

**Better Opportunities or Worse?:  
The Demise of Hand Harvest Labor and Cotton, 1949-64**

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At the end of World War II millions of workers from California to the Carolinas stooped over plants to gather almost every boll of American cotton by hand, as they had for the previous 200 years. When the mechanical cotton picker was finally perfected and commercially produced beginning in 1948, growers adopted it so rapidly that in 1970 the entire crop was gathered by machine. The connection between cotton harvest mechanization and the migration of African-Americans from the South—almost three million people between 1950 and 1970—has long been a matter of public interest; the regional relocation of blacks from the rural South to cities has had profound social and economic consequences. One effect of migration, whatever the cause, was the narrowing of the black-white wage differential (Smith and Welch, 1989).<sup>1</sup> If the contribution of migration to black economic progress had been exhausted by 1965, and thus if sustained strides forward in narrowing the black-white income gap would have abated without Federal Civil Rights Legislation and enforcement (Donahue and Heckman, 1991), how were cotton mechanization and the decline of cotton involved? Both the direct wage and indirect, but powerful, political effects of migration on black economic progress have been examined, but the role that mechanization and the decline of cotton played has not been resolved.

Alston and Ferrie (1993, 2000) have addressed the question of how southern political forces powerful as they were in Congress throughout this period, first prevented but later

allowed, the passage of legislation that would threaten the South's method of control over a pool of cheap labor prior to the mechanization of the cotton harvest. The retreat of the southern political effort at the federal level that once sustained the system of social control came about because the livelihood of rural landed elites no longer depended upon an isolated, discriminatory labor market that valued, above all else, an inexpensive, malleable workforce (Alston and Ferrie, 1993).

Since the cotton harvest comprised at least half of the year's labor, most significantly the mechanical picker eliminated this labor "bottleneck." The existing evidence that the cotton harvester chiefly caused the disappearance of the Old South, however, is seriously flawed. It is true that the work of Day (1967) on mechanization and Cogan (1982) on black teenage unemployment implies that harvesting machines displaced workers from the cotton fields who subsequently left the region (Wright, 1986; Wilson, 1987). Margo and Finegan (1993), however, show that Cogan overestimated the role of mechanization with respect to the decline in black teenage labor force participation. With respect to migration, Heinicke (1994), demonstrated that cotton harvest mechanization accounted for less than a quarter of black migration in the 1950s. Finally, Peterson and Kislev (1986) estimated that the lion's share of the decline in cotton hand harvesting (almost 80 percent) resulted from rising wages outside of agriculture and only a small portion was due to mechanization.

This paper revises our empirical understanding of the decline in cotton harvest employment with the use of much improved data. We find that mechanization, along with declining cotton prices and government programs which induced planters to reduce cotton

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<sup>1</sup> Yet despite progress on the wage front, a widening unemployment gap between whites and African-Americans also became a feature of the U.S. labor market (Fairlie and Sundstrom, 1997; 1999).

acreage, formed the main impetus to rid the cotton fields of hand labor for good. The draw of better wages outside agriculture that decreased labor supply in the hand harvest market, played a smaller, although crucial, role. Our evidence constructs the crucial link concerning the effect of cotton harvest labor markets and incentives for preserving the system of social control. This, in turn, bears directly as well as indirectly on the postwar record of black progress.

The *long run* effects of mechanization, paradoxically, must have had a favorable effect on black progress, if they reduced the incentive of southern political interests to protect paternalism and block both Civil Rights legislation and enforcement (Alston and Ferrie, 1993). Once the effects of Federal legislation took hold, an “episode” of black progress ensued after 1965 (see Donahue and Heckman, 1991; Heckman, 1990; Card and Krueger, 1993). Also, if mechanization and the movement of cotton prices led to a “soft” southern agricultural labor market in the 1950s and early 1960s, that is consistent with the lack of black progress within regions during this period. Whatever the associated evidence on political activities, our results show that after the early 1960s, the rural southern elites *no longer had the incentive* to preserve the cheap pool of labor for hand harvesting of cotton. This does not mean that southerners suddenly and uniformly welcomed social change (see Wright, 1999). In contrast to social views, the perfection of the cotton picking device abruptly changed economic incentives, reducing the need to pour substantial resources and political “capital” into preserving the system of social control that those with access to political power at the Federal level -- and with economic power within the South -- had maintained for a century following the Civil War.

