Migration and human capital

Abramitzky, R.; Braggion, F.

Migration and Human Capital: Self-Selection of Indentured Servants to the Americas

RAN ABRAMITZKY AND FABIO BRAGGION

When contracting, European merchants could at least partially observe character-istics such as the health, physical strength, and education of indentured servants. These characteristics, unobservable to us, were likely to influence servitude dura-tion, which is observable to us. We employ a switching regression model to ana-lyze 2,066 servitude contracts from the seventeenth and eighteenth centuries. Servants were positively selected to American mainland colonies in terms of their unobservable human capital and negatively selected to the West Indies. Thus, the relative quality of migrants' human capital may have played a role in the subse-quent relative economic performance of these regions.

Throughout the colonial period, indentured servitude was an impor-tant form of white migration to the New World. Abbot Emerson Smith and Farley Grubb suggested that roughly half of the white immi-grants who arrived to the American colonies used indentured servitude contracts.[1] These contracts, under which emigrants would become servants in the colonies, enabled them to finance their trip to the New World.

We focus on servitude migration and examine whether the mainland and the West Indian colonies attracted migrants with different endow-ments of human capital as early as the seventeenth and eighteenth cen-turies. Although the literature looks at the characteristics of servants bound for various colonies as they appear in the surviving records, most aspects of servants' human capital such as education, experience, health, and physical strength are not currently observable and, thus, were not analyzed.[2] We infer these unobservable aspects of human capi-

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[1] Smith, *Colonists*; and Grubb, "Incidence."

[2] Galenson, *White Servitude*, pp. 91–96. Servants' ability or inability to sign his contract was recorded, but this is a rough measure of education.

tal by noting that they could be observed at the time of contracting and were likely to influence servitude duration, which is observable to us. We can therefore econometrically test the relations between unobservable characteristics affecting the servitude duration and destination choices.

More specifically, migrants who were expected by the European merchants to be more productive received shorter terms of servitude.[3] Although migrants had choice and so selected themselves to a destination, the duration of the servant contracts offered by merchants per migrant characteristics for different destinations influenced the migrants' choice. Thus, to the extent that individuals who migrated to a certain colonial destination persistently received shorter terms of servitude than their observable characteristics imply, we conclude that they were positively selected in terms of characteristics that are currently unobservable.[4] Migrants who had to serve a longer term than their observable characteristics imply were negatively selected.

Following David Galenson, we restrict our sample to nonadult servants because of uncertainty over the role that unrecorded cash payments may have played in altering adult servant contract duration.[5] We analyze two important collections of English registrations of indentured servants, the two for which enough detailed information has survived to allow our econometric analysis, namely the indentures of 162 contracts from Middlesex County between 1682 and 1685 and the indentures of 1904 contracts from London between 1718 and 1759.

We employ a switching regression model (type five tobit) and estimate the length of servitude expected by an individual with certain characteristics in both the mainland and the West Indian islands, taking into account the endogeneity of that individual's migration decision.[6] Migrants are assumed to choose their colonial destination based on factors such as their age, gender, literacy, county of origin and the length of the contract expected in each location, which is itself a function of individual's observable and unobservable characteristics.

We find that servants bound to the West Indies were negatively selected in the sense that, ceteris paribus, they served half a year more

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[3] Galenson, "Market Evaluation" and *White Servitude*; and Grubb, "Auction."

[4] On the self selection of migrants, see, for example, Borjas, "Self Selection" and "Economics"; and Chiswick, "Is the New Imigration" and "Are Immigrants."

[5] According to Galenson, *White Servitude*, the full conditions of the contract for young servants were recorded and the duration of servitude appears to be the main variable. For adult servants, cash payments at the end of the term were an important contractual clause, but they were rarely recorded.

[6] The colonial destination was a major choice variable of prospective servants, Pitman, *Development*; Smith, *Colonists*; Galenson, "Market Evaluation" and *White Servitude*; and Sheridan, *Sugar*.

than predicted by their observable characteristics. Conversely, servants migrating to the mainland were positively selected in the sense that they had to serve over half a year less than predicted by their observable characteristics. Notably, the regression analysis suggests that servants' characteristics that are currently unobservable were more important determinants of servitude duration than observable characteristics such as occupation, literacy, and gender.

The nature of human capital selection of immigrants to the Caribbean islands and to what later became the United States may suggest the importance of human capital in their subsequent distinct economic development. Despite a higher initial income per capita in the islands compared to the mainland, by the nineteenth century the United States was well on its trajectory of sustained economic growth while the Caribbean islands lagged far behind. Economists and economic historians have explored the role of factor endowments and initial distinct institutions in explaining this divergence.[7] The finding of this article reveals that the colonies in these regions had, early on, attracted migrants with different endowment of human capital. To the extent that the destination selectivity by human capital that we found here can be generalized to other migrants, then this suggests the potential importance of the relative quality of migrants' human capital in the subsequent relative economic performance of these regions.[8] In finding that, this article lends support to the work of Edward Glaeser, Rafael La Porta, Florencio Lopez-de-Silanes, and Andrei Shleifer that suggests that the different human capital brought by immigrants to the New World may have been important in the subsequent development of good institutions and economic development.[9] It may nevertheless be the case that the selection we find reflects distinct geographical endowments.

