

5-2012

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The Evolution of Rural Farming in the Scottish Highlands and the Arkansas Delta: Investments
and Inequalities

An Undergraduate Honors Thesis

in the

Crop, Soil, and Environmental Science Department

Submitted in partial fulfillment of the requirements for the
University of Arkansas
Dale Bumpers College of Agricultural, Food and Life Sciences
Honors Program

by

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April 2012

I. Abstract

The development and evolution of an agricultural system is influenced by many factors including binding constraints (limiting factors), choice of investments, and historic presence of land and income inequality. This study analyzed the development of two farming systems: mechanized, “economies of scale” farming in the Arkansas Delta and crofting in the Scottish Highlands. The study hypothesized that the current farm size in each region can be partially attributed to the binding constraints of either land or labor. In Scotland, it was found that the continuous binding constraint was the availability of arable land. In Arkansas, the binding constraint began as land, but experienced points of inflection where the constraint became labor as a result of the end of slavery and mechanization. Each region’s respective inelastic supplies contributed to the investments that were used to maximize the output per binding constraint. This study also explored the idea that those investments related to binding constraints have influenced the levels of land and income inequality in the Highlands and the Delta today. It was found that the historic presence of slavery in the south has contributed to the Arkansas Delta’s relatively high income and land inequality today. The Induced Innovation Model and the Gini coefficient were employed in the analysis of data pertaining to the respective regions’ agricultural constraints, investments, and economic inequalities.

II. Introduction

The Neolithic Revolution (8300-6000 BCE) moved the problem of domesticated food production and distribution to the forefront of humanity’s concerns (Stein, 2010). Domestication first started in the Middle East and spread throughout Europe (Sampietro et al, 2007). No longer ruled solely by the migration patterns or availability of hunted game, a sedentary lifestyle of agriculture and

animal husbandry emerged with its own host of difficulties and developments in Europe (Stein, 2010). Urbanization, economics, farming, and culture are only a few examples of the developmental maelstrom that occurred during the Revolution. The historic selection of appropriate farming systems, in particular, involved a complicated set of decisions based on a variety of factors which characterize the community that they will support. In order to realize maximum efficiency (high yields, caloric sufficiency, and profit) and environmental health (sustainability and degree of biodiversity) in food production and distribution the proper farm size, number of farms, crop choice, and management practices are among the factors affecting communities when developing an appropriate farming system (Spencer and Stewart, 1973). Spatially and temporally analyzing empirical farming differences can assist in the identification of the factors that most directly affect the efficiency, sustainability and suitability of these systems and therefore, can reveal connections to the nature of a farming system's progression and development. Agricultural constraints (natural resources, labor and technology) also have played a historic role in shaping farming communities both in Europe and the United States. Historic constraints from over 100 years ago still affect farming size and output today. Two such specific examples are the current farm systems in use today in the Arkansas Delta in the United States and in the Highlands and Isles of Scotland.

In the Scottish Highlands the farming system currently in place is known as crofting. Crofting is a small-scale food production system that is largely unique to the Highlands and Isles of Scotland. Typically crofters are tenants of their strips of land, meaning they rent land from a landowner in exchange for money or crops they produce on the land. Crofters use the land as a means to supplement their family and income while they are also typically employed by industries or the public sector, making most crofters semi-subsistence farmers (Hawkins, 2011).

Today, crofting can be seen as a part of the Highland culture by some because of its frequent and thorough integration into the surrounding community and the small size of the crofts. However, crofting originally started as an “economy of survival” because of the harsh conditions in the Scottish Highlands and Isles (Abrams, 2005). The average croft size in the Highlands is around 12 acres of land but in some cases can be as large as 150 acres. The main use of crofts is lamb and beef production, but crofters continue to endeavor in many types of seasonal vegetable and fruit production (Logie, 2007).

In contrast, the farming system in the Arkansas Delta in the United States is predominately large-scale cotton, rice, and soybean production with an average farm size of around 281 acres of land with some farms as large as 10,000 acres (USDA, 2012). These farmers are tenants as well, in the sense that approximately 50% of the land is rented, but also serve as suppliers to large agricultural and food corporations. The ample amount of land and fertile soil, economies of scale, and high price of labor make ideal conditions for these large, mechanized farms and, because they are so vast, there are fewer operations in general.

These two regions are both located in high-income countries but historical constraints have led them in differing directions in terms of agricultural development. A common thread in agricultural regions such as these has been that as the per capita increases in an area, the farm size increases and labor demand decreases as mechanization replaces labor (Woodruff, 1994). Given the historical development of these regions, Arkansas seems to fit this trend of agriculture consolidation while Scotland has taken a different direction by preserving small scale farming.

This study hypothesizes that certain factors such as binding constraints, investments, and land and income inequality have greatly affected the formation of current rural farming systems

in the Scottish Highlands and Arkansas Delta. The objective of this comparative study will be to analyze the historical setting during the time of agricultural development in each area. The objective is also to explain the limiting factors in each system and in turn analyze how each region evolved in their distinctive ways. The first hypothesis that this study will explore is that farm size in both areas has evolved as a result of the inelastic supply of land or labor. In Scotland's case the binding constraint is land while in the Arkansas, the binding constraint is labor. These limitations have stimulated the investment in particular agricultural technologies that maximize the output per elastic supply. Another hypothesis for this study is that these investments relating to constraints have affected land and income inequality trends that persist today, particularly in the United States. The study hypothesizes that the development of large, mechanized farms, as well as the presence of slavery, has contributed to the southern United States' (which includes the Arkansas Delta) level of inequality while the smaller, more frequent crofts and the grassroots efforts for crofters' rights has served to combat the same levels of inequality in Scotland today.

Several indices will be used in comparing factors such as income and land inequality and technological investments. These include the GINI index and the Induced Innovation Model. The study will focus specifically on the Arkansas Delta region because of its historical importance and the fact that it encompasses the majority of Arkansas' farmland and row crops. In Scotland, the specified area will be the West Highlands and the Islands where crofting is the dominating farm system in place.

III. Literature Review

A. Development and Evolution of the Arkansas Delta Agricultural System

A1. The Establishment of Row Crop Agriculture in the Delta

The earliest farms in Arkansas were in the Delta region around the Mississippi River settled by French, German, and Anglo-American farmers in the late 18th century (Williams, 2011). Specifically, the developments started in the Grand Prairie sub region on Crowley's Ridge, a region of hilly terrain that extends from southern Missouri into eastern Arkansas. Most early cultivation was done on the hillsides and included corn, cereals, and potatoes. It was not until after the Louisiana Purchase in 1803, when the United States purchased the region that included the current state of Arkansas, that cotton cultivation began in the territory (Williams, 2011). The Delta region is home to the thickest and most productive soils in Arkansas and also some of the flattest terrain, making it ideal for row crop agriculture (Foti, 2011). Early farmers discovered this efficiency as the region's soil produced 50% more pounds of cotton per acre than the state's average (Williams, 2011). Cotton price and demand (mainly from the northern US factories and in Europe) provided incentives for farmers to adopt it as a cash crop. Additionally, slavery, which was rising in prominence during this time, helped to increase the profitability of cotton by reducing labor costs (Williams, 2011).

A2. Social and Economic Inequalities in Agricultural Development (1820-1840)

Unequal distribution of taxable capital (including land, livestock, and slaves) created a significant economic barrier against the Black population (largely slaves) in the Delta of Arkansas. A study of Arkansas County in the early 1800s (which represented two-thirds of the current land area in Arkansas) shows a large population and slave increase in the early 1800s. Between 1820 and 1840 the population of Arkansas County increased from 14,273 to 97,574 with 11% slaves in 1820 to 20% in 1840, respectively. In addition, the percentage of tax payers

who owned slaves during this time jumped 14 percent (Bolton, 1982). This cheap labor supply resulted in an increase in standard of living for slave holders, but it created discrepancies between the income equality of those who held taxable capital and those who did not; foreshadowing inequalities that would arise in the future. The Gini coefficient in Arkansas County between 1825 and 1840 was 0.78; quite unequal (Yard, 1988).¹ To put the extent of this income inequality into perspective in 2011 the largest Gini value in the world was even smaller at 0.74 (Namibia) (WIID v 2.0c, 1995). This is an indication that most of the wealth in Arkansas was held by a small portion of the population. This inequality was largely due to the fact that African Americans did not have the right to own land and as more wealthy whites acquired more land and slaves they continued to widen the gap between the rich and poor. In 1825 the wealthiest 10% of the population in Arkansas County owned 67% of the taxable capital in the County. This stayed relatively constant over the next fifteen years while the middle class increased their capital and the lower class possessed little to no taxable capital (Bolton, 1982). Without the legal support to the ownership of supplies, the lower level, including both poor Whites and Blacks, had no chance of creating a successful farming system and most land fell into the possession of the wealthy white population, elevating the plantation system into prominence. With the rise of plantations and cheap labor, the cotton industry had a perfect canvas on which to flourish. The factors surrounding the rise in the cotton industry and plantation agriculture served to enhance the present inequalities of the Arkansas Delta.

