

Postbellum Developments in the Louisiana Cane Sugar Industry

Mark D. Schmitz

Department of Economics, University of Delaware

The sugar industry of Louisiana underwent two significant transitions following the Civil War. First, there was a movement to separate the agricultural and manufacturing stages of sugar production. The industry slowly developed central factories that supplemented their own raw cane production with purchases from small farmers. Second, there was an increase in the percentage of the sugar crop that was refined into granulated sugar rather than left as raw brown sugar. The trend was accompanied by a fairly rapid incorporation of new technology.

These dual developments paved the way for the increased concentration of the processing stage and for this reason alone merit consideration. However, the issues that I wish to approach here are confined to the actual changes themselves. First, what economic factors led to the separation of the stages? Most commonly noted are the "labor shortages" following emancipation and the low efficiency in both stages when they were combined. This paper attempts to place these causes on a sounder theoretical and quantitative basis and to evaluate the actual meaning and effects of these and other factors. The related question of the development of a separate refining industry is treated in the same way. Although I attempt to explain the increased emphasis on refined sugar after 1870, it is also useful to ask why the transition took so long to begin. Although the East Coast had long refined imported raw sugar, Louisiana, seemingly the natural location for such enterprise, had only 10 percent of the refineries before the Civil War. This paradox has rarely been considered in the historical literature.

The remainder of the paper is divided into two major sectors. First, I briefly examine the production path from 1850 to 1900 concentrating on the causes of the postwar collapse of the industry. The planter's reactions to the rapid demise are examined in light of simple economic analysis. The section documents the separation of agriculture and manufacturing and the advances in the latter and suggests some of the more plausible explanations.

SUGAR PRODUCTION, 1850-1900

The Louisiana sugar sector capped its antebellum expansion with the record 1861 crop of 459,000 hogsheads. The postwar experience, however, was one of recovery rather than growth. The 1861 crop was not surpassed until 1893, although production had attained average prewar levels by the 1880s (see Table 1).

Table 1
CANE SUGAR PRODUCTION IN LOUISIANA, 1850-1900

Year	Tons (2,000 lbs.)	Year	Tons (2,000 lbs.)
1850	115,484	1876	95,314
1851	129,021	1877	73,737
1852	184,029	1878	119,736
1853	251,122	1879	99,496
1854	198,631	1880	136,512
1855	132,303	1881	79,860
1856	41,231	1882	152,507
1857	154,047	1883	143,816
1858	207,431	1884	105,696
1859	127,019	1885	143,313
1860	131,522	1886	90,661
1861	264,159	1887	176,926
1862	48,420	1888	162,633
1863	44,452	1889	143,745
1864	5,971	1890	241,744
1865	10,401	1891	180,249
1866	23,603	1892	226,033
1867	21,603	1893	292,736
1868	47,731	1894	355,382
1869	49,707	1895	266,246
1870	84,413	1896	316,970
1871	73,511	1897	347,701
1872	62,598	1898	274,972
1873	51,607	1899	164,824
1874	68,312	1900	302,778
1875	81,713		

Source: A. B. Gilmore, *Gilmore's Louisiana Sugar Manual* (New Orleans, 1920).

The historical literature provides a number of reasons for the dismal experience of 1862-80 [14 and 16]. All of these explanations focus on the supply side, a consensus that seems justified considering Louisiana provided only one-third of American sugar consumption in 1850 [5, p. 288]. Although consumption more than doubled by 1880, the Pelican state provided only one-eighth of that total [3 (1880-81), p. 98].

Naturally, we must focus on the Civil War and early emancipation as the crux of the problem. First, the early occupation of the sugar district resulted in substantial losses of capital, land improvements, and livestock. The crucial levee system went unattended, partly explaining a 70 percent decline in land values [3]. The state of disrepair was of constant concern to planters, many of whom called for federal aid to refortify the system. One went so far as to state that "the only material aid the government can give toward increasing the production of sugar in Louisiana is to build levees" [34]. Others asserted that Washington's help would allow Louisiana to provide for domestic sugar needs and, moreover, would provide "moral influence in healing past dissensions."

