Were Antebellum Cotton Plantations Factories in the Field?

Alan L. Olmstead and Paul W. Rhode

Univ. of California, Davis University of Michigan

17 April 2014

Abstract: Using census data, plantation records, and narrative evidence, we investigate whether the popular expression "factories in the field" appropriately characterizes antebellum cotton plantations. We argue that the direct analogies between plantations and factories and labor systems employing modern management techniques obscure more than they reveal.

Acknowledgements: We thank Jeremy Atack, Martha Bailey, Gregory Clark, Peter Coclanis, William Collins, Alan Dye, Stanley Engerman, Robert Follett, Barbara Hahn, Sumner La Croix, Naomi Lamoreaux, Margaret Levenstein, Robert Margo, Peter Richardson, Caitlin Rosenthal, Elyce Rotella, Richard Steckel, David Weiman, Thomas Weiss, Warren Whatley, and Gavin Wright for their comments and advice.

In his 1956 classic on American slavery, Kenneth Stampp wrote "each of the southern staples demanded its own kind of specialists. These agricultural enterprises, with their business directors, production managers, labor foreman, and skilled and unskilled workers, approached the organizational complexity of modern factories. Though agriculture was not yet mechanized, the large plantations were to a considerable extent 'factories in the field.'"[1] This identification of plantations with factories has since gained wide popularity.

Despite purported resonances to the nineteenth-century experience, the phrase "factories in the field" appears to be of mid-twentieth century coinage. Carey McWilliams popularized the phrase in his 1939 book attacking large California farms.[2] McWilliams decried the exploitation of migrant labor, the unequal distribution of wealth and power, and the violation of Jeffersonian agricultural ideals. McWilliams also tied the spread of power farming and extensive mechanization into his critique.[3] Both Stampp and McWilliams were contrasting large-scale agricultural enterprises with family farms and industrial factories.

On the family farms that prevailed in the East and Midwest, cultivators typically applied their labor to their own land to produce a mix of livestock, grains, and specialty crops. In *To Their Own Soil*, Jeremy Atack and Fred Bateman described how the availability of land coupled with the family farm organization influenced key demographic patterns and community development, leading to the widespread provision of public education and a relatively equal distribution of wealth.[4] Industrialization in the North created both tensions and opportunities for family farmers. Atack and co-authors later provided a rich account of the rise of the factory in the United States.[5] As with agriculture, the manufacturing sector was evolving, with small-scale artisanal shops being replaced by factories employing both power-driven machinery and a more extensive division of labor.

Stampp and McWilliams employed the term "factory" to large-scale agriculture enterprises with a clear purpose. Both sought to highlight the negative influences that they associated with factories: the depersonalization of work, the separation of workers from ownership and control, and the increasing social and economic inequalities. Both

criticized the exploitation of disempowered, ethnically-differentiated workers. Other scholars, including many cliometricians, have adopted and embellished Stampp's association of plantations with factories, but with a different purpose. The figure of speech now symbolizes modernity and efficiency. As an example, Jacob Metzer builds the case that plantations were rational modern business structures that like factories employed the division of labor to captured significant economies of scale and coordination.[6] In *Time on the Cross*, Fogel and Engerman go beyond the previous uses of the "factories in the field" appellation to emphasize the assembly-line driven efficiency of gang-labor plantations.[7] They note that "…the ultimate objective of slave management was the creation of a highly disciplined, highly specialized, and well-coordinated labor force. Specialization and interdependence were the hallmarks of the medium- and large-sized plantations. On plantations, hands were rigidly organized as in a factory."[8] By Fogel's reckoning, the owners of medium- and large-size plantations owners, through their perfection of the gang system created a revolutionary advance worthy of mention alongside the "blast furnace, electricity, and medical surgery."[9] Explaining his path-breaking findings, Fogel observed: "A slave working on an assembly-line basis in cotton, sugar and tobacco--the Southern staples--produced as much output in 35 minutes as a traditional worker produced in an hour."[10]

It has become common to apply the "factories in the field" label to sugar plantations. In *Sweetness and Power*, Sidney Mintz characterized seventeenth- and eighteenth-century West Indian sugar plantations as "industrial enterprises" due to the discipline and organization of the labor force as well as the high degree of time consciousness in production.[11] In his study of the Louisiana sugar plantations, Robert Follett also emphasizes the imposition of time-clock management and integration of field and mill work.[12] The industrial nature of sugar-producing operation is strongly reinforced in the vivid images of their boiler houses, distilleries, and mills.

As noted above, many scholars have also applied the "factories in the field" metaphor to antebellum cotton plantations.[13] Some see that the idea as solidly rooted in nineteenth century, offering selected sources to support this lineage. One touch-point is Michael Chevalier's 1839 account where he refers to the New South cotton plantation as is called "a sort of agricultural manufactory, in which [the planters] are obliged to

exercise more or less of the activity, and to feel more or less of the hopes and fears of a manufacturer."[14] The 1884 Currier and Ives print, "A Cotton Plantation on the Mississippi" is another touch-point. The chromolithograph depicts a post-bellum harvest scene, with a sky filled with smoke billowing from the plantation's steam-driven cotton gin and a distant steamboat.

In this chapter, we use census data, plantation records, and narrative evidence to investigate whether antebellum cotton plantations merit the title "factories in the field." Our focus is on cotton because it was the slave South's main cash crop and the leading user of enslaved labor. We also inquire whether management practices on cotton plantations were closely aligned with those of modern business enterprises associated with Frederick Taylor's scientific management prescriptions. We find that, by some measures, plantations were an intermediate form of enterprise located between the family farm and the contemporary factory, and in some ways, closer to the factory than to the farm. However, by other more important measures, plantations were very different from factories. We conclude that the analogies between cotton plantations and factories and between slavery and "modern" management practices obscure than they reveal.

The chapter has the following form. After defining key terms, we assembly the quantitative evidence on scale of production, labor force, and capital stock of plantations, family farms, and manufacturing establishments from the 1860 Census in order to compare the operating characteristics of the three sets of organizations. Next, we investigate the extent of the division of labor, the seasonality of work, regimentation at antebellum plantations, farms, and factories. We then question the relevance of analogies that liken slaves to machine parts and explore assertions that plantation practices were akin to modern management techniques. A fuller comparative analysis reveals substantial differences between plantations and factories.

Defining Terms

In his "Report on the Factory System" for the *Tenth Census of the United States*, Carroll D. Wright defined a factory as a "establishment where several workmen are collected for the purpose of obtaining greater and cheaper conveniences for labor than they could procure individually at their homes; for producing results by their combined

efforts which they could not accomplish separately; and for preventing the loss occasioned by carrying the articles from place to place...." The core principle was one of *association*: "each laborer, working separately…directs his producing powers to effect [sic] a common result…." The more prominent is the "principle of association," the more the establishment is "entitled to the name of factory and the more generally does it receive the name in common parlance."[15] Wright drew on the writings of the British authority, Andrew Ure, for whom "the term factory system, in technology, designates the combined operation of many orders of work-people, adult and young, in tending with assiduous skill a series of productive machines continuously impelled by a central power."[16]

In courses on the Industrial Revolution, the "factory" is commonly defined as a manufacturing establishment utilizing a power source (water or steam) and employing a number of wage-earners (the lower-bound cutoff is often around 15). Many scholars add the use of supervision (or what is known as "factory discipline") and the application of an extensive division of labor.[17] Applying the concept to census data, which are silent on the organization of work within establishments, requires modification. To do this we follow the guidance of Jeremy Atack, who defined a factory as "an inanimately powered plant," employing a large number of workers. "Factory production depended upon steam or water power to drive machinery. Artisan shops, sweatshops, and manufactories, on the other hand, relied on hand tools. Human muscle was sufficient for their power needs."[18] Factory production also entailed specialization, which "could not be practiced extensively" unless the plant operated on a sufficient scale. In his recent work, Atack set the employment threshold at 15 workers.[19] As Table 1 shows, fewer than one-in-twenty (4.5 percent) of American manufacturing establishments in 1850 met the joint standard of employing 16 or more workers and using water/steam power. Such establishments did employ 33.2 percent of all workers and produce 23.9 percent of all value added. By 1880, the shares of establishments meeting the joint standard had increased to 8.3 percent of units, 49.4 percent of workers, and 38.6 percent of manufacturing value added.[20]

In the southern history literature, the conventional dividing line separating plantations from yeoman farms is whether the operator owned 20 or more slaves. The degree of arbitrariness of this definition is widely acknowledged.[21] An alternative

definition involved whether the operator worked in the field.[22] The common practice in the economic history literature--one that we will follow--is to subdivide units into free farms (0 slaves), small-slave farms (1-15), medium–sized operations (16-49), and large plantations (50 plus slaves).

In addition to comparing plantations to factories, a growing literature has associated antebellum cotton plantation operations with those of "modern business enterprises," employing "scientific management" and "assembly lines." To separate reasonable claims from hyperbole requires yet more definitions. Alfred D. Chandler defined a "modern business enterprise" as a firm operating two or more distinct production/distribution units and run by a hierarchy of salaried managers who monitor and coordinate the activities at these units. This is contrasted with a "traditional business enterprise," a firm which is engaged in a single production activity, is owned and managed by family members, and bought its inputs from and sold its outputs to the market.[23] "Scientific Management" was a set of management practices developed by Frederick Taylor and his followers to prevent "soldiering" and to improve work efficiency. The practices included implementing incentive pay and designing "optimal" work methods based on time-and-motion studies rather than "rules of thumb."[24]

The "assembly line," according to David Nye's recent book, was a production technique combining five key components—the subdivision of labor, interchangeable parts, single-function machines, the sequential ordering of machines, and the movement to work to worker by belts and slides. Work was divided "into small operations of nearly equal duration;" "every job could be learned quickly." Use of precision-made interchangeable parts allowed assembly to proceed smoothly without "any last-minute sanding, filing, or polishing." Each machine tool was designed to do one thing, and one thing only, as quickly as possible. The machines and tasks were arranged to ensure the smooth flow of the product through the assembly process. And this flow of parts and sub-assemblies through the production process was automated.[25]

Henry Ford adds perspective: "[W]e began taking the work to the men instead of taking the men to the work. We now have two general principles in all operations--that a man shall never have to take more than one step… and that no man need ever stoop over.…[A]s nearly as possible, [a worker does] only one thing in only one movement."[26]

But Ford's efficiency-enhancing innovations were not universally applauded. The regularity and pace of work was so intense that the wife of one final assembler wrote to Ford in early 1914 complaining that the "chain system you have is a slave driver! My God! Mr. Ford. My husband has come home and thrown himself down & won't eat his supper - so done out."[27] Such statements illustrate the double-acting nature of this set of metaphors, which are used to assail modern management practices by equating industrial labor with slavery and to embellish the efficiency of slave labor by equating it with factory work. Our question is whether such analogies do justice to the realities of slave conditions.