#### **COTTON ECONOMY PRICES, LABOR FORCE AND TECHNOLOGY, 1930-70**

During World War II harvest wages increased compared with either general farm or industrial earnings. The sharp rise in war-time piece rate wages, cash payment per 100 pounds

of seed cotton gathered, resulted in part from a rise in the demand for cotton and in part was due to the WWII-induced mass exodus from the rural South (Wright, 1986). Following the war, cotton prices and piece rates trended down.

Because of the arduous nature of cotton harvesting by hand, people have spent great effort, time and money to reduce the labor-intensity of the task. Almost an entire century of innovative activity by tinkerers and farm equipment manufacturers passed between the first recorded design of a mechanical cotton picker and its successful commercial production by International Harvester in April 1948.

### **Cotton Harvest Costs by Machine and by Hand**

To date the displacement-replacement debate has taken place in something of an empirical vacuum. Frank Meier estimated machine harvest costs for the spindle-picker states from 1949 to 1964 in his unpublished dissertation entitled *An Economic Analysis of the Mechanical Cotton Picker*. Unfortunately, *hand* harvest costs have only been measured by using the USDA "piece rate wages," growers' payment to fieldhands for each 100 pounds of seed cotton harvested (e.g., Peterson and Kislev, 1986). These cash wages, however, poorly capture growers' total hand harvest costs. An important contribution of this paper is to advance an improved measure of this variable. First, growers care about unit costs per pound of *cotton lint*, whereas 100 pounds of unprocessed "seed-cotton" contained varying amounts of organic matter (removed at the cotton gin) that differed over time and by location.

Grove (2000) estimated a time series of hand harvest costs to match the Meier machine cost data by (1) converting piece rate wages to cash wages per pound of lint and (2) estimating non-wage costs for resident laborers, day-haul workers, domestic migrants, and foreign contract workers. Combining state wage costs and non-wage labor expenses (weighted according to the

types of labor employed) yields annual state hand harvesting costs. Table 1 provides the ratio of the expected real machine harvest to hand harvest cost per pound of lint. The west-to-east pattern of picker diffusion mirrors the relative costs of the harvest method by region.

### **THE COTTON HAND HARVEST LABOR MARKET: MODEL AND DATA**

The objective of this article is to determine the extent to which higher wages and better opportunities in the northern cities lured laborers away from the cotton belt or whether cheaper technology displaced them.

The following supply-demand model measures the shifts in supply and demand. In the cotton harvest labor market, demand for hand labor ( $Q$ ) is a function of the cotton harvest wage ( $W$ ), machine prices ( $MCOST$ ), the (lagged) price of cotton ( $PCT$ ), grower overhead expenses ( $OVERH$ ), and the two government acreage restriction programs ( $ALLOT$  and  $SOIL$ ). The ideal measure of harvest labor (the dependent variable) would be labor per unit time period, but it is not known how many hours and days were required to harvest a given amount of cotton. Therefore, we used the total quantity of cotton harvested by hand, i.e. the percent of cotton harvested by machine times cotton output. Lagged output has been added to account for the partial adjustment of hand harvested output (Nerlove, 1958). The “wage” here is the total compensation of labor employed in the cotton harvest ( $W$ ), that is the cash wage plus the value of in-kind benefits. The price of cotton lagged one year ( $PCT$ ) is inserted to reflect the fact that decisions are made on the basis of the expected price of output; since landowners sold and purchased in national markets, prices are deflated by the U.S. CPI.

### **EMPIRICAL RESULTS**

The results of estimating the cotton picking labor supply and demand functions by two-stage least squares, regarding  $Q$  and  $W$  as endogenous, are presented in Table 2. The data used

are pooled state level, annual observations for the 12 major spindle-picker states (N=180). All continuous variables are measured in logs. The coefficients are short-run elasticities and indicate elastic labor demand and labor supply. The results are reasonably robust with respect to differing specifications, but there are some exceptions.