In addition to the levee crisis, many sugar mills had been destroyed or left to rust. Of the 1,308 mills in operation in 1860, less than 300 ground sugar in 1870. Furthermore the Union army had appropriated virtually the entire working stock from the plantations. The state mule and horse populations fell 14 and 40 percent respectively during the decade. In the sugar parishes the losses were worse. Also, there was a serious shortage of working capital for running and repairing the remaining resources. The main sources of credit for the planters-factors, commission merchants and banks, were either gone or ruined by the war. This problem led also to calls for federal aid.

In the opinions expressed by planters, however, the most pressing problem was a "shortage" of labor caused by the freedmen's "demoralization" [16, pp. 231-44; and 13, pp. 17-27]. Some slaves had fled with the arrival of the Union Army in 1862 and many of the remainder "considered themselves emancipated not only from slavery but from the status of manual labor" [16, p. 221].

The occupying forces under Generals Benjamin Butler and N. P. Banks had little success in getting the freedmen to work during the war and afterwards the surviving planters lamented over their inability to hire the labor forces they had enjoyed under slavery. Beyond the loss of able bodies from migration and the departure of women and children from the labor force, it was also argued that the remaining men worked with less vigor and efficiency than when they were bonded.

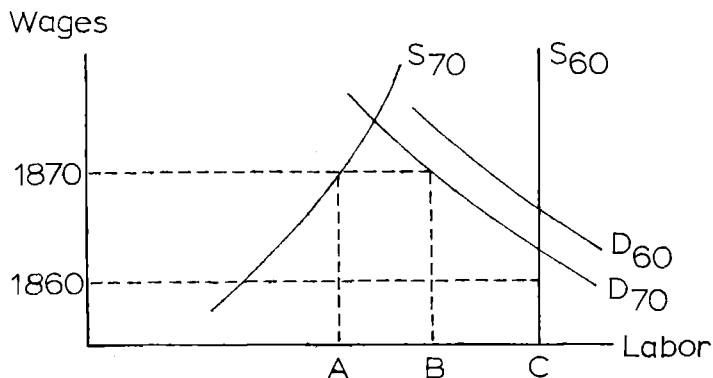
Reasonable assumptions for the loss of land, capital, and efficiency associated with economies of scale provide a residual estimate of the actual reduction in the labor input following the Civil War. Following the analysis of Richard Sutch and Roger

Ranson [18], it appears that the effective labor input in 1870 was less than half of its prewar level.¹ This figure is lower than that found for the Cotton South but not as unreasonable as it first appears. Women and children made up about 40 percent of the 1860 labor force (measured in prime male equivalents) and both groups refused to participate in field work after emancipation [15 and 16]. The rural black population of the sugar parishes fell 4 percent, although reservations still exist concerning the accuracy of the 1870 enumeration.² The remainder of the fall can be explained by a one-fourth decrease in the labor effort on the part of males.

It was the 50 percent decline in the quantity of labor disequilibrium supplied rather than a major market that concerned the planters. Though the demand for labor should have declined with the loss of capital, land, and economies of scale, it remained relatively inelastic because of the necessity of providing minimum cane inputs to the remaining mills (see the chart). Labor supply shifted drastically to the left, and the preferences of the ex-slaves suggest that this curve was also inelastic. The chart shows the probable changes in labor supply and demand from 1860 to 1870. Wage levels did rise with freedom, partly because labor received a larger portion of its marginal product, but more so from the shift in supply. Still, a real shortage of *AB* units of labor existed in 1870.

From the planters' point of view the shortage was much worse than indicated in the chart. For one thing, the demand shift suggested by changes in the production function was probably greater than that imagined by the planters. Although this suggests some irrationality on their part, it is consistent with their complaints about labor inefficiency and laziness. It seems that they simply failed to recognize that labor productivity was higher under slavery for reasons having nothing to do with the workers

THE LABOR MARKET IN 1870



themselves. Second, the planters did not focus on the true market shortage at the 1870 wage but on the difference between old and new input levels, or AC. By importing Chinese and European workers they somehow believed that they could return to the prewar wages and level of input. Finally, the planters clearly complicated the problem by trying to continue the exploitation of labor income. Paying less than the laborer's contribution had worked under slavery; the same approach in 1870 merely aggravated the labor problem.³

THE REFINING OF SUGAR

Cane sugar was distinguished from other agricultural pursuits by the large average size of operation and the degree of processing necessary to transform the raw product into a salable one. Before the Civil War, virtually every farm owned its own processing machinery. Even with this characteristic, two primary trends appeared in this era; the average farm size was increased and the equipment became increasingly sophisticated. Only the latter trend continued past the war.

