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The Market Evaluation of Human Capital: The Case of Indentured Servitude

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This paper examines the market for human capital created by the institution of indentured servitude in colonial America. The indenture system allowed English emigrants to obtain passage to the colonies by selling claims on their future labor. With the size of the debt approximately equal for all emigrants, the length of the term for which a servant was bound is predicted to have varied inversely with expected productivity in the colonies. Analysis of two collections of contracts made in the seventeenth and eighteenth centuries supports the prediction. Age, skill, and literacy were negatively related to length of indenture. Women received shorter terms than men at young ages, while servants bound for the West Indies and those bound in periods of high colonial demand for labor also received reductions.

I. Introduction

During the colonial period of American history, two institutions existed which provided for the explicit valuation of stocks of human capital in the market. One of these was slavery, under which blacks and their progeny were held in service for life. The other was indentured servitude, under which whites were bound to service for limited periods of time.

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As a result of both its direct importance for the history of the nineteenth century and its indirect importance for the history of the twentieth, slavery has long been one of the central concerns of American social and economic historians. However, in the labor markets of many regions, for substantial periods during the first half of the colonial era, indentured servitude was of greater quantitative importance than slavery.¹ In the eighteenth century the quantitative significance of indentured servitude declined in most of these areas, as slaves were substituted for servants in the sugar fields of the West Indies, in the tobacco fields of the Chesapeake colonies, and in the rice fields of South Carolina.² Yet indentured servitude nonetheless continued to perform an important role in the colonial labor market by providing skilled craftsmen and managers to the large plantations of the West Indies and the southern mainland colonies.³

The essential difference between servitude and slavery was that it was the labor of the servant, rather than the person, which was bought and sold. Because less attention has been devoted to the study of indentured servitude, we are less familiar with the history of the institution. An economic investigation of its functioning, based on the analysis of quantitative data generated by the operation of the market for servants, can therefore serve a dual purpose: It can provide evidence of how capital values were established when claims on the labor of humans for long periods were traded in the market, while at the same time increasing our understanding of the economic basis of white servitude in colonial America.⁴

II. The Indenture Bargain

Indentured servitude was a credit system under which human labor was leased. It functioned through two markets linked by a recruiting agent. In England, in the first market, a prospective servant signed a

¹ An example is Maryland, where a study of probate inventories has indicated that as late as 1674–79 the ratio of servants to slaves held in estates was 3.88 (Menard 1977*b*, p. 360). It should be pointed out that in some areas neither type of bound labor was quantitatively important. Slaves never accounted for more than 3 percent of New England's total population in the colonial period, and the share of servants was probably of a similar magnitude (Greene 1942, chap. 3; Abbot Emerson Smith 1947, pp. 28–29). A generalization that held for a number of major colonial regions is that the share of bound workers in a region's labor force tended to rise as one traveled south from New England, with progressively increasing shares in the middle colonies, the Chesapeake, South Carolina, and the West Indies. For evidence on population composition, see Greene and Harrington (1932), Sutherland (1936), and Wells (1975).

² For accounts of this process in the West Indies, see Dunn (1973); for the Chesapeake, see Menard (1977*b*); for South Carolina, see Wood (1975).

³ On this change, see Gray (1958, 1:350) and Pares (1960, p. 19); for additional evidence see Galenson (1979*a*, chap. 10).

⁴ The present paper extends the analysis and empirical findings of Galenson (1977*b*).

contract, or "indenture," with a merchant, promising to serve the latter or his assignees in a particular colony for a given period under stated conditions. The servant was then transported to the specified colonial destination, where the merchant or his representative sold his contract to a colonial planter or farmer in the second market. In return for the commitment of his labor, the servant received passage to the designated colony, maintenance during the term of the contract, and certain freedom dues at its conclusion. Once signed, the indenture was negotiable property, and at any time before its conclusion the servant could be sold to a new master for the balance of his term. When the contract expired, the servant became free. The conditions of servitude were regulated by colonial statutes as well as by agreements written into the contracts. The terms of the contract were binding upon both master and servant.

The indenture system normally operated within a context of competitive markets both in England and in the colonies. Servants were one important available backhaul cargo for English ships engaged in the trade for colonial sugar, tobacco, rice, and other agricultural staples.⁵ Contemporary fare quotations indicate that the charges for passage from England to America were uniform at a given time for all individuals and did not vary by specific colonial destination.⁶

The planter's demand for indentured servants was based on his calculation of the discounted value of their net future earnings, after deducting the expected costs of the servant to him. The present value of the servant to the planter therefore depended upon the expected value of the servant's output in each year of the contract; the expected cost of maintenance, supervision, and training for the servant during each year of the term; the discount rate; and the value of the freedom dues to be paid to the servant. These, or analogous variables, are the same considerations which enter into the derivation of a free worker's net age-wealth profile (Becker 1975, p. 223). Yet one critical difference is that, whereas for free workers evidence on flows is used to calculate the values of capital stocks, in the case of servants these calculations were performed by planters, who based their demand for stocks of bound labor for fixed terms on their calculations involving

⁵ See Bruce 1907, 1:622; Smith 1947, p. 39; and Middleton 1953, pp. 145-56.

