property to finance food crops. With this in mind, according to the census data, 99 households or 80% of the sample was produced food surpluses. This probability of being above subsistence is undoubtedly too low, since the subsistence level is notoriously subjective, so households probably reduced grain requirement in effect to feed the household members. In fact, 14 of the household with food deficits have head of households listed as non-agricultural positions, such as blacksmith, minister, or no listing at all. Since each of these households probably obtain income from other sources, enough to create buy foodstuffs on the market, then the probability of being above subsistence is 92%, which is probably more accurate than the earlier estimate.[68]

Given these census data on white farmers, as long as there was an 8% loss in output from shirking, the farmers would not share output. This result falls from the fact that if whites preferred not sharing to sharing, $q' \leq \alpha' = 0.92$. This result seems reasonable since only the slightest amount of shirking would not be tolerated by whites since the probability of falling below subsistence was already low.

Interestingly, the level of shirking can be identical in both types of farmers and since Cherokee farmers would have shared and white farmers would not have. In fact, there is a large range of shirking level will be satisfy this conclusion. If both farmers had identical levels of shirking, then if shirking reduced the total output by

[68]On Cherokee farms, there were only two households with food deficits that contained a head of household with a non-agricultural occupation. Therefore, using this criteria will only change the probability of being above subsistence from 45% to 47% on Cherokee farms.

between 8% and 55%, then Cherokees would share while whites would not. Given this wide range, it is highly probably that the level shirking fell within these bounds, therefore the model would correctly explain the role of the gadugi in the Cherokee community as well as the role of individualized farming in the neighboring white community.

6.8 Food Production Expanded: Pork and Dairy Estimates

In the prior estimates of marketable surpluses, milk and meat production were estimated. In Ransom and Sutch's and Weiman's work on Southern agriculture, they assume that production of milk and pork from milch cows and hogs, respectively, was simply corn-equivalent bushels fed to these animals in another form. In this section, this assumption is relaxed and pork and milk estimates at the level of the farm are determined.

Referring to western North Carolina, historian Robert Lambert writes, "Pork provided the basic ingredient of the settlers' meat diet. Hogs were more numerous than most other species of livestock combined."[69] Pork estimates are determined by dividing the value of animals slaughtered, which is reported in the manuscript census, by the average price of undressed meat, and then multiplied by a dressed-meat-to-live-weight ratio, which is 0.76 for this study. Robert Fogel and Stanley Engerman, in *Time on the Cross*, used a lower dressed-meat-to-live-weight ratio of 0.53; however, Richard Sutch in a critique of this measure believed the ratio was in the range of 0.75 to 0.80.[70] The determinant of the ratio depends on the assumption that the majority of households consumed solely pork in their meat diet, which, given the evidence, appears to hold for this case.[71]

[69]Lambert, "The Oconaluftee Valley," 422.

[70]Richard Sutch, "The Care and Feeding of Slaves," in *Reckoning with Slavery*, ed. David et. al. (Oxford: Oxford University Press, 1976): 231-301. Atack and Bateman used 0.76 as the ratio of dressed carcass weight to live weight.

[71]Poultry production, both in terms of the number slaughtered and egg output, could have been estimated as well; however, these figures would have relied on data from the 1880 published census. See Lee A. Craig, *To Sow One Acre More*, Appendix A, 107-16, for the techniques to extract poultry production from earlier censuses. However, the egg

Table 6.5: Grain, Dairy, and Meat Surpluses (and Deficits)

(Standard Deviation in Parenthesis)

	Grain (bu. corn)	Dairy (lbs. milk)	Meat (lbs. meat)	All (bu. corn)
Cherokee	10.49 (26.43)	-34.15 (264.29)	-142.63 (62.59)	3.01 (26.38)
White	31.90 (50.45)	234.99 (424.40)	-11.83 (183.19)	31.71 (55.58)

Source: see Table 6.1.

The average milk yield (in pounds) per milch cow for North Carolina in 1850 was multiplied by the number of cows on each farm to estimate the level of milk production per farm. The poor upkeep of Southern farms is reflected in milk yields far lower than the national average. In 1850, the average yield per cow of milk production was 2371 pounds, whereas, in North Carolina, the milk yield was a paltry 814 pounds.[72] Therefore, the average milk yield per cow in North Carolina is multiplied by the number of milch cows to obtain the estimated milk production. These estimates are adjusted for the allowance of reported butter and cheese production on the farm; thus the household's milk requirements are met through the combination of milk, cheese, and butter output.[73]

production does not appear to be significant; therefore, the omission of this production does not greatly impact these food surpluses estimates. Multiplying the estimated stock of poultry by the ratio of egg output per unit of poultry yields the egg output. In 1880, Haywood County produced 85,090 dozens of eggs with 19,063 units of poultry. The improved acreage was 52,132; therefore, the ratio of poultry per improved acre was 0.366, and the ratio of eggs per unit of poultry was 4.464. Both ratios are well below the weighted-average for the Northern states listed in Craig's study. Census Office, Tenth Census, *Report Upon the Statistics of Agriculture Compiled from Returns Received at the Tenth Census* (Washington, D.C.: Government Printing Office, 1883), 300, 302.

