COMPARING SYSTEMS OF FORCED LABOR: EXPLANATIONS FOR HOW THE U.S. SOUTH'S SLAVE ECONOMY BECAME PROSPEROUS

An Undergraduate Research Scholars Thesis

by

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ABSTRACT

Comparing Systems of Forced Labor: Explanations for how the U.S. South's Slave Economy Became Prosperous

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This paper showcases negative results of two common theories surrounding United States cotton literature. It has been proposed that the amount of land available to the U.S. South allowed for lucrative expansion that other nations physically could not obtain. Others have proposed that the United States created an effective labor system that created immense productivity and, as a result, prosperity. However, our findings suggest that the United States was not more productive than Egypt and that it did not benefit from a spatial fix. These negative findings contribute to an understanding of why the South prospered using a system of labor that has economically retarded other nations by eliminating theories commonly proposed by the literature.

CHAPTER I

INTRODUCTION

This paper address two common theories on the success of the cotton economy in the United States' South. A critical component of the United States economy is the dominant cotton economy that arose in the 18th and 19th centuries. The superior cotton industry of the United States continued after the Civil War into the 20th century and it provided ample investment that contributed to the industrialization of the North. Typically, the literature contrasts the United States with less developed nations, namely Egypt, although India and Brazil are also commonly mentioned. Traditional explanations produced less than satisfying explanations. Time and labor constraints prevent us from running a full analysis of this phenomenon. However, two particularly important theories that conceivably explain why the United States prospered and Egypt did not are the spatial fix theory and the economic advantage of slavery over other systems of coerced labor.

In order to test why the United States succeeded where Egypt did not, we analyzed the theory of David Harvey's spatial fix and ran a comparative productivity analysis to see whether the United States was more productive than Egypt. Though the literature indicated that both the U.S. spatial fix and high United States productivity were factors that contributed to United States prosperity, our study reports negative findings.

Background

United States Cotton Industry

Originally, the American slavery system revolved around tobacco and rice. However, the British Industrial Revolution created an insatiable demand for cotton. This demand, coupled with the continual decline in world tobacco and rice markets and the implementation of new technology, including Whitney's cotton gin, encouraged American farmers to grow short-staple cotton. Labor-intensive cotton growth spurred a recommitment to the institution of slavery in the U.S. South, which in turn, created substantial economic growth in the United States South. By 1840, the South supplied three-fourths of the world's cotton (Johnson 2007). After the Civil War, a system of debt peonage essentially replaced the slave system in terms of agricultural labor and the United States remained the world's dominant producer of cotton.

History of Egypt

Egypt's cotton industry tells a different story. In the early 19th century, Egypt was a grain-centered economy. However, once their population began to grow exponentially, they lowered their exported amount of grains due to internal consumption and began to commercially produce cotton. The fertility of Egypt's land gave it the ability to cultivate what is now popularly known as Egyptian cotton. Egyptian cotton has a long staple length of about 1 ¼ inches and is known for its "strength, luster, and silky appearance" (Norris 1934). Egypt quickly became ranked as one of the highest cotton producing countries in the world. American states that produced long-staple cotton similar to Egypt's cotton would be forced to meet the standards of Egyptian cotton and depended on changes in the crop size of Egyptian cotton (Norris 1934).

During the American Civil War, demand for Egyptian cotton in Europe increased due to America's decreased cotton exportation. Egyptian cotton prices rose exponentially in response to this rise in demand. Once the Civil War ended and America began to export cotton into Europe once again, Egypt's cotton industry plummeted. In 1879, Europe used this time to colonize Egypt and gain control of their cotton industry. Europe kept control over the cotton industry until 1922, when Egypt gained their independence. Once their independence was obtained, the Egyptians continued to rely on cotton as their main export and the country remained one of the leading cotton exporters. Yet, Egypt did not develop into a world power like the United States.

Coerced Labor in Egypt

Once cotton became a major Egyptian export, large estates began to take the land that was given to peasants under religious laws. Since profits were best noticed when they were grown on large estates, Egypt began to transition from small scale farming to large estates (Bent 2015). The creation of these large estates resulted in changes of their property right agreements. Originally, Islamic laws gave peasants certain property rights. However, the Egyptian elites, the Khedives, used their large estate development to take these rights away and transform most of the land into private property (Bent 2015). Many peasants ended up owning little to no land, causing them to have to work for the large estates. Instead of giving the peasants wages, most estates gave peasants a little plot of land for them to farm.

However, peasants were not satisfied with this system because they were paid in tax credits instead of actual wages once they sold their cotton. This meant that any currency they received underwent high inflation, and therefore it was not sold for market value. Another reason the laborers were unsatisfied was due to their limited labor on these farms. Many peasants were also forced into corvee labor. This labor meant the peasants were sent to work on other projects, such as building canals, which hindered their planting of cotton and subsistence crops. The majority of these projects did not benefit them, due to their placement away from their villages, and they would have to supply their own food and supplies with little to no compensation.

Peasants rebelled against these conditions with "lethargy and surreptitious resistance", in addition to running away and mutilating themselves (Alleaume 1999). Others fled to Syria while a small number attempted to fight against this rule, but the rebellions were put down easily. The peasants did not find an effective solution to this problem and their conditions did not change until the 20th century.

Coerced Labor in the United States

The early United States cotton industry was almost entirely dependent on the labor of enslaved African Americans, though planters occasionally employed hired hands as well. In 1808, the United States outlawed the importation of slaves into the country. Thus planters relied on interregional slave trade to supply their labor force. Enslaved African Americans were considered property, or chattel. Enslaved men, women, and children were forced to work their masters' fields from sunrise to sunset for no pay. Slaves lived on their masters' plantations and were afforded no rights by U.S. law. Under the slavery system, countless African Americans endured physical and mental abuse and many were murdered. The law allowed a master to treat his property in any way that he desired. The desire to make a profit from cotton led to one of the darkest human rights chapters in history.

During the Reconstruction Era, a system of debt peonage effectively replaced slavery as the source of cotton labor. In a system of debt peonage, or debt slavery, an indentured servant works to pay off a debt to their employer. Although debt peonage was technically outlawed in the United States in 1867, African Americans found themselves in the system through non-traditional methods. For instance, some employers gave their workers advanced pay, paid for transportation costs or living expenses, gave sharecropping loans, paid legal fees, extended credit, etc. (PBS 2012). These loans trapped many African Americans in debt that they could never fully repay. As a result, cotton plantations employed many African Americans for no wages. The United States cotton industry continued with a system of labor that looked roughly identical to traditional slavery.

Theories

Spatial Fix Theory

Our first theory deals with the concept of land availability. David Harvey examines the concept of a spatial fix in *The Limits to Capital* (1982). Capitalism creates contradictions between the forces and relations of production. Moving to a new space and utilizing the new space to create fresh, viable activity provides a repair for this dysfunctional relationship (Harvey 1982). Jason Moore supports this notion in *Capitalism in the Web of Life: Ecology and the Accumulation of Capital* (2015). Moore believes that the agricultural industry is particularly subject to stagnation, and therefore is more dependent on spatial renewal (2015).

One of the most controversial attempts at explaining these contrasting outcomes comes from Robert William Fogel and Stanley L. Engerman's 1974 *Time on the Cross: The Economics of American Negro Slavery.* Though many of the theories and much of the methodology of Time on the Cross have been debunked, the work proposes several factors of United States cotton production that continue to persist in modern literature and pose questions relevant to our research. Fogel and Engerman examine the importance of technology, soil, and the size of cotton farm as crucial factors in productivity.