"UNOBSERVABLE" DETERMINANTS OF SERVITUDE DURATION

Our main argument relies on the presence of servants' characteristics unobservable to researchers now but observable to and rewarded by the

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[7] For example, Engerman and Sokoloff, *How Latin America* and "Colonialism"; Acemoglu, Johnson, and Robinson, "Colonial Origins" and "Reversal"; and Acemoglu, Johnson, Robinson and Thaicharoen, "Institutional Causes."

[8] For the impact of human capital on economic growth, see, for example, Becker, Murphy, and Tamura, "Human Capital"; Galor and Weil. "Population"; Lucas, "On the Mechanism"; and Mankiw, Romer and Weil, "Contribution." Schultz, "Value," emphasizes the role of human capital in the efficiency of reallocation of resources after economic shocks. Shastry and Weil, "How Much"; and Weil, "Accounting for the Effect," show the importance of health in the cross country variation of income. Becker, Murphy, and Tamura, "Human Capital."

[9] Glaeser, La Porta, Lopez-de-Silanes and Shleifer, "Do Institutions."

European merchants who shipped the servants to the New World and sold their contracts once there. In what follows, we describe these characteristics and outline their potential importance in determining servitude duration.

First, healthier and stronger servants may have received shorter terms of servitude, as they were better suited to the physically demanding work of growing, processing, and transporting the sugar, tobacco, or rice; packing and shipping the staple; building houses and farm sheds; and so on. Besides, the stronger and healthier were more likely to survive the long and exhausting trip to the Americas. Thus, servants determined by the merchants to be healthy and strong are expected to have received a shorter length of servitude in the colonies.

Health and physical strength are not observable to us today but were to some extent observable by European merchants and American planters. Grubb considers convict servants and constructs a proxy of physical strength and health by using servants' heights.[10] He finds that the price of convict servants in the auctions of Maryland between 1767 and 1775 was 20 percent higher for exceptionally tall servants concluding that the higher price was the result of planters' concern about servant' physical conditions.[11] Grubb's finding is also confirmed by anecdotal evidence. There is evidence that planters walked among convict servants arriving to the ports, inquiring their trade, examining them like horses and interviewing them.[12] When a servant named John Lauson was asked for his trade, he answered that he was a cooper. The planter replied that "That will not do for him" and continued the interview. Lauson later recalled that:[13]

> Some felt our hands other our legs and feet,
> And made us walk to see were compleat
> Some view'd out Teeth to see if they was good,
> And fit to Chaw our hard and homely food

The health of servants was the main concern of merchants and planters. As reported by Bernard Bailyn:

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[10] Grubb, "Market Evaluation." Data on servants' heights are not indicated in the available information on voluntary servants used in this work.

[11] Grubb defines exceptionally tall servants as those servants whose height was one standard deviation above the average height of male British convict servants in Maryland between 1767 and 1775. The secular and cross-sectional differences in human heights have been used by economic historians as measures of nutritional quality, physical strength, and well-being of individuals. See Steckel, "Stature."

[12] Lauson, *Felon's Account*, p. 8.

[13] Ibid.

> the dominant concern is clear in the pages of the merchants' letter books. The seller [of servants] were haunted, above all else, by the fear of disease. Everything depended on the health of their charges, which was unpredictable and uncontrollable.[14]

Moreover:

> the first concern, at the receiving end of the process as at the sending, was thus always health: the best markets were for the "young, healthy, and not deformed"—a concern reflected in innumerable newspaper advertisements announcing the recent arrival and pending sale of "healthy servants—men, women, and boys." Only slightly less weighty was the stress on occupations and skills.[15]

Second, correspondence between merchants and planters suggest that planters were looking for servants who were laborious and industrious men, characteristics which merchants could potentially detect but are unobservable to the econometrician.[16] By the late seventeenth century and eighteenth century, planters increasingly requested servants who not only possessed a skill, but had good character and were good in their profession, which are again characteristics that cannot be observed today. Thus, in 1732, a Glasgow merchant wrote to a correspondent to send tradesmen to servitude, but be sure that none but good tradesmen be indentured.[17] Similarly, a Bristol merchant was advised by Samuel Martin in 1757 to send him "A good jobbing Sadler & Collar maker who understands tanning & dressing leather for his own use" or "A sober Jockey who is a good rider & breaker of young horses. Of this man you must insist upon a good Character for Sobriety & skill in his profession; because generally speaking they are a drunken profligate breed of people."[18]

Whether a servant was indeed skilled in his profession could be easily detected by planters, thus it made sense for the merchant to verify servants' qualities as best as he could. A planter from Virginia who found out that he was misled by a servant, wrote in his diary in 1758:[19]

> Sent home the fellow sent here for a gardiner. He knows nothing of the matter. Plowman . . . I keep. He seems a workman and willing fellow.