A3. The Cotton Boom and Persistent Inequality in the South (1850-1900)

¹ The numerical value for inequality, the Gini Coefficient, has a range from 0 to 1; 0 being totally equal, 1 being the highest inequality possible.

The changes that occurred surrounding the Civil War had a lasting effect on the farm size and frequency of farms in the Arkansas Delta. The invention and adoption of the cotton gin in 1793 changed agriculture by increasing the profitability of cotton production. Before the invention of the cotton gin the cost of producing cotton and the labor required to separate the lint from the seed was far beyond most southern American farmers' means. The largest plantations were the only farms that could consider cotton production without looking at an imbalance in inputs and outputs. The invention of the cotton gin was the tipping point that made cotton production affordable to many producers in the South. While Phillips (2010) asserts that the invention of the cotton gin was not the only factor in sustaining slavery in the south, the boom in the industry as a result of the new technology certainly encouraged the spread of slave labor into the southern states. In 1860 Arkansas was sixth in cotton production in the nation and had experienced a sharp increase in the number of slaves. By 1860, 26% of the Arkansas population consisted of slaves (Ransom, 2010). This can be compared to 11% of the population in 1820 (Moneyhon, 2011). This population was concentrated mostly in the Delta and Lowlands, with 50% of all slaves in only 6 counties. It is inevitable that the slaves' inability to hold land and the wealthy white owners' increasing possession of taxable capital would encourage inequality in Arkansas and the whole of the south even post Emancipation Proclamation, the Thirteenth Amendment, and the Civil Rights Movement.

A4. Emancipation and Land Distribution

In the years leading up to the Civil War and the high slave populations the debate over slavery was becoming heated and action was demanded by anti-slavery parties. From 1850 up to the Civil War in 1861 the northern abolitionist movement pushed to influence southern farmers into freeing slaves on their plantations. Although a mass movement of manumission never occurred

in the south as a result of the abolitionists' efforts, a small increase in freed slaves can be seen from 1 (.002% of slave population) freed slave in 1850 to 43 (0.0369% of slave population) freed slaves in 1860 (United States Census Bureau, 1860). As some farmers started to free slaves other farmers became threatened and raised indignant concern over the competition that these newly freed men posed. When slaves were first liberated from their plantations they faced the challenges of cultural and social isolation induced by the slave lifestyle. They naturally tried to turn to farming as a means of survival, but often lacked the funds, credit and connections needed for success (Lovett, 1995). Even with these obstacles, Arkansas farmers saw a threat and sought to bar slaves from entering into the economy through political legislation. By the late 1850s state legislation passed a law that made it illegal for farmers to manumit their slaves. The governor of Arkansas, Elias Conway, declared that by January 1st, 1860 all freed slaves would either have to move to another state or would be forced back into slavery (Lovett, 1995). Naturally, many freed slaves fled Arkansas to find work elsewhere and avoid being forced back to the fields with no pay.

In September of 1862 President Lincoln declared all slaves free in the Confederate states with the Emancipation Proclamation, theoretically adding thousands of new, working members of society to Arkansas' economy. In actuality this was a much slower process as the Confederacy did not abide by the Proclamation until after the collapse of the Confederate government in 1865. A small proportion of the slaves who were free (most of them had taken refuge with the Union Army) were given small plots of land (10-50 acres) for subsistence living and cotton production by the federal government. Mostly concentrated in the Helena, Arkansas, the total income for Black farmers in the area was forty thousand dollars at the end of 1864 (Lovett, 1995). Unfortunately, many of those farmers still lacked the supplies and inputs to take advantage of the

opportunity and the progress was short-lived. Seeing this lack of progress with the new working population the government implemented several programs to aid the plight of the freed man. One such program involved the creation of the Freedman's Bureau in 1865 which became the first federally funded social work program for African-Americans. The purpose of the organization was to encourage agricultural development in the former slave population and by the end of 1865 the Bureau reported 400 freedmen and their families as holding sharecropping positions where the tenant would provide labor usually for 50% share of the crops (Lovett, 1995). While the intentions of the Freedmen's Bureau were well placed, their efforts failed to give former slaves what they desired: economic independence. The progress of the population was met with resistance from many sides including whites that did not find the Emancipation favorable and African-Americans often took sharecropping positions which left them in debt to their land owner (Lovett, 1995). In an attempt to further improve the situation of these poor Black farmers the Southern Homestead Act was signed in to law in 1866. This offered small sections of public land to farmers, but denied the right to any individual who fought against the Union army in the Civil War until 1867. Unfortunately, due to more bureaucratic barriers many newly freed farmers did not file for claims on public land (Williams, 2011). Offices to make claims in Arkansas were located far from the Delta which was an agriculturally active region of the state with a large farmer population (Stroud, 2012). By the time Congress amended the Southern Homestead Act in 1876 only 2.3 of the nine million acres of public land that was set aside had been claimed. The amendment allowed unrestricted access to the purchase of the public land which resulted in most of Arkansas' most productive farmland falling into the hands of seven companies (Williams, 2011). This caused an uneven distribution of land and resulted in inequalities that are reflected in Delta agriculture today.

A5. Fight Over Drained Lands: Example of Economic Clout of Plantation Owners

More land was brought into cultivation between 1908 and 1921 as a result of a mass drainage project by the St. Francis Levee District, an organization created by the state of Arkansas in 1883 to manage drainage issues in St. Francis County (Whayne 1993). Around 81,000 acres of land were drained for cultivation in the Delta region and it was estimated that another 119,000 acres of land existed in lake beds outside of the drained lands. The state government seized around 96,000 acres by 1914 and a political fight ensued over the distribution and ownership of that portion of land in Arkansas. There were three groups of people fighting for the rights to this land: Small land owners with support of the federal government (The Department of Interior), Entrepreneurs (plantation owners and companies), and the Arkansas State government (The St. Francis Levee District Board). By the end of the confusing battle it was clear that the entrepreneurs had the most economic clout and therefore secured the largest proportion, relative to their population, of the drained land (around 42,000 acres). This showed the continuing increase of influence of large, centralized farms and only added to the growing land and income inequality in the Delta (Whayne, 1993).

A6. The Great Migration and Mechanization of Arkansas Agriculture

The grabbing of land by plantation owners and private companies left little space for the average farmer in Arkansas to make a living and by the 1890s the state saw the emigration of close to 20,000 people; a foreshadowing of the larger exodus to come. This led to another major historical event that had an impact on the agricultural structure of Arkansas: the Great Migration. It is estimated that over 15 million Americans emigrated away from their homes between 1930 and 1970. This mass movement encompassed many different states, but one unifying factor was

that people, especially Black farmers, were not satisfied with the job opportunities in their home state. By the end of the Migration Arkansas alone lost 1.2 million people which resulted in several implications for agriculture in particular (Holley, 2005). Farm structure in the Arkansas Delta experienced a shift in second comparative criteria of this study: degree of mechanization. It is arguable that this emigration occurred as a result of mechanization; many scholars believe that it was the development of new technology that pushed farmhands away from the south. The leaving process, however, started well before the implementation of the tractor, which points to the idea of replacement rather than displacement (Grove and Heinecke, 2003). The sharp dip in population resulted in cheap labor shortages that the former plantation system relied upon for efficient production. Cheap labor was no longer an option for land owners and they had to turn to mechanization to survive as farm sizes grew larger (a result of the land grabs after the Civil War). Unfortunately, there were several obstacles to complete mechanization. Peak labor needs in agriculture include pre-harvest and harvest periods. The mass adoption of the tractor around the 1920s reduced the need for pre-harvest labor, but harvesting still required many human hands. This forced landowners away from complete mechanization and into a reliance on annual tenancy contracts to ensure that they would have the labor they needed when harvest time arrived (Whatley, 1987). However, the need for human hands during harvest sharply decreased after World War II as a result of the rise of the mechanical cotton and rice picker, thus allowing the Delta's agriculture to completely mechanize and have little reliance on the now relatively expensive human labor (Whatley, 1987).

A7. The Southern Tenant Farmers Union- Inequalities and Government Policy

Although a significant amount of people migrated away from Arkansas, many stayed because of they lacked the funds to move and sought to work on large farms for a living. In the 1930s a

biracial union of tenant farmers, sharecroppers, and wage laborers created the Southern Tenant Farmers Union (STFU). The inequalities that had persisted in the Arkansas agriculture system must have been great to produce such high risk action from these farmers (Yard, 1988). Between 1934 and 1937 STFU membership rose from 18 people to 11,846 in 5 upper Delta counties (Crittendon, Cross, Poinsett, St. Francis, and Woodruff). The main concern of the STFU was social and economic independence. The Union became outraged by the tendency of wealthy land owners to employ wage laborers or convert existing tenants and sharecroppers to this system. Wage laboring paid much less than sharecropping, tenancy, or cash renting and was a much less stable form of work. This tendency occurred primarily because of the Great Depression and New Deal agricultural restriction programs (Yard, 1988). The Agricultural Adjustment Act of 1933 offered financial incentives to farmers to reduce their cotton production in order to raise prices. The Soil Conservation Act of 1936 contributed to this as well because of incentives to produce crops that did not deplete the soil's nutrients as much as cotton. Around 73 million dollars in subsidies was directed towards southern farmers between 1933 and 1938, but wealthy land owners did not stop trying to cut costs. The per acre cost return for wage labor was around 8.93 percent higher than sharecroppers and increased mechanization reduced the cost per acre even more. This displaced a large amount of labor and it was not until 1938 that land owners were prohibited from converting sharecroppers into wage laborers to avoid sharing subsidies (Yard, 1988). The overwhelming trend was towards a "centralized, mechanized and wage labor dependent economic structure"; precisely what the STFU was fighting to halt. This trend has continued into the agricultural system of farming in the Arkansas Delta today. Small farmers are at a disadvantage as the unequal distribution of subsidies, depletion of resources, and consolidation of land in the Delta continue to exacerbate the challenges of farming. In 1997, 7%

of the largest farms made 60% of the total farm sales in the state (Arkansas Public Policy Panel [APPP], 1999). These percentages are largely due to government support for high output, mechanized farms. Nearly 1.5 billion dollars was given to farms by the federal government in 1997, most of it going to the largest operations (APPP, 1999). The continued support for “economies of scale” farming has contributed to the sustained income and land inequalities that exist in Arkansas today.