Perhaps most importantly, Fogel and Engerman discuss the "natural limits" thesis (1974). *Time on the Cross* declares that slavery required territorial expansion to remain profitable. According to Fogel and Engerman, since slavery led to "rapid soil exhaustion," an acceptable level of productivity could be only maintained by "continuously bringing new land into production" (1974). The "natural limits" thesis falls directly in line with the concept of a spatial fix that is supported by other literature.

Further examining secondary sources gave a strong indication that territorial expansion allowed the United States to excel in ways that other nations could not. In Empire of Cotton: A Global History, Steven Beckert writes that "what distinguished the United States from virtually every other cotton-growing area in the world was planters' command of nearly unlimited supplies of land, labor, and capital, and their unparalleled political power" (Beckert 2014).

Furthermore, “the territorial expansion...was tightly linked to the territorial ambitions of planting, manufacturing, and finance capitalists. Cotton planters constantly pushed the boundaries, seeking fresh lands to grow cotton” (Beckert 2014). Additionally, Beckert cites cotton planters who asserted that a plot of land could not be used for cotton production for more than a few years. Plots that previously produced a thousand pounds of cotton would bring in only half as much the next year (2014). Thus, the concept of a spatial fix is supported by the United States cotton industry literature.

Finally, Engerman and Sokoloff’s “Factor Endowments, Inequality, and Paths of Development Among New World Economics” explores the United States’ factor endowment and the role of land in the development of the United States (2002). As opposed to the United States, “approximately 97 percent of [Egypt]… is of no agricultural value. The remaining area… supports 98 percent of the population” and “the productive area is limited to the valley and delta of the Nile River” (United States Department of Agriculture 1934). Owen explains their possible ability to expand by claiming the only reason total crop area may exceed the area under cultivation is due to the extensive system of double cropping (Owen 1969). Due to their double cropping and irrigation system, “[Egypt’s] rapid economic growth ended in the early 1900s. The supply of readily available land had been largely exhausted” (US Library of Congress). Having an abundance of workable land is an asset to agricultural economies because of soil depletion. When lands become unsuitable for agricultural, territorial expansion becomes necessary.

Additional sources assert the link between the survival of the cotton industry and territorial expansion. Andrew Torget claims that a “massive expansion of American cotton farming” required “expanding that cotton frontier...,” and even documents attempts by cotton farmers to expand into Mexico (Torget 2015). Moreover, Gene Dattel states “from 1800 to 1860 cotton production provoked human and territorial expansion at a blistering pace...cotton was the most important proximate cause of expansion” (Dattel 2011). In other words, the amount of serviceable acres is imperative in assessing the viability of an agricultural society. The territorial expansion of cotton is believed to have been a major component in the industry’s productivity.

The Proposed Economic Advantage of Slavery over Other Systems of Coerced Labor

This research will also consist of the exploration of the relationship between coerced labor, productivity and economic growth. Historically, nations that rely on coerced labor have failed to industrialize (Williams 1994). However, the South became very wealthy despite possessing an economy dependent on slave labor (Fogel, Engerman 1974). However, some of the literature indicates that the United States was productive not in spite of slavery, but because of it. Fogel and Engerman assert that the American slavery system was economically beneficial. The book challenges the idea that American slavery was unprofitable and inefficient; instead it claims that American slavery provided a mutually beneficial economic relationship between owner and slave (Engerman and Fogel 1974).

Edward Baptist’s *The Half that Has Never Been Told: Slavery and the Making of American Capitalism* explores the importance of slavery in the creation of the United States’ success. Baptist rightfully acknowledges that the 18th and 19th century Southern economy, and the U.S.'s subsequent economic success, was due to the labor of enslaved African Americans. However, Baptist also makes claims about the economic viability of the forced labor system. Baptist claims, "Slavery's expansion...multiplied the incredible productivity and profitability of enslaved people's labor and allowed slavers to turn bodies into commodities with which they changed the financial history of the Western World" (Baptist 2014). In other words, as slavery expanded, Baptist believed that productivity increased. Furthermore, "The data of declining productivity over the ensuing three score and ten years suggested that slavery might have been the most efficient way to produce the world's most important crop" (Baptist 2014). If slavery is equated with efficiency and productivity, then the United States was able to prosper because of brutality.

Beckert, in *Empire of Cotton*, echoes Baptist's claims. Beckert states, "slave owners secured these productivity gains by taking almost total control of the world process- a direct result of the violent domination of their workers" (2014). Additionally, "the all-encompassing control of workers...experienced its first great success on the cotton plantations of the American South" (2014). The bleak narrative being perpetuated across the cotton literature is that the United States was able to be successful because the inhumanity of its slave system gave it advantages that other counties could not obtain.

The idea of beating slaves into productivity appears in slave narratives as well. John Brown, who was a fugitive slave, said that "when the [cotton] price rises in the English market, the poor slaves immediately feel the effects, for they are harder driven, and the whip is kept more constantly going" (Brown 1854). What is implicit in this statement is that brutality can cause increased efficiency, therefore giving the morally unrestrained United States farmers an advantage. This is a frightening case to hold up as a model of productivity.

According to the literature, part of the effectiveness of slavery came from the organization of labor. Cotton caused the organization of slave labor to shift from task-based to gang labor. This transition took away the little autonomy slaves had over their work and instead forced them to be watched by overseers. This organization of slaves "further expanded their output" due to the "systematic intensification of exploitation" (Beckert 2014). Bill Cooke, a scholar of management, argues that "there is no real question...that [the plantation] was a site of early development of industrial discipline" and that as productivity increased on American farms, cotton industries worldwide were undermined. Sources propose that the gang labor system further increased productivity on U.S. farms.

These theorists are not alone in their assessments. Other scholars who attribute the United States' success to the system of slavery include the *American Cotton Planner*, which noted that "the cheapest and most available labor in the world" contributed to economic prosperity (1853). Beckert states that the United States' virtually unlimited supply of slave labor allowed it to excel where other countries could not. *The De Bow's Review* concurs with this assessment citing that "the true limitation upon the production of cotton is labor" (1851). Torget claims that many cotton farmers would not move outside of the United States into Mexico, because it was slavery "that made their cotton fields so profitable" (Torget 2015). Lewis Cecil Gray states that the “unified direction and control” of slaves allowed for an increase in productivity (Gray 1958). The system of slavery, according to these sources, provided the United States with an irreplaceable advantage.

Furthermore, the case for the productivity of slavery is based, in part, due to the perceived inefficiency of other countries’ systems, such as Egypt’s. At the end of the 1800s, most of the cotton in the world was grown by quasi-free people; people who often worked as sharecroppers or lived in a state of poverty. Many of these people worked or owned their own land, however there was a gradual increase in the number of farmers who became wage workers for a small amount of money. Beckert bluntly states that “becoming a wage worker was a measure of their defeat” (2014). In the case of Egypt, almost 40 percent of all farmers had become workers who did not own their own land, but rather worked for pitiful amounts of money. Beckert believes that this transition spurred inefficiency in Egypt’s cotton industry. In theory, the wage laborers did not provide the same productivity gains as American slaves did.