⁶ While £6 was the fare cited in the early colonial period, after the middle of the seventeenth century £5 was the fare normally quoted for passage to all colonies. For references to quotations of passage charges from England to a number of colonies, see, e.g., John Smith (1624, pt. 1, p. 162); Purchas (1625, pt. 4, p. 1791); Bullock (1649, p. 47); Taunton (January 4, 1670); Wilson (1682, p. 19); Littleton (1689, p. 17); Jeaffreson (1878, pt. 2, p. 102); Kingsbury (1906, pt. 1, pp. 277-78); Abbot Emerson Smith (1947, p. 35); and Alexander (1972, p. 45). A qualification to the statement in the text is possible seasonal variation in the cost of delivering servants to some colonies, discussed below.

the relevant flows. Therefore, like the slave market, the market for indentured labor produced capital values, and the flows underlying these must be inferred.

The institutional arrangements which provided for the ownership of human capital for discrete periods produced potential differences between the patterns of human-capital values under indentured servitude and those implicit in the operation of free labor markets. An advantage of the indenture system for the planter, relative to the hiring of free workers, was the greater control it gave him over the servant's time and effort once the bargain was made. Because the servant would have been compensated for his loss of freedom, in the absence of uncertainty, the price of indentured human capital would have been higher than that of free workers.⁷ However, in practice, uncertainty makes the direction of the inequality between these prices unpredictable without additional information, for it cannot be determined a priori whether the insurance value of the contracts was normally greater to the planter or the servant.⁸

All servants who migrated to America incurred debts of similar value. As noted above, passage charges were uniform for all servants, and maintenance costs and freedom dues varied little across individuals. As a result, every servant contract was a promise to repay approximately the same sum of money. Therefore, the present discounted value of every servant's contract should have been approximately the same at the time of binding. Since the productivity of servants varied, the conditions of their indentures had to vary. The higher the servant's marginal-value product above his maintenance, the faster he could repay the loan made to him, and the shorter the term of the contract. The length of indenture across servants should, therefore, have been negatively correlated with individual productivity or, equivalently, with the market valuation of the current flow of income generated by the individual's stock of human capital.

⁷ This assumes a solution to the problem of monitoring the servant's work in which the productivity gains from the master's control over the servant's time and effort were not offset by shirking.

⁸ In a world in which futures contracts for free wage labor could be made with certain fulfillment, the present value of an indenture for a given number of years and of a series of contracts for hires for the same years would differ only by a premium which would reimburse the servant for the loss of freedom resulting from his residence in the master's household and due to other legal provisions governing servitude. However, in the absence of these guaranteed futures contracts, in some cases the master might also have been willing to pay more for an indenture because of the assurance it gave him of labor supply in peak seasons or future years; similarly, workers might sometimes have been willing to accept lower implicit wages in return for the guarantee of employment the indenture represented. The relative cost of this insurance to master and servant could vary, and as a result the relation between the implicit wage paid to servants and the hire rate for free workers is indeterminate.

Strictly, if costs had been precisely the same for all servants, all should have been bound on conditions that would yield the same expected price on arrival in the colonies. This, of course, does not imply that no variation should have occurred in the realized auction prices of servants in the colonies, for random disturbances between the time of binding and auction—such as illnesses of servants during the voyage or changes in the price of colonial outputs—could have produced differences between actual and expected prices. What the analysis does imply, however, is that if the market for contracts of servitude was efficient, variation in servants' auction prices should have been uncorrelated with all the characteristics of the servants which were known at the time of making the indenture bargain.⁹

Very little evidence of the prices of newly arrived servants at colonial auctions has survived: From the entire colonial period the only known records of auctions of English servants come from the accounts of two ships, the *Tristram and Jeane*, which sold 68 servants in Virginia in late 1636 or 1637, and the *Abraham*, which sold 56 servants in Barbados in January 1637 (London, Public Record Office, 1636, 1637). The listings of the amounts paid for the servants show that the median and modal prices of both men and women were identical—500 pounds of tobacco—in both auctions. Thus, although as will be seen both sex and colonial destination had a significant effect on the length of servants' indentures, the available evidence, though limited, suggests that neither may have affected the initial colonial auction prices for the servants. This is consistent with the hypothesis that the variable dimensions of the contract were adjusted for the servants' characteristics so as to make the expected auction prices of all servants the same.

The relation between auction prices of servants and the simple cost of passage is also of interest. The modal price of 500 pounds of tobacco observed in the auctions was 11 percent greater than the fare that two free passengers each paid for passage to Virginia on the *Tristram and Jeane* on the same voyage as the servants and 4 percent above the fare quoted elsewhere for passage from England to Maryland in 1638.¹⁰

⁹ This statement neglects one potential element of cost. The marginal cost of delivery, and therefore auction prices, would have included any costs the merchant incurred in recruiting servants in England. These could clearly vary across individual servants, producing differences in expected auction prices. These costs could have been correlated with individual productivity, as in some instances skilled servants were given lump-sum payments at the time of binding. For some evidence of this practice, see the analysis of the Middlesex sample in the Appendix.

¹⁰ The two free passengers each paid 450 pounds of tobacco (London, Public Record Office 1637). For the 1637 Chesapeake farm price of tobacco, see Menard (1975, p. 475). The fare quotation, of £6 sterling per person, is in Maryland Historical Society (1889, p. 206).