Hand harvested employment fell by an annual average of 9.9 percent from 1949 to 1964. We seek to identify the contribution of the exogenous variables on the equilibrium quantity of labor (Table 3) by using the elasticities reported in Table 2. We first estimate the annual average rate of change in the relevant variables from 1949 to 1964. The annual horizontal shifts in either the demand or supply function is obtained by multiplying the change in the variable by its estimated elasticity (coefficient). The effect of each variable on the change in (endogenous) wages is determined by multiplying the shift in the function and the elasticities with respect to wages in the supply and demand functions. Finally, the change in the quantity of labor is calculated by multiplying the resulting endogenous change in wages and the elasticity with respect to wages in the other (supply or demand) function (see notes to Table 3).

We summarize the effect of the exogenous variables upon the equilibrium quantity of labor in Table 3. For example, machine harvest costs per pound of lint declined on average by 4.4 percent per year from 1949-64, shifting demand for hand harvest labor to the left at an annual rate of 5.7 percent (see Table 3). Assuming no change in the supply equation, the equilibrium wage was reduced by 1.47 percent annually and the equilibrium quantity of labor fell by 1.77 percent each year. Thus, these estimates imply that 18 percent of the 9.9 percent average annual decline in hand harvested cotton employment from 1949 to 1964 resulted from worker displacement due to cheaper machine substitutes.

In addition, cotton prices, non-farm wages, yields, and government programs importantly

influenced cotton employment. The cotton price fell by an average of 1.9 percent a year, prompting farmers to plant less acreage to cotton which decreased hand harvesting labor by 2 percent per year (Table 3). Explaining 21% of the average annual decrease, our estimates show that falling cotton prices affected the harvest labor market more than mechanization of the harvest. Combined, these two demand-side factors, mechanization and cotton prices, account for 39 percent of the actual annual decline in harvest labor. Non-farm wages rose by 1.7 percent a year, causing labor to fall by 2.39 percent a year. The pull effect of higher non-farm wages (24 percent of the total decrease in harvest employment) was somewhat greater than the push effect of cotton harvest mechanization (18 percent) by itself.

Cotton yields rose rapidly during the 1950 and early 1960s, by 3.87 percent annually. Higher output per acre increased labor supply (in anticipation of more harvest-time employment) by 2.74 percent per year. Although the allotment variable is not significant, acreage planted in cotton fell so sharply due to the federal soil bank program that it accounts for 4.75 percent reduction in hand harvest employment in the relevant years. In those years the soil bank alone explains close to one-half of the annual decrease in harvest employment, and its effect is larger than any single factor (Table 3).

## **CONCLUSIONS**

This article uses newly reconstructed data on hand and machine harvest costs and nonagricultural wage rates to reevaluate the causes of the exodus of hand harvest labor from the cotton fields during the 1949-64 period. Our estimates show that a decrease in labor demand contributed a greater share to declining employment in the cotton harvest labor market than decreasing labor supply during this period; this reverses to the conclusions advanced by Peterson and Kislev (1986), who found that the “pull” of higher wages outside of agriculture was

greater than “push” of labor from the cotton harvest labor market. Our estimates suggest that the agricultural-nonagricultural wage differentials explains about a quarter of the decline in the hand harvest workforce, clearly an important factor. We also find, however, that the combination of mechanization and decreasing cotton prices led to a decrease in cotton harvest employment of –3.8% annually, or 39% of the total decrease in harvest employment. Add to this the effect of federal soil bank in several years (which explained 48% of the decrease in employment in relevant years), and decreasing labor demand clearly outweighs the effect of decreasing labor supply. All told, the concurrence of these events within two decades—the departure of millions of, especially black, families from American cotton fields, the decline of cotton, and the mechanization of the cotton harvest—fundamentally altered the economy, politics, and social and cultural life in those areas as well as nationally.