Assembling the Evidence

To compare antebellum cotton plantations with farms and factories in the same period, we can draw on the wealth of census-based micro-level data related to business organizations in 1860. These include the Parker-Gallman sample (ICPSR 7419), covering farms and plantations in cotton-producing counties; the Bateman-Foust sample (ICPSR 7420), covering the rural North; and the Atack-Bateman sample (ICPSR 4048), covering manufacturing nationwide.[28]

A comparison of the data collected in the 1860 Censuses of Agriculture and Manufactures shows many similarities, but the significant differences suggest that the designers of the census thought of the two types of businesses as different entities. Both censuses collected data on location, and the name of the operator (owner or manager). The censuses differed in the cutoff for inclusion. For farms and plantations, the threshold for coverage was annual production of $100 or more; for industrial establishments, the threshold was $500 annual output.[29]

The manufacturing schedule noted the *value of total product* and the physical number of key outputs (for cotton: pounds of yarn, etc.). It also recorded the quantities, kinds, and *value of the raw materials* employed. This, in principle, allowed for calculating the value-added produced by a given firm. The agricultural schedule collected the physical output of 33 commodities in the previous year—some important such as wheat and corn and others of minor significance such as silk cocoons. Some, including wine, butter, and cheese, were manufactured or processed on the farm. Output

values were reported only for orchard and market garden products, home manufactures, and animals slaughtered. The failure to collect output values more generally may reflect that census designers thought that much of the output was consumed on the farm. The agricultural schedule did not collect data on raw material costs. Importantly, there is no information on the quantities or value of the inputs used to feed livestock. Computation of the value added for stock requires assumptions about feed costs and changes in inventories. We will calculate industrial output as value added—that is, the value of product minus the cost of raw materials. We gauge farm output as the value of all crops (at national prices) and the reported value of animal slaughtered, orchard products, and market garden products.[30] We proceed with the sense that this procedure understates the output associated with the animal production. The instructions to the census marshals recognized that many agricultural data were likely to be imprecise. This concern was not emphasized in the instructions for manufacturing enumerators, suggesting that agricultural data were not as accurate as the manufacturing data.[31]

Another important distinction deals with the treatment of *labor*. The manufacturing schedule collected data on the "Average number of hands employed," subdivided between males and females, by each firm and on the total wages, the "average cost." Perhaps reflecting the perception of the family nature of the farm enterprise, there are no comparable questions in agricultural schedule about the external (or internal) labor force or the expenditures for labor. Researchers must link demographic information on households in the population schedule to gauge the farm labor force. Hired workers were included only if they resided on the farm. A separate Census of the Slave Population did inquire about the number, ages, and gender; but offered no direct information about work.

To create comparable labor units across activities we rely on established research. For manufacturing, Atack, Bateman, and Margo present total employment and an effective (or adult-male-equivalent) employment.[32] For northern agriculture, Lee Craig has created a set of weights to calculate adult male equivalents.[33] For southern agriculture, we will use both the total labor force and the "adult-male-equivalent" labor force derived based on the weights of Fogel and Engerman.[34]

Both census schedules inquired about the sources of power and value of the *capital stock*. The agricultural schedule recorded the cash value of the farm, the value of

livestock (some of which were capital and power sources), and the value of farm implements and machinery. (The "cash value" of the farm included "the actual cash value of the whole number of acres returned by you as improved and unimproved"; it is unclear whether farm buildings were included, although it is commonly assumed that they were.[35]) The manufacturing schedule recorded the value of the capital, specifically the "dollars invested, in real and person estate, in the business." Both schedules inquired about an establishment's machinery. However, the manufacturing schedule gathered information on the number of specific types of power sources and machines, that is, on the "kind of motive power, machinery, structure, or source." The agricultural schedule asked for the value of "all implements and machinery used to cultivate and produce crops and fit the same for market or consumption." It also collected information on the number of horses, mules, and working oxen (on 1 June of the year of enumeration).

The capital stock ratios in agriculture can thus be subdivided into various categories. Most agricultural units used mobile power sources (such as draft animals) rather than fixed power sources (such as steam engines or water wheels) when driving machinery. To measure the extent of substitution away from tools powered by human muscles, we will include statistics on capital invested in draft animals and implements.[36] Census enumeration procedures in 1860 unfortunately do not allow the manufacturing capital stock to be subdivided in an equivalent way at the establishment level. According to Robert Gallman's aggregate estimates for 1860, equipment made up 22 percent of the aggregate manufacturing capital stock, buildings 23 percent, and land 24 percent.[37]

We calculate the capital-to-labor ratios using the total labor force and the adult-male-equivalent labor force. We treat slaves as labor, not as capital; their value is not included in the capital stock. One can derive a broad sense of the differing gender-and-age compositions of the labor forces by comparing the results for total labor and adult-male-equivalent labor. The ratios will be similar in activities where men made up the bulk of the labor force and different in activities where women and children were important.

A number of previous studies, which have investigated these samples separately, raise salient comparisons to examine. The rise of the factory in the late-nineteenth century United States has been associated with capital deepening and the growth of the

capital-to-labor ratio. In their analysis of 1880 manufacturing data, Atack, Bateman, and Margo showed that the capital-to-labor ratio and capital-to-effective-labor ratio were higher for those establishments employing 16 or more workers than those employing 15 and fewer and much higher for those establishments using inanimate power than those that did not.[38] Focusing on the antebellum agricultural sector, Heywood Fleisig contrasted differences in the use of specific forms of capital, most notably implements, on plantations and free farms.[39] He argued plantations could expand output by adding slave workers whereas free farms, facing a family labor constraint, could expand output only by mechanizing, that is by adopting machinery *and* draft power to increase the land-to-labor ratio. Wright shows that the value of implements per unit of labor rose sharply in the North by 1860 as the scale of operations (as measured by acres of improved land) rose; however, the ratio fell on Virginia Piedmont farms as scale (here measured by the number of slaves) increased.[40] A more systematic comparison of the scale of operations and the capital-to-labor ratios of plantations, farms, and manufacturing establishments promised to shed more light on the relevance of the "factories in the field" appellation.

Comparing Plantations, Farms, and Factories

Figure 1 graphs the distribution of output in manufacturing and agricultural samples by size of operation in 1860. Size is measured in two ways: the total number of workers per establishment and the number of adult male equivalent works. By either measure, agricultural production is concentrated in in far larger units in the Cotton South than in the North. This is no surprise. The larger production units in the South, which were almost exclusively slave plantations, had no real counterparts in northern agriculture. In our sample drawn from the Bateman-Foust data set, the largest northern farm, measured by the total number of workers, has a labor force of 28. (This Iowa farm accounted for a negligible share of total output.) In our sample drawn from the Parker-Gallman data set, 4 percent of units, accounting for 32 percent of output, are of this size or larger. In this sample, the largest enterprise, a Rapides, Louisiana plantation, had 257 workers.

Comparing the cotton farms and plantations with manufacturing establishments puts the "factories in the field" idea into perspective. The very large units in the cotton

sample account for a far smaller share of output than their counterparts in the manufacturing sample. The top five percent of manufacturing units (on a workers per establishment basis) employed 46 or more workers and accounted for 45 percent of total output. (The largest industrial establishment in the sample was a water-powered textile mill in Maine that employed 1,825 workers.) The top five percent of units in the cotton sample had 25 or more workers and accounted for 36 percent of total output. The top five percent in northern farm sample had 7 or more workers and accounted only 10 percent of total output. So by this measure, large plantations were much more akin to factories than to large northern farms. But there were large differences between large plantations and factories as seen in Table 2, which describes how output varied across the organization units in the different sectors.

The top panel of Table 2 reports summary statistics including the mean and standard deviation of the log of output for the different categories of activities. Here, a "factory" is defined as an establishment with an inanimate power source and 16 or more employees; a "mill" is an establishment with an inanimate power source and 15 or fewer employees; a "manufactory" is defined as an establishment with no inanimate power source and 16 or more employees; an "artisanal shop" is an establishment with no inanimate power source and 15 or fewer employees. Operations in the cotton sample are also distinguished by the size of the slave population. Output per unit was ranked from highest to lowest: factories, manufactories, plantations with 50 or more slaves, those with 16 to 49 slaves, mills, artisanal shops, operations in the cotton sample with 1 to 15 slaves, northern free farms, and free operations in the cotton sample. The bottom panel of Table 2 reports regression results placing the three sectors into a common framework. It presents two sets of standard errors, those that correct for heterogeneity alone and those that are clustered by sector. Even the largest category of slave plantations--those with 50 or more slaves--produced less output than the average factories (the omitted category in the regression).

Table 3 investigates variations in the output-to-labor ratios across the organizations in the different samples. Here the differences between the total and adult-male-equivalent labor are more pronounced, especially within the agricultural operations in the cotton sample. In the regressions reported, slave operations in all three

categories—those with 1 to 15 slaves, 16 to 49, and 50 or more—have lower output-to-labor ratios than factories. Another notable result is that mills and manufacturing establishments with power sources but with 15 or fewer employments, have output-to-labor ratios above (in raw terms) or roughly equal (in adult male equivalents) to factories. Manufactories also have lower output-to-labor ratios than artisanal shops. Such patterns may arise from the use of the labor variable to categorize the units, and its inclusion in the denominator of the output-to-labor ratio.

Table 4 presents statistics on the capital-to-labor ratio in manufacturing and agricultural samples. These data reveal that the difference in the aggregate capital-to-labor ratios across these broad activities was not large. However, greater differences at the more fine-grained level are apparent. In the 1860 sample, manufacturing establishments (i) powered by water or steam had higher capital-to-labor ratios than those which were not and (ii) those in the larger employment scale category had lower capital-to-labor ratios than establishments in the small-scale category. This is consistent with increasing scale saving capital by spreading a fixed stock over a larger employment base. The result (i) is consistent with the findings of Atack, Bateman, and Margo for 1880; the result (ii) is inconsistent with their results for 1880.[41] The differences may be due to inclusion in their analysis of the rich set of controls for location and 3-digit SIC industry which we omit.

