

Slave Prices and the Economy of South Carolina, 1722-1809

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Abstract

Based on data from several samples of probate inventories we construct and analyze a time series of slave prices for South Carolina from 1722 to 1809. These estimates reveal that prices fluctuated without trend prior to the 1760s and then began to rise rapidly, more than doubling by the early nineteenth century. Estimates of supply and demand functions indicate that while long-run slave supply was highly elastic, the short-run supply function was quite inelastic. Our analysis of the slave price series indicates that the price of rice was the major determinant of the demand for slaves and in turn largely explains the rise in slave prices. These findings have important implications for the interpretation of evidence on rising yields in rice production over the eighteenth century and the sources of wealth accumulation in South Carolina

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Slavery was central to the economic development of South Carolina in the eighteenth century. Slaves were a majority of the population and labor force for much of the century, and made up close to half of the personal wealth recorded in probate inventories in most decades. Despite the proliferation of studies examining various facets of the slave-based economy of South Carolina in recent years, there has been no serious consideration of the evolution of slave prices in the course of the eighteenth century.¹ As the most important productive asset of the economy, and a key component of the region's wealth, however, information on slave prices is a crucial indicator that can shed new light on the pace and pattern of economic growth in the lower south. The data necessary to construct a series of slave prices are available in samples of probate inventories from the region collected by several scholars for the entire period from the early 1720s through the first decade of the nineteenth century, but have not previously been examined.

Using data drawn from probate inventories between 1722 and 1809 we present and analyze a new series of prices for adult male slaves in low country South Carolina. Our slave price series shows fluctuations but no trend before 1770, and a sharp rise thereafter. Although this increase was interrupted briefly in the 1790s, by the first decade of the nineteenth century, prices had more than doubled from their mid-eighteenth century levels. This history can readily be interpreted in terms of movements in the supply of and demand for slaves in South Carolina. Based on an econometric model of the market for slaves we conclude that although shifting

¹ Among the most important general economic histories are those by Philip Morgan (1998), Joyce Chaplin (1993), and Peter Coclanis (1989). Other important contributions include Menard (1995, 1988), Bentley (1977), Terry (1981), Nash (1992), (Egnal 1998, ch. 6), Ryden (1993), Richardson (1991).

supply conditions played some role in determining slave prices, demand-side forces, and especially movements in the price of rice—the principal export crop produced using slave labor in South Carolina—explain most of the movements in slave prices.

The evolution of slave prices that we document bears directly on two important issues in the economic history of South Carolina. The first concerns the effects of shifting cultivation practices on agricultural productivity. The development of new methods of irrigation during the eighteenth century is widely believed to have contributed to a substantial increase in the productivity of rice growing. We conclude, however that the behavior of slave prices is inconsistent with such an interpretation. We cannot rule out some improvement in productivity, but it appears that progress was more modest than has previously been believed. The second issue concerns the sources of wealth accumulation in the lower south. On the eve of the Revolution, the per capita wealth of South Carolina's free population exceeded that of any other region of what would become the United States. Our estimates show that rising slave prices can account for much of the dramatic increase in the region's wealth levels in the decades prior to the 1770s. This does not, of course, alter estimates of relative regional wealth, but it does place them in a rather different light. Instead of reflecting the continued accumulation of real assets by the colony's inhabitants, increased wealth was due largely to rising asset prices.

An Overview of South Carolina's Economic Development

The economic history of South Carolina in the eighteenth and early-nineteenth centuries is dominated by the development of staple agricultural production, primarily rice, but after 1740 including indigo, and at the end of the century cotton.² Roughly speaking we may divide the period into three distinct episodes. The first, running from the beginning of the century to the

American Revolution was characterized by the sustained expansion of rice cultivation. The second period, from the Revolution through the early 1790s, was one of transition. During these years production of the state's leading staples was essentially stagnant, and the center of gravity of the economy began to shift toward the interior where population growth was proceeding rapidly. The third period, dating roughly from the mid-1790s, saw the beginning of a new phase of growth based on the introduction and rapid adoption of cotton cultivation.

In 1700, 31 years after European settlement, South Carolina's population had grown to about 5,700, including 2,444 slaves (see Table 1).³ Although there is evidence of rice cultivation as early as the mid-1690s, rice remained at this time a minor crop. Cattle raising, production of naval stores, and deerskins (acquired through trade with the aboriginal population) were important economic activities at the time.⁴

After 1700, however, events rapidly transformed the South Carolina economy, encouraging the rapid growth of rice cultivation at the expense of other products. Driven by rising European demand for rice, exports increased from 450 thousand pounds in 1700 to 6.5 million pounds in 1720 (see Figure 1). Although European demand conditions were less favorable after 1720, rice prices in South Carolina followed an upward trend, approximately doubling between 1720 and their peak in 1738.⁵ Responding to rising prices the volume of rice exports continued its upward trend, reaching a peak of 43 million pounds in 1740.

² Coclanis (1989) provides the most extensive account of South Carolina's economic history.

³ In addition to these European and African residents, the region was also home to a large aboriginal population. It is difficult, however, to estimate Indian populations within specific colonial boundaries. For the lower South as a whole—including Georgia and North Carolina as well as South Carolina—Indians made up perhaps 80% of the regional population in 1700. Because Indian populations fell across the eighteenth century, while the numbers of colonists and slaves grew, the Indian share of regional population fell dramatically, so that by 1800, they represented just 4% of the total regional population. See Mancall, Rosenbloom, and Weiss (1999a, Table 3).

⁴ Coclanis (1989, pp. 63-69); Menard (1996, p. 275); Dethloff (1982, p. 233); Clifton (1981, p. 274); Nash (1992, pp. 679-81).

⁵ On European demand conditions in this period, see Nash (1992, pp. 685-86). That South Carolina prices continued to rise in the face of relatively stagnant European demand may be attributed to economies of scale in shipping, and

As rice production expanded, cultivation shifted to more productive inland swamps. Early settlers had planted rice in dry upland areas, relying upon rainfall to provide adequate irrigation. Beginning in the early 1720s, however, cultivation shifted to lowland swamps that could be irrigated from ponds and reservoirs. At this point, irrigation was limited to supplying moisture. Not until the widespread adoption of tidal irrigation later in the century would planters begin to use water to systematically control weeds, and insects (Gray 1958, p. 279). Irrigation raised yields, but was also more labor intensive. Construction and maintenance of the dikes, canals, and floodgates necessary to implement this shift required large amounts of labor. Rice cultivation also required a great deal of weeding: difficult and unpleasant work performed ankle- or even knee-deep in mud. According to contemporary estimates successful plantations required a labor force of 30 or more slaves (Chaplin, 1992, pp. 31-33; Philip Morgan 1998, pp. 35-37). To meet these labor demands, slave imports boomed. Between 1700 and 1720, 9,000 slaves were imported (see Table 2), contributing to a more than 4-fold increase in the slave population. By 1720 the slave share of the population increased to 70 percent, reaching its highest level. In the next twenty years more than 32,000 additional slaves were imported, nearly 3 times the number of slaves resident in the colony in 1720.⁶ As great as that increase was, however, it did not keep pace with the growth of the free population.