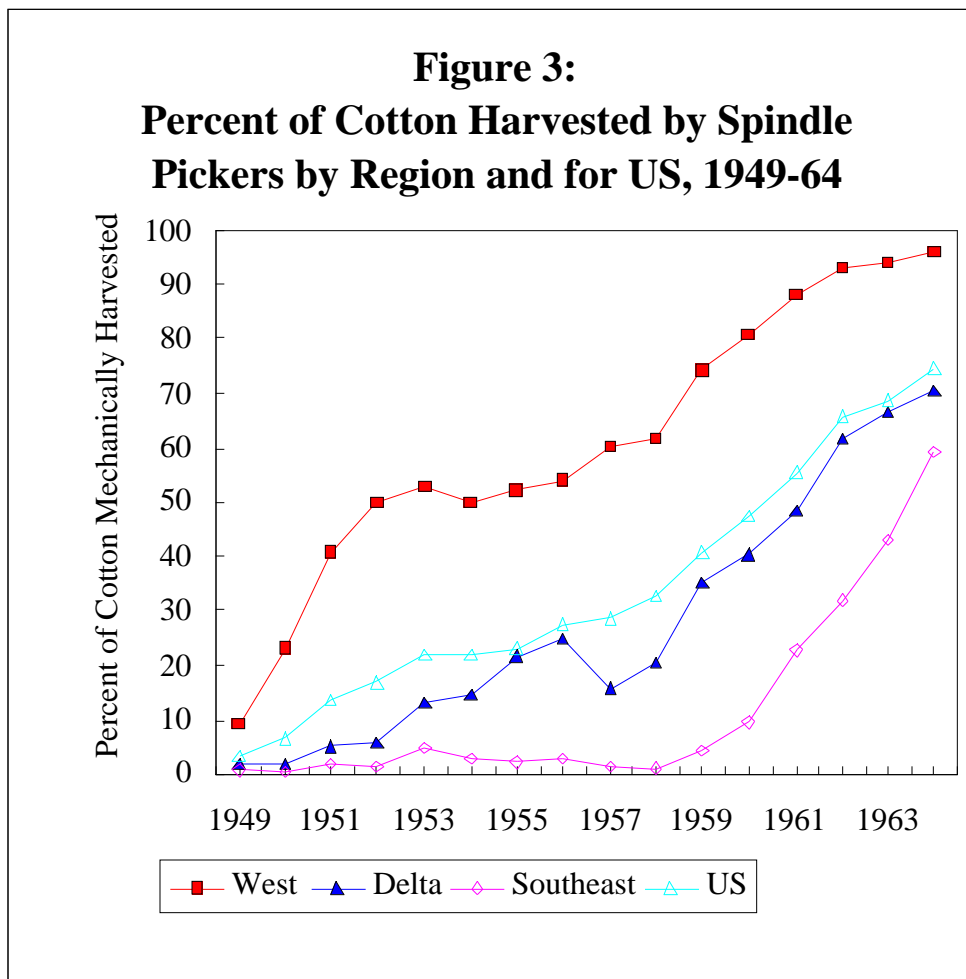
This extraordinary episode of demographic and technological change produced many ironies. Following the 1930s, the “tight” labor market of the early 1940s provided the incentive for the final push to perfect a mechanical cotton harvesting device (Wright, 1986). Improvements in farm machinery exogenous to the cotton economy, aided the process. Yet, for contemporaries in 1946, and, in fact, in 1950, it was unclear that a way of life in place since the Civil War would be swept away so swiftly. The old system of social control held on for three more wrenching decades, and more turbulent time beyond that. Would the institutional system that inhibited mechanization be sustained? (see Whatley, 1985; 1987, on institutions.) We know only now that it crumbled amazingly swiftly, between 1949 and 1970.<sup>2</sup> The incentive structure to maintain a low-wage economy based on poor education generally and, for blacks, fear,

intimidation and institutionalized discrimination, changed as mechanization, government farm programs, and the withering of the market for raw cotton took their toll.

Perhaps the greatest irony of all is that despite the adverse effect mechanical cotton pickers had on the harvest labor market in the 1949-64 period, the incentive to retain the elaborate informal and legal codes of racial separation largely disappeared in the wake of its adoption. Add to that, the contribution of government programs that reduced cotton acreage and declining cotton prices between 1949 and 1964 and we have a collapse of demand for hand harvesting labor that rendered the Old South largely an anachronism. The old system of social control and its proponents, however, did not fade away easily. The Civil Rights movement interacting with federal politics produced change within as well as outside the South. With little reason to preserve the labor market for hand cotton picking, Federal Civil Rights legislation and the emergence of Federal programs that eroded the old system of social control had a chance. The way was then cleared for the possibility, however faltering, of some progress for African-Americans throughout the nation.