B. Development and Evolution of the Scottish Highland Crofting System

B1. Climate and Geography of the Highlands: An Innate Challenge

The Scottish Highlands, located in the northwest mainland and islands of Scotland, represent a region that is limited in arable land and has considerable geographical variation. Largely dominated by acidic, poorly aerated, shallow soils the Highlands do not prove favorable to many types of crops. Potatoes, turnips, and cereal grains like oats grow well in the harsh, windy, unpredictable climatic conditions of the uplands of Scotland. Fortunately, the wet climate (45-58” of rain per year in the Outer Hebrides, the north-western most group of islands off of the mainland) and shallow soil lend themselves to healthy pasture land that is well suited for livestock production, particularly sheep farming (Hance, 1952). However, even this pasture land is limited. For example, in the Outer Hebrides less than 10% of the land is classified as better than rough grazing and only 3% of the land is devoted to crop production. This is the extreme case as The Outer Hebrides are most northern set of islands in Scotland and they are subject to high winds and soil erosion, but similar constraints effect the whole of the Highlands (Rohde, 2010). A varied, hilly landscape breaks up the arable land and has directly affected farm size since agriculture emerged in the region. Hills are often utilized in sheep and cattle farming, but

have to be carefully managed to avoid overgrazing and erosion (Hance, 1952). This landscape has also affected levels of social communication and economic isolation within the crofting communities, which are groups of families and individuals that rely on the farming of small strips of land (crofts) to supplement their income and food supply.

B2. The Pre-Crofting Highlands (Early 18th century)

In the pre-crofting era the Highlands had a high population density and low amount of arable land, contributing to the small size of farm holdings that still persist today in the Crofting counties. Even a conscious attempt at amalgamation of holdings, which began in 1776, could not ignore the limiting factor of land. Before crofting townships made their appearance in the second half of the 18th century the Scottish Highlands experienced a system of farming called runrig. A typical runrig farm included a group of small families that each rented a portion of a larger piece of land (Gray, 1952). Individuals in the run-rig system did not rent a fixed *area* of arable land, but instead rented a fixed *share* of the total land on the farm. These shares were annually re-allotted to the tenants on the farm in a rotational farming system. Therefore, the farm was managed on both an individual and cooperative level. Separate holdings were scattered in infield and outfield areas with continuous cultivation on the former and intermittent cultivation on the latter. These farms were relatively small holdings, most ranging around five acres. Even within such a small area, there existed a social hierarchy that was important to the structure of the runrig system. The joint-tenants rented directly from the landlords. Working under the joint-tenants were the cottars (farming peasants) and servants. These individuals rented smaller plots of land from the joint-tenants (Gray, 1952).

In the mid-18th century joint-tenants started to call for improvements to their runrig system as a result of the influence of improved agrarian methods in Scottish Lowland farming such as larger scale grazing operations. In the Highlands holdings seemed too small for significant economic gain and the tenants were becoming increasingly unsatisfied with the amount of power that landlords held in regards to removal and rearrangement of land. Also, separate holdings on the runrig farm often varied in size, which caused conflicts among tenants. A call for an amalgamation of small holdings and a more permanent structure was made by joint-tenants across the Highlands in the mid-1700s. Two of the most powerful landlords, The Duke of Argyll and the Earl of Breadalbane, saw the possible benefits of appeasing these tenants (Gray, 1952). Larger holdings could give farmers more space, incentive, and flexibility to try new agricultural methods that might increase economic prosperity. Starting in 1776, the two landlords started disaggregating their runrig farms and reconsolidating lands. By 1800 most of the other large and many of the smaller estates had abolished the runrig system and adopted the crofting township structure which consisted of groups of neighboring crofts and houses that were owned by single tenants and were not rotated annually (Gray 1952).

Although the purpose of this reorganization was seen by farmers as a way to increase their land rights, the more truthful intention of the change was to increase the size of agricultural holdings. Certain obstacles presented themselves when trying to achieve this goal and the structure of a crofting township was revealed to be quite different than the originally planned amalgamation of holdings. Increasing holding size had the consequence of decreasing holding frequency as there was a scarcity of arable land and no scarcity in population. For example, on the Isle of Tiree in 1767 there were 1,676 individuals in residence of which 170 were full tenants of land. In 1802, after the reorganization of land, there were 2,776 individuals in residence with

319 small crofts and in 1846 there were 5,000 individuals and only 380 crofts (Gray, 1952). This natural population growth paired with a de-emphasis on emigration served as a significant barrier to the increase of individual holdings (now called crofts) in the Highlands. Crofting townships developed into rigid, small, and uniformed crofts that were often arbitrarily assigned by landlords. What appears clear is that the binding constraint to economic growth in the Highlands was arable land and property rights. Because of landowners' need to keep labor on the land, farm holdings were forced to remain in small, sectioned areas of arable and pasture land; a condition that is still in place in the Highlands today.

B3. Mass Emigration from the Highlands (Late 18th Century to mid-19th century)

Although emigration from the Highlands in the late 18th century started as a threat from the grassroots, as an outcry from the tenants, it ended as a violent and forced solution to the growing population problem. Landlords, whose initial intention of holding amalgamation was linked to the well-being of their tenants, began to take forceful actions to allow the access to budding and profitable industries such as kelping, fishing, and particularly sheep farming. In order to overcome the barriers against increasing holding size many landlords started evicting tenants off their land. This practice resulted in a pivotal event in Scottish agricultural history: the Highland Clearances (Mackenzie, 1883). The Clearances occurred during the 18th and 19th centuries. The term "Clearances" refers to the mass, forced emigration that was enacted upon the farming population in the Highlands by landlords. Sheep farming, above all other factors, was the main catalyst for the Clearances. In 1754 Sir John Sinclair of Ulbster in Thurso became the first president of the British Wool Society funded Board of Agriculture. He was the first to introduce the Cheviot sheep to the Highlands in 1772, a breed highly prized for its wool. In the coming years sheep would overtake thousands of acres of grazing land, resulting in the eviction by

landlords of thousands tenants off their rented land and earning 1772 the name Bliadhna nan Caorach (The Year of the Sheep). An example of the brutality of the Clearances as a result of the desire to raise more sheep was seen in Sutherland. The Duke of Sutherland employed Patrick Sellar to evaluate the possibilities for improvement on the estate and in 1814 Sellar ordered that all hill grazing areas be burned in order to force tenants off the land. With no grass to feed their cattle, the tenants in Sutherland had no choice but to move off with no compensation (Mackenzie, 1883). This rise in sheep-farming served to encourage larger grazing units, although these units were still small in comparison to lowland farms (Turnock, 1967). Sheep farming was a staple until around 1895 when Australia started exporting highly coveted Merino wool to Europe and the demand for Cheviot wool decreased. This served to put more strain on the remaining tenants and influence more emigration from the Highlands (Holland, 1992).

Factors such as the Jacobite Rebellion also had a significant effect on the population decrease in the Highlands. The Rebellion's efforts began in 1689 when the last Stewart king, King James VII, was deposed from the British throne. The fight to restore the Stewart line to power lasted nearly half a century and ended in the destruction of the clan system and the violent displacement and murder of thousands of Highlanders. This occurred because the Highlands were home to a significantly large portion of the King James VII supporters and in an effort to completely eradicate the Jacobites the British government allowed the raiding of hundreds of Highland townships. The result was the decimation of a culture where even the language, Gaelic, became prohibited. These factors, as well as widespread poverty and famine, resulted in the sharp decrease in population that made the Highlands one of the least populated regions in Europe (Mackenzie, 1883).