Discrepancies in the Theories

Though the literature indicated that the amount of viable land was essential to a cotton economy’s success, we found no evidence of a spatial fix in Egypt (as expected by literature) nor the United States (which was unexpected by literature). The spatial fix theory presents intrinsic discrepancies. The theory assumes that moving to new land will lead to an increase in productivity. Yet, newly acquired land could have a number of issues. One of these issues could be lower soil quality. One of the implications of expansion is that farmers will be forced to plant in unknown areas. The soil in these new areas could not be as nutrient rich as the land they were previously using. In order reach its potential, the land might require different agricultural techniques, such as needing to be watered or planted in a different way. Expanding to new land might entail planting land that will never be able sustain as much output as the previous, more fertile land was able to sustain. Even if the land could sustain sufficient amounts of cotton, making the land viable might take time and resources that decrease the overall productivity.

Climate and costs of expansion pose dilemmas for the idea of a spatial fix as well. Even if the land itself is fertile and viable, variation in climate conditions could pose problems for farmers. The new areas could receive less rainfall or less daylight during their prime growing season. Since cotton is very sensitive, changing any conditions when growing cotton can cause major changes in cultivation. Farmers who might have mastered familiar land and conditions could significantly hurt by expanding into unknown land. Soil quality and climate vary not only regionally, but within states as well. Even expansion within close distances could pose problems. Furthermore, the costs of expansion could outweigh the benefits. For example, a lack of infrastructure could accompany expansion into new territory. If transportation costs offset increased output, then productivity could not increase. The proximity of raw cotton markets could make a huge impact on productivity levels. The spatial fix theory is widely accepted, but there are many complications associated with expansion that could hamper productivity.

Our productivity comparison demonstrates higher productivity in Egypt rather than the United States. The idea that slavery is a more effective system than other coerced labor forms is problematic. The literature fails to account for the lack of incentives among slaves and the indentured servants of the debt peonage system.

The potential psychological effects of slavery, including depression, anxiety, post-traumatic stress disorder, etc. could significantly decrease a worker's output potential. Slaves would be beaten by their masters if they did not harvest a sufficient amount of cotton. Yet, a slave did not want to pick too much cotton or the standard expectations of their master would increase. Therefore the slaves were not motivated to work to maximum potential, but rather they were motivated to work to avoid even more cruelty.

Additionally, the efficiency of plantation-style farms with large slave populations could be different from small farms. The majority of American slave owners owned less than three slaves (Johnson). Plantation-style farms possessed the ability to discard slaves when they were inefficient or injured and replace them with new workers or children. Small farmers did not have the same opportunity. With a limited workload, masters could only grow the amount of cotton their workers could harvest. Moreover, cotton-farming is said to work best on a large scale versus a small scale (Johnson). Since their amount of labor and resources were limited, the small farms could be inefficient enough to offset more productive plantations.

Due to these limits, we expected to find no spatial fix in the United States and we expected to find no Egyptian productivity disadvantages.

CHAPTER II

METHODOLOGY

In the spatial fix analysis, the provinces, regions, states, and years were the independent variables. The acreage, yields, price, and productivity were dependent variables.. Mitchell's *International Historical Statistics: Africa, Asia & Oceania* provides Egyptian regional acreage data, cotton yields, and price data. The regions used will be Upper and Lower Egypt. Egypt's *Annuaire Statistique de L'Egypte* gives the provincial acreage data for both Upper and Lower Egypt. The 1940 United States Agricultural Census issued the Special Cotton Report that provided the entirety of the United States cotton data, with the exception of price data, which came from Mitchell's *International Historical Statistics: The Americas*. To create the productivity graphs, we divided the cotton crude outputs by the acreage data given in our sources above. The acreage data and cotton yields were collected in feddans and cantars for Egypt, while the data was collected in bales and acres for the United States.

A basic analysis of the data tables provide a general overview of productivity and acreage expansion. However, determining expansion growth rates and productivity growth rates based on data from the first and last year of analysis would paint an incomplete picture. We ran a series of regressions to represent the changes in expansion and productivity over time. These regressions have the ability to represent changes over time because they find the average relationship between the independent (time) and dependent (acre expansion and productivity) variables. The regressions take all of the data throughout the years and calculate the average amount of acre expansion or productivity per year calculated. These calculations allow us to determine the growth rates beyond a simple subtraction of the variables from the last year minus the variables from the first year. Instead, we can account for all of the data gathered from year to year. We determine the rate of acre expansion by running a regression of the number of acres per state (y) on time (x). To determine the regression coefficients to demonstrate the productivity growth rate, a regression of the productivity per state (y) on time (x) was calculated. Additionally, we calculated the average productivity per state to help us ensure that productivity data remained consistent across the years and strengthen our productivity regression coefficients. Pearson coefficients allowed us to observe the same thing as the regressions, which was the relationship between the two variables observed. However, Pearson coefficients also allowed us to see the correlations between the expansion and productivity regressions and then the average productivity and expansion regressions.

After we completed our testing of the spatial fix, we began to compare their productivity rates to determine whether the U.S. was indeed more productive and lead to their profitability. To calculate their productive values, we used our previously collected data from the spatial fix theory. Next, we established a common form of measurement and converted our individual units to pounds per acre. In order to obtain these units, the United States bales were converted to pounds. According to the census, beginning in 1860, 450 pounds of cotton constituted a bale. Thus, the number of bales produced nationally in a given year was multiplied by 450. The United States data was already recorded in acres, so no other conversions were necessary.

In Egypt, we converted feddans to acres. We used multiple cotton conversion charts to conclude that there are 1.038 acres in one feddan. Using this information, we multiplied our acreage data by 1.038 to properly convert the feddans to acres. Next, we found that there are 50 kilograms in one cantar and .453 kilograms in one pound. When we divided 50 by .453, we calculated that one cantar is approximately 110 pounds. Using this knowledge, we multiplied the production data by 110 to convert the cantars to pounds. Once we converted all of the data to similar units and divided the pounds by acre, we found the productivity rates for both Egypt and the United States from 1880-1940.

CHAPTER III

RESULTS

Spatial Fix in Egypt

To achieve a successful spatial fix, the newly introduced land should have contributed to an overall higher land usage and ultimately a higher productivity rate due to the use of fresh land. We first compared this theory with Egypt.

Hypothetical

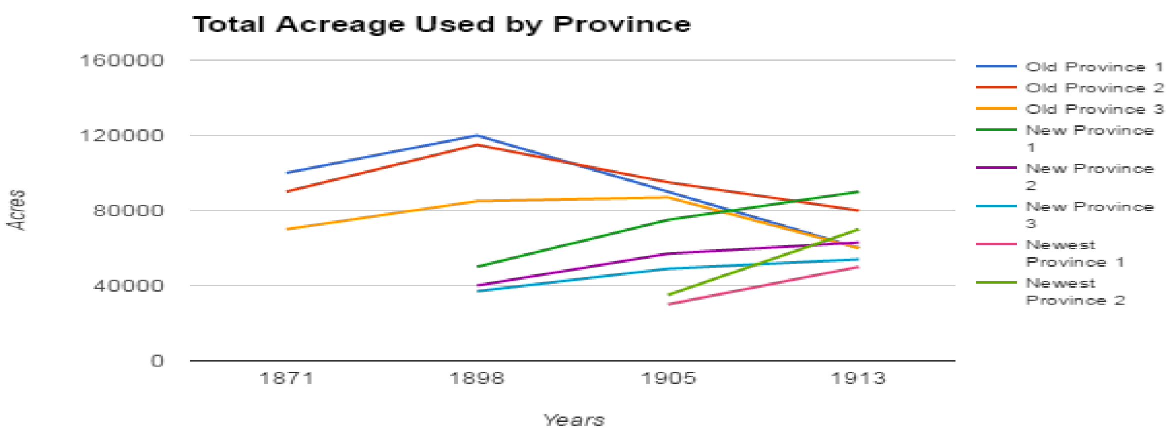

Figure 1: Hypothetical acreage expansion by provinces for a nation with a successful spatial fix.