The initial period of expansion came to a sudden end in 1740. In 1739, the Stono slave rebellion contributed to the colonists' fears about the growing Black majority in the colony, and resulted in the passage of a prohibitive duty on slave imports which lasted until 1744 (Richardson 1991, p. 131, Crouse 1977, p. 56). At nearly the same time international conflicts

the beneficial effects of Britain's decision to allow direct shipments of rice from the colonies to ports in Southern Europe, thus reducing the burden previously imposed on rice exports by the requirement that all exports to Europe pass through Britain (Dethloff 1982, p. 236).

substantially raised shipping and insurance costs, restricting the market for rice. As Figure 1 shows, prices plummeted, and exports fell along with them after 1739. Slave imports also fell precipitously (Table 2), dropping to only a fraction of their level in the previous decade. The depressed conditions persisted for most of the decade. During this period, planters experimented with other crops, including indigo, which emerged as an important complement to rice. British bounties made the crop commercially attractive, and because it was less bulky than rice, it was less affected by the wartime rise in shipping costs. Moreover, since it could be grown on lands not suited to rice cultivation, and its peak labor demands did not coincide with those of rice cultivation, planters could add indigo without substantially reducing their commitment to rice (Gray 1958, p. 289). By 1748, indigo already accounted for 10.4% of South Carolina's exports, putting it third in importance behind deerskins (22%) and rice (55%).

With the return of peace in the late 1740s, rice prices recovered along with exports, and the importation of slaves resumed. Then in the early 1760s, rice prices began to increase again, reflecting an increase in European demand as continental food production fell behind the rate of population expansion (Nash 1992, p. 692; Dethlof 1982, p. 235). Particularly important in this period was the lifting of prohibitive British tariffs on rice in after 1767, which opened a large new market. Responding to rising prices, exports shot upward in the decade and a half before the Revolution. To accomplish this increase, cultivation spread out into Georgia—facilitated by that colony's having lifted its prohibition on the use of slave labor—and the Cape Fear region of North Carolina. South Carolina remained by far the largest producer, and exports through Charleston continued to dominate total exports, but the growth of other sources of supply is apparent in Figure 1. By the early 1770s, rice exports from Charleston were in the range of 60-

⁶ That imports were greater than the total increase in population reflects the harsh demographic regime. Deaths outnumbered births among slaves in the colony making it necessary to import slaves simply to replace these losses.

70 million pounds, well above the peak reached in the 1740s, and total American exports were in excess of 80 million pounds.

The expansion of markets for rice and indigo after 1750 was reflected in the substantial accumulation of wealth among the colony's free population. In the words of Peter Coclanis (1989, pp. 85-90), this accumulation was "truly remarkable...For nowhere else in British North America or perhaps in the World for that matter did so sizeable a population live so well." By the time of the Revolution "the low country was 'the most opulent and flourishing' region in British North America, even the 'the most thriving Country perhaps on this Globe'" (Menard 1996, p. 273). According to Alice Hanson Jones's study of probate records from 1774, average per capita wealth for the free population in the Charleston district was 416 pounds sterling, more than 8 times the level of the middle colonies, and over 10 times as great as in New England at this time. More than half of this wealth was held in the form of slaves, but even if one focuses only on nonhuman wealth, the average wealth per free individual in South Carolina was still more than 4 times that of the average free person in the Middle Colonies.⁷

The upward trajectory of rice exports came to an end with the American Revolution. Material losses during the war were substantial due to the sustained conflict in the region. Perhaps the most important effect was the loss of slaves occasioned by the war. The conflict interrupted the importation of slaves, and resulted in significant losses to the existing slave population. In the chaotic conditions of the war some slaves seized the opportunity to flee or rebel against planter authority, while others were commandeered by British or American troops.

⁷ See Coclanis (1989, p. 125) for these calculations. It should be noted, that if one excludes the value of slaves, and calculates wealth per capita for the entire population, the figure for the lower south (35.9 pounds sterling) is essentially identical to that for the Middle Colonies (40.2 pounds sterling) and New England (36.4 pounds sterling). Thus plantation agriculture enabled free individuals to accumulate substantial wealth, but regional disparities in economic prosperity were largely the result of differences in the inequality of distribution, rather than in the productivity of the underlying economies.

Although data are imprecise, it is estimated that approximately 25,000 slaves were lost during the war (Morgan 1983, p. 111; Gray 1958, p. 596). The impact of these losses is clearly apparent in Table 2, which suggests that over the course of the 1780s imports of nearly 20,000 slaves were needed to increase the slave population by 10,000. The loss of slaves combined with other wartime disruptions led to the neglect of repairs necessary to maintain the complex irrigation systems used in rice cultivation. Water damage compounded this neglect leading to significant capital depreciation (Chaplin 1992, p. 38).

No systematic export statistics are available for the war years, and data for the post-Revolutionary period are neither complete nor entirely consistent. Figure 2 traces rice prices and the volume of exports from Charleston and for the entire U.S. for the years 1782-1810. That exports from Charleston appear to exceed those from the entire country in a few years is most likely a reflection of the fact that the two series were assembled from different sources, and in some cases reflect crop years rather than calendar years. The devastation caused by the war is apparent in the very low levels of exports in the immediate post-war period. Although exports rose rapidly in the second half of the 1780s, even at their peak in 1793, Charleston's exports were well below the level they had attained in the early 1770s. Gray (1958, p. 723) has suggested the failure of exports to increase after 1795 "was due in part to the competition of cotton and in part to [an] increase in domestic consumption."

The destruction of agricultural capital that occurred during the Revolution opened the way for the widespread adoption of tidal irrigation. That tide-induced changes in river levels could be used to irrigate rice had been noticed as least as early as the 1730s, but the extensive use of tidal irrigation did not begin until the 1780s (Chaplin 1992, p. 42; Gray 1958, pp. 279-80; Clifton 1981, pp. 275-76; Dethloff 1982, p. 238). In comparison to the use of ponds and

reservoirs, tidal irrigation reduced the risks of unintended flooding, and provided a more reliable source of water. It also reduced the amount of labor required for weeding, and appears to have raised yields-per-acre. But these benefits came at the cost of substantial capital. Some sense of the scale of the undertaking can be gained from Chaplin's (1992, p. 36) description of the requirements: "Planters needed tremendous structures to control tidal flooding. They had first to build a permanent embankment about five feet high, three feet wide at the top, and twelve to fifteen feet wide at the bottom, its sides carefully pitched to prevent erosion....Smaller banks divided the field into sections, each watered by a system of internal ditches. Each square of the plantation had to be enclosed by banks and each half acre subdivided into 100-125 trenches for sowing."⁸ The widespread destruction caused by the war swept the slate clean, however. During the 1780s, as planters faced the need for large investments in one kind of irrigation system or another, many opted for tidal irrigation in the 1780s. Because tidal irrigation was not feasible everywhere, however, many planters continued to use older irrigation methods.

The stagnation of rice exports after the Revolution was paralleled by a dramatic demographic shift within South Carolina. Beginning in the 1750s, the colony's free population had begun to expand beyond the boundaries of the low country. For the most part, the settlement of the back country consisted of small independent farmers possessing few if any slaves, and producing only small quantities of marketable crops (Hughes 1985; Johnson 1997, pp. 40-60; Klein 1990, pp. 10-27).. As late as 1770, only 6,000 (8.7%) of the colony's 76,000 slaves had lived in the backcountry. In contrast, 30,000 (61%) of the colony's 49,066 free inhabitants resided in this region (Coclanis 1989, p. 75). Over the next 20 years, the backcountry's share of both free and slave population increased. But the growth was especially dramatic in the slave population, which increased by nearly 400%, growing to slightly more than 29,000 by 1790. At

⁸ See also Gray (1958, p. 726).

this date, the back country's share of the state's slave population had increased to 27%. The introduction and rapid expansion of cotton cultivation beginning in the early 1790s perpetuated this shift, so that by 1810, close to 44% of the state's slaves were living in the back country. Thus, while rice remained the dominant employer of slaves into the early nineteenth century, the stage was set for the ascendance of cotton.