[72]Fred Bateman, "Improvement in American Dairy Farming, 1850-1910: A Quantitative Analysis," *The Journal of Economic History* 28 2 (1968), Table 1-2, 257-58.

[73]It is assumed that twenty-two pounds of milk was required for a pound of butter and ten pounds of milk for each pound of cheese. These are the same allowances used by Atack and Bateman, "Self-Sufficiency," 302fn31.

The per capita surpluses were based on a slight adjustment of the earlier human consumption requirements. As first suggested by Fogel and Engerman, Battalio and Kagel's human consumption requirements are adjusted for the inclusion of a dairy consumption. Therefore, the diet provides for an annual consumption of 237 pounds of milk (as milk, butter, or cheese), 182 pounds of meat, and 16.25 bushels of corn-equivalents.[74] The conversion rates for the three food groups are as follows: 2 bushels of corn per 1,000 lbs. of milk, and 6 bushels of corn 100 pounds of meat, the same conversion ration used earlier. This generates slightly higher human consumption requirements which are 26.9 corn-equivalent units.[75]

The individual surpluses (and deficits) for each food group are shown in Table 6.5. The inclusion of meat and diary production, assuming that this production did not change the previously-assumed grain requirements for the livestock, increased the number of Cherokee households producing food surpluses only marginally, from 54 to 55, or 45.8% of the North Carolina Cherokees. On white farms, the increase was more substantial: 87 households or 72.5% of the white sample were producing food surpluses, whereas 76 households were producing surpluses given the prior estimation procedure. The high number of households producing surpluses is not surprising as white farmers, on average, held for more milch cows, between 2-3 cows per farms as compared to less than one on Cherokee farms, and swine, among 20 hogs per white farms as compared to only four per Cherokee farm.

The meat deficits were probably made up through hunting. According to the article in the *Friends' Weekly Intelligencer*, "Their cattle subsist all the year without any other expense to their owners, except furnishing them with salt."[76] Cherokees probably got a majority of their meat from hunting: "wild-fowl and game sufficient to

[74] Atack and Bateman used the same adjustment in their northern self-sufficiency study. Fogel and Engerman, *Time on the Cross: Evidence and Methods*, 97; Atack and Bateman, "Self-Sufficiency," 302.

[75] The meat rations are converted into corn-equivalents under the assumption that hogs attain a weight of at least 90 pounds on forage. Weiman, "Farmers and the Market," 635fn29; Hutchinson and Williamson, "The Self-Sufficiency," 600-602.

[76] *Friends' Weekly Intelligencer*, 2.

furnish the sportsman with amusement."[77] This article also published game figures for 1844: "540 deer, 78 bears, 18 wolves, and 2 panthers" killed.[78] If the Cherokees completely supplemented meat production on the farm with game killed in the hunt, then the difference in average food surpluses between Cherokees and whites would still be significant. The Cherokees on average would have a food surplus of 10.05 corn-equivalent bushels, still much lower than the 31.71 corn-equivalent units of whites, assuming that white farmers did not hunt at all. Any meat obtained though hunting by whites would have exaggerated this difference.

6.9 Commercial Production in Haywood County

The mountainous landscape coupled with a poor infrastructure limited the degree of long-distance trade. However, commercial agriculture was feasible given the existence of local markets as well as the level of marketable surpluses. These surpluses, along with the production of other commercial crops, are listed in Table 6.6. The level of commercial production was very low on both types of farms; however, it was much lower on Cherokee farms. No cotton, tobacco, hay, hops, hemp, flax, and flaxseed was produced on Cherokee farms. Wool production was far greater on white farms, where 57% of the farms in the sample produced some amount of wool, and one farm produced 300 pounds of wool which can be valued at $91.50 using the national average for wool.[79] On Cherokee farms, only 37% of the farms produced wool, as the highest amount of wool on an individual farm was 50 pounds. White farms also averaged more tobacco, 9 pounds per farm, while some farms cultivated as much as 100 pounds of tobacco, which was worth $9.80, although as much as the average value of marketable surpluses.[80] The cultivation of tobacco was not solely on large white farms, as the three farms with 100 or more pounds of tobacco cultivated held on average 30 improved acres.

[77]Ibid.
[78]Ibid., 2-3.
[79]Towne and Rasmussen, "Farm Gross Product and Gross Investment," 289.
[80]Ibid., 307.