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<sup>2</sup> See Wright (1999) for a discussion of the unexpected speed of the Civil Rights movement and its implications for black economic progress. Farm sector predictions of yields and rates of mechanization in 1950 for 1955 vastly underestimated the pace of those changes (Grove, 2000).



Note: These are weighted averages according to cotton production.

Sources:

Percent of cotton crop harvested by machine per state: Statistics on Cotton (1974), 218.

Bales of cotton harvested per state: Statistics on Cotton (1974), 64-77.

**Table 1****Ratio of Total Expected Real Cost of Machine to Hand Picked Cotton:  
Selected States and Regions\***

	West	Delta	SE
1950	.64	.98	1.46
1952	.53	.93	1.29
1954	.48	.82	1.11
1959	.44	.77	1.04
1963	.32	.63	.85

Source: See Grove (2000).

Three year production-weighted averages centered on the year listed.

**Table 2:**  
**2SLS Estimates of the Cotton Hand Harvest Labor Market**  
 Dependent Variable: Quantity of Hand Harvested Cotton

Independent Variable:	Demand	Supply
Lagged hand harvested cotton $Q_{t-1}$	<b>0.79</b> (15.55)	<b>0.68</b> (14.06)
Labor Compensation (W)	<b>-2.68</b> (-4.37)	<b>1.20</b> (4.10)
Lagged cotton price (PCT)	<b>3.43</b> (5.06)	
Mechanical Harvesting Costs (MCOST)	<b>1.29</b> (5.68)	
Overhead costs of labor (OVERH)	<b>0.34</b> (2.83)	
Cotton allotment dummy (ALLOT)	<b>0.07</b> (1.04)	
Soil bank dummy (SOIL)	<b>-0.15</b> (-3.58)	
Nonagricultural wage rates (WNON)		<b>-2.02</b> (-2.88)
Cotton Yields (Y)		<b>1.03</b> (9.09)
Pre-harvest agricultural wage (PREHW)		<b>-0.60</b> (-1.36)
Planted cotton acreage (ACRES)		<b>0.14</b> (1.31)
Intercept	-8.27	-6.71
Adjusted $R^2$	0.93	0.92
n x T	180	180

t-statistics in parentheses

State dummies not reported here.

Table 3

**Average Annual Percent Change in Quantity of Labor Employed  
In Hand Harvesting, Response to Shifts in Demand and Supply**

	<u>Annual Average Percentage Change</u>				<u>Percent of Total Change in Labor Predicted of Actual</u> <sup>5</sup>
	<u>Change in variable</u> <sup>1</sup>	<u>Shift in function</u> <sup>2</sup>	<u>Change in wages</u> <sup>3</sup>	<u>Change in qty. of labor</u> <sup>4</sup>	
<b><u>Demand</u></b>					
Real Machine Harvesting Costs	-4.42	-5.70	-1.47	-1.77	18
Real Cotton Price	-1.91	-6.55	-1.67	-2.03	21
Soil Bank Dummy Variable for Years: 1956-58, 1964 <b>only</b>	---	-15.3	-3.94	-4.75	48
<b><u>Supply</u></b>					
Real Nonagricultural Wages	1.71	-3.46	0.89	-2.39.	24
Cotton Yields	3.87	3.98	-1.02	+2.74	-28 <sup>6</sup>

Notes:

<sup>1</sup> Annual rate of change estimated from regression equation:  $\log(x) = a + rt + sd + e$ .

<sup>2</sup> Shift in function is change in variable times estimated elasticity.

<sup>3</sup> Reduced form change in wages (due to variable) is shift in function times  $\left[ \frac{1}{\alpha_1 - \beta_1} \right]$ .

<sup>4</sup> Change in employment is change in wages times wage elasticity (of supply or demand).

<sup>5</sup> Cotton harvest labor employment decline on average by 9.9 percent annually.

<sup>6</sup> Negative sign denotes this counteracts the decline in labor, i.e., is an increase.