Slave Prices

Table 3 summarizes the derivation of our estimates of slave prices in low country South Carolina from 1722 through 1809. Our series is based on the appraised values of adult male slaves found in samples of probate inventories from the region that have been collected by William George Bentley, and Joyce Chaplin.⁹ To facilitate comparison we have converted all of the values to dollars.¹⁰

The first column of the table shows average prices for each decade estimated from Chaplin's data for the period from 1740 through 1809. The second column reports estimates from Bentley's data extending from 1722 through 1760.¹¹ The two series are not entirely consistent in the years that they overlap, but these differences are not inconsistent with the extent of sampling variation present in the underlying data. To combine the series we use a weighted average of the two sets of observations for the 1740s and 1750s, where the weights reflect the

⁹ Bentley collected and analyzed all extant probate inventories for South Carolina from 1722 through 1762. We have been unable to locate a machine-readable version of Bentley's data. However, he reproduced selected data including information on slave values as an appendix to his dissertation (Bentley 1977), and we have drawn a one-in-eight sample from this data set for analysis here. Chaplin's data are ten percent random sample of extant probate inventories for the period 1740-1815, and are described in Chaplin (1993, pp. 367-68). Professor Chaplin has kindly provided us with a machine-readable version of her data set for analysis.

¹⁰ The pre-Revolutionary figures, which were reported in South Carolina currency, which we convert to pounds sterling using the exchange rates reported in McCusker (1978). We then convert these values to dollars by multiplying by 4.44, the value suggested by McCusker (1992, pp. 313-14).

relative number of adult males represented in each sample. To obtain prices for the 1730s and 1720s we extrapolate backward from the 1740s using the index of price changes calculated from Bentley's data for these years. The resulting Combined Series is shown in column 4 of the table.

The evolution of slave prices depicted in Table 3 can be interpreted in terms of the interaction of supply and demand.¹² To disentangle these forces it is necessary to formally model the process of market equilibration. We begin by discussing the major factors affecting demand and supply, and then specify and estimate an econometric model of the market for slaves in low country South Carolina.¹³

Assuming that planters evaluated the purchase of slaves in an economically rational manner they would have wanted to purchase additional slaves as long as the discounted stream of expected net revenue (gross revenues minus maintenance costs) that each slave was expected to generate exceeded the purchase price. Demand for slaves then would depend positively on the marginal value product of labor, negatively on the cost of food and other necessities, negatively on the opportunity cost of money (the interest rate), and negatively on expected mortality (because of its effects on length of the stream of expected future income).¹⁴ Although slaves were employed in a wide variety of activities throughout the economy, rice was the dominant factor in South Carolina's economy from the 1720s forward. Thus the demand for slaves was inextricably linked to the state of demand for rice. According to Kenneth Morgan (1998, p.

¹¹ The decision to aggregate the data by decade is imposed in part by the fact that Chaplin's data are classified only by decade. Given the relatively small size of annual samples, however, a more disaggregated approach would introduce a considerable amount of spurious variation in the series.

¹² Ryden (1993) also uses a supply and demand framework to analyze the market for slaves, but in the absence of slave price data for South Carolina, he was obliged to assume that the supply of slaves was perfectly elastic so that he could in effect treat it as exogenously determined. As we show below, the evidence contradicts the assumption that prices were exogenously determined.

¹³ Factors affecting the supply of and demand for slaves in South Carolina are considered at some length in Ryden (1993); Kenneth Morgan (1998), and Richardson (1991).

914): “Planters calculated whether they could afford slaves mainly on the basis of their projected income from sales of staple produce....Slave markets were therefore inextricably linked with the economic health of the plantation economy...”

The supply of slaves depended upon the combined effects of natural increase (or decrease) in the resident slave population, and importation from abroad. Table 2 summarizes the available information on the relative contributions of natural increase, and importation in the growth of the slave population. For the pre-Revolutionary period, relatively complete data on the volume of slave imports is available, but for the post-Revolutionary period, slave imports are largely imputed on the basis of estimates of the likely course of natural increase, in combination with data on the slave population at various dates. It is clear from these data that imports played a significant role in the expansion of the slave population throughout the entire period. During much of the first half of the eighteenth century, deaths outnumbered births in the colony’s slave population, and the slave population grew only because of the large volume of imports. In the 1740s, the combined effects of prohibitive tariffs and slack demand for rice combined to reduce importation substantially, but the heavy volume of imports resumed after 1750. Not until the 1790s did natural increase begin to contribute substantially to the growth of the slave population.¹⁵

In the pre-Revolutionary period, there were few barriers to the importation of slaves into South Carolina, except for the period of prohibitive duties imposed in the wake of the Stono rebellion in 1739. In light of the depressed demand conditions that prevailed in the 1740s, it is

¹⁴ In addition to producing marketed crops, slaves generally produced much of their own subsistence as well. Consequently the relevant price of this subsistence was the opportunity cost of their foregone labor in producing marketable crops, which would thus also be tied to the state of demand for rice.

¹⁵ For a more extensive discussion of slave demography in the first half of the eighteenth century see Menard (1995). According to Morgan (1983, p. 90) the rate of natural increase became positive for the first time in the 1750s.

not clear that these restrictions were a binding constraint. Although South Carolina received more slaves than any other mainland colony, it still accounted for only a small fraction of the larger Atlantic slave market in this period.¹⁶ Conditions in this external market exerted a powerful influence on slave prices in this period. International supply responses were not, however, perfectly elastic, and significant price differentials could persist for some time. Figure 3 compares our slave price estimates for South Carolina with slave prices in the West Indies, and the Chesapeake region. It is apparent that during the early period of the colony's growth—from the 1720s until 1740—slave prices were substantially above the general Atlantic level. The collapse of the market for rice in the 1740s precipitated a pronounced equalization of prices, which then persisted through the 1760s. By the early 1770s, however, prices in South Carolina had again risen well above those in other regions of the New World.

After 1775, the Revolution and subsequent legislative actions impeded the flow of slaves to varying degrees. During the Revolution the international slave trade was effectively blocked. Although the trade was briefly resumed in the immediate post-war period, the South Carolina legislature in 1787 suspended foreign and domestic imports for three years. The next year this law was replaced by an act allowing slaves to be imported from other states, but extending the ban on foreign imports until 1793. Subsequent laws extended this ban and imposed restrictions on the importation of slaves from other states.¹⁷ While slaves could not be brought from other states to be sold in South Carolina, white settlers were allowed to bring essentially unlimited

¹⁶ Richardson (1991, pp. 127-29) estimates that South Carolina imported perhaps 93,000 slaves from 1706 through 1775, while total slave shipments in this period amounted to about 1.7 million.