This decrease in population had significant effects on the social and economic climate of the Highlands and it is important to note the magnitude of inequalities in the region when understanding how little power the Highland crofters had over their holdings. The Celtic community of the Highlands experienced an alienation from the “anglicized core culture” in Great Britain (Knox, 1986). Often seen as barbaric or uneducated, the Celtic Highlanders were subject to the subordinate role that they filled for centuries and which eventually led to the allowance of the aforementioned atrocities during the Clearances. Furthermore, crofting communities were some of the poorest areas of Great Britain. In 1907 Highlanders earned 13% less income per year than the British average income per year (Knox, 1986). Emigration served to worsen the economic stability of the region. The mass out-migration of Highlanders to other parts of Europe and the outer islands resulted in an imbalance of age distribution. Throughout the 19th and 20th centuries the younger population decreased, leaving an older, less active population in the Highlands. For example, between 1951 and 1961 the Borders of the Highlands lost 6.6% of their population, leaving the area with only 22.5% of the population under 15 (Scotland’s population under 15 was 25.9% as a whole) and with 18% of the population over 65 (Scotland’s was only 10.6%) (Turnock, 1969). This unequal distribution of age served to intensify the already fragile economic state by causing an increased demand for certain services like medical care and a withdrawal of others, like small grocery stores or supply depots, because of low population densities. The economic strain emphasized the need for repopulation. This emphasis largely affected the crofting policies of the 20th century.

B4. Further Crofting Development and the Crofter’s Act (Mid- to late-19th century)

After nearly half a century of unjustified evictions the remaining crofters and cottars of the Highlands, most having been forced into livestock farming, began a series of resistances

including occupations of crofters' land and rent strikes that finally prompted the British government into action. The outraged farmers formed the Highland Land League which was the main organizer of public displays that caught the attention of government officials. In 1883 British Prime Minister William Gladstone formed the Napier Commission to investigate the grievances of the crofters and to formulate a series of recommendations that would increase the rights of tenants and improve their overall livelihood. The journey began in Breas and Skye (two Islands off the north west coast of Scotland) and the Commission slowly worked its way through the entirety of the Highlands, including the Isles. In 1884 the Napier Report was released to the dissatisfaction of many Highlanders. The Report, although thorough, was seen as insufficient in inducing any substantial change in the treatment of crofters and it led to more protests and increased involvement in the Highland Land League (Padget, 1993). As a result, the Crofters Act of 1886 was framed in order to grant rights of crofters including the right to dispute increased rent, security of tenure, the right to terminate their tenancies, and the right to compensation when they were required to amend their holdings (Doughty, 1999). These rights, however, hinged on the crofting community's ability to maintain stability and productivity in their farming and side industries as well as their active and continued participation in government policy (Padget, 1993).

B5. Twentieth Century Crofting Policy and Management

Population in the Highlands continued to decrease in the first half of the 20th century. In 1961 the Crofting counties had a population of 280,000 while the whole of Scotland had 5,226,000; approximately 5% of the total population as compared to 20% in 1755 (Turnock, 1969).

Highland development became high priority to the Scottish Government because of the crofting system's contribution to economic success in rural areas, to the preservation of natural upland

habitats, and to income and land equality. This realization of crofting's importance led to the significant influence on the system's current structure by government policy and management of Highland crofting. Governmental development in the Highlands faced several challenges, one main factor being finance. The Highland Fund was established to raise money, primarily from private entities, for industry and crofting development in hopes of establishing a stable, regional economy in the Highlands. In addition, the Highlands and Islands Development Board was created in 1965 in order to stem depopulation from the region. The HIDB is integral in creating infrastructure that will allow business investment and development and is a support to communities that are interested in buying their own land (Hughes, 1982).

The maintenance of the crofting system has gained direct organizational support from the crofters themselves. In the 1960s the Scottish Crofters Union was developed and later became known as it is today, the Scottish Crofting Federation (SCF). This group of crofters, the largest assembly of small-scale food producers in the United Kingdom, aims to protect and promote the crofting way of life (SCF, 2012). They work together with the Crofters Commission, a public body of the Scottish Government that regulates crofting activities. Together these two organizations have influenced the current structure of crofting by ensuring the continued rights of crofters to a secured tenure and promoting the integral, community aspect of crofting through communal mapping of croft boundaries (SCF, 2012).

As of 2006 there were 18,000 crofts and 13,000 crofters in the Highlands and Islands of Scotland. The average crofting household income is £21,000 a year with 30% of that income from crofting. Around 2000 crofters are owners of their land with the rest as tenants (Harvey, 2006). Farm holding size has increased from an approximate average of 5 acres during runrig agriculture to an average of 12 acres in 2007 (Logie, 2007). The relatively small size and higher

frequency of farms in the Highlands today contributes to a higher level of land and income equality in comparison to the system in place in the Arkansas Delta today.

IV. Methods

The sources cited in this study include a range of readings and data involving the agricultural development of the Arkansas Delta and the Scottish Highlands as well as studies done on the historical evolution of the regions. Specifically this study looked to obtain information on population fluctuations, degree of mechanization, and degree of income inequality within these regions and how this information would connect to the current farm structures in place in the Delta and Highlands (size and income inequality today). Two methods were implemented to better understand how the development of agriculture evolved and the level of inequality in each region, the Induced Innovation Model and the Gini coefficient, respectively.

A. The Gini Coefficient

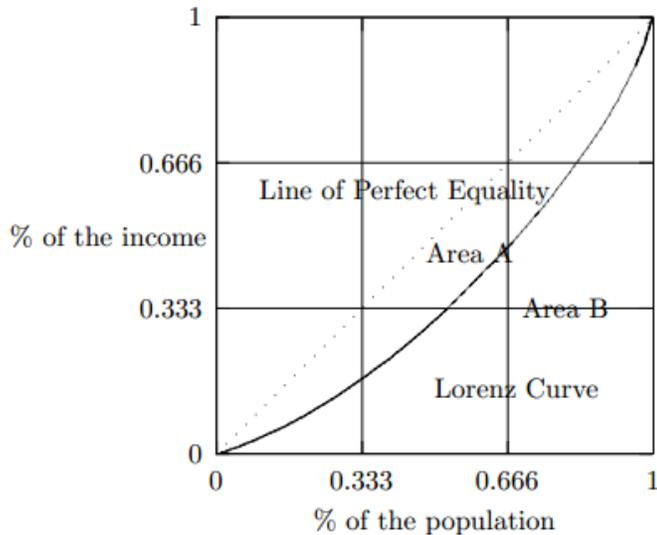
In 1912 Italian economist, Corrado Gini, proposed what came to be known as the Gini coefficient or the Gini ratio (Leathers and Foster, 2004). The Gini coefficient is one of the primary quantifiers of inequality in research and is a summary statistic of the Lorenz curve (Xu, 2004). The index is used to measure the dispersal of data points of a distribution (income, land, consumption, etc.). This study used the index to measure income inequality in the Arkansas Delta and the Scottish Highlands. It should be noted that the Gini coefficient does not speak to the wealth of a country only how that wealth is divided amongst its citizens.

The Lorenz curve was first proposed by M. O. Lorenz in 1907 and is denoted as Equation 1.

$$(Eq. 1) L(p) = L(F(y))$$

L(p) represents the proportion of total income of the area that is obtained by the lowest p^{th} fraction of the population. F(y) is the cumulative distribution function of income when the distribution is continuous (Xu, 2004). The Lorenz curve includes the entire income distribution of a population instead of excluding those incomes above a certain value. When income distribution is equal (e.g. 50% of the population makes 50% of the income) the Lorenz curve is represented by an angle of 45 degrees (The diagonal line of equality in Figure 1). Since income in a population is rarely equal, Lorenz curves lie below the line of equality, as they do in Figure 1 (Grainger and Stewart, 2007).

Figure 1- The relationship between the 45 degree line of equality and the Lorenz curve.



Source: Xu, Kuan. "How Has the Literature on Gini's Index Evolved in the Past 80 Years?" The Munich Personal RePEc Archive. The Munich University Library, 2 Dec. 2004.

The area between the diagonal line of equality and the Lorenz curve for a population is the value of the Gini Coefficient and is a ratio. This can be represented by Equation 2 (Xu, 2004).

$$(Eq. 2) G = \frac{A}{A + B}$$

If all the available income in a group is held by one person then the Gini coefficient would be equivalent to one. As income distribution approaches equality, the ratio approaches 0. The ratio is often multiplied by 100 and noted on a scale from 0 to 100 (Leathers and Foster, 2004). The Gini coefficient does not simply illustrate the amount of wealth a country possesses, but instead the equality of the distribution of total income in that country (Xu, 2004). While certain criticisms exist on the validity of the Gini coefficient (presence of an informal market, age and wage differences, etc.) it is a widely used and cited inequality indicator.