Table 6.6: Non-Food Production per Farm Population

	Cherokee	White
cotton	0.0	0.0
tobacco	0.0	1.3
wool	1.0	3.0
hay	0.0	0.1
hops	0.0	0.0
hemp	0.0	0.0
flax	0.0	1.2
flaxseed	0.0	0.0

Notes: Cotton is measured in bales (400 pounds per bale). Tobacco, wool, and hops are measured in pounds. Hay and hemp (water-rotted and dew-rotted) are measured in tons. Flaxseed is measured in bushels. The value of marketable surpluses is determined by Table 6.2 and evaluated at average national prices reported in Marvin W. Towne and Wayne D. Rasmussen, "Farm Gross Product and Gross Investment in the Nineteenth Century," 297.
Source: see Table 6.1.

The higher amount of tilled acreage to food crops by Cherokees is inconsistent with past studies on crop choices of smallholders.[81] The tobacco crop was a more risky crop to grow as the return per acre depends on its yield per acre, the market price of tobacco, and market price of corn.[82] The market risk inherent in tobacco production has been shown to lead poorer farmers to grow one's own corn instead of relying on the sale of staple crop production. The inverse relationship between acres tilled to cash crops and the critical yield per acre to maintain a substitutable household consumption level hold in these case as the labor per acre was higher on the smaller, Cherokee farms. Farmers exhibiting risk averse behavior would substitute more away from cash crop production than farmers with larger farm sizes.

6.10 Summary

Haywood County in 1850 provides a unique chance to determine the differences in crop production, in particular the level of marketable surpluses, between collective and individual, private agriculture. Two distinct modes of agricultural production are identified. On Cherokee farms, the production of agriculture was solely to satisfy the needs of each household. By all accounts, the gadugi provided just enough production to feed each household, whereas the individual farms of their white neighbors produced a higher level of food surpluses, implying that they often sold their crops in local markets. Commercial agriculture was secondary on most white farms, while almost completely nonexistent on Cherokee farms.

The main explanations for differences in food surpluses mainly involve the differences in wealth accumulation, which generated a higher demand for farm implements and machinery, improved acreage, and slave usage, and differences in organization form. Team production might have reduced the incentive for wealth accumulation;

[81] See Gavin Wright and Howard Kunreuther, "Cotton, Corn, and Risk in the Nineteenth Century," *The Journal of Economic History*, 35 3 (1971): 526-51.

[82] Ibid., 530. Wright and Kunreuther compared corn and cotton, however, comparing tobacco and corn is equally as consistent.

however, each individual is much poorer than their neighboring whites and anthropologists have only cited a percentage of the community being in a gadugi. As emphasized by Gavin Wright, farmers typically needed a modicum of wealth to expand farm production into regular food supplies to either local or regional markets.[83] The level of wealth was far lower on Cherokee farms, as according to the population schedule, no Cherokee owned any real estate. By 1860, only nine Cherokees in Quallatown held real estate as the gadugi was still in operation.[84]