As demonstrated in the hypothetical graph, as time passes, new land is introduced (see figure 1). This is shown by new provinces being introduced halfway through our time period and the newest provinces appearing towards the end. In addition to the introduction of new provinces, those provinces would be increasing in land usage. They would start out with a small amount of land being used, but throughout the years they would quickly expand their land usage and plant on fresh land. While the new provinces are increasing, the older provinces would be simultaneously decreasing in land usage. They would be replaced with the fresh land and depleted soil would be abandoned.

Observed

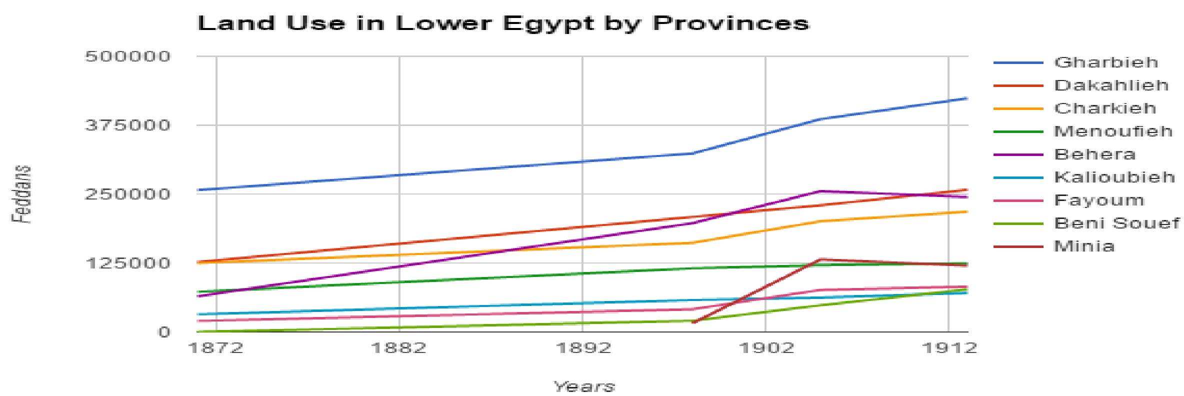

Figure 2: Observed acreage usage in Lower Egypt by provinces.

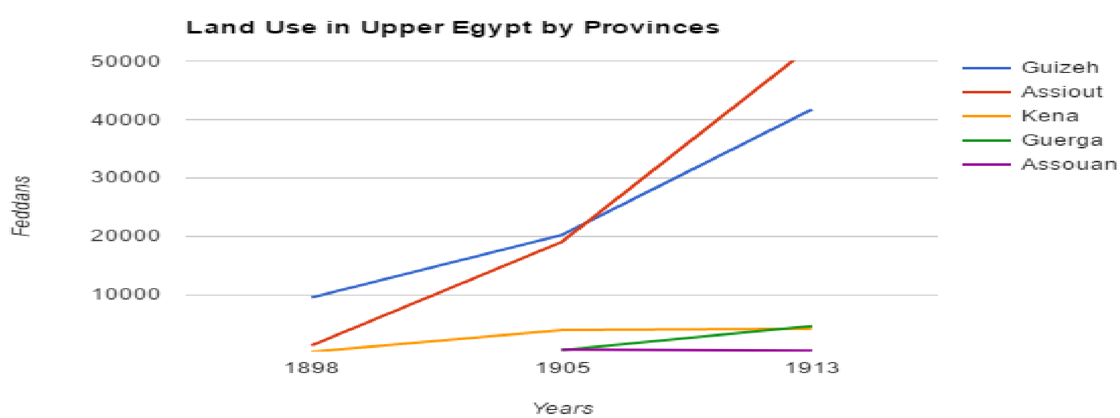

Figure 3: Observed acreage usage in Upper Egypt by provinces.

Though the graphs does not depict all of the provinces being used in Egypt, the observed graphs are able to determine the rate of expansion in both regions of Egypt. Lower Egypt has significantly more provinces in use than Upper Egypt, but they attempted to expand into Upper Egypt and use the region for production. For the hypothetical spatial fix to have occurred in Egypt, the provinces introduced in Upper Egypt during the early 1900s, or were being used the least in the 1800s, should have increased in land usage while the dominating provinces during the 1800s should have decreased in usage. Our data shows that this is not the case. As shown in figure 2, Lower Egypt was introduced into cotton production before Upper Egypt. In Lower Egypt, Gharbieh was the original leading province in land usage at about 250,000 feddans. By 1912, Gharbieh should have decreased in usage to allow for expansion to new, fresh land. Gharbieh is still the leading province and shows negative signs of decreasing in land usage. In addition, the other provinces of Lower Egypt were increasing at essentially similar rates or not at all. Minia, which was introduced in 1897, increased for a couple years but then began to decrease and level off.

There was no significant introduction of new, fresh land in Lower Egypt like our results for the hypothetical spatial fix. In figure 3, we examine Upper Egypt from 1898 to 1913. Guizeh and Assiout show increased usage in land for cotton production during the period, from 10,000 to 50,000 and 2,000 to 42,000 feddans respectively, while the other three provinces either remained stagnant or barely increased. Next we examined all of the regions together.

Hypothetical

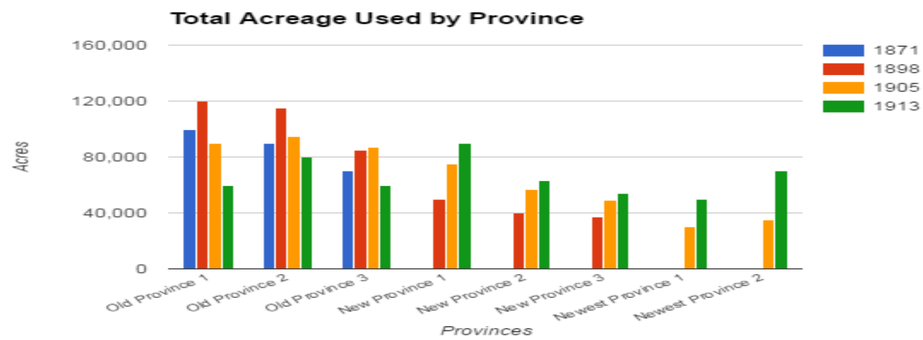

Figure 4: Hypothetical acreage usage by every province in a nation with a successful spatial fix.

When looking at the provinces in a bar graph for the hypothetical spatial, we can see the optimal results in a different way. The old provinces peak early but diminish in land usage quickly after (see figure 4). The new provinces would be introduced later but increase in land usage at a gradual pace. Lastly, the newest provinces would be introduced last, but would be gradually growing in land usage as well. Overall, we would see an expansion into fresh land by introduction and increased acreage.