¹⁷ South Carolina's delegates to the Constitutional convention were instrumental in delaying the federal ban on slave importation until 1808. Brady's (1972) analysis of voting in the state legislature suggests that support for the restriction of imports in the 1790s derived mainly from large slaveholders and low country residents, while the owners of small numbers of slaves and back country residents generally supported allowing continued importation. As Brady suggests, low country slave holders supported restrictions on slave imports as a means of moderating the sharp decline in slave prices in the 1790s. But, anticipating the return of more favorable conditions, they wished to keep open the option of further importation in the future.

numbers of slaves with them. The relatively high volume of imports in this decade (see Figure 3) provides one indication that the restrictions may not have been a binding constraint.

Consistent with this interpretation, when the market for slaves tightened early in the nineteenth century, the legislature removed all restraints on trade. Between 1803, when the ban on imports was lifted, and 1808, when the Constitutionally imposed ban on slave imports took effect, nearly 40,000 slaves were imported into Charleston, though a significant number of these were subsequently sold to purchasers outside South Carolina (Brady 1972, pp. 608-15).

These observations allow us to provide an informal account of the evolution of slave prices. The rapid expansion of rice cultivation after 1720 created a substantial demand for slave labor driving prices well above the prevailing levels in the larger Atlantic economy and initiating a large volume of slave imports. Despite this importation, continued growth in demand for rice kept prices above those in other parts of the New World throughout the 1720s and 1730s. Only after the collapse of the market for rice in the 1740s was there significant progress toward price equalization. In the 1740s, slack demand combined with prohibitive tariffs reduced importation. With the recovery of rice in the 1750s and 1760s prices began to rise gradually initiating renewed importation. The acceleration of growth in the late 1760s and early 1770s was reflected in the rapid acceleration of slave price increases and very heavy importation in the years immediately preceding the Revolution. The Revolution cut off access to external sources of supply and caused significant reductions in the slave population contributing to a sharp upward movement in slave prices in the 1780s. Prices fell, however, in the 1790s, reflecting the recovery of rice production and relatively weak demand for rice at this time. Stronger demand for rice, combined with the expansion of cotton production after the turn of the century then contributed to a further upward movement in prices after 1800.

This account can be formalized in a simple econometric model of supply and demand. We assume that the short run supply of slaves (Q^s) was an increasing function of slave prices (PS). To capture the effects of supply disruptions caused by the American Revolution we include an indicator variable (WAR) which takes the value one in the 1770s and 1780s, and zero at other times. In the long-run, the supply curve was substantially more elastic. To reflect the outward shift in supply due to importation and natural increase of the slave population we include a linearly-increasing trend term. Formally, we can write the supply function at time t as:

$$(1) \quad Q_t^s = a_1 + a_2PS_t + a_3WAR_t + a_5TREND_t + e_t$$

where e is a random error term incorporating the net effects of other unmeasured variables.

We model the demand for slaves (Q^d) as a declining function of slave prices, and an increasing function of the price of rice (PR). Over time the demand for slaves was growing for a variety of reasons. Most importantly, the growth of the white population added to the number of potential slave-holders and hence to demand. Increases in slave's life-expectancy and growth in productivity over time, may also have contributed to rising demand. To control for these effects we include a linear trend. The demand function at date t can be written as:

$$(2) \quad Q_t^d = b_1 + b_2PS_t + b_3PR_t + b_4TREND_t + u_t$$

where u is a random error reflecting the effects of other unmeasured variables.

The model is closed by requiring that the price of slaves at each date equilibrates supply and demand. That gives us the following condition:

$$(3) \quad Q_t^d = Q_t^s$$

Because the price of slaves is determined simultaneously with the equilibrium quantity of slaves we cannot treat it as an exogenous variable in estimating the supply and demand functions.

Instead we estimate equations (1) and (2) by Two Stage Least Squares. Because the variable

WAR appears only in the supply equation, while the variable PR appears only in the demand equation the model is exactly identified, allowing us to obtain estimates of the structural parameters of both supply and demand.

Table 4 reports our estimates of the supply and demand functions along with reduced form estimates showing the impact of the exogenous variables on each of the two endogenous variables. The coefficients on slave prices in the demand and supply functions have the expected signs, although only the supply function coefficient is statistically significant. Evaluated at the sample means, both supply and demand are less than unit elastic; the supply elasticity is 0.47, while the demand elasticity is -0.61. Thus it appears that both short-run supply and demand were relatively inelastic, and we cannot reject the hypothesis that the short-run demand curve was vertical. The coefficients on the trend variable show that supply was growing at a rate of about 15,500 slaves each decade, while the demand was increasing by a little more than 12,000 slaves per decade. Thus, in the absence of the impact of rising rice prices, the long-run supply response would have contributed to a gradual reduction in slave prices, a fact reflected in the small negative coefficient on TREND in the reduced form price equation. The large and negative coefficient on the WAR variable indicates that after controlling for other factors, the Revolution substantially reduced the supply of slaves.

The reduced form equations show that the primary determinant of slave prices was the price of rice. At the sample means, the elasticity of slave prices with respect to the price of rice was 1.02, indicating that a one percent increase in rice prices would cause an increase of 1.02 percent increase in slave prices. The dummy variable for the Revolutionary war decades is also significant at the ten percent level, confirming the role of war induced scarcity in driving up

slave prices. In the quantity equation, both the price of rice and the trend variable are positive and statistically significant.

Slave Prices, Productivity, and Wealth Accumulation in South Carolina

Our estimates of slave prices bear directly on several important issues in the economic history of South Carolina, including the pace of productivity advance in rice production, and the reasons for the rapid accumulation of wealth in the colony. Over the course of the eighteenth century methods of rice cultivation underwent a series of changes, moving from dry land to irrigated swamps in the 1720s, and then shifting later in the century to tidal irrigation. Tidal irrigation itself was refined as planters shifted from “flow culture,” in which fields were flooded and drained several times, to “water culture,” in which fields were kept flooded and the water level raised to keep up with the rice as it grew taller (Chaplin 1992, pp. 32-49). Paralleling these shifts in technique are a number of observations from contemporary observers indicating a rise in yields-per-acre, from around 1,000 pounds early in the century to about 1,500 pounds by the time of the Revolution, and an increase in output-per-worker from around 2,250 pounds at mid-century to between 3,000 and 3,600 pounds toward the end of the century.¹⁸

Taken together the evidence of advances in irrigation techniques and the rise in yields-per-acre and output-per-worker, have led to the widely held belief that, as Peter Coclanis (1989, p. 96) puts it, “technical improvements in rice cultivation were important sources of aggregate productivity gains.” If the latter term was intended to mean total factor productivity, then this conclusion may be overdrawn. There is a difference between increases in partial factor productivity measures such as yields-per-acre and output-per-worker, on the one hand, and

¹⁸ Coclanis (1989, p. 96). These estimates have been widely accepted by other authors. See for example, Philip Morgan (1998, p. 39); Egnal (1998, p. 106); Nash (1992).

advances in total factor productivity, on the other, since partial factor productivity may grow as the result of factor substitution as well as increased productive efficiency. It is apparent from the descriptions of advances in irrigation practices that each advance was associated with an increase in the capital intensity of production. Tidal irrigation, for example, required more extensive investments in dikes, ditches, and the leveling of fields, than earlier methods of irrigation relying on ponds and reservoirs; and those earlier methods were, in turn, substantially more capital intensive than the dry land cultivation practices they replaced. Thus, at least some of the growth in yields-per-acre or output-per-hand must reflect factor substitution rather than advances in productivity.