That in these cases the typical auction prices tended to be higher than the fare may have been due to the cost of recruiting servants, or to the existence of a premium received by merchants for bearing the risk of servant mortality on the ocean voyage.

Related evidence on the nature of the labor-market equilibrium in the colonies which induced flows of labor from England is available from surviving valuations of indentured servants recorded in Maryland for probate courts. The mean price of 28 male servants with 4 remaining years of servitude recorded on Maryland's lower western shore during 1704–57 was £8.95, with a median of £9 and a mode of £10; while the mean price of 19 females with 4 years remaining was £7.75, with a median of £8 and a mode of £10.¹¹ The typical marginal cost to an English merchant of delivering servants to the colonies cannot be estimated precisely but probably fell within a range bounded at the lower end by £5, the usual cost of passage, and at the upper end by the £10 estimated by Abbot Emerson Smith as the maximum expense of delivery.¹² The evidence of the probate valuations—although again limited in quantity—suggests that the central tendency of the colonial price of servants did fall within this range and, therefore, offers additional support for the hypothesis that the price of a servant's indenture in the colonies was equal to the marginal cost of delivering labor there from England.

A number of other general considerations relating to the adjustment of the bargain deserve mention. One is the role of mortality. The smaller the probability of a servant's serving a given year of his term, the lower his expected net earnings and, *ceteris paribus*, the less favorable the terms of the contract he would be able to sign. This is true whether the mortality in question is that during the Atlantic crossing, when the merchant bore the risk, or that after arrival in the colonies, when the planter had purchased the contract and assumed the risk.¹³

A second factor with a similar effect was the possibility of a servant failing to serve out his term for a reason other than death, principally

¹¹ I am grateful to the St. Mary's City Commission, Annapolis, Maryland, for transcriptions of the probate price quotations, from Maryland Hall of Records. Most of the quotations are from the early decades of the period; on devaluation of Maryland currency and its reflection in probate valuations, see Main (1972, pp. 14–18) and McCusker (1978, pp. 189–204).

¹² Smith 1947, p. 37. A precise analysis would include a positive premium in the probate valuations, for these servants had normally been "seasoned," i.e., had spent a year in the new colonial disease environment, and consequently had a longer life expectancy than the new arrivals, *ceteris paribus*.

¹³ Mortality rates differed among colonies, and the effects of this on the length of indenture will be discussed below. The assumption here will be that mortality rates among servants both during passage and in the colonies were not systematically related to individual productivity.

running away. All the colonies enacted legislation intended to discourage servants from running away; of these some were preventive measures and others punitive. While some colonies provided for corporal—and even capital—punishment for runaways, the most common penalty was extension of the servant's contract by some multiple of the time he was absent.¹⁴ One of the provisions of the contract, the servant's freedom dues, constituted a nonvested pension and, therefore, also acted to discourage servants from running away. While the form and worth of the dues varied across colonies and over time, they were often of substantial value and could have constituted a significant deterrent to servants who considered escaping from their masters.¹⁵

Servants were not allowed to marry during their terms. Since, by English practice, the expense of raising the illegitimate children of servants fell on the county, colonial legislation provided that the father should be discovered by oath of the mother and that he should reimburse the county for the expense of raising the child until it could be bound out to work. Since servants could not normally pay this sum, either the master would pay it and the servant's term would be extended, or the servant would be bound over to the county for an additional term after the conclusion of his normal term, to be sold for the necessary amount. The mother's term was also extended to reimburse the master for her lost working time.

III. Empirical Results

The principal sources of quantitative evidence bearing on this market for human capital are servant contracts recorded and held in English

¹⁴ For references to laws relating to runaways, see Semmes (1938, pp. 116–18) and Smith (1947, pp. 264–70). The strong terms of this colonial legislation were an important element in the indenture system's success, and some authors have argued that changes in the legal provisions for the enforcement of contracts were central to its decline in the early nineteenth century; see, e.g., Geiser 1901, p. 42. Similarly, the lack of success of the attempt to revive a contract labor system during 1864–85 has been attributed in part to the high cost of enforcing contracts through civil action; see Erickson 1957, pp. 46–48.

¹⁵ On freedom dues, see Smith (1947, pp. 238–41) and Heavner (1976, pp. 50–51). For a discussion of an analogous provision, nonvested pensions as a firm's insurance against quits, see Becker (1975, p. 34). The nature of freedom dues has some implications for other dimensions of the servant contract. The dues were specified by colonial law and were equal for all servants in a given colony. Therefore, the discounted cost of the dues to the planter at the time he purchased a contract varied inversely with the length of the contract. One effect of the fixed nominal value of the freedom dues may, therefore, have been to reduce the amount of variation in the length and other dimensions of the contracts, since the variations in the latter were intended to equalize the net present values of all contracts. This point should not obscure another basic effect of the existence of freedom dues, for, *ceteris paribus*, they raised the cost of servants and therefore tended to lengthen the term of indenture.

courts. These were made both to protect servants from kidnapping and to protect merchants from false charges of kidnapping. The two largest known surviving collections will be analyzed here; the earlier set, recorded in Middlesex during 1683–84, covers a total of 812 individuals, while the later, recorded in London during 1718–59, covers 3,187 servants.