These results suggest that we compare farms, plantations, and manufacturing establishments controlling for the level of output. Table 5 reports regressions examining whether, controlling for output in a common way, the organizational forms had measurably different capital/labor ratios. It presents two sets of standard errors, those that correct for heterogeneity alone and those that are clustered by sector. The cotton plantations with a greater numbers of slaves have progressively lower capital-to-labor ratios than cotton producers with fewer slaves. If one takes into account controls for sectors, slave plantations have higher capital-to-labor ratios than factories. Thus, the null hypothesis that the intercepts are the same may be rejected. The differences are statistically significant at conventional levels using either set of standard errors. It is clearly desirable to investigate the expansion paths of the capital-labor ratios in a more flexible way, allowing variation across type of unit. And it is undesirable to continue

using categorical variables (dummy variable for factories, large plantation, etc.) that are defined by labor force numbers that also enter, directly or indirectly, into the capital-labor ratios under investigation.

To help address these concerns, Figure 2 graphs the expansion paths of the total capital-labor ratio as estimated by locally weighted regression separately for northern farms, free farms in the cotton sample, slave operations, and manufacturing establishments.[42] Panel A shows the relationship between the log of the capital-labor ratio to the log of output. The series for adult-male-equivalent labor (not shown here) has the same general pattern. The graph presents results for ranges of output where all four types of establishments co-existed, thus allowing for reasonable comparisons. Northern farms are the most capital-intensive, followed by free cotton farms, slave operations, and finally, at a much lower level, by manufacturing establishments. (At lower levels of output, the relationships between the agricultural units are reversed.) Not only are the levels different, but so are the slopes of the expansion paths. The capital-labor ratio rises sharply with output for northern farms. For manufacturing establishments and slave operations, the increase is much more muted. The overall patterns suggested in the locally-weighted regressions are re-enforced by the results of OLS regressions (not reported). The total capital-to-labor ratio grew rapidly with output on free farms in both the northern and southern samples, but in a more moderate way on slave operations or in manufacturing establishments.

Panel B graphs the expansion path for machinery and power. The agricultural series shows the log of the ratio of value of the capital in implements and draft stock to the number of laborers. Limitations in the manufacturing data prevent us from calculating an exact analogue; instead for the manufacturing series, we graph the fraction of establishments with steam or water power (as displayed on the right axis). While the manufacturing series obviously cannot be compared directly with the series for the agricultural units, the relationship between the fraction with power and output is informative. The manufacturing series follows a U-shaped pattern. The minimum for the manufacturing series occurs near a log(output) value of 6.71. Over 71 percent of manufacturing establishments, accounting for 98 percent of total manufacturing output,

produced to the right of this point--that is, on the upward sloping portion of the manufacturing curve.[43]

On free farms in the northern agricultural and cotton sample, the ratio of capital invested in machinery and power sources relative to labor increases sharply with output. The growth is especially rapid for northern farms, mirroring the increase in total capital to labor for these units. For slave operations, the machinery and power ratio increases at low scale and then declines at higher scales. Overall, the expansion path of slave plantations follows a shallow inverted U-shaped pattern. This contrasts with both free farms and with manufacturing establishments. The maximum point for the slave power series occurs near a log(output) value of 6.93. Over 53 percent of slave operations, accounting for over 90 percent of the output of such units, produced at a scale greater than this. Whereas, an upward sloping part of the expansion path was relevant for the overwhelming bulk of manufacturing units, the downward sloping segment was relevant for most slave operations. Once again, the overall patterns suggested in the locally-weighted regressions are re-enforced by the results of OLS regressions (not reported). The machinery-to-labor ratio grew rapidly with output on free farms in both the northern and southern samples, but not on slave operations. In summary, large cotton plantations differ from free farms because the plantation total capital-labor does not increase rapidly with scale; and they differ from free farms and manufacturing establishments (including factories) because the plantation power and machine-intensity does not increase rapidly with scale.

The evidence on the composition of the agricultural capital stock displayed in Table 6 points to a core difficulty with the "factory in the field" appellation. The capital mix of large cotton plantations was heavily weighted to "fields" -- over 87 percent for land and buildings--and not to the accoutrements of "factories" -- only 7 percent for machinery and power sources. The low share for power and machinery was not due to the inherent incompatibility of slavery with industrial production or mechanized farming as the example of sugar plantations shows. Instead it was a product of the cotton regime. The owners of largest cotton plantations often sought to occupy the richest and most valuable lands and to accumulate a stock to hold in reserve.

Division of Labor, Regimentation, and Seasonality of Work

What about other attributes of the factory system, such as the use of the division of labor? By most accounts, the harvest was the binding constraint in cotton production. Stampp asserted this view and added the during the peak of harvest season almost all able-bodied hands, including those skilled in a craft and working in the big house, were sent to the field to pick.[44] In our investigation of plantation production activities, we are exploring the allocation of the labor force over the harvest season. The surge of laborers into the picking work during September and October is plainly evident. It was all hands on deck, or rather into the fields. This difference is in part rooted in the different nature of the annual production process. Cotton plantations produced a marketable output once a year. Factories likely produced marketable commodities every day or week. Each stage of production of the cotton crop was depended on the success of all prior stages. There was little parallel to this annual cycle of production in manufacturing.[45]

Large plantations maintained specialized slaves trained as smiths, wrights, and carpenters and thus were like factories which coordinated all these divisions of labor within the enterprise. But care must be taken in concluding that the existence of such slave specialists implied greater efficiency.[46] This presumes northern farmers actually performed similar work (instead of purchasing such specialized services in local towns and villages) or that northern farmers, who did preform some of these tasks for themselves, were less efficient than slave craftsmen. No evidence has been offered that slave crafts workers were more adept than free farmers or towns' people.

Vertical disintegration was a hallmark of northern industrialization. Factories regularly performed tasks internally in the early phases of an industry, but over time external specialists emerged to provide the services more cheaply. Agglomeration economies allowed northern factories to specialize in what they did best. Northern farmers followed the same route. The existence of such markets was typically a sign of an increase in the division of labor and greater efficiency. The literature arguing self-sufficient plantations were somehow more efficient or like factories because they failed to evolve and specialize misses this fundamental element of northern industrialization. The mirror image of the supposed efficiency of plantation craftsmen was the absence of small and medium size towns compared to northern agricultural regions.[47] Herein, lay an

important source of the broader negative impacts of the plantations internalizing craft activities.

According to the conventional view, work in factories was regular and freed from dependence of seasonal conditions. Factories were indoor spaces where external forces could largely be controlled. In practice, this ideal took time to be fully realized and that many industrial workplaces in the mid-nineteenth century America reduced their hours of operation in the winter due to weather conditions, inadequate light, and lack of flowing water to drive power equipment. In the early nineteenth century, industrial work had been "from sun to sun." In addition, many early industrial activities involved processing agricultural products, which were available on a seasonal basis. By the early post-bellum period (1870 and 1880) when the relevant data on the seasonality of manufacturing activity first became available, "the typical establishment (weighted by the value of its capital stock or by employment)…operated for 12 months on a full-time-equivalent basis." Part-time establishments had not disappeared, but they were smaller and less capital intensive.[48]

Historians have debated the role of natural time and clock time in the antebellum South. Eugene Genovese, reflecting the dominant view, argued that the southern plantation "setting remained rural, and the rhythms of work followed seasonal fluctuations. Nature remained the temporal reference point for the slaves."[49] Mark M. Smith has pushed a revisionist perspective, asserting that after 1830 southerners came to view the clock as the "legitimate arbiter of time."[50] To address the regularity, seasonality, and duration of work on slave plantations, we have surveyed about 800 slave narratives and oral histories. Of these, about one-in-four gave an indication of the daily hours of work including both starting and ending times. Of this latter group, 90 percent were consistent with the notion that the hours extended from "sunrise to sunset," from "kin to can't" or from "before daylight to dark" (or "almost dark" or "after dark"), or "all day." Clearly the plantation work schedule depended on natural conditions, such as the seasonal variability of light. The same was undoubtedly true of northern farms (although the seasonal variation obviously increased with latitude).[51]

Work and life on slave plantations were far more regimented than on northern farms. The regimentation was crucial for the mobilization of all able-bodied hands for

field work, especially during the picking season. The laborers on a given plantation were awakened by the same horn and sent into the fields under the same supervisors. The provision of food, clothing, and housing was also centrally controlled. In early American textile factories many workers lived in dormitories and ate in communal facilities. Many labored under factory discipline subject to explicit work rules.[52] Hence, there were some parallels with the slave labor force (we emphasize *some*). But this regimentation of factory housing gave way to more dispersed and presumably more efficient living arrangements as the composition of the labor force evolved and as suppliers of housing and food supplanted factory provision as a part of the general process of vertical disintegration. The continuing extent of regimentation of slaves on plantations exceeded that prevailing in factories.

Slaves as Machine Parts

In 1956, Martin Luther King, Jr. observed that under slavery African-Americans were "considered a thing to be used, not a person to be respected. He was merely a depersonalized cog in a vast plantation machine."[53] King was neither the first nor last to conger the image of slaves working like machines or being treated as parts of a larger mechanism. The "Rules" of Bennet H. Barrow's Highland Plantation read "A plantation might be considered as a piece of machinery, to operate successfully, all of its parts should be uniform and exact, and the impelling force regular and steady; and the master … should be their impelling force…."[54] In his *Journey in the Back Country*, Frederick Law Olmsted characterized slaves on Mississippi Valley cotton plantations as laboring in a "stupid, plodding, machine-like manner." As an example, he noted the case of "nearly two hundred hands… moving across the field in parallel lines, with a considerable degree of precision…." Even when he and others charged by on horse, the slaves toiled without "the smallest change or interruption…."[55]

The immediate victims of the slavery often invoked a different analogy, one that was more organic and less mechanical.[56] Frederick Douglass described slaves as being treated akin to livestock. Upon his master's death and the division of the estate: "We were all ranked together at the valuation. Men and women, old and young, married and single, were ranked with horses, sheep, and swine. There were horses and men, cattle

and women, pigs and children, all holding the same rank in the scale of being, and were all subjected to the same narrow examination…the same indelicate inspection."[57] In *Twelve Years a Slave*, Solomon Northup referred to slaves in transport and trade as being treated like "human cattle."[58] Slave owners were deeply interested in the rate of increase of their slave population and exerted extensive control over family life and the raising of children. Northup repeatedly emphasized the widespread use of corporal punishment on plantations.[59] And in the passage mentioned above, Olmsted observed the hoe hands were being threatened by a driver brandishing a whip. The sound of the whip cracking was intimation enough. Threats and displays of violence matter only for conscious beings making choices.