Our slave price estimates suggest that advances in total factor productivity must have been relatively modest. Intuitively, if total factor productivity rises so that more output can be produced from a fixed set of inputs, then, holding output prices constant, there will be more revenue. This revenue must be paid to one of the factors of production, and will be reflected in a rise in the payments to one or more of the inputs to the production process. More formally, begin with the identity between revenues and factor payments:

$$(4) \quad PQ = RK + PL + WN$$

Where P is product price, Q is output, K , L and N are capital, land and labor, respectively, and R , P , and W are the payments to the respective factors of production. In the case of slaves, the payments W net of subsistence costs will accrue to the slave's owner. Since slave prices are simply the capitalized value of current and expected future net income, movements in W will produce parallel shifts in slave prices. Dividing through by P , and using lower case variables to denote the real input prices we obtain:

$$(5) \quad Q = rK + pL + wN$$

Differentiating both sides of this expression with respect to time and dividing by Q , yields the following expression:

$$(6) \quad Q^* = s_k(r^* + K^*) + s_l(p^* + L^*) + s_n(w^* + N^*)$$

where $s_k = rK/Q$, $s_l = pL/Q$, and $s_n = wN/Q$, are the factor income shares, and an asterisk after a variable denotes its time derivative. Rearranging terms, equation (6) can be written as:

$$(7) \quad Q^* - s_kK^* - s_lL^* - s_nN^* = s_kr^* + s_lp^* + s_nw^*$$

The left hand side of this equation, however, is the conventional measure of total factor productivity—the difference between the rate of growth of output and the weighted sum of the growth rates of the inputs. If total factor productivity is increasing, then equation (7) makes clear that this result must show up in an increase in one or more of the real input prices.

In Table 5, we compare the movement of slave prices with those of rice prices from 1722 through 1809. Across the colonial period, from the 1720s through the 1760s, when yields-per-acre were rising by 50 percent, there is, if anything, a slight downward trend in the real price of slaves. The ratio of slave prices to rice prices fell 16 percent from the 1720s to the 1760s, before bouncing back in the 1770s. Similarly, across the post-colonial period, the ratio of slave to rice prices remained roughly constant or fell slightly between the 1780s and the early 1800s.

The lack of any increase in the real price of slaves does not conclusively rule out an increase in total factor productivity, but if there were such an increase it would had to have manifested itself in a relatively large increase in the payments to other factors of production. Assuming that labor's share of output was 60 percent, the combined payments to land and capital would had to have increased by 150 percent relative to the price of rice for the 50 percent rise in yields-per-acre in the pre-Revolutionary period to be explained as a rise in total factor

productivity.¹⁹ Similarly, if the late eighteenth-century increase in output-per-slave of somewhere between 33 and 60 percent was due primarily to total factor productivity growth then the combined prices of land and capital would have had to have risen by between 82.5 and 150 percent relative to the price of rice.²⁰

We have so far been unable to locate reliable estimates of the trends in payments to capital and land, but increases of the scale necessary to account for the rising production per-acre and per-slave seen across the eighteenth century seem implausible, especially in the pre-Revolutionary period. The bulk of agricultural capital was in the form of dams, ditches, and other improvements related to irrigation. The primary input in the production of these improvements was slave labor, suggesting that the prices of capital would most likely have moved with the price of slaves. Increases in the price of land may have been more likely, but only if land suitable for the cultivation of rice was in limited supply. In general, we would expect the increased income due to improvements in productivity to be captured primarily by the least elastically supplied input. The evidence suggests, however, that land remained relatively abundant at least in the colonial period. As production expanded after 1750 planters were able to extend cultivation into previously unexploited lands in Georgia and the Cape Fear region of North Carolina. Based on examination of Loyalist compensation claims Nash (1992, p. 693) concludes that many South Carolina planters held large reserves of unimproved rice land at the

¹⁹ Taking the decline in real slave prices to be 16% over the pre-Revolutionary period, then if total factor productivity were to have increased by 50 percent, it would be necessary for the weighted average of land and capital prices to rise by a factor of $(.5 + .16*.6)/.4 = 1.5$. We do not have any direct evidence about factor income shares in the eighteenth century, but for the mid-nineteenth century Coclanis and Komlos (1987) assume that factor shares in rice production were labor-0.58, land-0.25, and capital-0.17. If anything, we would expect that labor's share of output was larger in the eighteenth century. To the extent that we have understated labor's share our estimates of the increase in land and capital costs needed to account for any given amount of productivity advance will be biased downward.

²⁰ Recall that output per worker is estimated to have increased from around 2,250 pounds to between 3,000 and 3,600 pounds.

time of the Revolution. In his view the principal obstacle to expansion was obtaining enough labor to develop and cultivate this land.

In the post-Revolutionary period there is some evidence that the shift to tidal irrigation may have been linked to gains in total factor productivity. According to Chaplin (1992, p. 43), at the close of the eighteenth century swamps suited for tidal irrigation sold for about twice the price of inland swamps irrigated from ponds or reservoirs. On the assumption that land's share of output was 25 percent, this doubling in value would indicate that the move to tidal irrigation which began after 1780 was responsible for a 25 percent improvement in total productivity. Thus, it is possible that productivity advances accounted for somewhere between one-third and three-quarters of the advance in output-per-worker in the post-Revolutionary era.

Turning to the issue of wealth accumulation, the rise in slave values documented in Table 3 implies that a large part of the "remarkable" levels of wealth found in the low country at the time of the American Revolution was due to rising asset prices, rather than the accumulation of real assets. According to Bentley (1977) already in the 1720s slaves accounted for 45 percent of estate values, and by the 1750s this figure had risen to perhaps 51 percent. Calculations based on the sample of probate inventories collected by Joyce Chaplin for the years 1740 to 1809 suggest that slaves made up an even higher proportion of wealth, accounting for about 70 percent of probated wealth in most decades. Average slave holdings per estate were rising in the first half of the century—increasing from 7.7 in the 1720s to 13.3 in the 1730s, and 19.2 in the 1740s—but thereafter they appear to have leveled-off or even fallen slightly.²¹

²¹ Figures for the 1720s, 1730s, and 1740s mentioned in the text were calculated from the one-in-eight sample of Bentley's inventories that we have analyzed. In Chaplin's sample of probate inventories the average number of slaves per inventory fluctuated without apparent trend in the range of 13 to 17 slaves from the 1740s through the first decade of the nineteenth century. These averages are calculated across all inventories included in the samples, so this overall stability could be consistent with an increasing concentration of slaveholding on larger plantations.

To examine the impact of changes in slave prices on probate wealth we have constructed counterfactual wealth estimates in which we hold the price of slaves constant and compared them with the actual probate wealth series. The results of this comparison are reported in Table 6. The top half of the table compares actual and counterfactual wealth estimates based on Bentley's sample of probate inventories for the period 1722-62, while the bottom half of the table makes the same comparison using Chaplin's sample of probates for the low country from 1740 through 1809. According to the Bentley series, both actual and counterfactual wealth figures increased substantially between the 1720s and the late 1750s, with the increase in actual wealth being only about 19 percent greater than the increase holding slave values constant. Much of the increase in wealth in these years reflected rising slave holdings.²² After the 1760s the actual and counterfactual series diverge more significantly. While actual wealth more than doubled between the 1760s and 1770s, and grew another 20 percent from the 1770s to the 1780s. The counterfactual series increased only 40 percent between the 1760s and 1770s, and hardly at all over the next decade. Over the entire 70 years covered by Chaplin's data actual wealth nearly doubled, while our counterfactual series was actually lower in the early nineteenth century than it had been in the 1740s.