Third, characteristics such as education, skill, ability, entrepreneurial and managerial skills are important determinants of individuals' produc-

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[14] Bailyn, *Voyagers*, p. 330.

[15] Bailyn, *Voyagers*, pp. 330–31.

[16] Christopher Jeaffreson writing to his London merchant in 1677; quoted in Galenson, *White Servitude*, p. 134.

[17] Quoted in Galenson, *White Servitude*, p. 135.

[18] Quoted in Galenson, *White Servitude*, p. 136.

[19] Quoted in Galenson, *White Servitude*, p. 137.

tivity, and thus potentially important determinants of servitude duration. These characteristics probably gained importance over time. By the late seventeenth century, the demand for skilled servants increased and servants were often employed as slave supervisors, which meant that servant's qualities such as high ability, ambition, and managerial skills must have been sought for and rewarded by shorter length of servitude. Once again, merchants who dealt with the trade of servants had an incentive to identify such qualities.

Even the observable surviving measures of skill and experience are rough and incomplete. The merchants, by inspecting, examining and interviewing prospective servants, must have had a better sense of the education of a prospective servant than indicated by his ability to sign. Similarly, work experience must have been conveyed better from servants to merchants than is captured by a servant's age, which is the only indication for experience available in the registrations. A servant's occupation, observable to us today, may indicate his skill, but we cannot see how good a carpenter, or cooper, or shoemaker he was. We also cannot observe how motivated and ambitious he was, and we cannot asses from the surviving data his ability to supervise slaves. The merchants must have been able to evaluate a servant's productivity better.

A MODEL OF DESTINATION CHOICE

Unlike African slaves, many Europeans migrated voluntarily in the hope of improving their lives. For those who financed the trip using the indentured contract, a main contractual clause was the colonial destination. Abott Smith noted that:

> . . . most striking of all evidences is that which shows servants preferring one colony over another . . . in one way or another, whether by published literature or by word of mouth, a certain amount of sound knowledge and honest opinion got about among prospective emigrants concerning the relative excellencies of various colonies.[20]

Based on his characteristics, each prospective servant could compare the conditions of the indentured contract in each colony and the expected prospects of various colonies, and choose his preferred destination. In our main analysis, prospective servants are assumed to choose between serving in a mainland colony and serving in a West Indian colony.[21]

[20] Smith, *Colonists*, pp. 57–58.

[21] A second specifications allow servants to have three choices, namely mainland southern colonies, mainland northern colonies, and the West Indies. Because the results are very similar and for ease of presentation, we present here only the binary choice model. Results from the three-choice specification are available from the authors upon request.

Formally, we employ a switching regression model (type five tobit) that allows for two regimes (in our case migrate to the American mainland or migrate to the West Indies), a criterion function (a migration rule that determines the regime) and two regression equations describing the length of the servitude determination in the mainland and in the West Indies. This framework has been used to study migration, returns to schooling, and the way joining unions effects wages.[22]

Assume that an individual chooses his colonial destination, D_i^*, based on the difference between the servitude length in the mainland and the West Indies, $L_{iA} - L_{iWI}$, as well as other individual characteristics that may affect one's taste for location, Z_i

$$D_i^* = \delta_1 Z_i + \delta_2 [L_{iA} - L_{iWI}] + u_i \qquad (1)$$

where $E(u_i) = 0$ and var(u_i) is normalized to one without loss of generality. For every person, we either observe the length of the servitude in the mainland L_{iA} if the servant migrated to the American mainland or the length of servitude in the West Indies L_{iWI} if he migrated to the West Indies. We do not observe the counterfactual length of term that a migrant to, say, the mainland would have served had he chosen the West Indies colonies instead. Note, however, that the length of the servitude reflects a servant's expected productivity, which can be written as a function of his observable personal characteristics X_i affecting expected productivity

$$L_{ij} = \beta_j' X_i + \varepsilon_{ij} \qquad (2)$$

where $j = WI, A$ and $E(\varepsilon_{ij}) = 0 \forall_j$, var($\varepsilon_{iA}) = \sigma_2^2$, var($\varepsilon_{iWI}) = \sigma_3^2$.

Thus, if we can estimate the parameters β_A' and β_{WI}', then given a servant's set of characteristics X_i, we can predict the length of the servitude in the mainland (West Indies) for actual migrants to the mainland (West Indies) as well the counterfactual length of servitude in the mainland (West Indies) for those who migrated to the West Indies (mainland).

An important fact to note is that actual migrants may not constitute a random sample, so that $E(L_A \mid D = 1) = \beta_A' X_i + E(\varepsilon_{iA} \mid D = 1)$ and $E(L_{WI} \mid D = 0) = \beta_{WI}' X_i + E(\varepsilon_{iWI} \mid D = 0)$ and an OLS regression might produce biased estimators. The terms $E(\varepsilon_{iA} \mid D = 1)$ and

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[22] On migration, see Robinson and Tomes, "Self-Selection"; and Ferrie, *Yankeys*. On returns to schooling, see Willis and Rosen, "Education." On unions and wages, see Lee, "Unionism."