Apologists for the plantation system also emphasized its living and personal dimensions, including its penetration into almost every aspect of the slave's life. In 1918, Ulrich Phillips noted that on southern plantations there was "little of that curse of impersonality and indifference which too commonly prevails in the factories of the present-day world where power-driven machinery sets the pace, where the employers have no relations with the employed outside of work hours, where the proprietors indeed are scattered to the four winds, where the directors confine their attention to finance, and where the one duty of the superintendent is to procure a maximum output at a minimum cost."[60] In 1929, Phillips opined that contemporary urban industry "did not give work to women, their administration did not facilitate a cherishing of health or a training of the youth, and their limitations of capital excluded investment in persons who were not laborers. These, in short…were masculine enterprises conveniently ignoring family complications."[61]

Phillips did note that as an enterprise, either agricultural or industrial, grew in scale, eventually its owner could "no longer combine manual work with supervision…. [W]here full differentiation of administration from labor occurs, the shop becomes a factory, the farm changes into a factory, whatever the number of its operatives may be."[62] But in keeping with his general perspective, Phillips applied the factory analogies to West Indian plantations but found them less appropriate for the American South. Phillips wrote: "On the generality of the [West Indian sugar] plantations the tone of the management was too much like that in most modern factories. The laborers were

considered more as work-units than as men, women, and children. Kindliness and comfort, cruelty and hardship, were rated at balance-sheet value; births and deaths were reckoned in profit and loss, and the expense of rearing children was balanced against the cost of new Africans. These things were true in some degree in the North American slave-holding communities, but in the West Indies they excelled."[63] The slave owner in the American South often lived on the farm or plantation where his bondmen and bondwomen worked. Even the owners of the largest estates usually resided on or nearby their holdings. By Phillips' reckoning, they were not absentees but rather styled themselves as the heads of large plantation families.

The southern plantation went beyond the company town associated with some manufacturing and mining enterprises. In the company town, the firm served as the employer, landlord, store-keeper, and local government. (As Price Fishback notes, the very scope of the company's domain bred resentment and protest.[64]) The plantation owner controlled or sought to control family life, education, and religious life. More fundamentally, the plantation owner determined the slave's geographic location and, together with the surrounding community, prevented his or her escape. Even the most paternalistic manufacturing employer of the 1910s and 1920s when Phillips wrote did not exercise these powers.

These issues are related to the question about whether plantation agriculture was a business or a way of life. Whether it was a capitalist profit-seeking enterprise or a system for social control? For the apologist Phillips, the social control motives—maintaining white supremacy over African-Americans—was the dominant consideration. For most economic historians, the profit motive dominated the calculus. As Conrad and Meyer famously asserted, investing in a slave was like investing in any other capital asset.[65] But it does not impoverish one's historical analysis to acknowledge that both motives were likely at play.

Modern Management

A number of scholars have equated systematic exploitation of slave labor to factory discipline and later doctrines of scientific management. R. Keith Aufhauser argued that in their administration of labor, southern slaveholders anticipated and

conformed to F. W. Taylor's principles of scientific management. As an example, planter George Fitzhugh shared many of the Taylor's precepts regarding the lack of motivation, self-discipline, and intelligence among workers and about the need for constant supervision. Both Taylor and southern slaveholders sought through routine, task design, job enrichment, and physical coercion to secure greater work effort.[66]

Drawing such connections has a long history. Lewis Gray reads in George Washington's 1769 description of his wheat harvest an account that "savors a sort of Scientific Management."[67] Washington sought to reduce his use of hired cradlers and rely solely on his own enslaved labor force. To this end, he proposed to stagger his planting to spread out the harvest demands and to separate his cradler-binder crews into individual teams to speed up the pace of work above that achieved when all the cradlers worked together. Surely, concerns about work effort in groups long preceded Frederick Taylor.

Taylor attributed slow work to two causes. The first cause, associated with so-called "natural soldiering," was "natural laziness" or "natural instinct and tendency of men to take it easy." Taylor believed this characterized "the average man (in all walks of life)" and only "men of unusual energy, vitality, and ambition" choose on their own to work hard. The second cause, associated with so-called "systematic soldiering," was due to the "fallacy, which has from time immemorial been almost universal among workmen, that a material increase in the output of each man or each machine in the trade would result in the end in throwing a large number of men out of work."[68] The first cause has been the subject of great debate in the literature on slavery. One observer's "laziness" is another observer's "slave resistance and exercise of agency." The second cause is irrelevant, or largely so, in operation of slavery. The fear of losing work was not an issue, and Taylor's remedies do not apply. Slaves had other concerns. House slaves feared being moved to harder labor in the field, but this is explained by greater effort inducing disutility rather than a fear of unemployment. Slaves in general feared that if they were more energetic and more productive, their owners might ratchet up their allotted tasks. Taylor understood the ratchet effect, but he studied a world in which workers received a wage in a competitive economy. Workers could quit if management increased its demands, and managers had to worry about voluntary turnover. Such concerns were far less salient for slave owners.[69]

The dean of American business historians, Alfred D. Chandler, offered a mixed opinion on appellation of "factories in the field" to antebellum southern plantations. In his 1977 classic, *Visible Hand*, he argued that southern plantations were not in any meaningful way precursors to the development of modern business enterprise in America.[70] True, southern plantations were larger than contemporary family farms but they were not as large as New England textile factories. Chandler (incorrectly) asserted that plantation owners did not commonly employ white overseers and that management was not widely separated between ownership. When the plantation owners did employ overseers, their instructions (as reflected in the plantation rules) typically dealt with the treatment of slaves rather than other forms of capital. According to Chandler, the plantation books did not allow the comparison of performance of individual workers or the entire operation over meaningful stretches of time.

Other scholars have disagreed, pointing out that numerous plantations met Chandler's definition of modern business enterprise. Historian Bill Cooke goes so far as to say "visible hand was holding a whip."[71] Many plantation owners did utilize overseers and drivers to manage their operations.[72] Furthermore, a considerable number of plantation owners had multiple units. Those operating plantations within the same region—for example, with a home plantation and a bottomland plantation—often decided how to allocate the combined labor force, draft stock, and supplies (food, seed, and feed) across the units. In a technical sense, these plantations did fit Chandler's bill as employing salaried managers to allocate resources across distinct operating units without using market mechanisms. In addition, accounting historians describe plantation bookkeeping practices as being as sophisticated as those employed in the industrial North.[73]

We have spent more than a decade scouring archives for plantation accounts, chiefly with an eye to investigating work activities. The most popular cotton account book was produced by Thomas Affleck, of Mississippi and later Texas.[74] The first edition of the *Affleck Plantation Journal and Account Book* appeared in 1847. Within a few years, he offered different volumes for small, medium, and large plantations. In addition to space for a journal of daily activities, Affleck provided forms for listing the slaves' names, ages, and values, births and deaths, stock and equipment inventories, the weight

of individual cotton bales, the pounds of cotton picked daily by individual slaves, and other valuable information.[75] According to one source, Affleck sold between two and three thousand books per year.[76]

Thomas Affleck was the most famous but hardly the only or first producer of pre-printed cotton books.[77] In the 1850s, W. H. Fox of Natchez, Mississippi sold a similar product under the title "Statement of Cotton."[78] Other publishers released were copycat versions with similar general appearance as Affleck books.[79] In the early 1850s, J. W. Randolph of Richmond, Virginia produced a "Plantation & Farm Instruction, Regulation Record, Inventory & Account Book" with pre-printed pages for "Manager's Journal or Daily Record" as well as larger editions with "Daily Record of Cotton Picked."[80] There were a variety of earlier cotton books printed by others.[81] Even in the absence of pre-printed forms, planters and overseers often kept records in other, more generic, bound volumes. We agree with the accounting historians who argue that plantation record keeping represented signs of modernity and acquisitiveness, but we caution against overstating the case.

The "factories in the field" notion runs into a problem in the plantation account books. For all the attention given to labor, "fields" have little role in pre-printed account books. None of the books that we have studied offered any specific form relating to fields, their size, use, improvements, crop rotation, daily activities, or production. There are no forms for fertilizer use, land cleared, drainage, and other important activities on plantations. The layout of the Affleck ledgers and other account books are in accord with Gavin Wright's depiction of southern masters as being first and foremost labor lords rather than landlords.[82] The record-keepers sometimes mentioned what happened in specific fields, but the books are not structured to extract such information from the users or to make an organized accounting of activities easy. In the account books that we have surveyed, a small fraction of record keepers occasionally crafted their own schedules summarizing production (output and acreage) by field by year. Some kept separate diaries or logs of daily activities. Most did not.

The pre-printed plantation books were not set up to record the systematic use of incentives, negative or positive. Neither Thomas Affleck nor his competitors provided specific sheets for tallying whippings, for example. A few record keepers did note

lashing in the "Daily Record of Passing Events," but most were silent. The books did not include pages to enumerate payments to slaves for the produce grown on slave plots; there are no pages or prompts to document contest or tournament results. Again, surviving evidence depends on what the record keepers chose to add. Many scholars have touted picking contests as an important example of modern incentive practices. However, the records that we have seen suggest picking contests were rare events and of minor significance in the overall scheme of plantation life. Picking on Sundays, a practice which Affleck discouraged, was far more common than offering prizes to stimulate production.[83] Our reading of the plantation records and slave narratives suggests that the primary methods of incentivizing slaves were terror, corporal punishment, and the threat of family breakup.

While plantation bookkeeping was far more common than one might think, it was rarely meticulous for long periods. Even in the pre-printed books, practices were typically idiosyncratic and often incomplete. We have examined thousands of archival plantation records. This search allowed us to assemble a data base of individual-level picking records for some 113 antebellum plantations covering 396 crop years (or parts thereof).[84] In our sample, the number of years covered for individual plantations range from a one (the modal coverage with 43 cases) to 22 (in the remarkable records of Francis Terry Leak in Tippah, Mississippi). The mean coverage was 3.5 years; the standard deviation was 3.64 years; and the median coverage was 2.0 years. Among those 67 plantations with individual picking records covering more than a single year, 30 (or about 45 percent) have a break in the middle of the available records of one crop-year or more. The short span covered and the breaks in some of the records are undoubtedly, in part, due to destruction, loss, and failure of books to be archived. But chronological gaps in the coverage within the surviving volumes—starting in one year, stopping, and then picking up again after of months or even years—indicate lapses in the recording were common. Making long-run comparisons for individual plantations is difficult now and would have hard even in the antebellum period.