B. The Induced Innovation Model

First developed by Vernon Ruttan and Yujiro Hayami in the 1960s, the Induced Innovation Model includes technical change as an internal factor in agricultural development. The model seeks to explain the historical trends that affect how technology (e.g. labor-saving or yield-enhancing) evolves in an agricultural system to balance abundant resources with binding constraints (Ruttan and Hayami, 1998). The term “technical change” can encompass many different oscillating shifts including natural-resource-based to science-based agriculture, “unimodal” to “bimodal” organization, and low skills and knowledge to high skills and knowledge (Ruttan, 1998). For this study the specific constraints (inelastic supply) of both land and labor were considered in the mechanization and farm size of the Arkansas Delta and the Scottish Highlands. The Induced Innovation Model indicates where money should be invested in an agricultural system based on the limiting factor. In countries with an inelastic supply of land like Japan, Taiwan, or the UK agricultural investments have historically been in increased inputs (fertilizers, pesticides, etc.) and biological technology such as high-yielding crop varieties

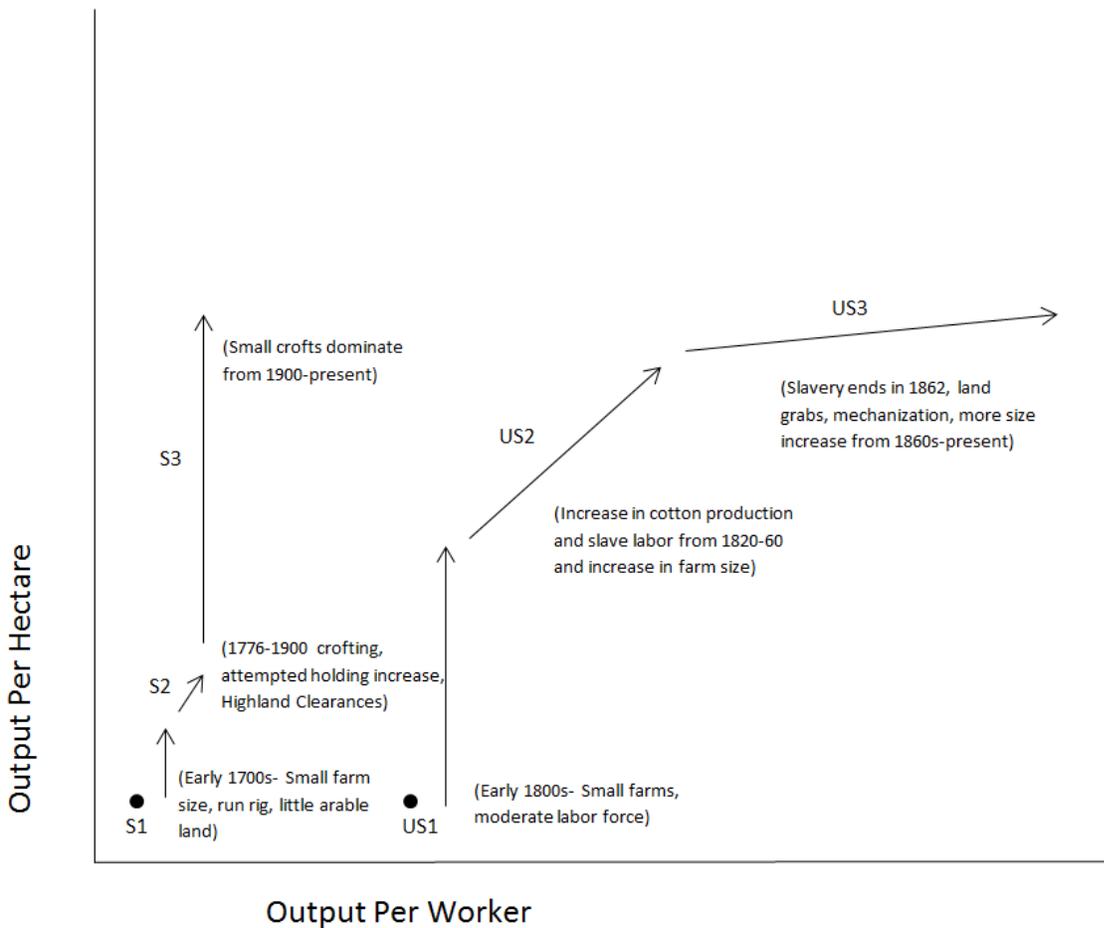
(increasing output *per unit of land*). In contrast, in places with abundant land and a more inelastic supply of labor like the United States, animals and mechanization have been widely used to replace the limiting labor factor which increases output *per unit of labor* (Goldman, 1993). Different paths of agricultural development have evolved out of the aspiration to increase output per limiting factor.

IV. Results and Discussion

The methods of the Induced Innovation Model and the Gini coefficient aided in the understanding of the trends that have developed during the agricultural evolution of the Scottish Highlands and the Arkansas Delta. Analyzing binding constraints and investments allowed this study to explore their relationship to land and income inequalities in an agricultural system.

The Induced Innovation model for agricultural development helps explain how binding constraints (land or labor) have affected investments in agricultural technology in both the Delta and the Highlands. The first hypothesis of this study was that farm size in both agricultural regions has evolved because of different binding constraints a resulting in differing technological investments. The study hypothesized that the investments would strive to maximize the output per the factor with the highest inelastic supply. Figure 2 exhibits the historic trends in labor and capital investments and constraints that helped shape the agricultural development in the Delta and the Highlands overtime.

Figure 2- Plotted trends of agricultural development in the Arkansas Delta (US) and the Scottish Highlands (S). Illustrates the relationship between output per hectare and output per worker in an agricultural system and exhibits the degree of limitation by land and labor.



In the Scottish Highlands land is currently and always has been the binding constraint given the small amount of arable land. The runrig system in the early 1700s was largely inhibited by land limitations (S1) and thus the tenants had to extract the most productivity out of their small holding in order to maximize the output *per hectare*. The terrain in Scotland served to break up most of the larger sections of arable land because of hills, bracken, and moorland. The Induced Innovation Model would indicate that the productivity of the land had to be maximized which led to the investment in increased land management techniques like drainage, re-seeding, liming, and bracken control (Scottish Natural Heritage, 2002). During the Highland Clearances

(S2) farms were consolidated in the inner Highlands for sheep pasture and tenants were removed from the land (most emigrated or moved to the islands). The sharp population decrease, however, was not enough to change the limitation to labor as the amount of land suitable for pasture and arable crops in the Highlands is dramatically sparse. Only around 4 million acres of the 16.5 million acres of classified farmland in Scotland is actually classified as arable and grassland (Catto, 1973). The main agricultural investments after the Clearances continued to be technologies and crops that maximized output *per unit of land* (S3). Potatoes, barley, turnips, and oats were the main arable crops grown (Hance, 1952) and lime was a major soil input to combat soil acidity (Scottish Natural Heritage, 2002). The investments resulting from this land constraint have encouraged small farm sizes in Highlands as the current average farm size is about 12 acres (Table 1) (Logie, 2007). The geography of the Highlands also still serves to inhibit connection of arable land, making it nearly impossible to attain consolidation of separate farms.

Table 1. Average farm size of crofts in the Scottish Highlands (2007) and farms in Arkansas (2012)

Region	Average Farm Size (acres)
Scottish Highlands	12
Arkansas	281

Source: United States. United States Department of Agriculture. Economic Research Service. State Fact Sheets: Arkansas. United States Department of Agriculture, 17 Jan. 2012.

The Induced Innovation Model can assist in understanding why Scotland today has more income equality in comparison to Arkansas farming communities.² This study hypothesized that the investments resulting from historical agricultural constraints have contributed to land and income inequality trends that continue to exist in the two regions today. More specifically, the

² It should be noted that more income equality is not equivalent to more wealth per farmer, only that the wealth that does exist (which could be more or less) has a more even distribution.

study hypothesized that the development of large, mechanized farms and the historical presence of slavery have contributed to high levels of land and income disparity in Arkansas today and furthermore that the small, frequent crofts in the Highlands coupled with a strong initiative for crofters' rights has served to combat inequalities in Scotland today. Table 3 illustrates that in the late 2000s Scotland had a Gini value of 0.34 and Arkansas had a value of 0.46, meaning Scotland was closer to income equality (Grainger and Stewart, 2007). The investments and constraints that Scotland has experienced, and the resulting farm size, have contributed to levels of income equality today. Smaller farm sizes allow for greater farm frequency and more opportunity for a larger portion of the population to own or rent land. In June 2010 the north west region of Scotland (Shetland, Orkney, the Outer Hebrides, and Highlands) was home to 45,024 agricultural holdings with crops and grass (Economic Report on Scottish Agriculture, 2011). It should also be noted that while the average farm size in Arkansas is 23 times larger this number is somewhat misleading. The standard deviation for Arkansas farm size is much greater given that of Scotland because of the fact that 4,000 acre plus farms are common throughout the Delta. Grassroots movements that exist to preserve the crofting way of life have also been successful in maintaining a more equal distribution of land and income through the campaign for crofters' rights. In 1976, as a result of the outcry by the Scottish Crofting Federation and other individual crofters, the Crofting Reform (Scotland) Act granted crofters the right to purchase the full title to their crofts, allowing for a higher percentage of total land to be distributed more evenly (Doughty, 1999).