$E(\varepsilon_{iWI} \mid D = 0)$ captures migrants' characteristics unobservable to the econometrician that are persistently correlated with the length of servitude. For instance, stronger and healthier individuals could choose to migrate to the mainland, and merchants potentially rewarded their strength and health with a shorter term of servitude. The econometrician, not being able to observe strength and health, will omit an important variable from his OLS regression and produce biased estimators. To properly estimate the model requires correcting the estimation for possible self-selection.

Intuitively, the econometrician can check whether servants' unobservable characteristics from their migration decision are correlated with the duration of servitude. If the unobservable characteristics from the migration decision are consistently associated with a longer duration of servitude, then migrants are negatively selected (e.g., they are weaker and less healthy). If, on the other hand, the unobservable characteristics from the migration decision are consistently associated with a shorter duration of servitude, then migrants are positively selected (e.g., they are stronger and healthier).

Formally, the servant's decision rule D_i^* is unobservable, but his choice between the mainland, $D = 1$, and the West Indies, $D = 0$, is observable

$$\left\{ \begin{array}{l} D = 1 \ \text{if} \ D_i^* = \delta_1 Z_i + \delta_2 [L_{iA} - L_{iWI}] + u_i = \gamma' W_i + \varepsilon_i \geq 0 \\ D = 0 \ \text{if} \ D_i^* = \delta_1 Z_i + \delta_2 [L_{iA} - L_{iWI}] + u_i = \gamma' W_i + \varepsilon_i \leq 0 \end{array} \right\} \qquad (3)$$

where W_i is observable and contains all the elements of X and Z.[23] To capture the dependence between individuals' migration decisions and their duration of servitude, and assuming that $(\varepsilon_i, \varepsilon_{iA}, \varepsilon_{iWI})$ are distributed Trivariate Normal, it follows that:[24]

$$E\ (L_{WI} \mid D = 0) = \beta'_{WI} X_i + \sigma_{13} \frac{\phi(\gamma' W_i)}{1 - \Phi(\gamma' W_i)} \qquad (4)$$

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[23] We are presenting a switching regression model, with endogenous switch, Maddala, *Limited Dependent and Qualitative Variables*, p. 223. Although the distributional assumptions used in the analysis are standard, they are strong and might have substantial effect on the estimation. Heckman, "Varieties"; Manski, "Nonparametric Bounds"; and Newey, Powell, and Walker, "Semiparametric Estimation."

[24] $(\varepsilon_i, \varepsilon_{iA}, \varepsilon_{iWI})$ are assumed to have the following covariance matrix

$$\sum = \left\{ \begin{array}{ccc} \sigma_1^2 & \sigma_{12} & \sigma_{13} \\ & \sigma_2^2 & \sigma_{23} \\ & & 1 \end{array} \right\}$$

where ϕ is the Normal pdf, Φ represents the Normal cdf, and $\dfrac{\phi(\gamma' W_i)}{1-\Phi(\gamma' W_i)}$ is the inverse mill ratio.[25] The term $\sigma_{13}\dfrac{\phi(\gamma' W_i)}{1-\Phi(\gamma' W_i)}$ is the magnitude of the self-selection of migrants to the West Indies, i.e., it is the magnitude of the effect of unobservable (to us today) characteristics of migrants to the West Indies on their servitude duration.[26]

Notice the difference between compensating differentials across colonies and servants' selection to the different colonies. The compensating differentials reflect differences in the quality of various colonies and are captured by the difference in the constants (between the mainland and West Indies) of regression. The servants' selection reflects differences in the quality of servants bound to the different colonies and is captured by the term $\sigma_{13}\dfrac{\phi(\gamma' W_i)}{1-\Phi(\gamma' W_i)}$ for the West Indies and $\sigma_{23}\dfrac{\phi(\gamma' W_i)}{1-\Phi(\gamma' W_i)}$ for the mainland.

The vector X includes individual characteristics thought to influence the length of servitude in the colonies: age, ability to sign, gender, occupation and the season when the contract was signed. The elements of Z include age, ability to sign, gender and the servants' county of origin (see Appendix A for the definitions of counties). The parameters are identified under the restrictions imposed by the model.[27] To identify δ_1 and δ_2, there must be at least one variable in X not in Z and vice versa. Both conditions are satisfied: Z includes variable not included in X—the county of origin, and X includes variables not in Z—the season of departure and the occupation category, which are assumed to affect the

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[25] We are adopting here an identification assumption traditionally used in the literature of self selection (see Heckman and Sedlaceck, "Heterogeneity"): the proportionality assumption. Differences in the evaluation of unobservable characteristics between locations are captured in the constant term of the regression. Therefore, the coefficient on the inverse mill ratio just captures a pure supply effects determined by the relative capabilities of servants arriving to the colonies, and does not reflect different evaluation of unobservable characteristics in different markets.