The advances in manufacturing can be broken into various stages. Initially, the equipment consisted of only horse-powered rolling mills to extract the juice from the stalks and a set of large open kettles to boil and purify the juice. The product of this relatively inefficient method was a coarse brown muscovado sugar.

Steam-powered mills were introduced in 1822 and gradually replaced the older models as the main mode of juice extraction. From 1831 the number of horse-powered mills did increase from 409 to 617. By 1860, however, the number had declined to 316. Steam mills increased from 282 to 992 over the 30-year period and accounted for 85 percent of production by 1860 [5, p. 39].

More important advances were being made in the purification of the cane juice. Purer sugar could be obtained by boiling in vacuum pans, first used in 1831. Perhaps the greatest advance was found in Norbert Rillieux's multiple-effect apparatus. Rillieux, a free black, "conceived the idea that the hot vapor arising from a vessel of boiling cane juice could be used to evaporate the water contained in a second vessel" [12]. His approach to the problem "laid the foundation for the elaborate system of evaporation now in use wherever capital and intelligence have combined in the making of sugar."⁴ Despite the later recognition of vacuum pans in general and Rillieux in particular, very few farms had made use of the technique by 1860. The advantages were higher-quality sugar, less danger of scorching the product, and a greater retrieval rate than open kettles. In addition, vacuum pans made it possible to reboil molasses into "second" sugar and to reprocess brown sugar into a purer yellow form.

It is interesting that refineries were virtually nonexistent in Louisiana if only those factories that reprocessed the brown sugar into a pure white form are included. Despite producing 90 percent of America's cane sugar, the US census reported that Louisiana had only 4 of the nation's 49 refineries in 1880, and contributed less than 4 percent of the refining industry's value added [24]. The census figures, however, exclude a number of operations that were capable of producing high-quality yellow and white sugar, as seen in Table 2, and results from the differences in definition used by the census and a local expert, P. A. Champomier [5]. While Champomier and his successor A. Bouchereau [3] enumerated refineries by their ability to reprocess raw sugar, the census apparently only included operations whose main endeavor was manufacturing. The latter bias is apparent in the 1880 manuscript Census of Manufacturing. The original records listed almost every sugar plantation as a manufacturing establishment, recognizing the dual nature of production. However, somewhere between the original enumeration and publication, the farms were lined out with the bold notation "not manufacturing" added to each page of the handwritten manuscripts. Even more interesting is the apparent change of heart experienced by census officials between 1890 and 1900. While the 1890 Census credited Louisiana with only 38 refineries and a capital stock of \$1.9 million, the 1900 volume identified a total of 384 operations as fitting the revised definition [29, p. 298]. The 39 percent annual increase in the industry's capital stock has probably been unmatched in modern history but does reflect the belated recognition of the manufacturing aspect of sugar production.

Regardless of these differences in definition it is still clear that little sugar was refined in Louisiana before the Civil War. It is also clear that an enormous shift occurred thereafter. While only 3 percent of the antebellum farms used vacuum pans, the figure was 75 percent in 1900 [3 and 5]. Moreover, those operations produced 95 percent of the state's sugar output. Technological change was not limited to vacuum pans and modes of combining them. The last 30 years of the century also saw the widespread use of sulphurous gas to bleach the juice, clarifiers for removing large impurities, and centrifuges to separate the sugar and molasses. All but the first were available in 1860 but were used only on the most innovative plantations, such as Judah Benjamin's and Valcour Aime's.

As already indicated, the practice of each farm's processing its own cane ended during the postbellum era. In 1860 cane growing was limited to few other than the 1,308 farms with mills and kettles. In 1900, however, 11,774 farms grew cane for only 275 factories. A total of 3,870 farms reported sugar as their principal source of income [25, p. 459]. The conclusion that land was divided among the masses with the loss of planter control is not correct, however.