Accounting historian Jan Hierer found that in a sample of over 50 antebellum plantation books from Alabama and Mississippi, the record-keepers deviated significantly from the protocols that Affleck had established.[85] The data enumerated and the

accompanying diaries describing daily activities are very valuable for some purposes, but they fail to provide much information now considered central to modern accounting. It is important to recall that decades of research by historians with access to such records could not even resolve the fundamental debate about whether antebellum southern plantations were profitable. Systematic generalization on this issue from the individual cases has proved elusive. The alternative approach of Conrad and Meyer to addressing the profitability question is celebrated with good reason.

Showing that the managerial practices of these southern plantations actually informed those implemented at large industrial enterprises in the nineteenth and early twentieth centuries remains to be demonstrated. But the lack of evidence suggests that this line of causality was weak at best. A fair assessment is that many plantation owners desired an accounting of farm activities to judge the work of their overseers and to reckon how their business affairs changed over time, but the records kept (by design and practice) and the actual operations in the fields were far removed from the dictates of Taylor and other apostles of modern business management.

Conclusion

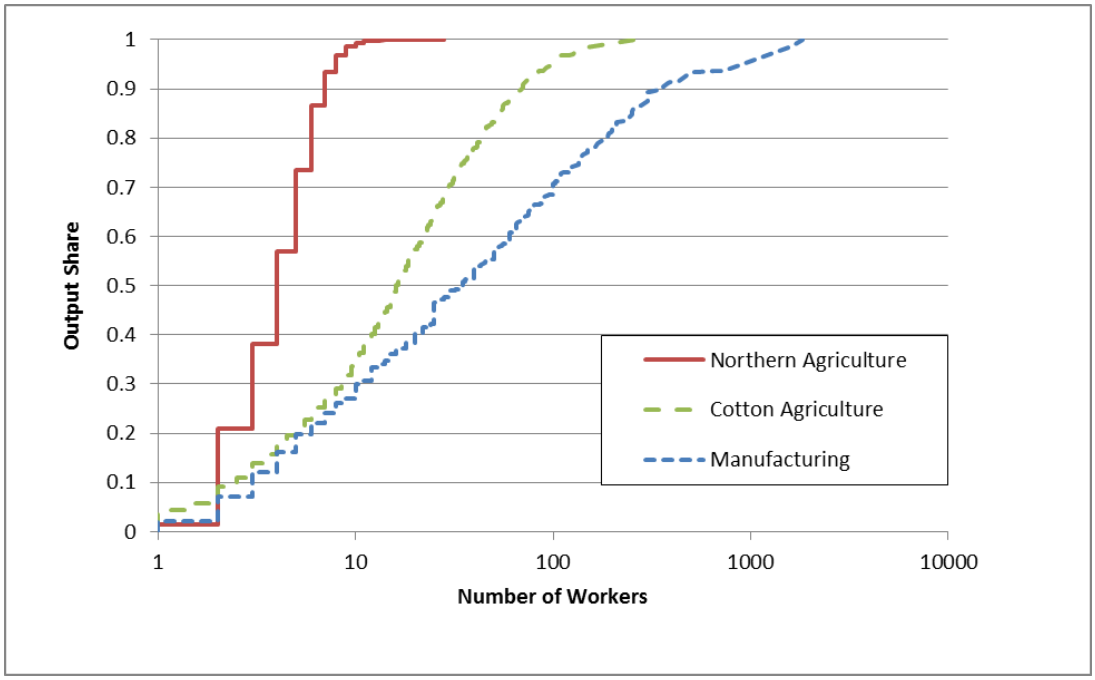
A formalist comparative history approach requiring constant definitions and standards shows plantations had some similarities and many differences with factories. Plantations used considerable labor—more than the median factory; plantations also had a high capital/labor ratio (counting land but not slaves as capital); many plantations employed professional managers as did many factories, and many plantation owners operated at more than one location. On the other hand there was a high turnover rate in plantation overseers and their oft described character flaws does not elicit visions of modern efficient supervisors; plantations carried on their primary business outdoors and were more susceptible to the conditions of daylight, the elements, and the season; and they used relatively little machinery.[86] Plantations kept records, but these were in many cases unsystematic and incomplete (we lack the expertise to compare these accounts to those kept by contemporary factories). The analogy of slave and machines appears not to work; the victims of the system compared their treatment to that of draft animals. The management of offspring, along with the doling out of whippings and rationing of food,

had little parallel with machines in a factory. Cotton plantations did not employ anything approaching an assembly line or even the batch system found in northern factories. In this key area the evidence does not support the popular claims.

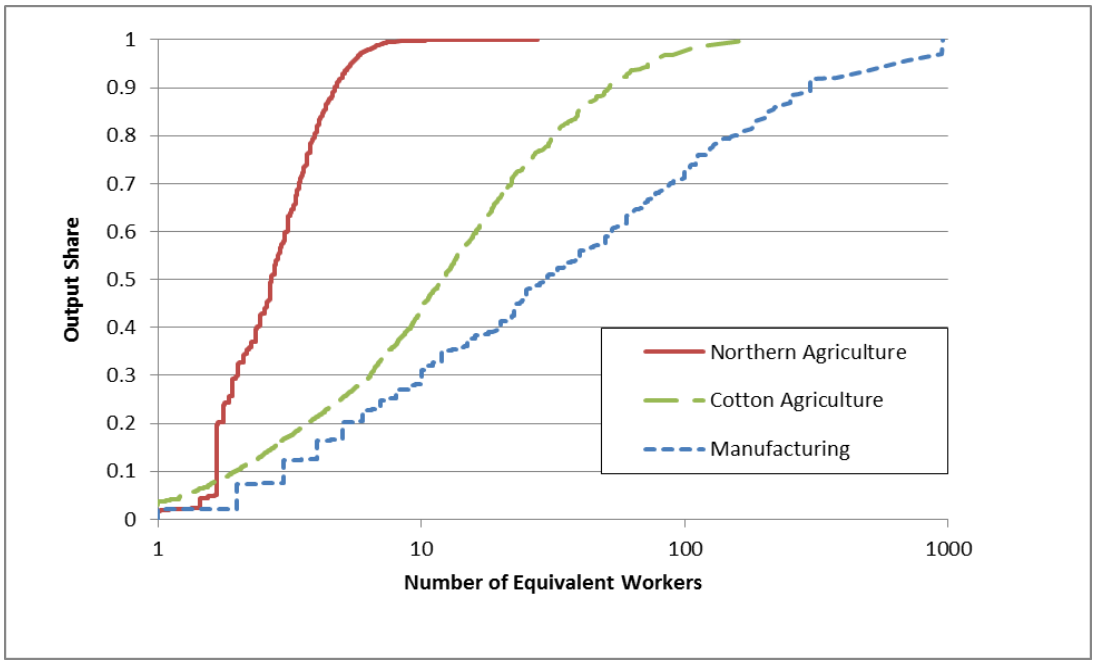
Our overall assessment is that the notion that slave plantations operated as "factories in the field" was adapted from its original negative connotation to help conjure a powerful but unwarranted image of modernity and efficiency. Even the most modern, progressive planters faced production and management challenges and employed managerial methods that were different in fundamental ways from those confronted in managing a factory. The view from the workers' perspective was also dramatically different. Although the term "factories in the field" may have a nice ring to it, southern plantations were not akin to the emerging northern factories.

Figure 1: Distribution of Output by Size of Operation, 1860

a. Number of Workers

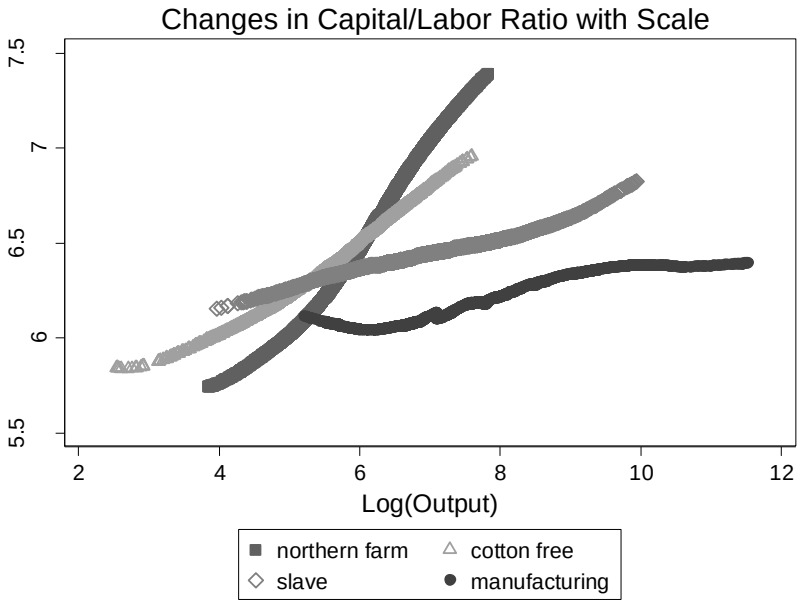


b. Number of Adult Male Equivalent Workers

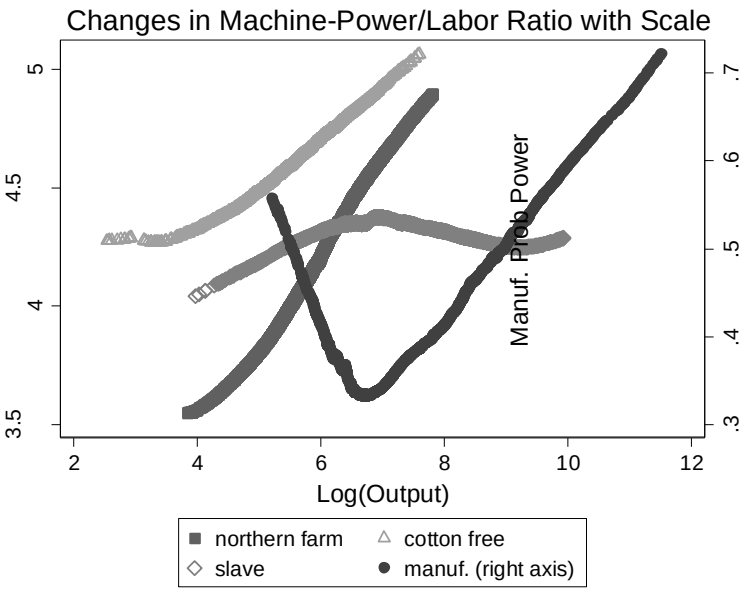


Notes and Source: See text for weights used to calculate equivalent workers. Data from Bateman-Foust, Parker-Gallman, and Atack-Bateman samples.

Figure 2: Expansion Paths as Revealed by Locally Weighted Regressions
Panel A



Panel B



Notes: The figures are for "All Labor"; the analogues for "Adult Male Equivalent Labor" are similar. The observations accounting for the top and bottom one percent of output are trimmed from each series.