Table 2. Gini coefficients for income inequality Scotland and Arkansas in 2000

Region	Gini Coefficient
Scotland	0.34
Arkansas	0.46

Source: Burkey, Mark L., and American Community Survey. *Gini values for Delta counties in 2000; 2005-2007. 2010. Raw data. County Health Rankings & Roadmaps, Madison, WI.*

Source:

In contrast, the Arkansas Delta has experienced two distinct inflection points which varied its binding constraints due to the end of slavery and advent of relatively expensive labor and relatively cheap mechanization. Land was the binding constraint in the early 1800s before the Civil War when slavery was becoming more prominent (US1). As the total percent population of slaves in Arkansas rose from 11% in 1820 to 20% in 1840, the supply of cheap labor increased (Bolton, 1982). This allowed plantation owners to devote more of their income to buying/ consolidating land which led to the loosening of constraint on land (US2). The line in Figure 2 labeled as (US2) shows that neither land nor labor was a binding constraint in this time due to increases in productivity from artificially cheap labor, leading to increased profits which allowed for more land purchases. That being said, after the end of the Confederacy which theoretically freed thousands of slaves in the south, the price of labor increased due to mass migration and an increasingly expensive labor supply. This resulted in a shortage in cheap labor and thus a move towards mechanization on the larger farms (US3). The effects of binding constraints are evident when comparing lines US2 and US3 in Figure 2. US2 is moving both vertically and horizontally (improving output *per person* and *per hectare*) where US3 is moving primarily in the horizontal direction of increasing output *per person*, implying a labor constraint. The decrease in cheap labor (freed slaves) was further exacerbated by the mass emigrations

(reduced supply) from Arkansas as a result of the Great Migration. Since the Great Migrations ended farms have continued to grow in size (land is not the binding constraint) and decrease in frequency due to the labor constraint. The small, family farm is being replaced by mechanized, monoculture farms in the Delta today. The current average farm size for Arkansas is 281 acres (Table 1) (USDA, 2012). As of 1997, 60% of the total farm sales in the state were made by 7% of the largest farms (Arkansas Public Policy Panel [APPP], 1999).³ Nearly every agricultural sector in Arkansas followed this “economies of scale” trend from 1987 to 1997. The number of poultry farmers decreased by 12%, but rose by 58% in average size. Rice farms decreased by 25%, but have seen a 78% average size increase. Cotton farms are down by 30%, but size has increased by 160%. There is fewer than half the amount of hog farms existing, but the size of an average hog operation has increased by 385%. There has been a 31% increase in corporate farms, but a 9% drop in privately owned farms (APPP, 1999). These percentages are largely driven by several factors including mechanization and farm subsidies which contribute to mechanization. In 1997 the federal government gave out almost 1.5 billion dollars to farms, most of it going to the largest operations. Farms of 2,000 acres or more received almost 14% of their annual income in subsidies that year (APPP, 1999). The policy of the Government’s agricultural subsidies has contributed to centralized, large-scale farming operations that now are prevalent in the Delta. Mechanization has become the chosen route for most Delta farmers and labor continues to be an inelastic supply in the area.

The historical constraints and their evolution have contributed to land and income inequalities that still affect Arkansas today. These large farms are concentrated in the Delta as it

³ Given the loose definition of a farm and the fact that the state average includes many smaller farms in the north west portion of the state the average Delta farm is inevitably much larger.

is the primary row and cash crop agricultural region in Arkansas. Table 3 illustrates the largest 15 Gini values for income inequality for all 75 counties in Arkansas in 2000.

Table 3. List of Delta county Gini values for income inequality in 2000.

Rank	County	Gini	Rank	County	Gini
1	Chicot*	53	9	Woodruff	50
2	Lee*	51	10	Cross*	49
3	Monroe*	51	11	Desha*	49
4	Phillips*	51	12	Fulton	49
5	Bradley	50	13	Jackson	49
6	Dallas	50	14	Stone	49
7	Drew*	50	15	Carroll	48
8	St. Francis*	50			

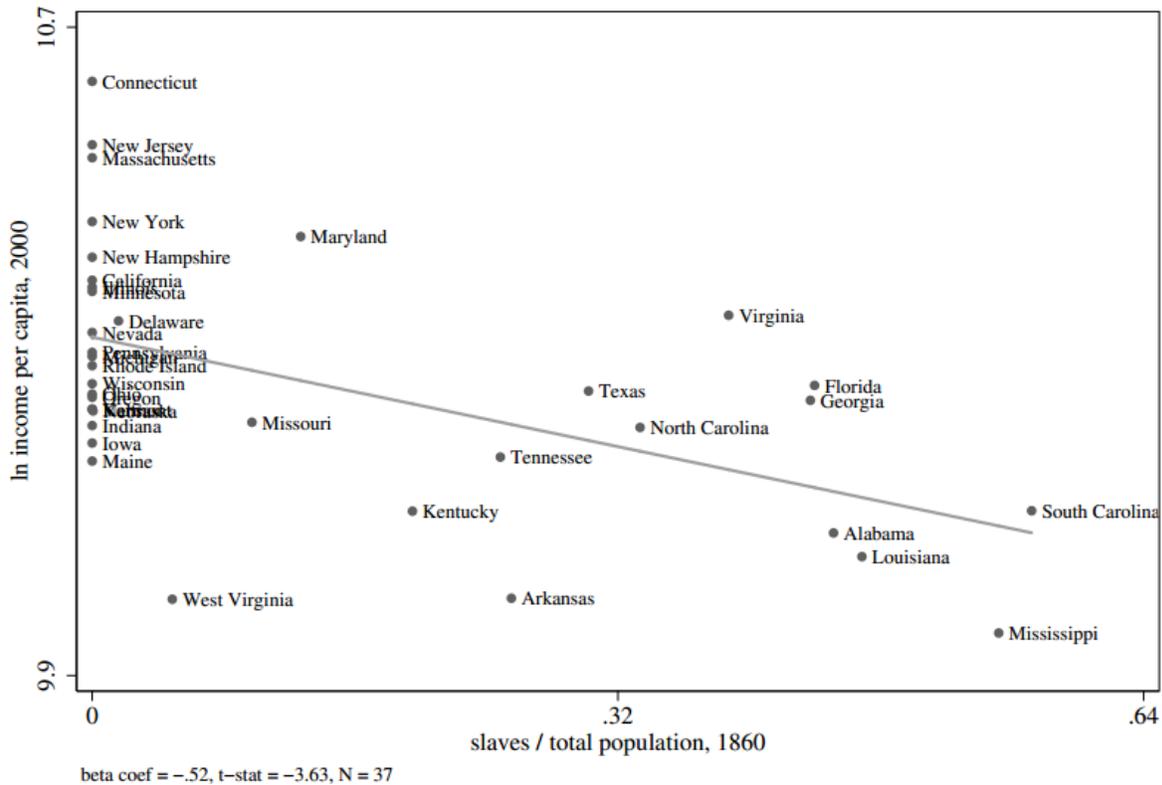
**Denotes counties in the Arkansas Delta*

Source: Burkey, Mark L., and American Community Survey. Gini values for Delta counties in 2000; 2005-2007. 2010. Raw data. County Health Rankings & Roadmaps, Madison, WI.

Of the 15 highest Gini values for income distribution in Arkansas, 8 are located in Delta counties. This exhibits a high level of income inequality in the Delta region which can be partially attributed to large, mechanized farms resulting from how agriculture evolved in Arkansas. Given the evolution of Arkansas agriculture the large farm size is ideal for mechanization because of relatively high labor costs, which has reduced the labor needed to produce goods, contributing to higher unemployment (and more income inequality), *ceteris paribus*. This is illustrated by the fact that agriculture represented 10.4 percent of the total state GDP in 2009 with a large portion of that going to the production of commodities which benefits the land owners (McGraw, Popp and Miller, 2009). This means a majority of the income is held by a few, wealthy farmers. Another factor that has influenced inequalities in Arkansas and in the south as a whole today is the historic degree of slavery in the state. This theory is backed by

Figure 3 which illustrates the relationship between income inequality in the USA in 2000 and percent of total population made up of slaves in 1860.

Figure 3. The relationship between slavery in 1860 and income in 2000 in the United States.



Source: Nunn, Nathan. "Slavery, Inequality, and Economic Development in the Americas: An Examination of the Engerman-Sokoloff Hypothesis." *The Munich Personal RePEc Archive*. Munich University Library, 21 Nov. 2007. Web.

It is clear that southern states (Mississippi, South Carolina, Alabama, Louisiana, Arkansas, Georgia, etc.), those with a higher slave proportion in 1860, have the highest level of income inequality in the country in 2000, suggesting that slavery has contributed to the inequalities that permeate southern society today. This assertion is further supported by the fact that in 1860 the southern states, the states with the highest numbers of slaves, had the highest land inequality during that time (Figure 4).