[26] In the same way, the expected length of servitude in the mainland is $E\left(L_A \mid D=1\right)=\beta'_A X_i + \sigma_{23}\dfrac{\phi(\gamma' W_i)}{\Phi(\gamma' W_i)}$, and the term $\sigma_{23}\dfrac{\phi(\gamma' W_i)}{1-\Phi(\gamma' W_i)}$ represents the magnitude of the self selection of migrants to the mainland.

[27] Note that the reduced form Probit (column 1 of Table 1 and Table 2) and the servitude duration equations (columns 3 and 4 in Table 1 and Table 2) are not affected by the exclusion restrictions of X and Z. However, the estimation of the structural Probit (column 2 of Table 1 and Table 2) does depend on the exclusion restrictions, which are required for identification. Under the exclusion restriction, a variable in X that is not in Z, such as the occupation variable, is interpreted as having an effect on the destination choice only through its effect on the servitude duration, but no direct effect on the destination choice.

migration decision only through their effect on the servitude duration. Several works show pattern of chain migration from a certain British area to a certain colonial region: we therefore find reasonable that county of origins was a strong determinant of the destination choice.[28] On the other hand, there is no reason to believe that just *being* from a certain county would have had an independent and separate effect on contracts' length. We rely on the work by Grubb and Tony Stitt to conclude that season of departure affected the period of servitude rather than destination choice.[29] Similarly, Smith and Galenson show that certain types of occupations were appreciated by colonial planters and potentially they could have received better terms of servitude.[30]

The structural parameters of the binomial model were estimated via a three-step procedure.[31] First, the reduced form equation is estimated by Probit maximum likelihood estimation to find $\hat{\gamma}$. Then, using $\hat{\gamma}$, we obtain the Inverse Mill Ratio for each observation: $\dfrac{\phi(\hat{\gamma}W_i)}{\Phi(\hat{\gamma}W_i)}$. Second, equation (for both the West Indies and the mainland) is estimated by OLS. That is, we run an OLS regression of L_{iA} on X_i and $\dfrac{\phi(\gamma'W_i)}{\Phi(\gamma'W_i)}$ and get $\hat{\beta}'_A$ and $\widehat{L_{iA}}$. Third, equipped with $\widehat{L_{iA}}$ and $\widehat{L_{iWI}}$, we estimate the structural decision equation to find the determinants of colonial choice, and determine whether or not migrants were expecting shorter servitude in their destination choice.[32]

THE DATA SETS

Our data sources are the two most important and informative surviving lists of servants registrations from the seventeenth and eighteenth centuries.[33] The first is a list of 823 servants recorded in Middlesex

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[28] Bailyn, *Voyagers*; and Horn, "'To Parts'" and *Adapting to a New World*.

[29] Grubb and Stitt, "Liverpool Emigrant Servant Trade," computed correlations between colonial destinations and month of departure and did not find any clear pattern.

[30] Smith, *Colonists*; and Galenson, *White Servitude*.

[31] See Maddala, *Limited Dependent and Qualitative Variables*, pp. 223–28; and Amemiya, *Advanced Econometrics*, pp. 399–402.

[32] The standard errors of the η coefficients have been corrected (using bootstrap method with 1,000 repetitions) for the fact that the regressor is an estimated, rather than observed, value.

[33] Four other collections of servants recorded in Bristol (1654–1686), London (1683–1686, 1773–1775), and Liverpool (1697–1707) survived, but they lack information that is crucial to our analysis, as variables such as age, literacy, occupation, and the servitude duration were often not recorded. The Bristol Collection is transcribed in Coldham, *Bristol Registers*. The London collection is reported by Ghirelli, *List*; and the Liverpool register is reported by French, *List*.

County between 1682 and 1684.[34] The second is a list of 3,182 servants recorded in London between 1718 and 1759.[35] Both lists contain detailed information of the servitude contract, including the name, date of departure, gender, age, occupation, ability to sign, county of origin, colonial destination, recruiter's name, and length of servitude, that allow us to analyze prospective servants' migration decisions and the determinants of the servitude duration.

Our analysis is more meaningful when the full terms of the contract were recorded and when the length of servitude, rather than cash payments, was the main contractual clause. According to Galenson, this was not the case for adult servants, i.e., those over 21 years old, but was the case for minor servants.[36] More specifically, for adult servants, cash payments were probably the main contractual clause but unfortunately, they were rarely recorded for adults. There is little variation in the length of servitude in adult contracts and four years of servitude appears to have been the norm.[37] For minor servants, on the other hand, cash payments were consistently recorded but were rarely made. The length of servitude was the main source of variation in the contracts of minor servants. Thus, our analysis focuses on minors, which leaves us with 162 observations in the Middlesex sample, out of which 86 individuals migrated to the mainland and 76 to the West Indies, and 1,904 observations in the London sample, out of which 1,087 moved to the mainland and 817 to the West Indies.