The principal variable analyzed here will be the length of the indenture. Furthermore, this analysis will be done only for the minors in both samples; these comprise 22 percent of the servants with known ages in the earlier and 67 percent in the later sample. The selection of the variable to be analyzed and of the minors follows from consideration of the evidence of the contracts. It is clear that 4 years was the normal duration of an adult's indenture in both samples, yet for a combination of legal and clerical reasons the full set of conditions of adults' servitude do not appear to have been recorded in either set of indentures. For minors, the full conditions do appear to have been recorded, and the duration of the contract appears to have been the chief variable dimension of the contracts. Both variations in freedom dues and restrictions on the servants' occupations in the colonies were rare. Cash payments made to adults were not generally recorded in the later sample, but the contracts of the minors, on which they do appear to be recorded conscientiously, show that fewer than 6 percent received cash payments. Some cash payments are recorded for both minors and adults in the earlier sample, and although it is uncertain whether payments were recorded in all cases in which they were made, less than 7 percent of the contracts contain such entries. A notable feature of the payments recorded in both samples is that virtually all—95 percent in the earlier and 97 percent in the later sample—were made to servants bound for 4 years. Insofar as payments were made (or promised) and recorded, analysis of the characteristics of servants who received them tends to reinforce the results obtained from the analysis of the length of indenture.¹⁶ The evidence of both samples, therefore, indicates that for minors the greatest variation in the conditions of indenture occurred in the duration of the term of servitude, while for adults this was not the case, as 4 years was both the standard term for adults and normally the minimum term assigned.¹⁷ For adults, cash payments were appar-

¹⁶ See the Appendix.

¹⁷ Terms of less than 4 years do occur, but they appear to have been rare after the midseventeenth century; thus, they account for only 0.5 percent of all indentures of known length in the Middlesex registrations of 1683–84 and 1.2 percent of those in the London registrations of 1718–59. The reasons for this are not known. Four years may have been the term required at most times and places for the average adult to repay the cost of passage out of his net earnings, but it is unclear why shorter terms were not more often given to highly skilled servants like the accountant James Corss, whom

ently substituted for reductions in the length of servitude below 4 years.

Earlier analysis suggested that a servant's term of indenture would be inversely related to the market valuation of his stock of human capital. This index of the servant's human capital can be related to a number of observable characteristics potentially relevant to the determination of the present value of that stock. When this is done by multiple-regression analysis, the estimating equation differs from the common hedonic method only in the use of an index for price. The estimated coefficients of the independent variables age, sex, literacy, and occupation can be interpreted as the marginal prices paid for servants' characteristics in units of the index, while those of destinations represent compensating differentials among regions.¹⁸

Table 1 shows a number of the basic relationships underlying the market valuation of the servants. In both samples, the length of indenture was negatively related to both age and skill: With other things equal, servants with skilled occupations and those able to sign received shorter terms. Women received shorter terms than men, *ceteris paribus*, and servants bound for the West Indies received shorter terms than those bound for the North American mainland.

A comparison of the estimated coefficients of the sex variable across samples indicates that, on average, women received considerably larger reductions in their terms in the 1680s than in the eighteenth century. This decline in the premium for females is not surprising in view of the generally declining colonial sex ratios during this period, for while women were preferred for some kinds of household work and some types of farming, their increasing relative availability in most colonies would be expected to lower the size of their wage differentials.¹⁹

Table 2 provides a more detailed analysis of the length of indenture for the later sample, allowing separate age profiles of length of indenture by sex and skill. It reveals that there was a tendency for women to receive indentures from 5 to 15 percent shorter than those of men through the age of 17, while for servants aged 18–20 there was no

Walter Tullideph sent to the manager of his plantation in Antigua in 1759 with a note stating that he "hath bound himself to serve me four years agreeable to the Laws of Antigua, but as he is 22 years of Age, he thought it hard to serve so long and for that reason, I have given him a Certificate that he is to be absolved from the last year's Service" (Tullideph 1759, vol. 3). That planters preferred to substitute salaries for reductions of the term below 4 years suggests the possibility that fixed costs of hiring and/or a desire to capture the returns from a servant's general training in the colony may have been important considerations.

¹⁸ On the interpretation of coefficients in hedonic price indexes, see Rosen (1974, pp. 34–35).

¹⁹ The difference between samples in the sex coefficients in table 1 is significant at the .01 level. On declining colonial sex ratios, see Wells (1975, pp. 156, 219, 244).

TABLE 1
ESTIMATED REGRESSION COEFFICIENTS, MIDDLESEX AND LONDON SAMPLES

INDEPENDENT VARIABLE	MIDDLESEX, 1683-84		LONDON, 1718-59	
	Estimated Coefficient	Standard Error	Estimated Coefficient	Standard Error
Age (years): ^a				
Total sample:				
Less than 15	2.655	.385	2.749	.134
15	2.201	.400	2.147	.080
16	1.457	.304	1.304	.068
17	.893	.367	.728	.062
18	.174	.270	.331	.055
19	.738	.306	.169	.050
Sex ^b	-1.484	.207	-1.195	.073
Literacy ^c	-.575	.217	-.082	.037
Date ^d	...	...	-.0060	.0023
Trade ^e	-.727	.445	...	...
Farmer ^f	...	...	-.313	.074
Laborer	...	...	-.146	.079
Services ^g	...	...	-.348	.066
Metal and construction ^h	...	...	-.320	.067
Clothing and textiles ⁱ	...	...	-.313	.060
Antigua ^j	-.227	.812	-.403	.110
Barbados	-.553	.274	-.176	.154
Jamaica	-.398	.462	-.233	.060
Other West Indies ^k	-.401	1.094	-.479	.088
Maryland	.203	.209	.306	.059
Virginia	...	...	.127	.073
Other mainland ^l	-.389	.673	.050	.116
Constant	5.227	...	4.665	...
R ²	.555	...	.539	...
F	12.87	...	112.82	...
n	171	...	2,049	...