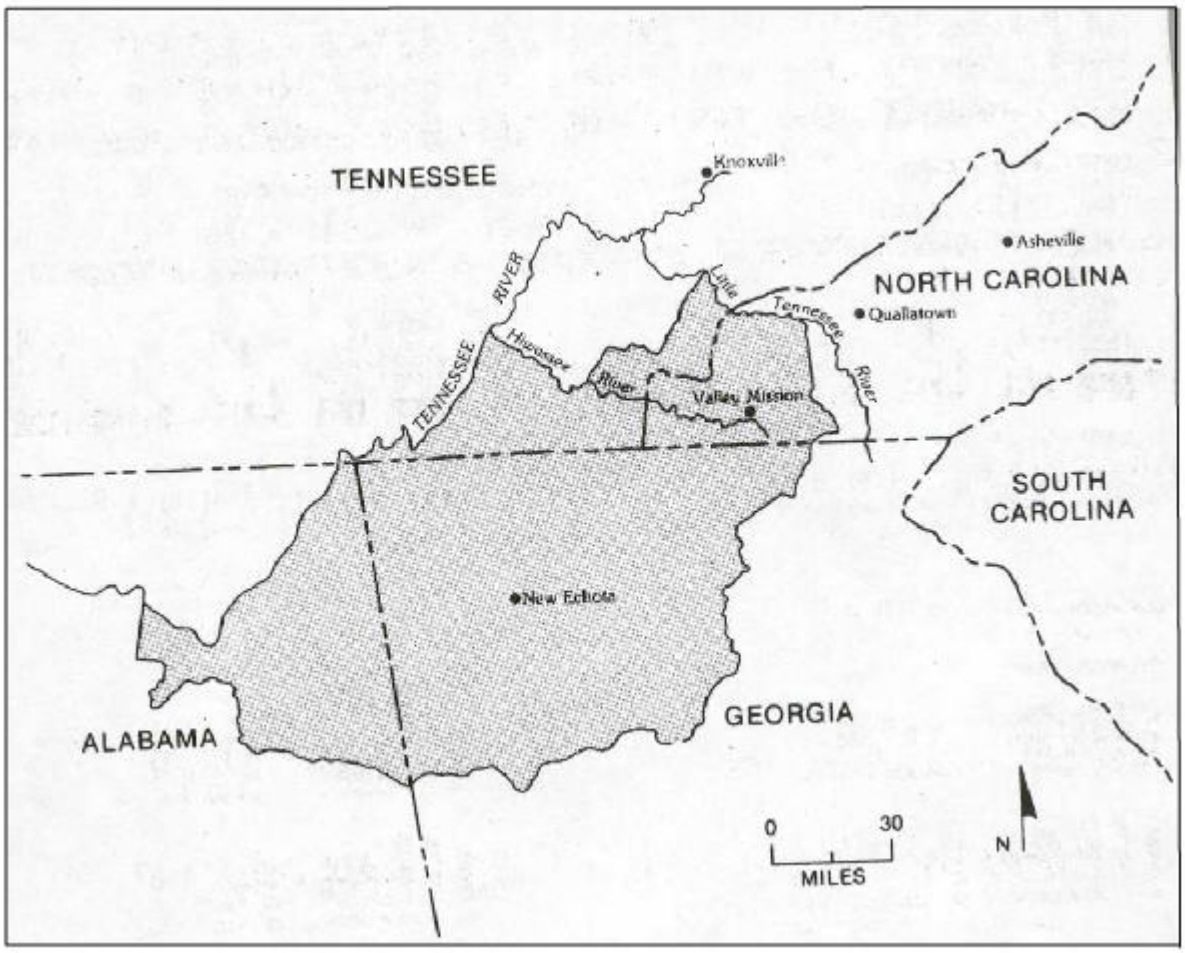
As characteristic of some Southeastern Asian peasant villages, the individual peasants "choose to create an institution that normally insures the weakest against ruin by making certain demands on better-off villagers."[85] The demand for a guaranteed minimum was higher on Cherokee farms given the marketable surpluses estimated in this study. By establishing a gadugi, the Cherokees were responding to the greater risk of falling below subsistence in the same fashion as other peasant farmers did in entire different communities. White farmers in Haywood County did not form teams for the same reasons: the demand for a guaranteed minimum was lower in this wealthier community. Therefore, this implies that Cherokee economic behavior can be characterized and explained through the standard economic theories which, although is not surprising to economists, is substantially different from that expressed by in the majority of Native American historical research which treats Indians as special cases.

[83]Gavin Wright, *Political Economy of the Cotton South* (New York, 1978), 62-74.

[84]Finger, *Eastern Band*, 81.

[85]James C. Scott, *The Moral Economy of the Peasant: Rebellion and Subsistence in Southeast Asia* (New Haven: Yale University Press, 1976), 41.

Figure 6.1: Cherokee Nation and Quallatown, North Carolina, 1850



From Finger, *Eastern Band*, 19.

Chapter 7

Conclusion

As the cause célèbre of the federal government's "civilization" program, the performance of Cherokee farmers during the early nineteenth century was vaunted by exponents of Indian removal and deplored by its antagonists. The disparity of opinions about the Cherokees has perdured as modern historians and economists continue to disagree over aspects of Cherokee agriculture. Despite the vast literature on Indian removal, no study has used quantitative methods to evaluate the cogency of these disparate views. This dissertation characterizes Cherokee agricultural productivity through the estimation of scale elasticities, technical efficiency measures, marginal products, and marketable surpluses of individual Cherokee households both before and after removal from the Southeast in 1838. These productivity measures are compared to those of white farmers who cultivated the same region of the Southeast in 1850.

In essence, the various studies in this dissertation show one simple finding: Cherokee Indians responded to relative prices. Such a statement is completely obvious to an economist, yet to my knowledge, Cherokee Indian behavior has never been described in such terms. The obvious reason is that few economists have studied the economic history of this diverse Indian Nation. Another reason is that their behavior has been typically sheltered from theories which have foundations in optimizing behavior. As Native Americanist Claudio Saunt explains, "Indian cultures remain the same when other cultures change, their societies embrace cohesion while their colonial counterparts fragment, they sell when everyone else buys. Economic historians can and should challenge these comfortable assumptions."[1] The

[1]Claudio Saunt, "What Can Economic Historians Tell Us about Native American History?," 6.

goal of this dissertation is to do exactly that, apply economic theory and statistical methods to test the "conventional wisdom" on Cherokee agriculture during the nineteenth century.

The first study of this dissertation is motivated by the long-standing debate regarding the farm performance of assimilated and traditional Cherokees. The most recent addition to this debate suggests that the large-scale adoption of Anglo-American customs should be deemphasized in Cherokee studies, as time-honored Cherokee traditions persisted throughout the nineteenth century. These views are challenged by first determining that Cherokee males contributed more to farm output than Cherokee women. The substitution away from hunting and towards farming in consistent with the increase in the relative price of hunting. Interesting, on the households with held farms as well as operating mills and ferryboats, the marginal contribution of Cherokee women on farm output was significant higher. Since Cherokee males were operating the mills and ferryboats in the Nation, Cherokee adult women would have had the comparative advantage in farming on these households. Therefore, standard claims that women held on to their traditional agricultural roles to consistent only on the few farms where they held the comparative advantage in farming.