Table 2
LOUISIANA SUGAR REFINERIES AND PRODUCTION, 1860-1900

Year	Sugar production (hogsheads)		Total sugar mills	Refineries in US census		Apparatus listed in local journals	
	Total	Refined and clarified		All US	Louisiana	Refin- eries ^a	Others with white sugar
1860	229,000	29,732	1,308	39	2	9	33
1880	169,972	55,623	1,111	49	4	10	108
1900	262,707	250,330	274 ^b	832	384 ^c	19	207

Sources: [5 and 3] and US Bureau of the Census, *Manufactures in the United States: 1860, 1880, and 1900* (Washington: US Government Printing Office, 1864, 1884, and 1904).

^aDefined as all firms listed as refineries; to qualify the firm had to engage in the reprocessing of brown sugar. The second category is farms with vacuum pans.

^bBouchereau noted that an additional 59 mills did not operate in 1899 because of a poor cane crop.

^cThe reason that the census number is greater than the local enumeration is that only the number of beet mills that were operated were counted in the census.

Though the number of nonfactory farms was impressive, their land holding and production were not. Cane produced on land owned by central factories still accounted for one-half of total tonnage in 1900. Tenants produced 15 percent and the remainder was spread across 10,000 farms. For the over-6,000 farms that reported selling cane in 1900, the average cultivation of sugar cane was approximately 17 acres.⁵ On the other hand, many of the factories were amassing enormous acreages on up to eight plantations. For example, J. N. Pharr and Sons held 19,000 acres in 1900 but still purchased twice as much cane as they produced [11 and 16]. Tenancy for shares or fixed rent was less common in the sugar parishes than in cotton. Statewide in Louisiana, over 30 percent of the white and 70 percent of the colored farmers were tenants whereas in the sugar parishes the corresponding figures were 20 percent and 30 percent. Of the farms having sugar as the principal source of income about one-third were worked by tenants [25].

The shifts across time can be examined with reference to a general production model. The model recognizes the dual nature of sugar production and includes three basic production equations. The outputs are raw cane (C) which may be either an intermediate or final product, refined sugar (R), and brown sugar (B).

$$(1) \quad C = C(A_C, L_C, T_C, K_C),$$

$$(2) \quad R = R(A_R, L_R, C_R, K_R, D_R), \text{ and}$$

$$(3) \quad B = B(A_B, L_B, C_B, K_B, D_B),$$

where A_i = the efficiency index for product i ; L_i = the labor input for product i ; T_C = the land in cane; K_i = the capital input for product i ; and D_i = the transportation cost of getting cane to mill type i . The purpose of the model and the associated cost and output demand functions is to explain the relative increase in refined sugar across time, the increase in the percentage of raw cane that was sold as a final product rather than consumed on the same farm, and the increase in refining efficiency. At this point, however, a complete formal model of these problems has not been developed or tested. I have been able only to identify a number of theoretically plausible explanations and suggest evidence that may tend to support them. Because the problems are interrelated, the arguments are presented jointly.

Economies of Scale

The nature of economies of scale can explain a portion of the

shifts. First, increasing returns to scale existed in Equation (1). The loss of slavery did not end the technical feasibility of achieving the economies but did increase the costs of doing so. This was because of the general unattractiveness of gang labor and the difficulty of organizing a sufficient labor force. The result was a decline in the relative profitability of larger plantations. Second, both long- and short-run economies probably existed in Equations (2) and (3). In the long run this is indicated by the increasing average value of machinery and movements in size distribution both before and after the war. In the short run the high fixed cost implied a minimum cane input to lower average total cost below price to make the mill profitable.⁶ Examination of farms from the 1850 and 1860 manuscript censuses suggests that 200 hogsheads was the minimum output for a steam and kettle mill whereas about twice that amount was necessary for a mill equipped with vacuum pans. The contemporary yield of one hogshead per acre of cane implied equivalent acres of cane to be planted to achieve the minimum. The war, however, reduced planting efficiency, and field labor, and therefore increased the minimum amount of land associated with each type of final product. The planters' initial attempts to feed the mills from their old acreage naturally led to the "labor shortages" already discussed and lowered rates of return. Hence, while many planters persisted in trying to hire and import additional workers, the 1870s began the necessary shift towards reliance on tenants and outside purchases [15, p. 251].