SOURCE.—Data used are all from records of minors (age less than 21). Middlesex, 1683-84: London, Greater London Record Office; Nicholson (1965); Wareing (1976). London, 1718-59: London, Corporation of London Records Office; Kaminkow and Kaminkow (1964); Galenson (1977a).

NOTE.—Dependent variable = number of years indentured; method of estimation used is ordinary least squares in tables 1 and 2.

^aFor age variable, indicated age = 1; zero class = age 20.

^bMale = 0, female = 1.

^cMarked = 0, signed = 1.

^dDate entered as final two digits of year of registration.

^eTrade = 0 for laborers and no recorded occupations; trade = 1 for all other men's occupations.

^fFor all occupational variables, indicated occupation(s) = 1; zero class = no recorded occupation. "Farmer" includes husbandman, plowman, etc.

^gIncludes accountant, barber, surgeon, etc.

^hIncludes blacksmith, carpenter, cooper, mason, etc.

ⁱIncludes clothier, tailor, weaver, etc.

^jFor all destination variables, for Middlesex sample, zero class = Virginia; for London sample, zero class = Pennsylvania.

^kIncludes Nevis, St. Christopher, etc.

^lIncludes Carolina, New York, etc.

TABLE 2
ESTIMATED REGRESSION COEFFICIENTS, LONDON SAMPLE, 1718-59

Independent Variable	Estimated Coefficient	Standard Error
Age (years):		
Total sample:		
Less than 15	2.976	.144
15	2.378	.092
16	1.542	.084
17	.959	.084
18	.473	.079
19	.260	.083
Women, age: ^a		
Less than 15	-1.034	.460
15	-.472	.390
16	-.969	.228
17	-.302	.161
18	.041	.159
19	.090	.135
20	.198	.156
Trade, age: ^b		
15	-1.496	.392
16	-.884	.206
17	-.502	.117
18	-.275	.085
19	-.224	.073
20	-.103	.076
Literacy	-.076	.036
Date	-.0093	.0024
Antigua ^c	-.260	.235
Barbados	-.005	.268
Jamaica	-.084	.209
Other West Indies	-.363	.221
Maryland	.194	.063
Other mainland	-.039	.072
February ^d	-.100	.092
March	.171	.113
April	.156	.119
May	-.095	.164
June	-.431	.132
July	-.196	.113
August	-.486	.098
September	-.223	.096
October	-.400	.101
November	-.225	.100
December	.014	.097
Sugar ^e	-.0162	.0074
Constant	4.830	...
R ²	.566	...
F	52.06	...
n	2,044	...

Source.—London, Corporation of London Records Office; Kaninkow and Kaninkow (1964); Galenson (1977a).
Notes.—See table 1 for variables not defined here.

^a Female age interactions: indicated variable = 1 for women of given age.

^b Trade age interactions: indicated variable = 1 for men of given age who recorded a trade (as defined in table 1).

^c For destinations, zero class = Virginia.

^d For months, zero class = January. Separate interaction terms between West Indian destination and month of registration were included in the equation, but their coefficients were generally small in value and are not reported.

^e Sugar = average annual price of muscovado sugar in London, in shillings per hundredweight, lagged 1 year, for servants bound for West Indies (Sheridan [1974, pp. 496-97], with linear interpolation for 1717-20 and 1727).

difference in the length of term by sex. In a suggestive parallel result, Robert Fogel and Stanley Engerman found that, excluding the value of childbearing, the net earnings of female slaves were greater than those of men prior to the age of 18, apparently due to the more rapid physical maturation of women.²⁰ The sex differentials in the terms of young indentured servants might have resulted from the same source.

The results of table 1 indicate that premia for skills were reflected in the length of servants' indentures. The more detailed specification of the occupations presented in table 1 for the London sample indicates that the marginal premium paid for servants in each of four occupational categories—farmers, services, metal and construction crafts, and clothing and textile trades—was virtually the same.²¹ Unskilled laborers received terms longer than servants with skilled occupations but shorter than those with no recorded occupations;²² the latter result may indicate that some premium was paid for the laborers' work experience.

Economists have devoted considerable attention to the analysis of the relationship between productivity and age and have accumulated much evidence on the association between age and wages in recent periods. Less is known of the nature of this relation in past times. It is, therefore, of some interest to consider in more detail the implications of the estimated relationships between age and length of indenture for the age-earnings profiles of servants.²³ Table 3 presents estimates of the relative annual net earnings of servants by age for unskilled and skilled men. The calculations are based on the assumption that the expected colonial sale price of each individual's contract was equal to the constant marginal cost of delivering servants to the colonies.²⁴ The relationship between age and net earnings is assumed to have been linear, making average net productivity during the term equal to net productivity at the term's midpoint. The estimates of average net

²⁰ Fogel and Engerman 1974, p. 77; see also Metzger 1975, pp. 136–37. Interestingly, evidence on the hourly earnings of North Carolina cotton mill employees in 1907 indicates that average female earnings were above those of males through the age of 15, equal at 16, and below male earnings thereafter (Wright 1980, p. 6).