Table 1:

Percentage Distribution of Manufacturing Activity by Scale and Power, 1850 and 1880

		1850		1880	
	Scale	No Power	Power	No Power	Power
Establishments	Small	61.0	29.2	59.6	26.4
	Large	5.3	4.5	5.7	8.3
Workers	Small	28.2	12.7	16.8	9.3
	Large	26.0	33.2	24.5	49.4
Value Added	Small	21.0	22.4	11.3	14.2
	Large	32.7	23.9	35.9	38.6

Source and Notes: Atack, Bateman, and Margo, "Capital Deepening," p. 593. Small Scale is 15 or fewer employees; Large Scale is 16 or more.
Power includes the use of steam or water power.

Table 2: Comparing Output across Organization Forms

Summary Statistics	Mean	St. Dev	Min	Max	Obs
Log(Output)	6.426	1.217	-0.879	13.560	19371
Northern Agriculture	0.559	0.496	0	1	19371
Log(Output)	6.094	0.787	0.507	10.437	10662
Cotton Free	0.131	0.337	0	1	19371
Log(Output)	5.555	0.906	-0.879	9.793	2529
Cotton Slave 1-15	0.091	0.288	0	1	19371
Log(Output)	6.562	0.969	0.219	9.707	1764
Cotton Slave 16-49	0.033	0.179	0	1	19371
Log(Output)	7.994	0.887	1.962	11.189	643
Cotton Slave 50+	0.008	0.087	0	1	19371
Log(Output)	9.146	0.888	4.449	11.669	148
Manufacturing	0.183	0.386	0	1	19371
Log(Output)	7.621	1.389	3.219	13.560	3466
Mill	0.065	0.247	0	1	19371
Log(Output)	7.441	1.232	3.219	11.963	1261
Artisanal Shop	0.093	0.290	0	1	19371
Log(Output)	7.219	0.985	4.317	11.626	1796
Manufactory	0.010	0.100	0	1	19371
Log(Output)	9.628	1.014	6.751	13.137	196
Factory	0.011	0.104	0	1	19371
Log(Output)	10.234	1.102	6.380	13.560	213

Explaining Log(Output)			
Full Specification	Coeff.	RSE	Cl. SE
Northern Agriculture	-4.141	(0.076)	(1.43E-11)
Cotton Free	-4.680	(0.077)	(1.43E-11)
Cotton Slave 1-15	-3.673	(0.079)	(1.43E-11)
Cotton Slave 16-49	-2.240	(0.083)	(1.43E-11)
Cotton Slave 50+	-1.089	(0.104)	(1.43E-11)
Mill	-2.794	(0.083)	(1.93E-11)
Artisanal Shop	-3.016	(0.079)	(1.21E-11)
Manufactory	-0.607	(0.104)	(1.63E-11)
Constant	10.234	(0.061)	(1.43E-11)
R^2	0.47		
Obs.	19371		

Notes: Robust standard errors correct for heterogeneity only; clustered standard errors are clustered at the sector level. A "Factory" is defined as an establishment with an inanimate power source and 16 or more employees; a "Mill" is establishment with an inanimate power source and 15 or fewer employees; a "Manufactory" is defined as an establishment with no inanimate power source and 16 or more employees; an "Artisanal Shop" is an establishment with no inanimate power source and 15 or fewer employees.

Table 3: Comparing Output/Labor Ratios across Organization Forms

Summary Statistics	Mean	St. Dev	Min	Max	Obs
Log(Output/Labor)	5.165	0.971	-1.978	10.354	19371
Log(Output/Equiv. Labor)	5.434	0.901	-1.788	10.354	19371

	Log(Output/Labor)			Log(Output/Equiv. Labor)		
Full Specification	Coeff.	RSE	Cl. SE	Coeff.	RSE	Cl. SE
Northern Agriculture	-1.490	(0.059)	(8.6E-12)	-1.261	(0.056)	(4.6E-12)
Cotton Free	-1.294	(0.061)	(8.6E-12)	-1.246	(0.058)	(4.6E-12)
Cotton Slave 1-15	-1.320	(0.062)	(8.6E-12)	-1.164	(0.059)	(4.6E-12)
Cotton Slave 16-49	-1.168	(0.066)	(8.6E-12)	-0.982	(0.064)	(4.6E-12)
Cotton Slave 50+	-1.125	(0.087)	(8.6E-12)	-0.944	(0.084)	(4.6E-12)
Mill	0.112	(0.063)	(9.2E-12)	-0.003	(0.061)	(5.2E-12)
Artisanal Shop	-0.106	(0.061)	(9.2E-12)	-0.198	(0.058)	(4.7E-12)
Manufactory	-0.421	(0.084)	(8.2E-11)	-0.342	(0.078)	(4.6E-12)
Constant	6.324	(0.058)	(8.6E-12)	6.453	(0.056)	(4.6E-12)
R^2	0.30			0.22		
Obs.	19371			19371		

Notes: Robust standard errors correct for heterogeneity only; clustered standard errors are clustered at the sector level. See Table 2 for definitions.

Table 4: Capital/Labor Ratios in Manufacturing and Agriculture, 1860
Log of Ratio in Dollars/Worker

	All Labor		Equiv. Labor		Obs.
	Mean	SD	Mean	SD	
All Manufacturing	6.182	1.133	6.226	1.111	3466
Artisanal Shop	5.791	1.001	5.828	0.993	1796
Manufactory	5.260	1.204	5.468	1.126	196
Mill	6.839	0.962	6.852	0.958	1261
Factory	6.435	0.962	6.564	0.936	213
Northern Farms	6.544	0.854	6.903	0.838	10821
Cotton Sample	6.418	0.822	6.651	0.811	5084
Cotton Free	6.385	0.899	6.561	0.880	2529
Cotton Slave	6.450	0.736	6.741	0.726	2555
Slave, 1 to 15	6.470	0/744	6.752	0.733	1764
Slave, 16 to 49	6.384	0.696	6.699	0.688	643
Slave, 50 plus	6.491	0.803	6.801	0.793	148

Table 5: Comparing Capital/Labor Ratios Across Organization Forms Controlling for Output

Summary Statistics	Mean	St. Dev	Min	Max	Obs
Log(Capital/Labor)	6.498	0.880	1.708	10.451	18953
Log(Capital/Equiv. Labor)	6.672	0.894	2.54	10.449	18953

	Log(Capital/Labor)			Log(Capital/Equiv. Labor)		
Full Specification	Coeff.	RSE	Cl. SE	Coeff.	RSE	Cl. SE
Log(Output)	0.327	(0.008)	(0.110)	0.339	(0.008)	(0.116)
Northern Agriculture	1.462	(0.072)	(0.449)	1.742	(0.072)	(0.478)
Cotton Free	1.479	(0.074)	(0.508)	1.583	(0.074)	(0.541)
Cotton Slave 1-15	1.235	(0.071)	(0.399)	1.433	(0.071)	(0.424)
Cotton Slave 16-49	0.681	(0.071)	(0.243)	0.894	(0.071)	(0.259)
Cotton Slave 50+	0.412	(0.089)	(0.118)	0.606	(0.089)	(0.126)
Mill	1.316	(0.073)	(0.303)	1.235	(0.073)	(0.323)
Artisanal Shop	0.341	(0.072)	(0.327)	0.286	(0.072)	(0.348)
Manufactory	-0.977	(0.106)	(0.066)	-0.890	(0.106)	(0.070)
Constant	3.091	(0.104)	(1.111)	3.094	(0.104)	(1.182)
R^2	0.19			0.24		
Obs.	19371			19371		

Notes: Robust standard errors correct for heterogeneity only; clustered standard errors are clustered at the sector level. See note to Table 2 for definitions.

Table 6: Composition of Agricultural Capital Stock

	Land and Buildings	Livestock	Implements	Implements and Draft Stock
	percent	percent	percent	percent
Northern	83.4	13.4	3.1	9.2
Cotton	80.1	16.3	3.6	10.7
Free	69.5	26.8	3.7	18.5
Slave	81.7	14.7	3.6	9.6
Slave, 1 to 15	76.8	19.6	3.5	12.1
Slave, 16 to 49	81.0	15.6	3.5	9.4
Slave, 50 plus	87.2	9.1	3.7	7.3

Notes: “Implements and Draft Stock” include the value of work animals, not all livestock.