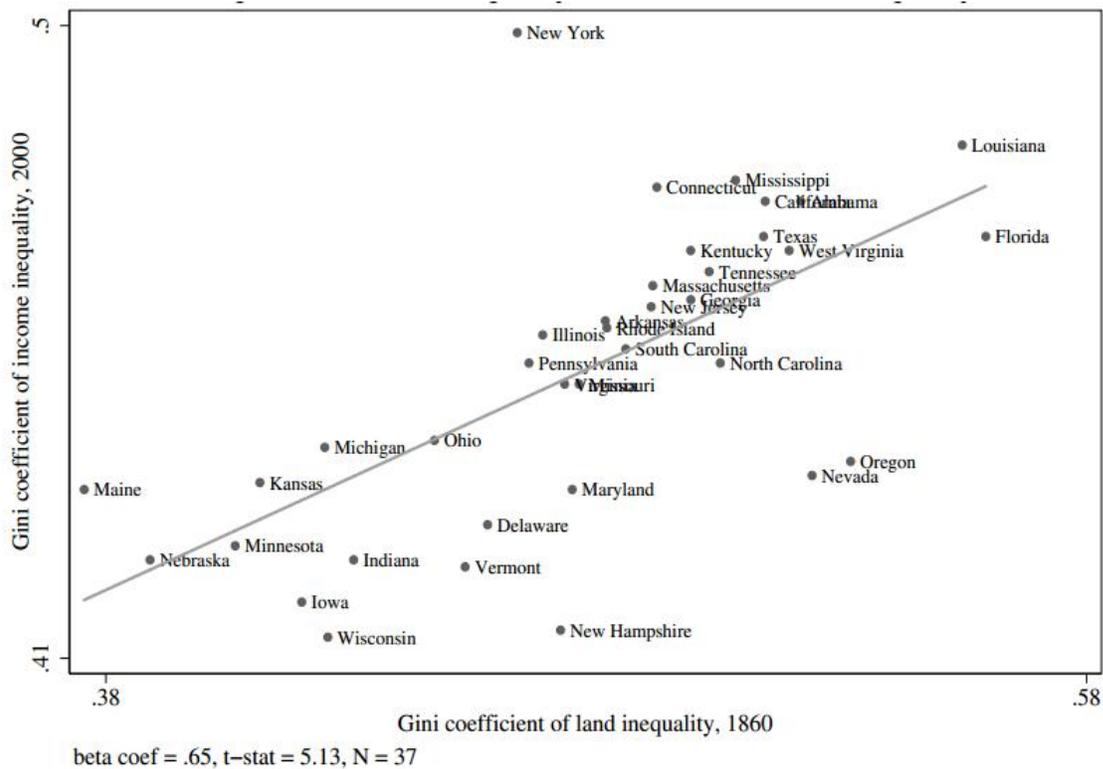
Figure 4. Relationship between slavery in 1860 and land inequality in 1860.



Source: Nunn, Nathan. "Slavery, Inequality, and Economic Development in the Americas: An Examination of the Engerman-Sokoloff Hypothesis." *The Munich Personal RePEc Archive*. Munich University Library, 21 Nov. 2007. Web.

The relationship between land inequality in 1860 and income inequality in 2000 also points to the continuation of inequalities in the south. Southern states with the most unequal land distribution in 1860 also had the most unequal income in 2000 (Figure 5).

Figure 5. Relationship between land inequality in 1860 and income inequality in 2000.



Source: Nunn, Nathan. "Slavery, Inequality, and Economic Development in the Americas: An Examination of the Engerman-Sokoloff Hypothesis." *The Munich Personal RePEc Archive*. Munich University Library, 21 Nov. 2007. Web.

The relationship between the historic degree of slavery and land and income inequality in the south points to the importance of the Induced Innovation Model in understanding the evolution of agricultural systems. Land limitations, the original binding constraint in Arkansas, encouraged investment in a cheap labor force (slaves) and fortified inequality that already existed in the south. Although slavery, and the inequality that comes with it, is not the only factor that contributed to the continuation of inequalities in Arkansas and the rest of the south, it is a significant factor in the unequal distribution of income and land in the Delta today.

V. Conclusion

Although it is undeniable that other factors have influenced the development of the agricultural systems in the Arkansas Delta and the Scottish Highlands, it is clear that historic binding agricultural constraints, the choice of investments, and economic inequalities have contributed to the current agricultural systems in place today, particularly in terms of farm size.

As a result of analyzing both the Scottish Highlands and the Arkansas Delta with the Induced Innovation Model it can be seen that the binding constraint for Scotland today remains land and in the Delta, labor. The hypothesis that farm size in both regions evolved as a result of the technological investments made to combat these constraints is supported by the chain of historical events depicted in Figure 2. Scotland's inelastic supply of land contributed to smaller farm sizes because more focus was placed on maximizing output *per unit of land* rather than output *per worker*. Land management technologies dominated investments in the Scottish Highlands. In the Arkansas Delta the binding constraint is currently labor. Historical setting again contributed to this outcome as investments in the 20th century were mainly related to mechanization. This type of investment, however, was found to have only come to prominence after the loss of the cheap labor (slaves) that occurred in the south. The variance in binding constraints in Arkansas was an unanticipated discovery in this study. It is also important to note that geography, population distribution, and government policy also had an effect on farm size evolution.

The hypothesis that the investments which resulted from binding agricultural restraints were found to contribute to the level of land and income inequality was supported when comparing Scotland's and Arkansas' current Gini values and the correlation between the historical presence of slavery and land and income inequality in the southern United States today.

The study found that the relatively small size and high frequency of crofts contributed to lower levels of inequality today in comparison with Arkansas. It was also found that the crofters' rights initiatives that have occurred in the 20th century have served to aid in combatting higher values of inequality in the Highlands today. This does not comment on the relative wealth of the average Scottish citizen in farming communities in comparison to their Arkansas counterparts, only that the wealth amongst them is more evenly distributed. In contrast, the large, mechanized farms that developed in the Arkansas Delta were found to be a contributing factor in the current high levels of land and income inequality today. Mechanization reduces the need for labor inputs, which in turn can increase unemployment in the affected area. The study also found that the greater the historical presence of slaves in a state, the greater the income inequality of that state today.

The future study of this topic could be extensive. Data were difficult to obtain for the specific areas of study (primarily Scotland due to the fact the United Kingdom did not disaggregate Scotland in its census data until recent reports), but were easily found for the country of origin. Other indicators of social and economic inequality should be explored to minimize the weakness of any one index or model. This study contributes an argument that states that historical setting, constraints, and investments have contributed to the current level of inequalities and size of farms in the Scottish Highlands and the Arkansas Delta today.

Works Cited

Abrams, Lynn. "Work." *Myth And Materiality in a Woman's World: Shetland 1800-2000*.

Manchester: Manchester UP, 2005.

Argyll West and Islands. Perth: Scottish Natural Heritage, 2002. Scottish Natural Heritage. Web.

<<http://www.snh.gov.uk/docs/A306372.pdf>>.

Bolton, S. C. "Inequality on the Southern Frontier: Arkansas County in the Arkansas Territory."

The Arkansas Historical Quarterly 41.1 (1982): 51-66. *JSTOR*. Web. <<http://0->

www.jstor.org.library.uark.edu/stable/40023373>.

Bolton, S. C. "Turning Point: World War II and the Economic Development of Arkansas." *The*

Arkansas Historical Quarterly 61.2 (2002): 123-51. *JSTOR*. Web. <<http://0->

www.jstor.org.library.uark.edu/stable/40023212>.

Burkey, Mark L., and American Community Survey. Gini values for Delta counties in 2000;

2005-2007. 2010. Raw data. County Health Rankings & Roadmaps, Madison, WI.

Catto, Gavin A. *Land Use-- A Perspective From Scotland*. The East of Scotland College of

Agriculture, 1973. Web.

<<http://ageconsearch.umn.edu/bitstream/17820/1/ar730093.pdf>>.

Changes in Arkansas Agriculture. Rep. Arkansas Public Policy Panel, 19 Feb. 1999. Web.

<arpanel.org/content>.

Doughty, Steven W. *Land Tenure and Crofting in Scotland*. Rep. Orono: Department of Spatial

Information Science and Engineering- University of Maine, 1999. Print.

Foti, Thomas. "Geography and Geology." *Encyclopedia of Arkansas History & Culture*. Central

Arkansas Library System. Web. 16 Dec. 2011.

<<http://encyclopediaofarkansas.net/encyclopedia/entry-detail.aspx?search=1&entryID=401>>.

Goldman, Abe. "Agricultural Innovation in Three Areas of Kenya: Neo-Boserupian Theories and Regional Characterization." *Economic Geography* 69.1 (1993): 44-71. *JSTOR*. Web. <<http://0-www.jstor.org.library.uark.edu/stable/143889>>.

Gray, Malcolm. "The Abolition of Runrig in the Highlands of Scotland." *The Economic History Review* 5.1 (1952): 46-57. *JSTOR*. Web. <<http://www.jstor.org/stable/2591307> .>.

Grove, Wayne A., and Craig Heinicke. "Better Opportunities or Worse? The Demise of Cotton Harvest Labor, 1949-1964." *The Journal of Economic History* 63.3 (2003): 736-67. *JSTOR*. Web. <<http://0-www.jstor.org.library.uark.edu/stable/3132306>>.

Hance, William A. "Crofting in the Outer Hebrides." *Economic Geography* 28.1 (1952): 37-50. *JSTOR*. Web. <<http://www.jstor.org/stable/141619>>.

Harrison, Robert W., and Walter M. Kollmorgen. "Socio-Economic History of Cypress Creek Drainage District and Related Districts of Southeast Arkansas." *The Arkansas Historical Quarterly* 7.1 (1948): 20-52. *JSTOR*. Web. <<http://0-www.jstor.org.library.uark.edu/stable/40026216>>.