Furthermore, the purposed insignificant role of racial differences among Cherokee Indians is also questioned through the estimation of technical efficiency and total scale of production for each farm household. The most productive Cherokee households, both in terms of cost and technical efficiency, are shown to be correlated with the households who were able to sell their excess crops. By controlling for all factors that influenced productivity, such as farm size and location, on free farms, the productivity of free farmers was not influenced by difference in the racial composition of a household. This supports the view that race was not a significant factor in productivity. However, on slave farms, households with married whites exerted the highest levels of technical efficiency among Cherokee slaveholders. Therefore, certain racial compositions did influence the productivity of slaveholders.

In several studies, it has been suggested that Cherokee agricultural productivity paralleled that of their white neighbors. The second essay compares differences in Cherokee agricultural productivity prior to removal to those of white farmers who later cultivated the same land. This analysis hinges on a matched sample collected from the manuscripts of the 1850 U.S. federal population, slave, and agricultural censuses. The sample contains individual white households that held farms in the ceded territory of the Southeastern Cherokee Nation. These estimates show that the marginal products of adult males and females were similar on both types of farms, which gives further evidence that traditional agricultural methods changed on Cherokee farms prior to removal. The insignificance of the marginal product of adult Cherokee females, like that of white adult females, also implies that the Cherokee females substituted away from agriculture as reflected in the high number of weavers and spinsters on Cherokee farms. On slave farms, the marginal product of males did not differ on either on Cherokee and white farms. Interestingly, the marginal product of males under 18 did differ on Cherokee and white farms as young Cherokee males contributed more to farm output than young white males. Given the relative scarcity of blacksmith shops in Cherokee Nation prior to removal, the work alternatives for young males were significantly different, thereby causing young males to work more on Cherokee farms.

The second study also decomposes the farm output-gap between Cherokees and whites to show that on free farms, the majority of the output-gap was due to differences in farm sizes. The largest difference between the two types of farms was that Cherokee farms were on average much smaller. Their smaller farms did result in Cherokees obtaining higher land productivity, a result which has led some to incorrectly maintain that Cherokee farmers were able to obtain higher yields because of superior farming methods. The estimation of the farm production function on pooled Cherokee and white data shows that the white total product curve lied substantially above the Cherokee product curve. Therefore, the white farm technology was quite different on both types of farms than the Cherokee farm technology, and,

given prior studies on antebellum agricultural progress, this difference cannot be considered solely technical change.

Regarding the level of marketable surpluses of Cherokee farms, in a rare debate of Cherokee agriculture engaged by economic historians, two prior studies have generated vastly different descriptions of Cherokee agriculture. One study described the Cherokee land requirements as being equivalent to that of hunters and gatherers, while the more systematic study of Cherokee self-sufficiency showed that a large majority of farmers produced marketable surpluses. The first study is limited in its poor estimation procedure and the second study is limited in the amount of data available. The third study improves on these studies by using more accurate cliometric techniques as well as a more complete set of data on Cherokee Indian crop production. By analyzing the returns from the 1850 U.S. census in Haywood County, North Carolina, a group of Cherokee farmers, who avoided removal by living outside the Cherokee Nation for many years prior to the 1835 Treaty of New Echota, are showed to be on average self-sufficient; however, the level of marketable surpluses is far less than their white Haywood County neighbors. The low levels of wealth, which is reflected in their amounts of real property, livestock, and farm implements and machinery, created the low levels of marketable surpluses across this community. Another unique characteristic of this community was that a number of these Cherokees used lang gangs to raise and harvest their crops. The level of shirking which accompanies teamwork would have undoubtedly decreased total farm output as well on these farms. Because the risk of falling below subsistence was more certain on these Cherokee farms, Cherokees used teamwork and reciprocity to lessen this probability. White regional farmers would not have benefited from forming teams since the risk of falling below subsistence was already low. This result is consistent with the sporadic use of these labor gangs in the Cherokee Nation prior to removal, because, as other studies have shown, a majority of Cherokee farms were surplus-oriented.

In sum, when Cherokee agricultural productivity differed from that of whites, the reasons easily fit under standard economic theory. When the agricultural produc-

tivity or even the organizational forms differed among Cherokees, the reasons were also economic in nature. If Cherokee agriculture can be easily explained through economic theory, then why has it not been in the past? First, the literature on Cherokee economic history has only recently been improved on by historians, let alone economists. Second, comparative studies on Cherokee and white agriculture have been stunted by the inability of identify the differences in farm production by solely interpreting results from the Cherokee census or solely from the U.S. Census of Agriculture. The collection of white farmers from this Southeastern region eliminated this identification problem.