[1] Kenneth Stampp, *The Peculiar Institution: Slavery in the Ante-Bellum South* (New York: Vantage Books, 1956), p. 42.
[2] Carey McWilliams, *Factories in the Field: The Story of Migratory Farm Labor in California* (Boston: Little-Brown, 1939). A text search reveals the combination of words appears earlier, but its meaning does not relate to agricultural operations. The heading "Factories in the Field" had first appeared over a series of articles by Carey McWilliams and Clive Belmont, Jr. (aka Herbert A. Klein) in *Pacific Weekly*, 30 March 1936, pp. 105-07; 6 April 1936, pp. 131-33; 13 April 1936, pp. 199-201; 27 April 1936, pp. 231-32; 4 May 1936, pp. 247-49; 11 May 1936, pp. 265-67. See Carey McWilliams Papers, Collection No. 1319, Box 64, Scrapbook XV, Department of Special Collections, Charles E. Young Research Library, Univ. of California, Los Angeles. See also Peter Richardson, *American Prophet: The Life and Work of Carey McWilliams* (Ann Arbor, MI: Univ. of Michigan Press, 2005), pp. 75-92. In a 1982 interview, Klein claimed credit for suggesting the phrase. Greg Critser, "The Political Rebellion of Carey McWilliams," *UCLA Historical Journal* 4 (1983), pp. 34-65, esp. p. 53.
[3] Carey McWilliams, "Farms into Factories: Our Agricultural Revolution," *Antioch Review* 1:4 (Winter 1941), pp. 406-31. Writing in roughly the same period as McWilliams, two leading scholars of agricultural history—Paul S. Taylor and Ulrich B. Phillips—drew parallels between the large-scale California farms and the southern slave plantation. Paul S. Taylor, "Plantation Agriculture in the United States: Seventeenth to Twentieth Centuries," *Land Economics* 30:2 (May 1954), pp. 141-52. Ulrich B. Phillips, "Plantations with Slave Labor and Free," *American Historical Review* 30:4 (July 1925), pp. 738-53.
[4] Jeremy Atack and Fred Bateman, *To Their Own Soil: Agriculture in the Antebellum North* (Ames, IA: Iowa State Univ. Press, 1987), pp. 11-12; 37-101.
[5] Jeremy Atack, Michael R. Haines, and Robert A. Margo, "Railroads and the Rise of the Factory: Evidence for the United States, 1850-70," in Paul W. Rhode, Joshua Rosenbloom, and David Weiman, eds., *Economic Evolution and Revolution in Historical Time* (Stanford, CA: Stanford Univ. Press, 2011), pp. 162-79.
[6] Jacob Metzer, "Rational Management, Modern Business Practices, and Economies of Scale in Antebellum Southern Plantations," *Explorations in Economic History* 12:2 (April 1975), pp. 123-50.
[7] David Nye, *America's Assembly Line* (Cambridge, MA: MIT Press, 2013), p. 2 observes: "The assembly line emerged in a specific place (Detroit), at a specific time (between 1908 and 1913), in a specific industry (the automobile industry). But it also expressed trends in American society that can be discerned during the nineteen century." Ford and his engineers took inspiration from Cincinnati pork-processing plants.
[8] Robert W. Fogel, and Stanley L. Engerman, *Time on the Cross: The Economics of American Negro Slavery* (Boston: Little, Brown, 1974), Vol. I, p. 203.
[9] Robert W. Fogel, *The Slavery Debates, 1952-1990: A Memoir* (Baton Rouge: Louisiana State Univ. Press, 2003), pp. 46-47.
[10] *Chicago Tribune*, 25 Feb. 1994, p. 20.
[11] Sidney Mintz, *Sweetness and Power: The Place of Sugar in Modern History* (New York: Viking Penguin, 1985), pp. 50-52.
[12] Robert J. Follett, *The Sugar Masters: Planters and Slaves in Louisiana's Cane World, 1820-1860* (Baton Rouge: Louisiana State Univ. Press, 2005), pp. 92-117.
[13] Peter A. Coclanis, "How the Low Country Was Taken to Task: Slave-Labor Organization in Coastal South Carolina and Georgia," in Robert L. Paquette and Louis A. Ferleger, eds. *Slavery, Secession, and Southern History* (Charlottesville, VA: Univ. Press of Virginia, 2000), pp. 59-78, esp. p. 61 labels "factories in the fields" a "nineteenth-century metaphor."
[14] Michael Chevalier, *Society, Manners, and Politics in the United States; Being a Series of Letters on North America* translated from the Third Paris Edition (Boston: Weeks, Jordan, 1839), p. 400. We thank Peter Coclanis for calling this source to our attention.
[15] Carroll D. Wright, "Report on the Factory System of the United States," in U.S. Census Office, *Tenth Census of the United States: Manufactures, 1880* (Washington: GPO, 1882), p. 523
[16] Andrew Ure, *Philosophy of Manufacturers* (London: Charles Knight, 1835), p. 13.
[17] Paul Mantoux, *The Industrial Revolution in the Eighteenth Century: An Outline of the Beginnings of the Modern Factory System in England* (New York: Harper and Row, 1961, orig. published in 1928), pp. 38-

39. The definition has to be adjusted with the evolution of power technologies, including the introduction of electricity. See Warren D, Devine, Jr., "From Shafts to Wires: Historical Perspective on Electrification," *Journal of Economic History* 43:2 (June 1983), pp. 347-72.

[18] Mills also relied on inanimate power sources but did not utilize specialization or the division of labor as extensively as factories. Atack acknowledged the dividing line between mills and factories was "arbitrary," but he assumed "specialization could not be practiced extensively" unless the plant employed a large labor force. He initially set the threshold at 25 workers but later lowered the number to 15. Jeremy Atack, "Economies of Scale and Efficiency Gains in the Rise of the Factory in America, 1820 -1900," in Peter Kilby, ed., *Quantity & Quiddity: Essays in U. S. Economic History* (Middletown, CN: Wesleyan Univ. Press, 1987), pp. 286-335, esp. pp. 287-88.

[19] Jeremy Atack, Fred Bateman, and Robert A. Margo, "Capital Deepening and the Rise of the Factory: the American Experience during the Nineteenth Century," *Economic History Review* 58:3 (Aug. 2005), pp. 586-95; Jeremy Atack, Fred Bateman, and Robert A. Margo, "Steam Power, Establishment Size, and Labor Productivity Growth in Nineteenth Century American Manufacturing," *Explorations in Economic History* 45 (2008), pp. 185-98. This work adopted the 15-worker threshold and separated the power use and scale dimensions.

[20] Atack, Bateman, and Margo, "Capital Deepening," p. 593.

[21] Peter Kolchin, *American Slavery 1619–1877* (New York: Hill and Wang, 1993), p. xiii.

[22] Ulrich B. Phillips, "The Origin and Growth of the Southern Black Belts," *American Historical Review* 11:4 (July 1906), pp. 798-816.

[23] Alfred D. Chandler, Jr., *The Visible Hand: The Managerial Revolution in American Business* (Cambridge, MA: Harvard Univ. Press, 1977), pp. 1-3.

[24] Frederick W. Taylor, *The Principles of Scientific Management* (New York: Harper & Brothers, 1913), pp. 9-29. "Soldiering" involves making a show of working in order to escape punishment.

[25] Nye, *America's Assembly Line*, pp. 22-27.

[26] Henry Ford with Samuel Crowther, *My Life and Work* (Garden City, NY: Garden City Publishing Co., 1923), p. 80.

[27] Letter to Henry Ford, 23 Jan. 1914, assessed 16 April 2014, from http://www.thehenryford.org/exhibits/smartfun/modelt/highlandpark/fivedollar/photo1big.html.

[28] William N. Parker and Robert E. Gallman, Southern Farms Study, 1860 [Computer file]. ICPSR07419-v1. Ann Arbor, MI: Inter-university Consortium for Political and Social Research [distributor], 1991. doi:10.3886/ICPSR07419; Fred Bateman and James D. Foust, Agricultural and Demographic Records for Rural Households in the North, 1860. ICPSR07420-v1. Ann Arbor, MI: Inter-university Consortium for Political and Social Research [distributor], 1976. doi:10.3886/ICPSR07420.v1.; for the Atack-Bateman sample; we use the 1860 national sample downloaded from my.vanderbilt.edu/jeremyatack/data-downloads/.

[29] U.S. Census, *Instructions to U.S. Marshals; Instructions to Assistants* (Washington: Bowman, 1860).

[30] The national crop prices for 1860 are from Marvin W. Towne and Wayne D. Rasmussen, "Farm Gross Product and Gross Investment in the Nineteenth Century," in William Parker, ed., *Studies in Income and Wealth, Vol. 24 Trends in the American Economy in the Nineteenth Century* (Princeton, NJ: Princeton Univ. Press for the NBER, 1960), pp. 255-316. We made no adjustment as in Elizabeth Field-Hendrey's work to re-estimate meat production in the South or to include estimates for missing products. We did not include the value of home manufacturing or adjust for the differences in procedures used to create the Bateman-Foust and Parker-Gallman samples.

[31] U.S. Census, *Instructions to U.S. Marshals; Instructions to Assistants* (Washington: Bowman, 1860); National Archives and Records Administration, "1860 Agricultural Census Schedule," NA Form 14131e (6/03), www. archives.gov.; U.S. Census, *Manufactures of the United States in 1860; Compiled from the Original Returns of the Eighth Census* (Washington: GPO, 1865), pp. ix-ccxvii; Jeremy Atack and Fred Bateman, "Nineteenth-Century U.S. Industrial Development through the Eyes of the Census of Manufactures," *Historical Methods* 32: 4 (Fall 1999), pp. 177-188; U.S. Census, *Agriculture on the United States in 1860 Compiled from the Original Returns of the Eighth Census* (Washington: GPO, 1864), pp. viii-clxxii.

[32] Atack, Bateman, and Margo, "Capital Deepening," p. 591. Total employment sums the males and females in the manufacturing labor force; adult-male-equivalent employment assigns a weight of 1 to males; and 0.5 to females. We did not follow their practice of imputation entrepreneurial inputs by adding one worker. We did follow their practice of dropping observations for establishments reporting non-positive value added (the value of product minus the cost of raw materials), raw materials, total employment, or capital.

[33] Lee A. Craig, *To Sow One Acre More: Childbearing and Farm Productivity in the Antebellum North* (Baltimore, MD: Johns Hopkins Univ. Press, 1993), p. 80 provides regression results on the dollar value of household labor in northern agriculture that are consistent with prime-age-adult-male (age 18-54) weights of 0.67 for adult females (18 years and over), 0.77 for senior adult males (55 years and over), 0.25 for teenage males (13-17 years), and 0.10 for children (under 13 years) and teenage females (13-17 years).

[34] Robert W. Fogel and Stanley L. Engerman, "Explaining the Relative Efficiency of Slave Agriculture in the Antebellum South," *American Economic Review* 67:3 (June 1977), pp. 275-96. These weights exceed unity in some cases, allowing equivalent labor to exceed raw labor. Our labor force numbers cover the ages 12 years and over. Our calculations assign one-half of those in the 10-14 age category to the total labor force, which in some cases results in estimates with fractions.

Gavin Wright, *Slavery and American Economic Development* (Baton Rouge, LA: Louisiana State Univ. Press, 2006), p. 106 highlights the sensitivity of the empirical outcomes regarding the relative efficiency of slave plantations and free farms to the labor weights assumed. He also points to the difficulties arising from the valuation of land (pp. 102-06).

[35] The agricultural schedule also inquired about the acreage of "improved" and "unimproved" land.

[36] We calculate the value of capital in draft stock by multiplying the sum of horses, mules, oxen (weighted by 0.5) times the national equine price of $59 per head from Towne and Rasmussen, "Farm Gross Product," p. 286. The one-half weight on oxen roughly captures the typical price ratio between bovine and equine draft power sources. See Alan L. Olmstead and Paul W. Rhode, *Creating Abundance: Biological Innovation and American Agricultural Development* (New York: Cambridge Univ. Press, 2008), p. 364.

[37] Gallman based the estimates on figures in U.S. Census Office, *Twelfth Census of the United States*, Vol. 7, Pt. I (Washington: GPO, 1902), p. xcvii.

[38] Atack, Bateman, and Margo, "Capital Deepening," p. 591.

[39] Heywood W. Fleisig, "Slavery, the Supply of Labor, and the Industrialization of the South," *Journal of Economic History* 36: 3 (Aug. 1976), pp. 572-97.

[40] Wright, *Slavery*, pp. 119-21.