These results do not of course controvert earlier findings that have emphasized the rising prosperity of colonial South Carolina, but they place these findings in a rather different light. Rather than reflecting the accumulation of real assets, the region's rising wealth after 1740 was the consequence mostly of increases in asset prices driven by world demand for the region's primary staple commodities.

²² The Chaplin data show a different picture for the 1740s and 1750s, with the average probate wealth level declining. Nevertheless, the difference between the actual and counterfactual figures for the 1750s using her data

Conclusion

Based on data available in samples of probate inventories from South Carolina it is possible to construct estimates of slave prices between 1722 and 1809. These estimates reveal that slave prices fell moderately between the 1720s and 1740s, before beginning to rise. The rate of price increases accelerated after 1770, and despite a sharp drop in the 1790s, prices had more than doubled by the early nineteenth century. Although the long-run supply of slaves was probably close to perfectly elastic, the short-run supply curve was relatively inelastic. In these circumstances, the growth of world markets for rice contributed to rising output prices which in turn helped to push up slave prices after the middle of the eighteenth century.

These findings have several important implications for our understanding of the economic history of South Carolina. First, they suggest that a significant fraction of the rise in yields-per-acre and output-per-slave that occurred in rice cultivation across the eighteenth century was the product of increased application of capital in the form of more expensive irrigation systems, rather than an improvement in total factor productivity. There is still room for some advances in total factor productivity, but these advances can account for only a fraction of the change in yields-per-acre and output-per slave that are believed to have taken place. Further research into the behavior of land and capital prices will be necessary, however, to establish conclusively the magnitude of any total factor productivity improvements. Second, the long-run rise in slave prices appears to have been responsible for much of the increase in the region's prosperity in this period. This finding suggests that rather than accumulating more physical assets, slaveholders were becoming wealthy through capital gains realized because of strong demand for the region's primary product, which drove up the value of labor. As long as

was also 19 percent.

the short-run supply of slaves remained relatively inelastic, the owners of this scarce resource were able to capture significant scarcity rents in the form of rising slave prices.

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Table 1:
South Carolina Population, 1700-1809

Year	Total	Free	Slave	
			Number	Percentage
1700	5,704	3,260	2,444	42.85
1710	10,883	6,783	4,100	37.67
1720	17,048	5,048	12,000	70.39
1730	30,000	10,000	20,000	66.67
1740	45,000	15,000	30,000	66.67
1750	64,000	25,000	39,000	60.94
1760	94,074	36,740	57,334	60.95
1770	124,244	49,066	75,178	60.51
1780	180,000	83,000	97,000	53.89
1790	249,073	141,979	107,094	43.00
1800	345,591	199,440	146,151	42.29

Notes and Sources: U.S. Census Bureau (1975, series Z15-17, and series A195, A199-200).

Table 2:
Source of Growth of the
South Carolina Slave Population, 1720-1809

Year	Slave Population		Slaves Imported	
	Number at beginning of Decade	Change over preceding decade	Number	Ratio of Imports to Total Increase
1700	2,444			
1710	4,100	1,656	3,000	1.81
1720	12,000	7,900	6,000	0.76
1730	20,000	8,000	11,600	1.45
1740	30,000	10,000	21,150	2.12
1750	39,000	9,000	1,950	0.22
1760	57,334	18,334	16,497	0.90
1770	75,178	17,844	21,840	1.22
1780	97,000	21,822	18,866	0.86
1790	107,094	10,094	19,200	1.90
1800	146,151	39,057	19,991	0.51
1810	196,365	50,214	30,195	0.60

Notes and Sources: Slave population from U.S. Census Bureau (1975, series Z15-17, and series A195, A199-200); Slave imports from Morgan (1983, p. 87), and Philip Morgan (1998, p. 59). Through 1775, there are reasonably complete data on the number of slaves imported into South Carolina. After 1775, it is necessary to impute the volume of imports using an estimate of the rate of increase of the resident population, and then calculating the difference between actual and estimated population at each date.

Table 3:
Derivation of the Prices of Adult Male Slaves in
Low Country South Carolina, 1722-1809

Period	Chaplin	Bentley		Combined
	Value (\$) (1)	Value (\$) (2)	Index (1740-49=100) (3)	Value (\$) (4)
1722-29		183.7	110.1	164.1
1730-39		196.3	117.6	175.4
1740-49	117.9	166.9		149.2
1750-59	160.7	179.4		167.7
1760-69	154.3			154.3
1770-79	245.7			245.7
1780-89	343.5			343.5
1790-99	197.2			197.2
1800-09	393.2			393.2
1810-15	343.5			343.5

Notes and Sources: Column (1) is derived from a machine-readable sample of probate inventories collected by Joyce Chaplin. See Chaplin (1993, pp.367-68) for details about the data. Because Chaplin reports only an aggregate value for all slaves, we have estimated the value of adult males using a regression framework that controls for the age and sex composition of slaveholdings in each estate. Details of this procedure are described in Mancall, Rosenbloom, and Weiss (1999). Beginning with data for 1780, we also include dummy variables to control for possible regional differences in slave values between the low country and other parts of the state. Chaplin does not provide location information before this date, but the number of estates from outside the low country is not very large in these earlier years. Column (2) is derived from a one-in-eight random sample of probate inventories summarized in Bentley (1977). For 1740-49 and 1750-59 the combined series in Column (4) is a weighted average of the Chaplin and Bentley series, where the weights are the relative number of observations on which each estimate is based. For years before 1740, the series is extrapolated by applying the changes in the Bentley series to the value of the Combined series in 1740-49.

Table 4:
Estimates of Determinants of Supply of and
Demand for Slaves, 1722-1809

Variable	Structural Model				Reduced Form Equations			
	Supply		Demand		Price		Quantity	
	Parameter (s.e)	P > t	Parameter (s.e)	P > t	Parameter (s.e)	P > t	Parameter (s.e)	P > t
PS	159.1 (52.1)	0.03	-206.1 (202.1)	0.36				
TREND	15502.3 (1491.8)	0.00	12032.3 (3684.0)	0.02	-9.5 (8.4)	0.31	13990.4 (2258.0)	0.00
WAR	-20539.4 (6722.1)	0.03			56.3 (27.2)	0.09	-11590.2 (7321.1)	0.17
PR			39357.3 (23958.1)	0.16	107.8 (24.9)	0.01	17148.3 (6699.3)	0.05
Intercept	-17526.1 (7827.2)	0.08	-10193.0 (12789.3)	0.49	20.1 (31.1)	0.55	-14331.0 (8350.5)	0.15
R-Squared	0.99		0.96		0.92		0.98	

Notes and Sources: The dependent variable in the structural model, and the reduced form quantity model is the mean of the number of slaves in South Carolina at the beginning and end of each decade. The dependent variable in the reduced form price equation is PS, the average price of adult male slaves in each decade. TREND is a linearly increasing term that begins at zero in the 1720s and increases by one in each subsequent decade; WAR is a dummy variable equal to one in the 1770s and 1780s, and zero otherwise; and PR is the average price of rice in each decade. Figures in parentheses are the standard errors. The column labeled P > |t| shows the probability that the estimated parameter is statistically significantly different from zero.