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Appendix A

Instructions for Assistant Marshals

Schedule 1. - Free Inhabitants[1]

1. Under heading 1, entitled *"Dwelling-houses numbered in the order or visitation,"* insert the number of the dwelling-houses occupied by free inhabitants, as they are visited. By a dwelling-house is meant a separate inhabited tenement, containing one or more families under one roof. Where several tenements are in one bloc, with walls either of brick or wood to divide them, having separate entrances, they are each to be numbered as separate houses; but where not so divided, they are to be numbered as one houses.

2. Under heading 2, entitled *"Families numbered in the order of visitation,"* insert the number of free persons, as they are visited. By the term family is meant, either one person living separately in a house, or a part of a house, and providing for him or herself, or several persons living together in a house or in part of a house, upon one common means of support, and separately from others in similar circumstances. A widow living alone and separately providing for herself, or two hundred individuals living together and provided for by a a common head, should be numbered as one family.

3. Under heading 3, entitled *"The name of every person whose usual place of abode on the 1st day of June, 1850, was in this family."* include the names of those temporarily absent, as well as those that were at home on that day. The name of any member of a family who may have died since the 1st of June is to be entered and described as if living, but the name of any person born since the 1st day of June is to be omitted. Indians not taxed are not to be enumerated in this or any other schedule.

4. Under heading 4, entitled *"Age,"* inset in figures what was the specific age of each person at his or her last birth day previous to the 1st of June, opposite the name of such person. If the exact age in years cannot be ascertained, insert a number which shall be the nearest approximation to it. If the person be a child under one year old, the entry is to be made by the fractional parts o fa year, thus: one month, one-twelfth; and so on to eleven months, eleven-twelfths.

[1]U.S. Census Office, *The Seventh Census of the United States: 1850* (Washington, D.C.: 1853), xxii-xxiv.

5. Under heading 5, entitled *"Sex,"* insert the letter M for male, and F for female, opposite the name, in all cases, as the fact may be.

6. Under *"Profession, occupation, or trade of each person over fifteen years of age,"* insert clergyman, physician, lawyer, shoemaker, student, farmer, carpenter, laborer, tailor, boatman, sailor , or otherwise, as the fact may be. If a person follow no particular occupation, the space is to be filled with the word "none."

7. Under *"Value of real estate,"* You are to obtain the value of real estate by inquiry of each individual who is supposed to own real estate, be the same located where it may, and insert the amount in dollars. No abatement of the value is to be made on account of any lien or encumbrance thereon in the nature of debt.

Schedule 2. - Slave Inhabitants

1. Under heading 1, entitled *"Name of slaveholders,"* insert, in proper order, the names of the owners of slaves. Where there are several owners of a slave, the name of one only need be entered, or when owned by a corporation or trust estate, the name of the trustee or corporation.

2. Under heading 2, *"Number of slaves,"* insert, in regular numerical order, the number of all slaves of both sexes, and of each age, belonging to such owner. In the case of slaves, numbers are to be substituted for names. The person in whose family, or on whose plantation, the slave is found to be employed, is to be considered the owner - the principal object being to get the number of slaves, and not that of masters or owners.

3. Under heading 3, entitled *"Age,"* insert, in figures, the specific age of each slave opposite the number of such slave. If the exact age cannot be ascertained, insert a number which shall be the nearest approximation to it.

Schedule 4. - Agriculture.

1. Under heading, *"Name of individual managing his farmer, plantation,"*, insert the name of the person residing upon or having charge of the farm, whether as owner, agent, or tenant. When owned or managed by more than one person, the name of only one should be entered.

2. Under heading, *"Improved Acres"*, include cleared land used for grazing, grass, or tillage, or which is now fallow, connected with or belonging to the farm which the

assistant marshal is reported. It is not necessary that it should be contiguous; but it must be owned or managed by the person whose name is inserted in the column.

3. Under heading, *"Unimproved Land*, insert the number of unimproved land of the farm. It is not necessary that it should be contiguous to the improved land; but may be a wood lot, or other land at some distance, but owned in connexion with the farm, the timber or range of which is used for farm purposes.

4. Under heading, *"Cash Value of Farm*, insert the actual cash value of the whole number of acres returned by you as improved and unimproved. In this, as in all cases where an amount of money is stated, make your figures represent dollars.

5. Under heading, *"Value of farming implements and machinery*, insert the value of all the farming or planting implements and machinery, including wagons, thrashing machines, cotton gins, sugar mills; in fact, all implements and machinery used to cultivate and produce crops and fit the same for market or consumption.

6. Under general heading, *"Stock, 1st June, 1850,"* of the whole number of animals which belong to the farm on the 1st day of June, the number of each description thereof is to be inserted under the proper headings, taking care that under "other cattle," you insert the number of all cattle not before enumerated, which are one year old and older. The number of all sheep which were on said date of one or more years old; number of swine; insert, in dollars, the cash value of all live stock on hand on the 1st of June.