[41] Atack, Bateman, and Margo, "Capital Deepening," p. 591 report that controlling for power use, manufacturing operations in 1880 in the higher employment category have higher capital-labor and capital-effective-labor ratio than those with fewer employees. In their sample, the "mechanical" inverse relationship between the capital-labor ratio and employment does not hold.

[42] The regressions were run using the lowess command in Stata. The bandwidth was 0.8 for all but the manufacturing power series where 0.4 was used. To avoid distracting clutter, we have trimmed the observations accounting for one percent of output at the top and bottom ends from each of the graphed series.

[43] The most of the powered manufacturing establishment operating at a scale below this threshold were located out of cities (95 percent), used water power (80 percent), and milled either lumber (50 percent) or grain (29 percent).

[44] Stampp, *Peculiar Institution*, pp. 37-38.

[45] We thank Gavin Wright for this point.

[46] Ralph V. Anderson and Robert E. Gallman, "Slaves as Fixed Capital; Slave Labor and Southern Economic Development," *Journal of American History* 64:1 (June 1977), pp. 24-46, esp. p. 32 notes that in "most of the cases examine, the planter attempted to satisfy his requirements for artisan and construction work with resident slave labor."

[47] Gavin Wright, *Old South, New South: Revolutions in the Southern Economic Since the Civil War* (New York: Basic Books, 1986), pp. 21-24, 39-43; David F. Weiman, "Staple Crops and Slave Plantations: Alternative Perspectives on Regional Development in the Antebellum Cotton South" in Louis Ferleger, ed.,

Agriculture and National Development: Views on the Nineteenth Century (Ames, IA: Iowa State Univ. Press, 1990), pp. 119-61, esp. p. 135.
[48] Jeremy Atack, Fred Bateman, and Robert A. Margo, "Part-Year Operations in Nineteenth Century American Manufacturing: Evidence from the 1870 and 1880 Censuses," *Journal of Economic History* 62:3 (Sept. 2002), pp. 792-809, esp. p. 793 and 807.
[49] Eugene Genovese, *Roll, Jordan, Roll: The World the Slaves Made* (New York: Pantheon, 1974), p. 291.
[50] Mark M. Smith, *Mastered by the Clock: Time, Slavery, and Freedom in the American South* (Chapel Hill, NC: Univ. of North Carolina Press, 1997), p. 240.
[51] Our search of slave narratives is still ongoing. To date, we have examined narratives posted online by the Library of Congress, *Born in Slavery: Slave Narratives from the Federal Writers' Project*, 1936-1938, http://memory.loc.gov/ammem/snhtml/snhome.html; we have also mined information found in numerous published slave narratives.
[52] Caroline F. Ware, *The Early New England Cotton Manufacture: A Study in Industrial Beginnings* (Boston: Houghton Mifflin, 1931), pp.236-68, esp. 263-66. These conditions invoke complaints such as "Some of the Beauties of Our Factory System—Otherwise Lowell Slavery," in *Factory Tracts. Factory Life As It Is*, No. 1 (Lowell, MA, 1845).
[53] Martin Luther King, Jr., *A Testament of Hope: The Essential Writings of Martin Luther King, Jr.*, James M. Washington, ed. (San Francisco: Harper & Row, 1986), p. 136.
[54] Bennet Hilliard Barrow, and Edwin Adams Davis, *Plantation Life in the Florida Parishes of Louisiana, 1836 - 1846: As Reflected in the Diary of Bennet H. Barrow* (New York: AMS Press, 1967), pp. 406-10. Barrow maintained a system of punishment inconsistent with treating his slaves as mere machine parts.
[55] Frederick Law Olmsted, *A Journey in the Back Country* (New York: Mason, 1860), pp. 81-82.
[56] David Brion Davis, *The Problem of Slavery in the Age of Emancipation* (New York: Alfred A. Knopf, 2014), pp. 15-44 provides an insightful analysis of the treatment of slaves as brute animals.
[57] Frederick Douglass, *Narrative of the Life of Frederick Douglass, an American Slave* (Garden City, NY: Doubleday, 1963, originally published in 1845), pp. 47-48.
[58] Solomon Northup, *Twelve Years a Slave*, ed. by Sue Eakin and Joseph Logsdon (Baton Rouge: Louisiana State Univ. Press, 1975, originally published in 1853), pp. 134, 138
[59] Northup, *Twelve Years*, passim.
[60] Ulrich B. Phillips, *American Negro Slavery* (Baton Rouge: Louisiana State Univ. Press, originally published 1918, reprinted 1966), p. 307.
[61] Ulrich B. Phillips, *Life and Labor in the Old South* (Boston: Little-Brown, 1929), p. 173.
[62] Phillips, *Life and Labor*, p. 305. For commentary, see Metzer, "Rational Management," pp. 124-25.
[63] Phillips, *American Negro Slavery*, p. 52.
[64] Price V. Fishback, *Soft Coal, Hard Choices: The Economic Welfare of Bituminous Coal Miners, 1890-1930* (New York: Oxford Univ. Press, 1992), pp. 133-70, esp. 166.
[65] Alfred H. Conrad and John R. Meyer, "The Economics of Slavery in the Ante Bellum South," *Journal of Political Economy* 66:2 (April 1958), pp. 95-130.
[66] R. Keith Aufhauser, "Slavery and Scientific Management," *Journal of Economic History* 33:4 (Dec. 1973), pp. 811-43.
[67] Lewis C. Gray, *History of Agriculture in the Southern United States to 1860* (Washington: Carnegie Institution, 1933), Vol. I, p. 550. See also Metzer, "Rational Management;" and Steven G. Collins, "System, Organization, and Agricultural Reform in the Antebellum South, 1840-1860," *Agricultural History* 75:1 (Winter 2001), pp. 1-27.
[68] Taylor, *Principles*, pp. 22-24.
[69] John Brown, *Slave Life in Georgia: A Narrative of the Life, Suffering, and Escape of John Brown…,* ed. by L. A. Chamerovzow, 2nd ed. (London: W. M. Watts, 1855, reprint 1971), p. 128.
[70] Chandler, *Visible Hand*, pp. 64-67.
[71] Bill Cooke, "The Visible Hand was Holding a Whip: The Denial of Slavery in Management Studies," Institute for Development Policy and Management, Univ. of Manchester, Discussion Paper No. 68 (July 2002); Bill Cooke, "The Denial of Slavery in Management Studies," *Journal of Management Studies* 40:8 (2003), pp. 1895-1918.

[72] William Kauffman Scarborough, *The Overseer: Plantation Management in the Old South* (Baton Rouge, LA: Louisiana State Univ. Press, 1966); Bassett, *Southern Plantation Overseer*. In a chapter entitled "Factories in the Fields: The Managerial Ideal and Plantation Realities," Oakes goes so far as to call the ideal plantation a "bureaucracy" achieving worker obedience and community harmony through the systematic imposition of rules by a managerial hierarchy. See James Oakes, *The Ruling Race: A History of American Slaveholders* (New York: Alfred A. Knopf, 1982), pp. 153-58.

[73] In interesting new work focusing on the use of pre-printed account books, Caitlin Rosenthal builds on the theme that plantations were modern business enterprises. Caitlin C. Rosenthal, "Slavery's Scientific Management: Accounting for Mastery," in *Slavery's Capitalism*, Seth Rockman, S. Beckert, and D. Waldstreicher, eds. (Philadelphia, PA: Univ. of Pennsylvania Press, forthcoming). See also Dale L. Flescher and Tonya K. Flescher, "Human Resource Accounting in Mississippi before 1865," *Journal of Accounting and Business Research* 10 (Supplement, 1981), pp. 124-29; D. Barney and Dale L. Flesher, "Early Nineteenth-Century Productivity Accounting: the Locust Grove Plantation Ledger," *Accounting, Business and Financial History* 4:2 (1994), pp. 275-94; Richard K. Fleischman and Thomas N. Tyson, "Accounting in Service to Racism: Monetizing Slave Property in the Antebellum South, *Critical Perspectives on Accounting* 15 (2004), pp. 376-99.

[74] Robert W. Williams, "Thomas Affleck: Missionary to the Planter, the Farmer, and the Gardener," *Agricultural History* 31:3 (July 1957), pp. 40-48.

[75] Alan L. Olmstead and Paul W. Rhode, "Biological Innovation and Productivity Growth in the Antebellum Cotton Economy," *Journal of Economic History* 68:4 (Dec. 2008), pp. 1123-71, esp. pp. 1144-46.

[76] Blake Touchstone, "Planters and Slave Religion in the Deep South," in John B. Boles, ed., *Masters & Slaves in the House of the Lord: Race and Religion in the American South, 1740-1870* (Lexington, KY: Univ. Press of Kentucky, 1988), pp. 99-126, 213-29, esp. p. 224.

[77] B. M. Norman also printed and sold Affleck books. See Robinson Papers (LSU 1413), RASP, Series I, Part 2 Reel 20, frame 701. RASP is Records of Ante-Bellum Southern Plantations: From the Revolution through the Civil War, ed. by Kenneth M. Stampp (Frederick, MD: University Publications of America, various dates after 1985).

[78] Robert Stewart, Account Books, Ms. 404, 4732, Louisiana and Lower Mississippi Valley Collections, Louisiana State Univ. Libraries (Baton Rouge, LA).

[79] Lewis papers at Univ. of North Carolina (Southern Historical Collection 2528) and A. F. Smith plantation records (Western Reserve Historical Society).

[80] Robinson Papers (RASP, Series I, Part 2, Reel 20, frame 546) and Branch family (SHC 2718, RASP, Series J, Part 4, Reel 46, frame 689). Randolph's books date to 1852 at the latest.

[81] James H. Hammond (RASP, Series A, Part 1, Reel 14). LeBlanc family papers (RASP, Series I, Part 2, Reel 17, frame 678) has a 1830s plantation book with sheets similar to an Affleck book. The Hope and Experiment plantation in the South Carolina Historical Society records has a cotton book for 1812.

[82] Wright, *Old South, New South*, pp. 17-50.

[83] Slaves likely viewed contests with trepidation, fearing that higher output levels might incite overseers to ratchet up their daily quotas.

[84] This sample differs from that discussed in Olmstead and Rhode, "Biological Innovation." Here we include only the subset of documents that identify the amount of cotton picked by individual slaves.

[85] Jan R. Hierer, "A Content Comparison of Antebellum Plantation Records and Thomas Affleck's Accounting Principles," *Accounting Historians Journal* 15:2 (Fall 1988), pp. 131-50.

[86] Scarborough notes that the tenure of overseers was "notoriously" brief and that the turnover problem was particularly acute in the New South. Scarborough, *Overseer*, pp. 38-40, 125-27, 197, 200.