²¹ None of the four coefficients is significantly different from any of the other three at the .10 level. On the value of skilled servants in the colonies, see, e.g., Martin (1761, vol. 4, fol. 97, verso); Jeaffreson (1878, 1:186); and Galenson (1979a, pp. 314–19).

²² The coefficient of laborer for the London sample in table 1 is significantly different from that of farmer at the .10 level for a one-tailed *t*-test, from those of metal-construction and clothing-textiles at .05, and from that of services at .025.

²³ It might be noted that the erratic behavior of the coefficients of higher ages in table 1 for the Middlesex sample may have been due to the falsification of the ages of some servants. This may have resulted from the legal requirements under which the registrations were made; for discussion and evidence see Galenson (1979a, appendix to chap. 3).

²⁴ Possible seasonal variation in delivery costs has been controlled for in the equation reported in table 2.

productivity are derived from the following formulation of the mean present value of the contracts of servants of age j at the beginning of the term:

$$PV_j = \sum_{i=1}^n \frac{NP_i - w_i}{(1+r)^i},$$

where NP = expected mean annual net productivity during the term; n = mean length of term for servants in each entering age group; w = mean annual wage payments made to servants during the term; r = discount rate.

To solve for the value of NP for each entering cohort, the mean present value of the contracts was set equal to £10, an estimate of the marginal cost of delivering servants to the colonies. The mean age of each group at the time of binding was taken as the recorded age plus one-half year to allow for the rounding of age upon registration. The mean length of term by age was derived from the coefficients of table 2, while the mean annual wage payments were taken directly from the indenture contracts.²⁵ The estimates were made with a discount rate of 10 percent.

The estimates of table 3, which indicate that the net-earnings profile of skilled servants was steeper than that of the unskilled, are consistent with the normal positive relationship between the steepness of age-earnings profiles and training. The ages at which the servants considered here were bound, between 15 and 20, were prime ones for training in a wide variety of skilled crafts in preindustrial England, through either apprenticeship or less formal arrangements. It is, therefore, not surprising that the net productivity of those in skilled trades rose rapidly during this period of the life cycle.

Skilled servants received a considerable premium: Even at age 15, a

²⁵ No wages were recorded for unskilled servants. The average wage payments received by the skilled servants in the London sample by age were as in the table below. The present value of freedom dues at the time of binding varied across colonies and over time, according to differences and changes in legislation and with changes in the value of colonial currencies and commodities. No explicit allowance has been made for the dues in the calculation because of the difficulty of estimating their typical value; inclusion of the effect of the lump-sum payment would lower the estimates of the net annual earnings of servants without changing their relative values by age.

Age (Years)	Mean Annual Wage (£)
15	.0
16	.40
17	.79
18	1.45
19	1.52
20	3.02

TABLE 3
ESTIMATED RELATIVE NET ANNUAL EARNINGS OF SERVANTS BY AGE

UNSKILLED			SKILLED		
Age	Mean Net Annual Earnings (£)	Relative Net Earnings (Age 22.9 = 1.00)	Age	Mean Net Annual Earnings (£)	Relative Net Earnings (Age 22.9 = 1.00)
19.1	2.01	.742	18.4	2.39	.413
19.7	2.20	.812	19.2	2.86	.495
20.4	2.36	.871	20.1	3.32	.574
21.2	2.52	.930	21.0	4.08	.706
22.0	2.60	.959	21.9	4.22	.730
22.9	2.71	1.000	22.9	5.78	1.000

NOTE.—Calculated from table 2 and n. 24. See text for procedure. The unskilled profile is calculated from the basic age profile of table 2, that of the skilled from the basic age profile combined with the skilled ("trade") coefficients.

skilled servant received a term 21 percent shorter than his unskilled counterpart. The existence of a sizable premium at such an early age could have been due in part to differences in the relative average work experience of the skilled and unskilled. Thus, possession of a skilled trade at any age implied prior work experience. The age of entry into the labor force for those men registered without occupations cannot be determined, but it is possible that the typical age of entry for the unskilled into employment was that at which English boys normally left home to live in service, roughly 15. If this were the case, work experience and acquired on-the-job training might have accounted for a significant portion of the premium for skilled workers. This would particularly be true for the younger servants, as the relative level of work experience of a skilled to an unskilled worker would be greatest at the lower ages observed here and would decline with age thereafter. That the ratio of skilled to unskilled net earnings increased with age would appear to be strong evidence of the presence of formal training for those in the skilled group.

An interesting feature of the relative age-net-earnings profile of the unskilled shown in table 3 is its close resemblance to those profiles obtained by Fogel and Engerman for unskilled male slaves in the southern United States during 1790–1860 (1972, charts 3 and 4). In view of the considerable differences among these samples with respect to such variables as location and crops cultivated, the similarity of the shapes of the profiles might suggest the importance of physiological factors, particularly the rate of physical maturation, in determining the change, with age, in the productivity of unskilled workers

under conditions of plantation agriculture in the eighteenth and nineteenth centuries.