There is substantial amount of missing information in these records, most of which is occupation information. More than half of the minors did not have a recorded occupation. There is a debate regarding the interpretation of missing recorded occupations.[38] Whereas Mildred Campbell argues that servants with missing occupation constituted a random sample of the servant population, Galenson holds that those without recorded occupation indeed did not have any professional

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[34] The data on servants who left from the port of the Middlesex county, 1682–1684, were retrieved from microfilms of the original indenture records entitled Plantation Indentures and created by the London Metropolitan Archives. The original records can be found in the Middlesex Guildhall, in the United Kingdom, and they are also reported in Nicholson, *Some Early Emigrants*; and Wareing, "Some Early Emigrants."

[35] The data used for servants who departed from London, 1718–1759 come from microfilms of the original records, entitled Agreements to Serve in America and can be found at the Guildhall, London. This source was transcribed by Kaminkow and Kaminkow, *List*; and Galenson, "Agreements."

[36] Galenson, *White Servitude*.

[37] Galenson, *White Servitude*, found that for minors, cash payments were recorded when made (in fewer than 6 percent of the contracts) and were almost always made to servants bound for four years. Because most adults were bound to serve for four years and because adults rarely appear to have served less than four years, Galenson concluded that for adults cash payments substituted for reduction of servitude below four years.

[38] See Galenson, *White Servitude*, pp. 39–64, for a detailed discussion.

skill.[39] We consider two specifications, one of which excludes the occupation variable from the analysis, and the other treats missing occupation as if the servant had no occupation. We report results from the latter specification, but results from the former specification are qualitatively the same.[40]

ESTIMATION RESULTS

Our estimation results are presented in Table 1 for the Middlesex sample of 1682–1684 and in Table 2 for the London sample of 1718–1759. The estimation results of the determinants-of-migration equations are presented in the first and second columns of both tables.[41] The first column of Tables 1 and 2 shows results from the reduced-form Probit regression ($D = 1$ if $\gamma' W_i + \varepsilon_i \geq 0$ and $D = 0$ otherwise), where the choice of destination is determined by individuals' observable characteristics W_i that contain both variables in X_i and in Z_i, as well as by individuals' unobservable characteristics ε_i. The second column of Tables 1 and 2 shows results from the structural Probit ($D = 1$ if $D_i^* = \delta_1 Z_i + \delta_2[L_{iA} - L_{iWI}] + u_i \geq 0$ and $D = 0$ otherwise), where the choice of destination is determined by individuals' observable characteristics Z_i, as well as by the difference in expected duration of servitude in each destination and an unobservable component u_i. The results from estimating the servitude duration equations in the mainland and in the West Indies are presented in the third and fourth columns, respectively.

Migrants' Selection to Colonial America

John Riley was nineteen years old when he left Britain in the summer of 1722 to St. Christopher in the West Indies. He signed his indentured contract with a merchant named Christopher Veale from Shoreditch, Middlesex. Riley did not have a recorded occupation, but he could sign his indenture contract. Given Riley's observable characteristics (gender, age, occupation, literacy, and season of departure), our model predicts that he should have served in the West Indies for a little over three and a half years. However, Riley's indentured contract assigned him five years of servitude, indicating that some factors that are unobservable to us prolonged his period of servitude.

Had Riley gone to the mainland, our model predicts that he would have served an even longer term, which reflects compensating differentials

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[39] Campbell, "Social Origins."
[40] Results from the second specification are available from the authors upon request.
[41] Description of the variables is reported in the Appendix.

TABLE 1
MIDDLESEX SAMPLE: ESTIMATION RESULTS

	(1) Reduced Form Probit	(2) Structural Probit	(3) Servitude Duration West Indies	(4) Servitude Duration Mainland
Constant			9.023**	16.97***
			(3.902)	(1.41)
$L_{US} - L_{WI}$		−0.456		
		(0.500)		
Age	−0.083**	−0.202***	−0.245	−0.515***
	(0.035)	(0.033)	(0.182)	(0.058)
Ability to sign	−0.042	−0.086	−0.211	−0.391**
	(0.103)	(0.101)	(0.172)	(0.188)
Gender	−0.114	0.019	−0.192	−0.495**
	(0.241)	(0.192)	(0.197)	(0.239)
County of origin				
Northern	−0.184	−0.039		
	(0.164)	(0.156)		
North central	−0.129	−0.020		
	(0.186)	(0.158)		
Western	−0.073	0.112		
	(0.205)	(0.149)		
Southern	−0.105	0.037		
	(0.182)	(0.160)		
Season of departure				
Fall or winter	0.087		0.402**	−0.684
	(0.119)		(0.153)	(0.541)
Summer	0.702***		0.153	−1.693**
	(0.066)		(1.257)	(0.817)
"Skilled" occupation	0.443**		−0.042	−0.599
	(0.086)		(0.535)	(0.411)
No occupation	0.322**		0.223	−0.086
	(0.126)		(0.283)	(0.236)
Mill ratio			0.009	−0.935*
			(0.801)	(0.482)
R^2			0.35	0.71
LR chi^2	88.33	66.67		
N	162	162	76	86