8. Under heading, *"Produce during the year ending June 1st, 1850,"* insert in the appropriate columns the whole number of tons, bales, bushels, pounds, or value, as the heading may call for, of the respective crops raised on the farm during the year ending the 1st of June. The grain which is gathered in that year is meant, though it may have been sown in 1848.

Appendix B

Relationship between Income and Marketable Surpluses

The impact of wealth on the level of marketable surpluses on a farm can be shown through the following model. I assume that each farmer's goal is to maximize the amount of marketable surpluses. Thus, the farmer's objective function is

$$\max_{l,s,k,a,v} \theta = f(L,S,K,A,V) - \psi * f(L,S,K,A,V) - \delta * d(L,S) - \phi * g(V), \quad \text{(B.1)}$$

where $f(L,S,K,A,V)$ is the food production function which, through household labor, L, slave labor, S, farm implements and machinery, K, improved acres, A, and livestock, V, produced food, either diary, meat, or grain, which are represented in corn-equivalent units. I assume that each input's marginal product is positive, a standard assumption of any production function, and the marketable surplus function is assumed to be quasiconcave, which ensures the optimization is at its maximum point. The second term, $\psi * f(L,S,K,A,V)$ reflects the seed requirement and therefore $\psi \in [0,1)$. The third term on the right-hand side of Eq. (1) is the human diet requirement were δ represents the number of corn-equivalents units per adult-equivalent as $d(L,S)$ is an aggregator function which converts free and slave labor into adult-equivalents. Since the conversion-ratio is positive for any age level of a slave or household member, $\frac{\partial d}{\partial L} > 0$ and $\frac{\partial d}{\partial S} > 0$. The last term on the right-hand side is the grain requirement for livestock, where ϕ is the amount of grain supplied to livestock and $g(V)$ aggregates each type of livestock. If all the nonswine livestock are fed from some of the grain cultivated on the farm, then $\frac{\partial g}{\partial V} > 0$ for all nonswine livestock. If the swine is fed completely on forage, then $\frac{\partial g}{\partial V} = 0$ for hogs and other cattle. Therefore, for this model, the sign of this partial derivative is assumed to be non-negative, or $\frac{\partial g}{\partial V} \geq 0$.

The ability to produce marketable surpluses is constrained by the budget of each farm which is represented as

$$M = p_l L + p_s S + p_k K + p_a A + p_v V, \tag{B.2}$$

where M represents income or wealth, and p_l, p_s, p_k, p_a, and p_v are the input prices for labor, slaves, capital, acres, and livestock, respectively. Therefore, each farmer's objective is to maximize Eq. B.1 subject to Eq. B.2. The goal of this model is to show that $\frac{\partial \theta^*}{\partial M} > 0$.

The Lagrangian for this optimization problem is

$$\mathcal{L} = f(\cdot) - \psi f(\cdot) - \delta d(\cdot) - \phi g(\cdot) + \lambda[M - p_l L - p_s S - p_k K - p_a A - p_v V],$$

and the first-order necessary conditions (FONCs) are:

$$\begin{aligned}
\mathcal{L}_\lambda &= M - p_l L - p_s S - p_k K - p_a A - p_v V = 0, \\
\mathcal{L}_L &= \frac{\partial f}{\partial L} - \psi \frac{\partial f}{\partial L} - \delta \frac{\partial d}{\partial L} - \lambda p_L = 0, \\
\mathcal{L}_S &= \frac{\partial f}{\partial S} - \psi \frac{\partial f}{\partial S} - \delta \frac{\partial d}{\partial S} - \lambda p_S = 0, \\
\mathcal{L}_K &= \frac{\partial f}{\partial K} - \psi \frac{\partial f}{\partial K} - \lambda p_K = 0, \\
\mathcal{L}_A &= \frac{\partial f}{\partial A} - \psi \frac{\partial f}{\partial A} - \lambda p_A = 0, \\
\mathcal{L}_V &= \frac{\partial f}{\partial V} - \psi \frac{\partial f}{\partial V} - \phi \frac{\partial g}{\partial V} - \lambda p_V = 0.
\end{aligned}$$

Rearranging the FONCs obtains the standard relationships between the ratio of price of two goods and the ratio of (net) marginal products of the two goods:

$$\begin{aligned}
\frac{p_L}{p_S} &= \frac{(1-\psi)\frac{\partial f}{\partial L} - \delta \frac{\partial d}{\partial L}}{(1-\psi)\frac{\partial f}{\partial S} - \delta \frac{\partial d}{\partial S}}, \\
\frac{p_K}{p_A} &= \frac{(1-\psi)\frac{\partial f}{\partial K}}{(1-\psi)\frac{\partial f}{\partial A}}, \\
\frac{p_V}{p_K} &= \frac{(1-\psi)\frac{\partial f}{\partial V} - \phi \frac{\partial g}{\partial V}}{(1-\psi)\frac{\partial f}{\partial K}}.
\end{aligned}$$