Observed

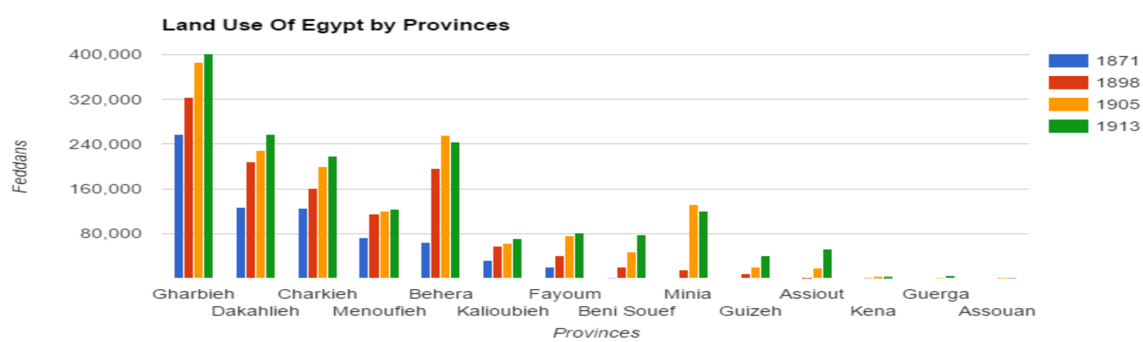

Figure 5: Observed acreage usage by every province in Egypt.

When we examine Egypt's graph, we receive a different result. When put into perspective, Upper Egypt's land usage was minimal and did not show a marginal increase of land usage (see figure 5). If they were effectively expanding, provinces from Upper Egypt would increase heavily in usage as opposed to remaining stagnant in these new areas. The observed graph demonstrated that Egypt was still planting on the same land that they used in 1871 and using the same provinces to attempt to increase their land usage on cotton production.

Hypothetical

Figure 6: Hypothetical total acreage usage for cotton production in a nation with a successful spatial fix.

In addition to the introduction of new land, the total acreage used would be increasing (see figure 6). Although the farmers would abandon depleted land, they would still salvage some land in the old provinces while they were expanding. With an optimal spatial fix, the growers would have unlimited land and could expand as rapidly as they wanted, while keeping use of healthy land in the old provinces. For Egypt, this would mean that they would expand into Upper Egypt and lessen their usage in Lower Egypt. This would cause a steady increase in acreage as Upper Egyptian lands are introduced and positively contribute to productivity.

Observed

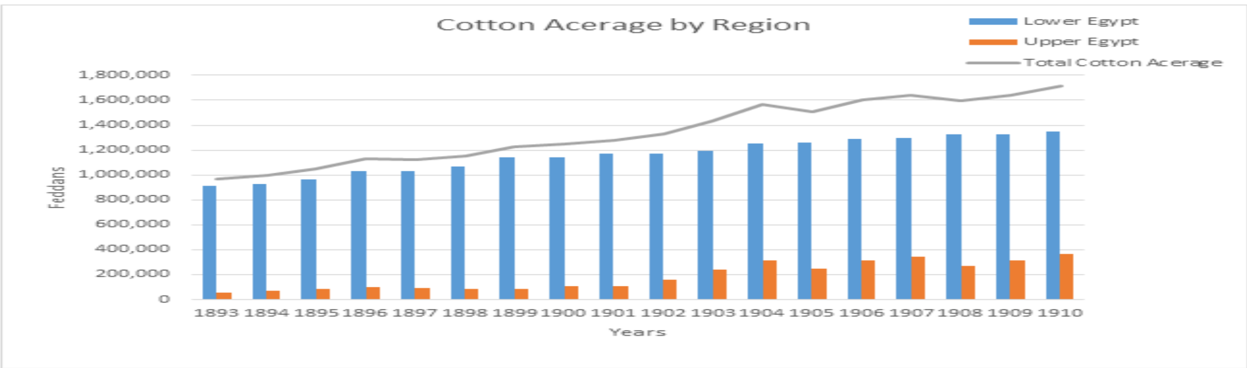

Figure 7: Observed regional and total acreage usage by Egypt for cotton production.

When comparing the acreage data, we did find total acreage to be generally increasing throughout the years with minor fluctuations (see figure 7). When we analyze Upper and Lower Egypt individually, we found Upper Egypt to be producing marginally less than Lower Egypt. Since they used less land in Upper Egypt, this was to be expected. However, there were also noticeable fluctuations to Upper Egypt acreage, showing unreliability in the region. Although Upper Egypt was generally increasing throughout the years, the usage of Lower Egypt was increasing simultaneously. Upper Egypt would have to heavily increase in usage for a successful expansion to occur. If they were expanding to new land in parts of Lower Egypt but mainly in Upper Egypt, the usage of Lower Egypt would be increasing at a slower pace than Upper Egypt.

Hypothetical

Figure 8: Hypothetical average total productivity in a nation with a successful spatial fix.

Lastly, an ideal spatial fix would have a positive productivity line. As shown in figure 8, the increase in acreage also contributed to increased output. Since the productivity line is increasing, this demonstrates that the introduction of new, fresh land allowed this country to produce more cotton per acre, as opposed to a decrease in productivity. The latter would indicate that the expansion to new land did not assist the states in producing cotton at higher quantities, and in turn harmed their cotton production.

Observed

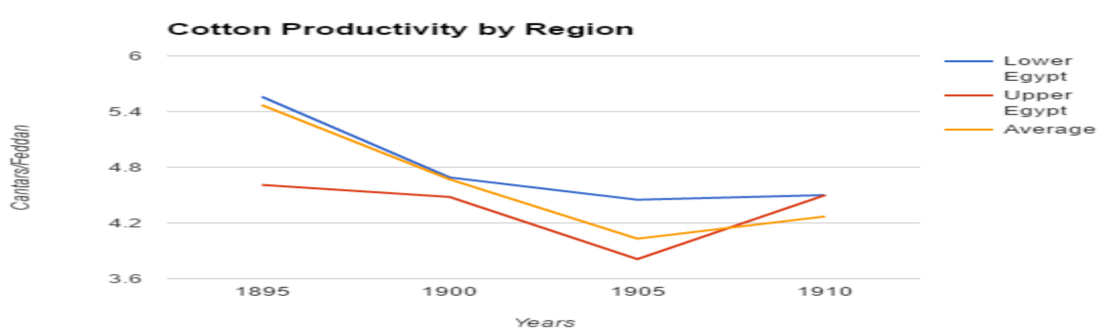

Figure 9: Observed regional and national productivity in Egypt.

This was the case in Egypt. When looking at the overall productivity, we calculated that both the productivity of the regions and the overall productivity were decreasing as they attempted to expand (see figure 9). With their attempt to introduce new land and increase their acreage, their productivity decreased and proved that the new land was not efficient or effective in their production. The decrease in productivity finalizes our conclusion that Egypt did not successfully complete a spatial fix.

Spatial Fix in the United States

Table 1: Top producers in the United States by total bale output.

Top Producers (Bales) 1840

Mississippi	483,504
Georgia	408,481
Louisiana	381,388
Alabama	292,847
South Carolina	154,276
North Carolina	129,815
Tennessee	69,253
Florida	30,276
Arkansas	15,072
Virginia	8,736
Kentucky	1,729
Illinois	502
Missouri	303
Other	16
total	1,976,198

Top Producers (Bales) 1940

Texas	2,724,442
Mississippi	1,533,092
Arkansas	1,351,209
Georgia	905,088
South Carolina	849,982
Alabama	772,711
Louisiana	717,713
Oklahoma	520,591
North Carolina	458,146
Tennessee	436,126
California	435,397
Missouri	433,196
Arizona	199,151
New Mexico	100,138
Kentucky	15,704
Virginia	12,865
Florida	11,424
Illinois	4,169
Kansas	156
Other	0
Total US	11,481,300

The first step in determining whether the United States benefitted from a spatial fix was to look at sheer output. As shown in table 1, the top producers in 1840 were Mississippi, Georgia, Louisiana, and Alabama with 483,504 bales, 408,481 bales, 381,388 bales, and 292,847 bales respectively. By 1940, Texas had appeared and dominated cotton production with 2,724,442 bales. Arkansas also surged from 15,072 bales in 1840 to 1,351,209 bales in 1940. Georgia, Louisiana, and Alabama all roughly doubled producing 905,088 bales, 717,713 bales, and 772,711 bales respectively. Mississippi effectively tripled in output, producing 1,533,092 bales. Based on our findings, cotton production underwent massive output growth during this decade.