Note: For variable definitions, see the Appendix.

between the mainland and the West Indies. At the same time, William Tayler possessed the same observable characteristics as Riley, and he left Britain in the same summer as Riley and even signed his contract with the same merchant (Christopher Veale). Tayler headed to Maryland and was assigned to serve there for only four years. Although Tayler and Riley possessed the same observable characteristics, Tayler had unobservable characteristics such as health or physical strength that shortened his servitude whereas Riley had unobservable characteristics that prolonged his servitude.

TABLE 2
LONDON SAMPLE: ESTIMATION RESULTS

	(1) Reduced Form Probit	(2) Structural Probit	(3) Servitude Duration West Indies	(4) Servitude Duration Mainland
Constant			9.862*** (0.576)	11.589*** (0.322)
$L_{US} - L_{WI}$		0.054 (0.098)		
Age	–0.029*** (0.008)	–0.036*** (0.007)	–0.323*** (0.021)	–0.332*** (0.021)
Ability to sign	–0.084*** (0.024)	–0.079*** (0.025)	–0.006 (0.065)	–0.082 (0.068)
Gender	0.178*** (0.045)	0.199*** (0.048)	–0.130 (0.165)	–0.269** (0.136)
County of origin				
Northern	–0.135*** (0.040)	–0.136*** (0.039)		
North central	–0.071* (0.045)	–0.070*** (0.044)		
Western	0.011 (0.044)	0.007 (0.043)		
Southern	0.044 (0.037)	0.032 (0.037)		
Scotland	–0.177*** (0.056)	–0.186*** (0.056)		
Ireland	0.012 (0.078)	0.019 (0.079)		
Season of departure				
Winter	–0.037 (0.041)		0.038 (0.095)	0.152* (0.089)
Fall	–0.171*** (0.039)		0.139 (0.107)	0.245** (0.115)
Summer	–0.110*** (0.041)		–0.060 (0.101)	–0.003 (0.103)
"Skilled" occupation	0.088*** (0.034)		–0.092 (0.077)	–0.218** (0.097)
No occupation	0.013*** (0.030)		–0.021 (0.076)	0.150 (0.094)
Mill ratio			0.553** (0.237)	–0.903*** (0.320)
R^2			0.39	0.44
LR chi^2	143.53	100.77		
N	1,904	1,904	817	1,087

Note: For variable definitions, see the Appendix.

We now turn to the regression analysis that formalizes and generalizes these examples. As shown in the third and fourth columns of both samples, the coefficients on the inverse Mill ratio are positive and big for servants bound to the West Indies in the latter sample and negative and big for servants bound to the mainland in both samples. These re-

sults indicate that servants migrating to the West Indies were negatively selected and servants migrating to mainland colonies were positively selected.[42] More specifically, our estimation suggests that in both the seventeenth and eighteenth centuries, an average servant who migrated to the mainland served about half a year less than predicted by his observable characteristics. A servant bound to the West Indies in the eighteenth century served half a year more than his observable personal characteristics would indicate.[43]

The difference in the constant terms suggests that, when abstracting from personal characteristics, servitude was shorter in the West Indies than in the mainland. This reflects the higher general desirability of the mainland over the West Indies. The positive and negative coefficients on the Mill ratios (columns 3 and 4) imply that, abstracting from the compensating differentials, there was a negative selection of servants to the West Indies and a positive selection to the mainland.[44]

The strong selection effects imply that in the seventeenth and eighteenth centuries, people who were of higher quality—as observed by their contemporaries but not by us—preferred mainland destinations over the West Indies colonies and that those who had lower unobservable qualities were more likely to migrate to the West Indies. These findings are consistent with the historical evidence, which highlighted the fact that migrants to the West Indies were "lazy useless sort of people . . . ," and that mainland colonies offered more attractive opportunities for talented servants than did West Indies destinations.[45]

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[42] When allowing a servant to choose between northern and southern colonies in the mainland, positive selection of servants to southern colonies such as Virginia and Maryland appears to be stronger compared to northern colonies. Moreover, the results are robust to the inclusion of the price of sugar in England.

[43] Moreover, we find that the unobservable characteristics varied with gender and literacy. In particular, the unobservable qualities of men were better than those of women (i.e., the term

$$\sigma \frac{\phi(\gamma' W_i)}{1 - \Phi(\gamma' W_i)}$$ is, on average, bigger for men than for women) in both the United States and the

West Indies. For example, whereas an average men served in the mainland seven months less than his observable characteristics indicate, women only served four months less than suggested by their characteristics. In the West Indies, men served five months longer than suggested by their observable characteristics, compared to seven months for women. Similarly, literate individuals seem to have brought with them better unobservable qualities than illiterate individuals.