For simplicity, let $p = [p_L, p_S, p_K, p_A, p_V]'$. Then, at the optimal level of each input, the objective function are be written as

$$\theta^* = f(L^*(p,M), S^*(p,M), K^*(p,M), A^*(p,M), V^*(p,M))$$

$$-\psi * f(L^*(p,M), S^*(p,M), K^*(p,M), A^*(p,M), V^*(p,M))$$

$$-\delta * d(L^*(p,M), S^*(p,M)) - \phi * g(V^*(p,M)).$$

Differentially through by M obtains the desired expression:

$$\frac{\partial \theta^*}{\partial M} = [\frac{\partial f}{\partial L}\frac{\partial L^*}{\partial M} + \frac{\partial f}{\partial S}\frac{\partial S^*}{\partial M} + \frac{\partial f}{\partial K}\frac{\partial K^*}{\partial M} + \frac{\partial f}{\partial A}\frac{\partial A^*}{\partial M} + \frac{\partial f}{\partial V}\frac{\partial V^*}{\partial M}]-$$

$$\psi[\frac{\partial f}{\partial L}\frac{\partial L^*}{\partial M} + \frac{\partial f}{\partial S} * \frac{\partial S^*}{\partial M} + \frac{\partial f}{\partial K}\frac{\partial K^*}{\partial M} + \frac{\partial f}{\partial A}\frac{\partial A^*}{\partial M} + \frac{\partial f}{\partial V}\frac{\partial V^*}{\partial M}]$$

$$-\delta[\frac{\partial d}{\partial L}\frac{\partial L^*}{\partial M} + \frac{\partial d}{\partial S}\frac{\partial S^*}{\partial M}] - \phi[\frac{\partial g}{\partial V}\frac{\partial V^*}{\partial M}]$$

Rewriting this equation allows for the simple inclusion of the FONCs:

$$\frac{\partial \theta^*}{\partial M} = [(1-\psi)\frac{\partial f}{\partial L} - \delta\frac{\partial d}{\partial L}]\frac{\partial L^*}{\partial M} + [(1-\psi)\frac{\partial f}{\partial s} - \delta\frac{\partial d}{\partial s}]\frac{\partial S^*}{\partial M}$$

$$+[(1-\psi)\frac{\partial f}{\partial K}]\frac{\partial K^*}{\partial M} + [(1-\psi)\frac{\partial f}{\partial A}]\frac{\partial A^*}{\partial M} + [(1-\psi)\frac{\partial f}{\partial V} - \phi\frac{\partial g}{\partial V}]\frac{\partial V^*}{\partial M}. \tag{B.3}$$

According to the FONCs, each expression inside the brackets is positive, assuming the solution is at an interior solution, thus λ is positive. Therefore, at each optimal level of the endogenous variables, the impact of an increase in wealth on the level of marketable surpluses depends on whether the endogenous variables are normal or inferior goods. This is an empirical issue, and using the white Haywood County data, the following regression model is specified to determine the relationship between wealth and these variables:

$$W_i = \beta_0 + \beta_1 L_i + \beta_2 S_i + \beta_3 K_i + \beta_4 A_i + \beta_5 V_i + \epsilon_i \tag{B.4}$$

where W_i is specified as the value of each farm's real estate, L_i is the number of free members of the household, S_i is the number of slaves, K_i is the value of farm

implements and machinery, A_i is improved acres, and V_i is the value of the total livestock. The error term, ϵ_i, is specified as N(0, σ^2). This regression is estimated by OLS and the regression results are as follows[1]

$$\ln W_i = \underset{}{\text{-35.028}} + \underset{(66.87)}{13.102}\ L_i + \underset{(12.79)}{47.181}\ S_i + \underset{(30.52)}{2.589}\ K_i + \underset{(1.45)}{3.220}\ A_i + \underset{(1.86)}{0.781}\ V_i. \quad (0.41)$$

Since input prices are not contained in the census data, a standard regression model controlling for simultaneity cannot be specified. However, the goal is to determine the correlation between income and each input, and not the elasticity or beta coefficient on the income variable. Therefore, it does not appear that the correlation coefficient with change when the inputs are endogenous in the regression model. In fact, five separate regression were run using each input as a dependent variable on a constant and wealth. In each case, the sign on wealth was positive and statistically significant, which is consistent with the above regression.

All the explanatory variables are positive, as land, capital, and livestock are statistically significant at the 10% significance level. Inverting each estimated coefficient gives the estimated relationship between the demand for each variable and income. Since each estimate is positive, inverting the coefficient will generate a positive value, which shows that all the inputs were normal goods. Therefore, according to Eq. (4), $\frac{\partial \theta^*}{\partial M} > 0$, which means when wealth increased, the level of marketable surpluses increased as well.

[1] N = 70, R^2= 0.827.