Table 5:
Decade Average Prices Slaves and Rice, 1722-1809

Period	Slave Price (\$/adult male)	Rice Price (cents/pound)	Index of Slave Price Relative to the Price of Rice (1722-29=100)
1722-29	164.16	1.40	100.0
1730-39	175.43	1.64	91.4
1740-49	149.16	1.18	108.1
1750-59	167.74	1.56	92.0
1760-69	154.30	1.58	83.8
1770-79	245.70	1.87	112.6
1780-89	343.50	3.15	93.3
1790-99	197.20	2.73	61.8
1800-09	393.20	3.81	88.4

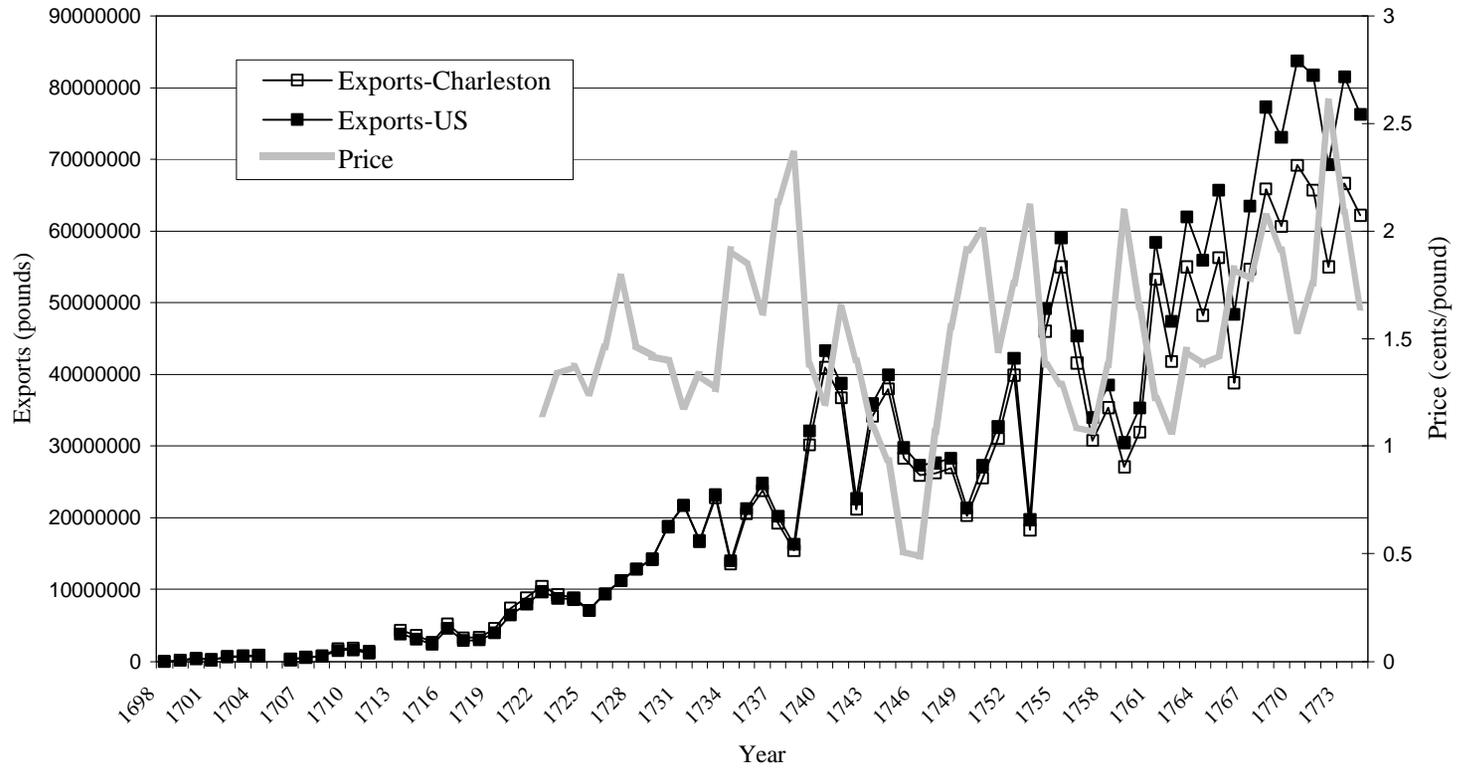
Notes and Sources: Slave prices from Table 2, Rice Price from Cole (1938, p. 152) and Coclanis (1989, p. 107).

Table 6:
Average Actual and Counterfactual Wealth per
Inventoried Decedent, 1722-1809

Period	Average Wealth (\$)		Index		Ratio
	Actual	Counterfactual	Actual	Counterfactual	Actual/ Counterfactual
<i>Bentley</i>					
(1722-26=100)					
1722-26	1851	1906	100	100	100
1727-31	1696	1730	92	91	99
1732-36	1935	1867	105	98	107
1737-41	1889	2178	102	114	89
1742-46	2575	2575	139	135	103
1747-51	3136	2973	169	156	108
1752-56	3414	3215	184	169	109
1757-62	3830	3324	207	174	119
<i>Chaplin</i>					
(1740-49=100)					
1740-49	2398	2477	100	100	100
1750-59	1992	1730	83	70	119
1760-69	2653	1970	111	80	139
1770-79	5879	2776	245	112	219
1780-89	6935	2808	289	113	256
1790-99	4370	2777	182	112	163
1800-09	4772	2358	199	95	209