The Supply and Cost of Labor

The cost of labor rose faster than interest rates before and after slavery ended, encouraging the use of labor-saving technology. The effect was more pronounced in Equations (2) and (3) because wages were significantly higher during the grinding season (sometimes as much as 100 percent) and because labor strikes such as those in the 1880s were much more costly when the cane was ready for processing. Moreover, under slavery the opportunity cost to the slaveholder approached zero during the late fall and winter. The processing stage, therefore, went from a situation of almost free labor to one where wages approached those of skilled workers.

The supply of technology limited the effect of labor costs on the separate efficiency parameters and resulted in the greatest gains being observed in refining efficiency. Work at the Louisiana State Experiment Station raised planting efficiency but only after 1890. Previous efforts followed the national pattern of using more horse- and mule-drawn equipment, but little progress was made in the most labor-intensive steps, the cutting and hauling of cane to the mills or transportation. Neutral efficiency shifts

were also limited, the major advances being in the identification of optimum row widths and the increased use of fertilizer [16, pp. 274-78].

Both manufacturing stages were improved by the introduction of hydraulic presses to remove the cane juice but little else could be done to improve the technology of open-kettle boiling. As already mentioned, a large backlog of technology existed in the 1850s. As occurred in the production of many American products, the rising cost of labor provided part of the impetus for the widespread utilization of better techniques.⁷

The Decline of Marginal Producers

The increase in refining efficiency reinforced the pressure on marginal producers and helped force them either to change techniques or drop out of the manufacturing stage. Never an extremely profitable enterprise on a small scale, the marginal sugar producer always teetered on the edge of disaster [36]. Before the war it was the horse-powered mills that either switched or failed, and afterwards it was the open-kettle operations. Examination of individual farm experiences from 1880 to 1900 reveals that the almost universal response of the open-kettle farms was to abandon the second stage and concentrate on the growing and marketing of cane. Less than 10 percent added vacuum pans to their apparatuses in order to compete on more equal grounds.⁸

Transportation

Improvements on transportation reduced the cost of bringing cane to the mills and widened the area from which a factory could profitably purchase raw cane. Small-gauge railroads spread from factories to surrounding fields and branches off the Texas and Pacific and other railroads provided refineries with easier access to both raw cane and their final markets. The lag of the interior parishes behind those on the Mississippi underscores the importance of transportation. All of the early refineries were on the Mississippi as were the planters with the most advanced equipment [5]. Even in 1880 most farms in the interior parish of St. Mary's retained their own mills, almost all of which were equipped with open kettles. The spread of the railroad was probably a necessary condition for St. Mary's transition to a central-factory, vacuum-process parish by 1890.

The Role of Demand

Less obvious is the role of demand for brown and refined

sugars in changing the relative shares of the two final products. Before 1850 about one-half of Louisiana's output was shipped up the Mississippi [6, p. 287]. Supposedly, the poorer grades satisfied the tastes of the West and the southern seaboard but were ranked as inferior to Cuban and West Indian sugars in the major New York market [16]. The latter was especially true when the brown sugar was to be reprocessed by an eastern refinery. There is qualitative evidence to suggest that the eastern evaluation improved with the demonstration by local planters that Louisiana sugar could be refined, but it is not clear that a greater portion of output was routed to the East.

Price data for the New Orleans and New York markets are available and both show a slight widening of the price differential between brown and clarified sugars. Since I have already suggested that the supply of refined sugar was shifting to the right after 1870, it would be consistent to say that the demand for the product was also increasing. Further analysis of the price differentials at different markets and destination of the products in the post-bellum period should shed more light on this issue.

SUMMARY

My analysis has focused on two main industry trends and the related issue of the postwar labor shortage. The labor "shortage" was seen to have resulted from a drastic shift in the supply curve of labor. The changing labor market conditions then provided direct impetus for sugar factories to find outside sources of cane and for labor-saving technology in production of the final products. The use of central factories was also encouraged by transportation advances, a technology that favored large-scale enterprises. The tendency to produce white and clarified sugars rather than brown was an extension of prewar trends and eventually led to almost all Louisiana sugar being boiled in vacuum. The acceleration of the antebellum trend came when the labor shortage increased the relative profitability of previously invented equipment.