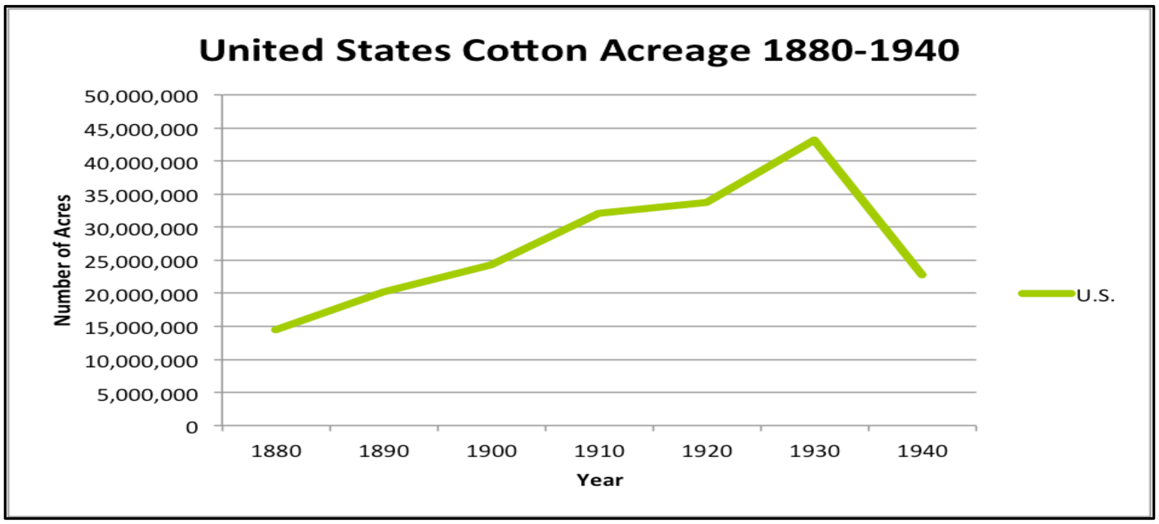

Figure 10: United States total acreage usage from 1880-1940.

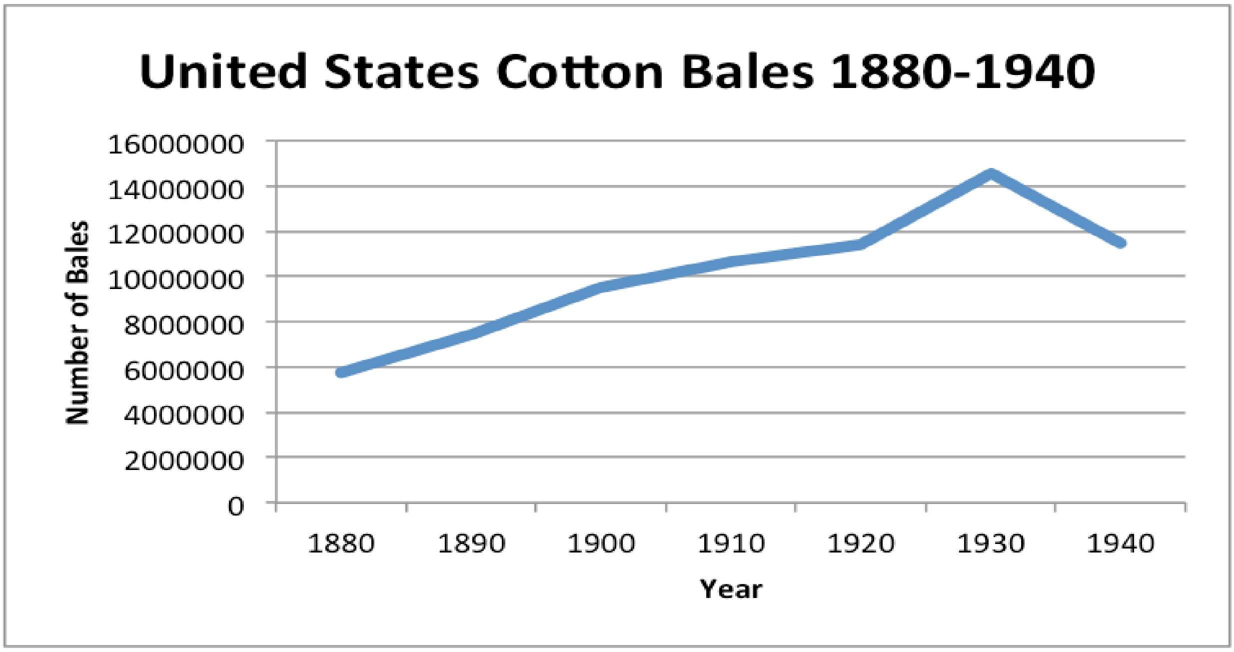

Figure 11: United States total bale output from 1880-1940.

According to our data collected, a spatial fix did not occur in the United States. As a whole, the United States experienced relatively consistent growth in the number of acres of cotton planted until 1930, where the numbers began to rapidly decline (see figure 10). The number of bales produced also steadily increased until around 1930 (see figure 11). This was inconsistent with the idea of a spatial fix due to the rapid decline of both the bale output and the acreage usage, which showed that they were not constantly expanding to new land throughout the years and producing higher volumes of cotton.

Hypothetical

Table 2: Hypothetical total productivity for a nation with a successful spatial fix.

	1880	*1890*	*1900*	*1910*	*1920*	*1930*	*1940*
Productivity (Bales/Acre)	*0.330*	*0.390*	*0.410*	*0.450*	*0.455*	*0.500*	*0.570*

For a successful spatial fix to have occurred, both the bale output and acreage would be constantly increasing throughout the years, with the bale output increasing at a greater rate than the acreage. Therefore, an increase in acreage would lead to an increase in productivity.

Observed

Table 3: Observed total productivity for the United States.

	1880	1890	1900	1910	1920	1930	1940
U.S. Productivity (bales/ acre)	0.397	0.370	0.393	0.332	0.337	0.337	0.503

As noted in our Egyptian analysis, in a successful spatial fix, the productivity of the country would be increasing as new land was being introduced (see table 2). Starting in 1880, we computed a productivity measure of bales per acre (see table 3). The United States' productivity table indicates that productivity remained generally consistent until 1940 as well, where there was a significant increase. This was still inconsistent with our hypothetical chart because they did not increase in productivity throughout the years, even though they were expanding to new areas. This furthered the idea that the United States was not expanding effectively like it has been assumed by the literature. However, this was not enough to disprove the theory of a spatial fix. In order to better understand whether a spatial fix was influencing the cotton industry, it became necessary to look at the productivity differences at the state level.