The relatively small premium paid for the ability to sign in the later sample may have been due both to the abundance of literate servants and to high literacy rates in the colonies. The decline in the size of the reduction of the term due to the ability to sign between the dates of the two samples may have resulted in part from a considerable increase in literacy among the servants, as only 35 percent signed in the earlier sample compared with 67 percent in the later one.²⁶

In both samples, with other characteristics constant, servants bound for the West Indies tended to receive shorter terms than those bound for mainland colonies. That servants who immigrated to the West Indies received shorter terms to compensate them for their choice is consistent with the fact that, while both working conditions for servants and economic opportunities for freedmen were known to be poor in the islands after the introduction of large-scale sugar cultivation in the second half of the seventeenth century—with its attendant slave gangs and consolidation of small farms into large estates—the mainland long continued to be considered a land of opportunity for poor immigrants, where freed servants could hope to own land and become prosperous members of society. A persistent theme of West Indian complaints appeared in a 1675 petition sent to the king of England by the Council and Assembly of Barbados: “In former tymes Wee were plentifully furnished with Christian [i.e., white] servants from England . . . but now Wee can gett few English, having noe Lands to give them at the end of their tyme, which formerly was their main allurement.” The higher mortality rates of the West Indian colonies decreased servants’ expected productivity and made them reluctant to go to the region. However, in conjunction with the high productivity of labor in sugar production, those rates acted to raise the demand for new flows of replacement immigrant labor. That servants bound for the West Indies received terms shorter than those bound for the mainland, in spite of the higher mortality rates in the islands, implies that the marginal productivity of labor was higher in the West Indies than in the mainland colonies.²⁷

Both the lower estimated intercept for the later sample and the estimated negative time trend of the later sample indicate a secular decline in the length of indenture. The direction of change is consis-

²⁶ On the relationship between ability to sign and other aspects of literacy in this period, see Schofield (1968, pp. 311–25). The difference between the coefficients of literacy in the two samples is significant at .10 for a two-tailed *t*-test. On the servants’ ability to sign, see Galenson (1979b).

²⁷ London, Public Record Office 1675. On relative mortality rates in the West Indian and mainland colonies, see Wells (1975, pp. 280–82).

tent with a number of long-term trends, including rising reservation wages of servants due to rising real wages in England between the mid-1680s and the middle of the eighteenth century, falling real shipping costs, and declining colonial mortality rates which could have produced a secular increase in the colonial demand for labor.²⁸ The negative estimated trend further suggests the presence of a secular increase in real wages in the colonies during the period spanned by these two samples.

A consistent seasonal pattern in the length of indenture appears in the results of table 2, as servants bound for mainland destinations whose indentures were signed between June and November received sizable reductions in their terms relative to servants bound in winter and spring. Most of these servants were bound for Maryland or Virginia, and the observed pattern could have been due to the effect of the seasonality of tobacco production on the costs involved in supplying servant labor to the Chesapeake. The shipping patterns which resulted from the timing of the harvests dictated that the amount of backhaul space for servants was greatest in summer and early fall. Since servants were provided with food and lodging from the time they signed their contracts, the cost of delivering a servant to the colonies may have declined in peak shipping seasons because the more frequent departures of ships reduced the average waiting time in port between binding and sailing. The lower costs of the peak seasons could, therefore, have resulted in shorter indentures for servants bound in peak seasons than for those bound in slack shipping months.²⁹

Another potential source of variation in the length of indenture was annual changes in the colonial demand for labor. The results presented in table 2 indicate that the lagged annual average price of muscovado sugar in London had a significant and negative effect on the length of indentures of servants bound for the West Indies during 1718–59; the estimated effect of a change in the price of sugar from its minimum to its maximum in the period, with other things equal,

²⁸ On English wages, see Gilboy (1934, pp. 219–25) and Phelps Brown and Hopkins (1956, pp. 302–13). On changes in colonial mortality rates, see, e.g., Menard (1977*a*, pp. 99–100). The organization and quality of information in the market for contracts may have improved during the period spanned by the two samples. It is suggestive that the coefficient of variation of the term of indenture among men of a given age was considerably lower in the later than the earlier sample for six of the eight age groups of minors above the age of 12. On the relation of wage dispersion to information, see Stigler (1962).

²⁹ On the seasonality of tobacco production and shipping, see Bullock (1649, p. 46); Alsop (1666, p. 51); and Bruce (1907, vol. 1, pp. 622–24). On the costs of maintaining servants between binding and sailing, see Smith (1947, pp. 36–37, 59–65) and Scottish Record Office (GD 23/6/98, nos. 4, 14, 18). For factors relevant to seasonality in the colonial demand for labor, see Mullin (1972, p. 15) and Morgan (1975, p. 158).

was a reduction of about 5 months in the term of indenture. The sign of this effect would be the one predicted if, as appears to have been the case, high sugar prices normally resulted from high levels of demand for sugar rather than reductions in supply, for high sugar prices would then have tended to produce high demand for labor and, *ceteris paribus*, to shorten terms.³⁰