NOTES

* I wish to acknowledge a faculty research grant from the University of Delaware for the underlying research.

1. The estimate is based on a Cobb-Douglas production function with output elasticities of .45, .40, and .15 for labor, land, and capital, respectively. The elasticities are based on functions fitted for samples of farms from the 1850, 1860, and 1880 manuscript censuses [15]. Real sugar output fell 40 percent between 1860 and 1870. Input reductions were estimated at 20 percent for land and 30 percent for capital (which included the

working stock). Efficiency fell 23 percent with the reduction in average size of operation. This leaves the labor estimate at 40 percent which is biased downward to the extent that planters and farmers substituted corn and other products for sugar. See [18] for a discussion of this approach for the cotton South. The production function also implies that 49 percent of the output decline was due to labor, 34 percent due to lower efficiency, 12 percent from land, and 5 percent from capital.

2. The problems of the 1870 Population Census and ways of dealing with it can be found in [18, pp. 6-11].

3. The final market condition, therefore, was one of disequilibrium but with a wage rate higher than the prewar level. Family incomes were lower, suggesting that the ex-slaves placed a positive value on leisure.

4. [27, p. 454]. Handbooks on sugar technology concurred with the census evaluation [17 and 19].

5. This can be computed from figures on the number of farms producing and selling cane in 1900, the total tonnage sold, and the average yields found in [25, p. 467]. The difference between the 10,000 farms producing cane and the 6,000 selling it is due to a large number of farms that retained their crops to make molasses for home use. Other farms kept their cane for seed for use in the following year.

6. It would be more correct to say that short-run economies existed to some point in the production range. Also increasing returns are relevant in the short run only when we refer to the use of machinery, not the stock.

7. This is not to say that this effect was absent before the Civil War. In fact, analysis of farms between 1850 and 1860 shows that the planters reacted to the rapid increase in slave prices by substituting land and capital for labor [15, pp. 199-208].

8. These conclusions are based on tracing a number of farms across time. The Bouchereau volumes [3] list the output and type of equipment on each farm during each year, allowing time-series of production and equipment to be developed. Most of the farms that advanced to the vacuum process used open pans in 1880, a process in which the juice was heated by steam but not in vacuum. This apparatus was much more adaptable to vacuum pans.

REFERENCES

1. Judah P. Benjamin, "Cultivation and Manufacture of Sugar," *DeBow's Review*, Vol. 2 (1846), pp. 322-44.
2. James C. Bonner, "Advancing Trends in Southern Agriculture, 1840-1860," *Agricultural History*, Vol. 22 (October 1948), pp. 248-59.
3. A. Bouchereau, *Statement of the Sugar and Rice Crops*

Made in Louisiana, Annual Reports, 1868-69 to 1900-1901 (New Orleans: Young Bright, and Company, 1869-1901).

4. C. A. Browne, "The Origins of Sugar Manufacture in America," *Journal of Chemical Education*, Vol. 10 (June 1933), pp. 323-30.

5. P. A. Champomier, *Annual Statement of the Sugar Crop of Louisiana, 1859-1860* (New Orleans: Cook, Young, and Company, 1861).

6. James B. D. DeBow, ed., *The Industrial Resources of the Southern and Western States* (New Orleans: Appleton, 1854), Vol. 3, pp. 195-321.

7. Ralph B. Flanders, "An Experiment in Louisiana Sugar, 1829-1833," *North Carolina Historical Review*, Vol. 9 (April 1932), pp. 153-62.

8. A. B. Gilmore, *The Machinery Equipment of the Louisiana Sugar Factories: Directory for 1923* (New Orleans, 1923).

9. Robert Higgs, "Patterns of Farm Rental in the Georgia Cotton Belt, 1880-1900," *Journal of Economic History*, Vol. 34 (June 1974), pp. 468-82.