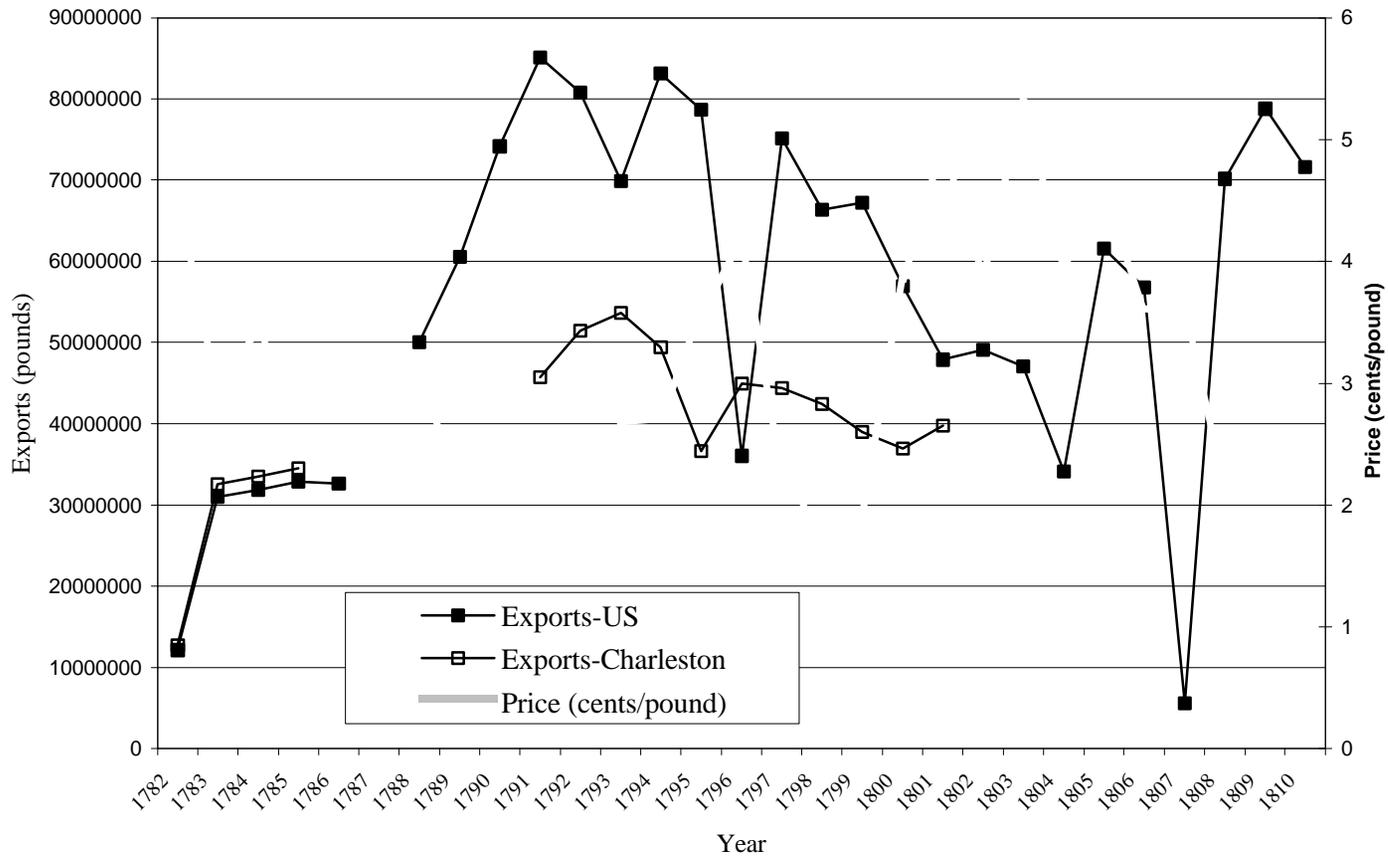
Notes and Sources: Bentley's probate wealth data are reproduced in Coclans (1989, p. 85). The counterfactual series was calculated by subtracting the share of wealth in each period attributable to slaves and then deflating the slave share of wealth using a price index set equal 100 in 1742-46. The slave price index was calculated from a one-in-eight random sample of slave values drawn from date reproduced in Bentley (1977). The actual and counterfactual wealth series from Chaplin's sample were calculated from the machine-readable version of her data. After 1780 they are limited to the South Carolina low country estates only. The counterfactual series was calculated by subtracting the total value of slaves from each inventory, and then valuing slaves at the prices prevailing in the 1740s. Where the age and sex of slaves was enumerated separate price data for each age sex category were used. When information on age and sex were not available, a weighted average of prices of slaves in each age and sex categories was used, where the weights were the shares of different age/sex groups in those estates for which information on age and sex were available.

Figure 1
Rice Exports (pounds) and Price (cents/pound), 1698-1722



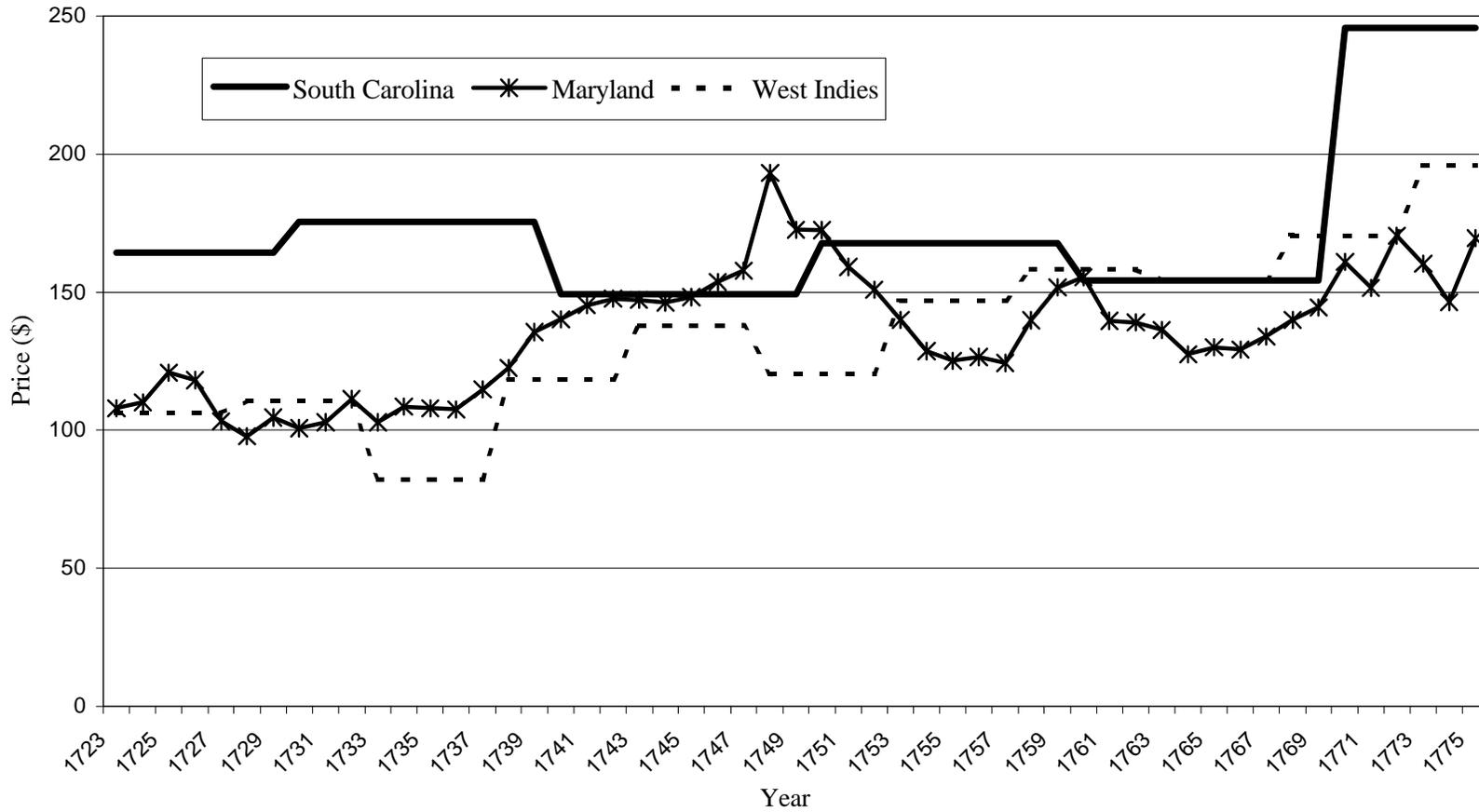
Notes and Sources: Exports-Charleston splices Coon's (1972, pp. 349-50) estimates for 1698-1724 and U.S. Bureau of the Census (1975, Series Z483) for 1725-1774; Exports-US is total exports for South Carolina and Georgia from U.S. Bureau of the Census (1975, Series Z481); Price data are from Coclanis (1989, p. 107), and Cole (1938, p. 154)

Figure 2
Rice Exports (pounds) and Price (cents/pound), 1782-1810



Sources: Exports-US from Gray (1958, p. 1030); Exports-Charleston from Gray (1958, p. 1022); price of rice from Cole (1938, p. 154)

Figure 3:
Comparison of Slave Prices at Different Locations, 1723-1775



Sources: South Carolina is from Table 2; Maryland is from Kulikoff (1976, pp.485-88; West Indies is from Bean (1975, p. 77).