IV. Conclusions

The price paid for human capital in the colonial American market for indentured servants varied systematically with respect to factors which influenced servants' productivity, as economic theory predicts. All servants incurred debts of similar value in immigrating to the colonies and sold claims on their future labor, in the form of indentures, to repay these debts. Characteristics which raised the expected productivity of servants in the American colonies raised the market valuation of their human capital and, therefore, shortened the term for which the servant was bound. Thus, servants with skilled trades and those able to sign served shorter terms than the unskilled and illiterate of similar age and sex. Women were found to have received shorter terms than men until the age of 18, perhaps due to their earlier maturation. The results also indicated that servants bound for the West Indies received shorter terms in compensation for their undesirable destinations. Servants bound during peak shipping seasons were found to have received reduced terms, perhaps due to the shorter average waiting time prior to departure in those months when backhaul cargo space was most abundant. Finally, the length of indenture of servants bound for the West Indies was found to have varied inversely with the price of sugar, suggesting that increases in the colonial demand for labor shortened the term of servitude.

Among the issues which need further investigation are the precise reasons for the observed shapes of the age-earnings profiles of servants. Additional research, including the collection of evidence on wage rates in the colonies by age and skill, may serve to distinguish

³⁰ Similar analysis of the contracts of servants bound for the Chesapeake during 1718–40 indicates that the lagged annual farm price of Maryland tobacco had no significant effect on the length of indenture; in a regression equation which included the variables of table 2, the estimated coefficient of an interaction term between the price of tobacco, lagged 1 year, and Chesapeake destination was insignificant. Due to a greater continuing reliance on production of a single staple in the West Indies in the eighteenth century, the price of sugar may serve as a better index of the West Indian demand for labor than does the price of tobacco for the Chesapeake. On diversification of agricultural production in the Chesapeake, see Clemens (1974, pp. 100–148) and Stiverson (1977, pp. 65–103).

and isolate the effects of such contributory factors as physical maturation and investment in human capital in producing the age-earnings relationships which lay behind the market valuation of indentured human capital. What the present research has indicated is that the application of economic analysis to quantitative evidence generated by the system of indentured servitude can provide information on the way in which the market once explicitly evaluated stocks of human capital and, in so doing, can yield new insights into the operation of labor markets in early America.

Appendix

For the Middlesex sample of 1683–84, a regression equation was estimated with the amount of the cash payment (in shillings, sterling) made to a servant as the dependent variable, with the same independent variables used in the analysis of the length of indenture. The sample used was that of all servants, minors and adults, whose contracts contained all the necessary information. The results are as shown in table A1.

The hypothesis that all the coefficients are simultaneously equal to zero can be rejected at the .01 level, but the proportion of the variance explained is small, as might be expected in view of the rarity of the payments. Only one coefficient is significant at the .01 level: Possession of a skilled trade, which table 1 shows to have reduced the term of an indenture, significantly raised the expected cash payment made to a servant.

As noted in the text, cash payments appear to have been recorded only for minors in the London sample of 1718–59. The form of the payments recorded differs from that of the earlier sample: Whereas the cash payments to servants in the Middlesex contracts of 1683–84 appear to have been simple lump-sum payments made at the time of binding, those contracted for in London in the eighteenth-century sample were generally salaries to be paid

TABLE A1
ESTIMATED REGRESSION COEFFICIENTS, MIDDLESEX SAMPLE, 1683–84

Independent Variable	Estimated Coefficient	Standard Error
Age (years)	.011	.038
Sex ^a	-.485	.456
Literacy ^b	-.443	.363
Trade ^c	1.466	.399
West Indies ^d	.088	.354
Constant	.323	...
R ²	.026	...
F	4.03	...
n	760	...

SOURCE.—London. Greater London Record Office (Middlesex Section).

^aMale = 0, female = 1.

^bMarked = 0, signed = 1.

^cLaborer or no occupation = 0; all other occupations = 1.

^dWest Indian destinations = 1; mainland = 0.

TABLE A2

ESTIMATED REGRESSION COEFFICIENTS, LONDON SAMPLE, 1718-59

Independent Variable	Estimated Coefficient	Standard Error
Age (years)	.144	.054
Sex	.306	.329
Literacy	.428	.167
Trade	1.397	.190
West Indies	1.291	.165
Constant	-3.141	...
R^2	.094	...
F	42.20	...
n	2,046	...

SOURCE.—London, Corporation of London Records Office.

NOTE.—All variables defined as in table A1.

annually in local currency. A regression was estimated with the amount of the annual salary (in pounds local currency) as the dependent variable, with the same independent variables used above. (The dependent variable is the unadjusted value of the colonial currency. Although most of the colonies' currencies were devalued relative to sterling, the differences in currency values across the principal American colonies in most of this period were small. See McCusker 1978.) The sample used was that of all minors (age less than 21) whose contracts contained all the necessary information. The results were as shown in table A2.

The relationship is again statistically significant, and the proportion of the variance explained is again low. Age, literacy, possession of a skilled trade, and West Indian destinations are all significant at .01 and positively related to the servant's salary; in table 2 it is shown that all are significantly and negatively associated with the length of indenture.

The results of the analysis of servants' cash payments and salaries in both samples are consistent with the hypothesis that these were positively related to the servants' expected earnings in the colonies. These results therefore reinforce the analysis presented of the length of indenture.

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