10. Edgar M. Hoover, *The Location of Economic Activity* (New York: McGraw-Hill, 1948).

11. Louisiana Sugar Planters Association, *Yearbook for 1910* (New Orleans, 1911).

12. Norbert Rillieux, "Sugar Making in Louisiana," *DeBow's Review*, Vol. 5 (1848), pp. 285-88.

13. Charles P. Roland, *Louisiana Sugar Plantations During the American Civil War* (Leiden, The Netherlands: E. J. Brill, 1957) pp. 92-116.

14. T. R. Savings, "Estimation of Optimum Size of Plant by the Survivor Technique," *Quarterly Journal of Economics*, Vol. 75 (November 1961), pp. 569-607.

15. Mark Schmitz, *Economic Analysis of Antebellum Sugar Plantations in Louisiana* (New York: Arno Press, 1976).

16. J. Carlyle Sitterson, *Sugar Country: The Cane Sugar Industry in the South, 1753-1950* (Lexington: University of Kentucky Press, 1953).

17. Guilford L. Spencer, *Cane Sugar Handbook*, 8th ed., (New York: Wiley, 1945), p. 126.

18. Richard Sutch and Roger Ransom, "The Impact of the Civil War and Emancipation on Southern Agriculture," *Explorations in Economic History*, Vol. 12 (January 1975), pp. 1-29.

19. L. A. Tromp, *Machinery and Equipment of the Cane Sugar Factory* (London: Norman Rodger, 1936), pp. 406-407.

20. US Bureau of the Census, *Compendium of the Sixth Census, 1840* (Washington: United States Government Printing Office, 1843) pp. 246-47 and 262-63.

21. _____, *Eighth Census of the United States, 1860: Agriculture* (Washington: United States Government Printing Office 1864), pp. 66-69 and 170-71.

22. _____, *Eighth Census of the United States, 1860: Manu-*

facturing (Washington: United States Government Printing Office, 1864), pp. 196-205 and 741.

23. _____, *Tenth Census of the United States, 1880: Agriculture* (Washington: United States Government Printing Office, 1883), pp. 212 and 227.

24. _____, *Tenth Census of the United States, 1880: Manufacturing* (Washington: United States Government Printing Office, 1884), pp. 77 and 125.

25. _____, *Twelfth Census of the United States, 1900: Agriculture*, Vol. 1 (Washington: United States Government Printing Office, 1903), pp. 9 and 87-89.

26. _____, *Twelfth Census of the United States, 1900: Agriculture*, Vol. 2 (Washington: United States Government Printing Office, 1903), pp. 443-94.

27. _____, *Twelfth Census of the United States, 1900: Agriculture*, Part 2, *Crops and Irrigation* (Washington: United States Government Printing Office, 1902), p. 453.

28. _____, *Twelfth Census of the United States, 1900: Manufacturing*, Vol. 7 (Washington: United States Government Printing Office, 1904), pp. 414-17

29. _____, *Twelfth Census of the United States, 1900: Manufacturing*, Vol. 8 (Washington: United States Government Printing Office, 1904) pp. 297-309.

30. US Commissioner of Agriculture, *Report of the Commissioner of Agriculture, 1869* (Washington: United States Government Printing Office, 1870), p. 435.

31. _____, *Report of the Commissioner of Agriculture, 1877* (Washington: United States Government Printing Office, 1878), pp. 23-46.

32. US Commissioner of Patents, *Report on Agriculture, 1845* (Washington: United States Government Printing Office, 1846).

33. US Department of Agriculture, *Number and Farm Value of Animals in the United States, 1867-1907* (Washington: United States Government Printing Office, 1908), p. 128.

34. _____, *Condition and Prospects of the Cane Sugar Industry*, Special Report No. 1 (Washington: United States Government Printing Office, 1877).

35. _____, *Relation of Land Tenure to Plantation Organization*, Bulletin No. 1269 (Washington: United States Government Printing Office, 1924).

36. Paul Vogt, "The Sugar Refinery Industry in the U.S.; Its Development and Present Condition," No. 21 in *Series in Political Economy and Public Law* (Philadelphia: University of Pennsylvania, 1908).

37. David O. Whitten, "Tariff and Profit in the Antebellum Louisiana Sugar Industry." *Business History Review*, Vol. 44 (Summer 1970), pp. 226-33.