Observed

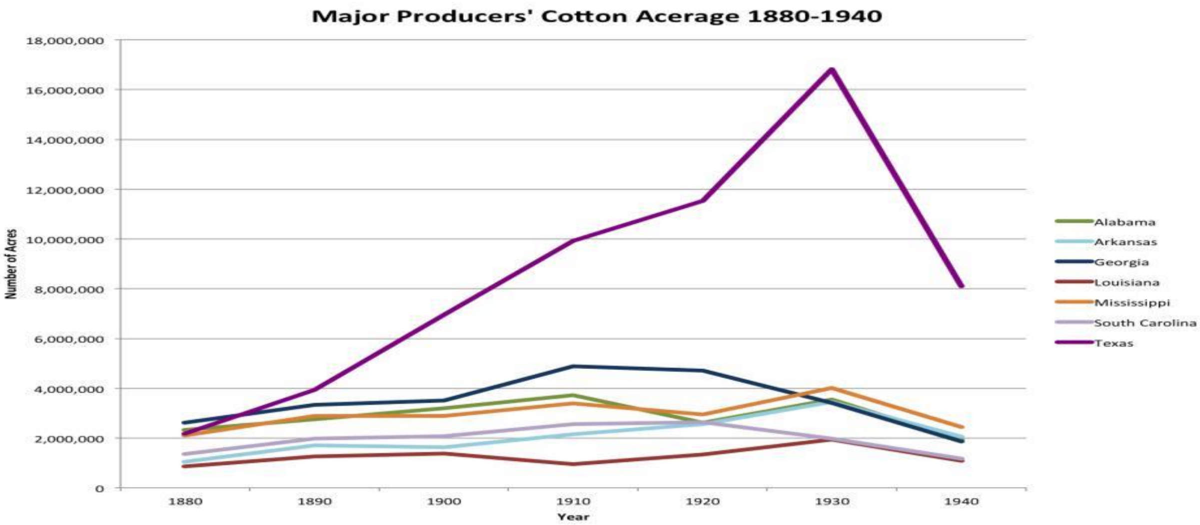

Figure 12: Observed acreage usage by states in the United States.

Once again, on the interregional level, in a hypothetical scenario the newer land introduced will begin to exceed the land that was being used in the earlier years (see figure 1). In addition, the older areas will also begin to decline.

As shown in figure 12, data from the individual states did not show the results that a spatial fix expected. With the exception of Texas, the other states appear to frequently intersect and remain relatively in the same range in terms of acreage. Although Texas was introduced later and greatly increased in acreage (similar to the hypothetical graph) the other states did not give an indication of actively introducing new land or discarding old land. For the United States to demonstrate introduction of removal of areas, there would be positive or negative trends in each state as opposed to slight fluctuations. Similar to Egypt, there is no evidence of new, viable land being introduced in the United States and replacing worn out land.

Hypothetical

Table 4: Hypothetical productivity by states in a nation with a successful spatial fix.

State	***1880***	***1890***	***1900***	***1910***	***1920***	***1930***	***1940***
Alabama	*0.403*	*0.407*	*0.411*	*0.415*	*0.297*	*0.322*	*0.213*
Arkansas	*0.263*	*0.267*	*0.265*	*0.271*	*0.273*	*0.332*	*0.263*
Georgia	*0.431*	*0.442*	*0.439*	*0.465*	*0.453*	*0.323*	*0.223*
Louisiana	*0.214*	*0.217*	*0.223*	*0.201*	*0.212*	*0.221*	*0.214*
Mississippi	*0.391*	*0.393*	*0.389*	*0.394*	*0.368*	*0.410*	*0.374*
South Carolina	*0.281*	*0.285*	*0.284*	*0.281*	*0.294*	*0.295*	*0.284*
Texas	*0.405*	*0.465*	*0.549*	*0.637*	*0.678*	*0.812*	*0.569*

As shown in the table 4, the expanding states would be experiencing higher productivity than the older ones in a hypothetical spatial fix. The states with higher acreage growth are producing more cotton bales, due to their use of fresh land, and thus have a higher rate of productivity.

Observed

Table 5: Observed productivity by states in the United States

Top Producers' Productivity 1880-1940 (Bales/Acre)

State	1880	1890	1900	1910	1920	1930	1940
Alabama	0.300	0.331	0.346	0.303	0.273	0.369	0.400
Arkansas	0.583	0.407	0.432	0.361	0.340	0.406	0.657
Georgia	0.311	0.356	0.367	0.408	0.356	0.395	0.488
Louisiana	0.588	0.519	0.515	0.281	0.228	0.411	0.659
Mississippi	0.457	0.400	0.453	0.331	0.325	0.468	0.626
South Carolina	0.383	0.376	0.425	0.501	0.561	0.424	0.722
Texas	0.370	0.374	0.360	0.247	0.257	0.226	0.336

Table 5 shows the productivity measures of each top producing state between 1880 and 1940. When we observed the United States productivity numbers, all of the states experienced fluctuations in their productivity without notable increases or decreases. In addition, all of the states increased their productivity in 1940. This is contrary to the hypothetical table because since every state decreased their acreage, their productivity should have decreased as a result. By 1930, some states, such Alabama, Georgia, and South Carolina, had experienced productivity gains; but others, namely Arkansas, Louisiana, and Texas, decreased in productivity overall. The variation in productivity levels in the observed table shows that they were not using their land introduction effectively and did not suggest a spatial fix.

Hypothetical

Table 6: Hypothetical regressions for a nation with a successful spatial fix.

State:	Number of Acres (y) on Time (x) 1880-1940	Productivity (Bales/Acres) on Time Regression Coefficient 1880-1940	Average Productivity 1880-1940
Total US	287722	.0075	.75
Texas	171792	.0065	.62
Oklahoma	53977	.0043	.59
Arkansas	26589	.0032	.54
Mississippi	11900	.0021	.46
North Carolina	7104	.0010	.41
Virginia	6176	.0005	.29
Kentucky	2872	.00002	.24
South Carolina	-116	.000011	.13

Table 7: Hypothetical Pearson Coefficients for a nation with a successful spatial fix.

Acre on Productivity	.8580
Acre on Average Productivity	.7490

In a hypothetical spatial fix, the states with the higher regression coefficients regarding the number of acres on time would also have the highest productivity regression coefficients (see table 6). Subsequently, the Pearson Coefficients would be positive, significant numbers (see table 7).

Observed

Table 8: Observed regressions and Pearson coefficients for the United States.

State:	Number of Acres (y) on Time (x) (1880-1940)	Productivity (Bales/Acre) on Time Regression Coefficient 1880-1940	Average Productivity 1880-1940
Total US	287722.8429	0.0007	0.381
Texas	171792.5143	-0.001785714	0.310
Oklahoma	53977.65714	-0.00341165	0.368
Arkansas	26589.88214	0.000457143	0.455
Mississippi	11900.675	0.001839286	0.437
Louisiana	7104.192857	-0.001035714	0.457
Missouri	6176.792857	0.007775	0.624
North Carolina	2872.964286	0.004075	0.492
Tennessee	2294.860714	0.003628571	0.419
Virginia	266.9107143	0.003575	0.423
Kentucky	244.7392857	0.006828571	0.568
South Carolina	-116.5035714	0.004460714	0.485
Alabama	-649.6178571	0.001082143	0.332
Florida	-3143.403571	-0.000503571	0.237
Georgia	-3405.435714	0.002135714	0.383

Acre on Productivity	-0.366815511
Acre on Average Productivity	-0.282686948

The final step in testing whether a spatial fix affected productivity in the United States was to run a series of regressions. A regression of the number of acres on time was computed for each state between 1880 and 1940. The states with the highest regression coefficients were Texas, Oklahoma, and Arkansas, meaning that these states were expanding the fastest. Then, a regression of the productivity measure on time was computed. However, as shown in table 8, the highest regression coefficients for productivity on time were Missouri, Kentucky, South Carolina, and North Carolina. Our observed results were not similar to the hypothetical results that should have occurred. These results demonstrated that the states that were expanding the fastest were not necessarily the states that were the most productive. Of the top productive states, Missouri ranks 6th out of 14 states regarding expansion, showing that the American farmers were not simply using the expansion of land to increase their productivity. Finally, in order to ensure the results remain relatively consistent across states, the average productivity per state was calculated. The states with the highest average productivity were Missouri, Kentucky, North Carolina, and South Carolina, which were the same states that received the highest regression coefficients for productivity on time. These findings proved that our data was consistent throughout the decades. A basic examination of the regression coefficients led us to believe that a spatial fix was not a factor in the productivity of the United States cotton industry.