Harvey, David. *EuropAfrica Project*. UK Food Group, Mar. 2006. Web. <http://www.ukfg.org.uk/UK_CAP_casestudy.pdf>.

Hawkins, Van. "Sharecropping and Tenant Farming." *Encyclopedia of Arkansas History & Culture*. Central Arkansas Library System, 10 Aug. 2011. Web. <<http://encyclopediaofarkansas.net/encyclopedia/entry-detail.aspx?search=1&entryID=2103>>.

Holland, John. *History of Sheep Farming in the Highlands*. Tech. Scottish Agricultural College. Web. <<http://www.sac.ac.uk/mainrep/pdfs/sheephighlands.pdf>>.

Holley, Donald. "Leaving the Land of Opportunity: Arkansas and the Great Migration." *The Arkansas Historical Quarterly* 64.3 (2005): 245-61. *JSTOR*. Web. <<http://0-www.jstor.org.library.uark.edu/stable/40028047>>.

Hughes, J. T. "Policy Analysis in the Highlands and Islands Development Board." *The Journal of Operational Research Society* 33.12 (1982): 1055-064. *JSTOR*. Web. <<http://www.jstor.org/stable/2581145>>.

Knox, W. W. "Poverty, Income and Wealth in Scotland 1840-1940." *A History of the Scottish People*. SCRAN. Web. <http://www.scran.ac.uk/scotland/pdf/SP2_5Income.pdf>.

Leathers, Howard D., and Phillips Foster. *The World Food Problem: Tackling Causes of Undernutrition in the Third World*. Boulder, CO: Lynne Rienner, 2004. Print.

Logie, Derek. *Houses on Crofting Land. A Study into Meeting Housing Needs in the Crofting Areas*. Scottish Crofting Federation, 2007. Web. <<http://www.crofting.org/uploads/news/houses-on-croft-land.pdf>>.

Lovett, Bobby L. "African Americans, Civil War, and Aftermath in Arkansas." *The Arkansas Historical Quarterly* 54.3 (1995): 304-58. *JSTOR*. Web. <<http://0-www.jstor.org.library.uark.edu/stable/40030945>>.

Mackenzie, Alexander. *The History of the Highland Clearances*. Aberdeen: UP, 1883.

McGraw, Katherine, Jennie Popp, and Wayne Miller. *Economic Contribution of the Agricultural Sector to the Arkansas Economy in 2009*. Rep. Fayetteville: Arkansas Agricultural Experiment Station, 2009. Print.

- Moneyhon, Carl H. "Slavery." *Encyclopedia of Arkansas History & Culture*. 2011. Web.
<<http://encyclopediaofarkansas.net/encyclopedia/entry-detail.aspx?entryID=1275>>.
- Nunn, Nathan. "Slavery, Inequality, and Economic Development in the Americas: An Examination of the Engerman-Sokolo." *The Munich Personal RePEc Archive*. Munich University Library, 21 Nov. 2007. Web. <http://mpa.ub.uni-muenchen.de/5869/2/MPRA_paper_5869.pdf>.
- Padget, Martin. "An Iconography of Difference: Internal Colonialism, Photography, and the Crofters of the Highlands and Islands of Scotland." *College Literature* 20.2 (1993): 177-95. *JSTOR*. Web. <<http://www.jstor.org/stable/25112037> .>.
- Phillips, William H. "Cotton Gin." *EH.net Encyclopedia*. Economic History Association, 1 Feb. 2010. Web. <<http://eh.net/encyclopedia/article/phillips.cottongin>>.
- Ransom, Roger L. "The Economics of the Civil War." *EH.net Encyclopedia*. Economic History Association, 1 Feb. 2010. Web. <<http://eh.net/encyclopedia/article/ransom.civil.war.us>>.
- Rohde, Richard F. "Written on the Surface of the Soil: West Highland Crofting Landscapes of Scotland during the Twentieth Century." *Repeat Photography: Methods and Applications in the Natural Sciences* (2010): 247-64. Scottish Crofting Federation. Web.
<http://www.crofting.org/uploads/news/repeat_photography.pdf>.
- "Rooted in Our Communities." *Scottish Crofting Federation*. 2012. Web.
<<http://www.crofting.org/>>.
- Ruttan, Vernon W., and Yujiro Hayami. "Induced Innovation Model of Agricultural Development." Ed. Carl K. Eicher and John M. Staatz. *International Agricultural Development*. Baltimore, MD: Johns Hopkins UP, 1998. 163-78. Print.

- Ruttan, Vernon W. "Models of Agricultural Development." Ed. Carl K. Eicher and John M. Staatz. *International Agricultural Development*. Baltimore, MD: Johns Hopkins UP, 1998. 155-62. Print.
- Sampietro, M. L., O. Lao, D. Caramelli, M. Lari, R. Pou, M. Marti, J. Bertranpetit, and C. Lalueza-Fox. "Palaeogenetic Evidence Supports a Dual Model of Neolithic Spreading into Europe." *Proceedings: Biological Sciences* 274.1622 (2007): 2161-167. *JSTOR*. Web. <<http://0-www.jstor.org.library.uark.edu/stable/25249305>>.
- Scotland. *Income Distribution in Scotland*. By Sara Grainger and Sandy Stewart. The Scottish Government. Web. 2007. <<http://www.scotland.gov.uk/Resource/Doc/933/0097341.pdf>>.
- Spencer, J. E., and Norman R. Stewart. "The Nature of Agricultural Systems." *Annals of the Association of American Geographers* 63.4 (1973): 529-44. *JSTOR*. Web. <<http://0-www.jstor.org.library.uark.edu/stable/2562058>>.
- Stein, Gil. *Teaching the Middle East*. The University of Chicago Library, 29 Dec. 2010. Web. <<http://teachmiddleeast.lib.uchicago.edu/foundations/origins-of-civilization/essay/essay-02.html>>.
- Stroud, Hubert B. "Mississippi Alluvial Plain." *Encyclopedia of Arkansas History & Culture*. Central Arkansas Library System. Web. 23 Jan. 2012. <<http://encyclopediaofarkansas.net/encyclopedia/entry-detail.aspx?search=1&entryID=444>>.
- Turnock, David. "Evolution of Farming Patterns in Lochaber." *Transactions of the Institute of British Geographers* 41 (1967): 145-58. *JSTOR*. Web. <<http://0-www.jstor.org.library.uark.edu/stable/621332>>.

Turnock, David. "Regional Development in the Crofting Counties." *Transactions of the Institute of British Geographers* 48 (1969): 189-204. *JSTOR*. Web.

<<http://www.jstor.org/stable/621498>>.

United States. United States Census Bureau. *Eighth US Census*. United States Census Bureau, 1860. Print.

United States. United States Department of Agriculture. Economic Research Service. *State Fact Sheets: Arkansas*. United States Department of Agriculture, 17 Jan. 2012. Web.

<<http://www.ers.usda.gov/statefacts/AR.HTM>>.

Venkataramani, M. S. "Norman Thomas, Arkansas Sharecroppers, and the Roosevelt Agricultural Policies, 1933-1937." *The Arkansas Historical Quarterly* 24.1 (1965): 3-28.

JSTOR. Web. <<http://www.jstor.org.library.uark.edu/stable/40023962>>.

Whatley, Warren C. "Southern Agrarian Labor Contracts as Impediments to Cotton Mechanization." *The Journal of Economic History* 47.1 (1987): 45-70. *JSTOR*. Web.

<<http://www.jstor.org.library.uark.edu/stable/2121939>>.

Wayne, Jeannie M. "The Power of the Plantation Model: The Sunk Lands Controversy." *Forest & Conservation History* 37.2 (1993): 56-67. *JSTOR*. Web. <<http://www.jstor.org.library.uark.edu/stable/3983877>>.

WIID Version 2.0c. Rep. Helsinki: United Nations University World Institute for Development Economics Research, 1995. *UNU-WIDER World Income Inequality Database (WIID)*.

Web. <http://www.wider.unu.edu/research/Database/en_GB/wiid/>.

Williams, C. F. "Agriculture." *Encyclopedia of Arkansas History & Culture*. Central Arkansas Library System. Web. 14 Nov. 2011.

<<http://encyclopediaofarkansas.net/encyclopedia/entry-detail.aspx?search=1&entryID=385>>.

Woodruff, Nan E. "Mississippi Delta Planters and Debates over Mechanization, Labor, and Civil Rights in the 1940s." *The Journal of Southern History* 60.2 (1994): 263-84. *JSTOR*. Web. <<http://0-www.jstor.org.library.uark.edu/stable/2210085>>.

Xu, Kuan. "How Has the Literature on Gini's Index Evolved in the Past 80 Years?" *The Munich Personal RePEc Archive*. The Munich University Library, 2 Dec. 2004. Web. <<http://economics.dal.ca/RePEc/dal/wparch/howgini.pdf>>.

Yard, Alexander. "'They Dont Regard My Rights at All": Arkansas Farm Workers, Economic Modernization, and the Southern Tenant Farmers Union." *The Arkansas Historical Quarterly* 47.3 (1988): 201-29. *JSTOR*. Web. <<http://0-www.jstor.org.library.uark.edu/stable/40021338>>.