Even so, in order to numerically determine the correlation between acreage and productivity, we employed Pearson coefficients. In a hypothetical spatial fix, the Pearson coefficient between the regression of number of acres on time and the regression of productivity on time would be a positive, significant number. However, the observed Pearson coefficient was -0.367, which was both negative and inconsistent (see table 8). To review our work, The Pearson coefficient between the regression of number of acres on time and the average productivity per state was calculated as well. This coefficient should have also been positive and significant. We calculated the coefficient to be -0.282, which was negative and even more insignificant. These were the opposite of the results that would be expected from a successful spatial fix. Therefore, we concluded that there is no evidence of a spatial fix in the United States.

Comparative Productivity

Table 9: Total acreage, output, price, and cotton productivity of the United States and Egypt.

NATION	DATE	LAND (acres)	PRODUCT (lbs)	PRICE (dollars per lb)	PRODUCTIVITY (lbs per acre)
US COTTON	1880	14,480,019	2,589,911,550	0.1165	179
	1890	20,175,270	3,362,629,950	0.1016	167
	1900	24,275,101	4,290,618,150	0.0781	177
	1910	32,043,838	4,792,170,600	0.1403	150
	1920	33,740,106	5,119,258,500	0.3574	152
	1930	43,227,488	6,558,482,250	0.1424	152
	1940	22,811,004	5,166,585,000	0.1041	226
EGYPT COTTON	1880	800,137	290,840,000	0.0014	363
	1890	948,146	523,490,000	0.0014	552
	1900	1,297,380	670,230,000	0.0011	517
	1910	1,776,268	802,890,000	0.0022	452
	1920	1,707,510	679,910,000	0.0104	398
	1930	1,742,802	785,950,000	0.0023	468
	1940	1,235,220	646,140,000	0.0020	523

Since the United States' lack of spatial fix was contrary to our original hypothesis, we compared the productivity levels between Egypt and the United States (see table 9). The productivity differences between the nations are surprisingly significant, but not in the way the literature would have predicted. When comparing the acres used throughout the years, we found over ten times as much usage of land by the United States and steadily increasing land usage until 1940, during the mechanization of cotton. In Egypt, there was significantly less land used for cotton production. As a result, the United States produced more cotton throughout the years as well, with their only decrease in production being in 1940. Egypt generally increased yet had greater fluctuations in their pounds produced throughout the decades. Finally, the United States charged a significantly higher selling price per pound for their cotton, while Egypt struggled in selling their cotton for a competitive wage.

Although the United States lead in acreage, product, and price, Egypt was more productive than the United States per acre used. For every decade between 1880 and 1940, Egypt had a higher productivity measure than the United States. The starkest differences occur in 1890 when Egypt's productivity measure was 3.31 times greater than that of the United States. At their closest, Egypt's productivity was still 2.03 times greater than the U.S.' productivity. On average, between 1880 and 1940, Egypt was 2.75 times more productive than the U.S. without the use of slave labor.

This finding is contrary to what the literature suggested. Even though the analysis takes place after the antebellum era, the system of debt peonage maintains the forced labor findings. Therefore, the United States' darkest chapter in history was not only inhumane, but unproductive. Southern planters justified the enslavement of African Americans because they perceived the system to be an economic necessity (Johnson 2007). However, the results imply that the United States did not only build its power by enslaving an entire race of people, it did so without economic benefit.

CHAPTER IV

CONCLUSION

Our research suggests that the spatial fix theory was wrong in the case of the United States cotton industry. David Harvey's spatial fix theory predicted that the United States' vast amounts of land and ability to expand contributed to increased productivity. We determined that the United States did not produce a successful spatial fix and actually decreased in productivity throughout the decades. Although the U.S. were expanding in land use and increasing in production, this land did not produce more cotton per acre; thus, the productivity measures disproved the theory of a David Harvey "spatial fix" in the United States.

Our research also suggests that coerced labor did not successfully increase productivity in the United States. Many sources indicated that the United States' slavery and debt-peonage system contributed to increased productivity and therefore led to increased profitability. We found that Egypt, using their corvee labor system, produced two to three times as much cotton per acre than the United States. This conclusion further taints the idea of slavery because it implies that hypothetically the United States could have employed a different system of labor and become more productive, and thus more profitable.

The external limitations of our study are mainly centered on the lack of data availability. The United States only provided acreage data beginning in 1880, so our analysis excluded the antebellum area and Egypt's prosperity during the American Civil War. Additionally, Egypt was unable to produce correlation coefficients due to the lack of consistent decadal data. Therefore, although the quantitative analyses were not as directly comparative as we would have hoped, they provided sufficient trends to reach our conclusions.

Additionally, we planned to test more countries to further strengthen our argument. A larger sample size would diminish the margin of error. However, due to time constraints, we were limited to examining only the two nations. However, the United States and Egypt were the quintessential examples of cotton economies and provided prime cases for the theories explored. Therefore, even though our study is not wide in scope, it gives a solid indication of these theories.

According to the secondary sources, there were two other unsubstantiated theories we found could be the answer to the United States' prosperity. Mowery's *Technology and the Pursuit of Economic Growth* provides a historical account on the importance of technological innovation from an economic standpoint. Furthermore, Landes's *The Unbound Prometheus* details innovations that aided in the development of Western Europe and concluded that technology positively correlates with education levels, with the more educated societies experiencing higher economic growth (Landes 1991). Without developments in technology, an agricultural society cannot hope to reach the efficiency and production levels of developing nations.

The underdevelopment theory also could explain why other cotton economies failed to develop in the way the United States' did. Frank's *The Development of Underdevelopment* and Chang's *Bad Samaritans: Rich Nations, Poor Policies, and the Threat to the Developing World* provide evidence that an exploitative relationship with a rich nation led many poorer nations into a cycle of debt and dependence (1966, 2007). Chossudovsky's *The Globalization of Poverty* affirms the importance of debt repayment in the economic development of nations (1998). Egypt in particular suffered from an insurmountable debt crisis that forced it to pay creditors all of their cotton trade profits (Owen 1969). Furthermore, the existence of tariffs in America kept foreign competition overwhelming local markets, whereas nations like Egypt were flooded with British imports (Chang 2007). These imports kept the nations from supporting a successful cotton-manufacturing sector (Chang 2007).

The exploration of these theories are an important next step in research because the discrepancy in long-term success between the United States and other cotton economies still merits investigation. Currently, research and literature paints a contrasting and incomplete view of this phenomenon.

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