[44] The result is robust to the inclusion of year of departure, and birth cohort of the servant (constructed as year of departure minus age of the servant). On the distinction between selection and compensating differentials, see, for instance, Goddeeris, "Compensating Differentials."

[45] Pitman, *Development*, p. 52. Continental colonies are believed to have provided better opportunities than West Indies for talented individuals. Smith noted that in continental colonies: "there was always a scarcity of labor; always land to be had; always a decent livelihood to be won by those who had the qualities necessary to win it. Thus the freed servant with his new clothes and his small stock of corn need never have lacked for employment. If he desired land and independence he could acquire them in time, even if not immediately on his freedom" (*Colonists*, p. 293).

In terms of selection patterns over observable characteristics, our analysis shows (as reported in Tables 1 and 2, column 1) that servants who were more skilled (defined as carpenters, blacksmiths, spinsters, weavers, and shoemakers) were more likely to move to America's mainland. In the case of the London sample this result is in contrast with that reported by Galenson: according to his analysis skilled servants were more likely to migrate to the West Indies.[46] The reason for this difference lies both on the definition of skill and on the different methodologies employed: whereas Galenson computes the rough proportion of skilled servants in each colonial destination, we control in our regression for other servants' personal characteristics.

However, both Galenson's analysis and ours suggest that individuals who could sign their names were more likely to migrate to the West Indies rather than to the mainland.[47]

It is interesting to notice that the selection over unobservable characteristics had a larger effect on the length of servitude than the ability to sign or occupation.[48] This may either suggest the limited information contained in the observable variables as measures of education and skills or reflect the relative importance of characteristics such as health and physical strength that we cannot currently observe and measure.

Returns to Human Capital

Galenson estimates returns to human capital in the seventeenth and eighteenth centuries by joining observations for the West Indies and the

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Hector St. John de Crevecoeur, in his Letters from American Farmer published in 1782, writes that: "there is room for every body, in America. Has he any particular talent, or industry? he exerts it in order to procure a livelihood, and it succeeds . . . Is he a laborer, sober and industrious? he need not go many miles, nor receive many informations before he will be hired, well fed at the table of his employer, and paid four or five times more than he can get in Europe" (Smith, *Colonists*, p. 292).

According to Smith, West Indian colonies "presented no such satisfactory prospects. Excepting Jamaica they were all of small size, and it was not long before the land was taken up." Servants to the West Indies were described as "Artificers and Laborers that come from Europe, that soon grow lazy and Indolent." They were "Runagadoes and a loose sort of people" (Pitman, Development, p. 54). The English governor commented that a servant arriving to the West Indies were "a lazy useless sort of people who come cheap and serve for deficiencies and their hearts are not with us" (Pitman, *Development*, p. 54). Smith asserts that "it is plain that no intelligent and informed man or woman would emigrate to the West Indies as a servant after the first years of settlements were over . . . No doubt there were some good servants, and some successful careers even in the eighteenth century, but we must look upon the white servant in the West Indies generally as being unfortunate individual, prized mainly for the color of his skin, unable to find work, apt even to conspire with slaves, a tragic outcast in the colonial world" (Smith, *Colonists*, p. 295).

[46] Galenson, *White Servitude*, pp. 91–95.

[47] Galenson, *White Servitude*.

[48] The results of the probit estimation are robust to the inclusion of year of departure and birth cohort.

American mainland.[49] It is implicitly assumed that the determinants of servitude duration are the same in both locations. Our econometric analysis of equation 2 reveals that the returns to human capital differ across colonial destinations. In particular, during the period covered by our analysis, age was on average more rewarded in the mainland than in the West Indies. Servants' skills were more important determinants of the servitude duration in mainland colonies than in the West Indies, especially in the eighteenth century. Servants who were occupied in the Old World in more skilled occupations as carpenters, blacksmiths and spinsters, served about three months less than other servants in the mainland, but got similar terms in the West Indies. Women appeared to have been more valued in the mainland than they were in the West Indies.[50]

Our results are consistent across the seventeenth- and eighteenth-century samples. In both samples we find compensating differentials such that, abstracting from personal characteristics, servitude was longer in the mainland compared to the West Indies. Women received a shorter period of servitude in the mainland in both the seventeenth and eighteenth centuries. In the seventeenth century, age was more valued in the mainland colonies than in the West Indies, but in the eighteenth century this gap disappeared.

Notice that our estimators of the determinants of servitude duration are not directly comparable with Galenson's.[51] In particular, Galenson analyzes a pooled regression and places fixed effects on a thin selection of colonial destinations to measure compensating differentials.[52] In our analysis the colonial destination is an endogenous variable, and thus it is not taken as given. In order to have a more powerful test of selection, we group the destinations in two broader categories: West Indies and American mainland.[53] In our analysis the compensating differentials on colonial destinations can be measured by looking at the differences in the constants of the two human capital evaluation equations. Another difference between our analysis and Galenson's is that whereas Galenson has dummy variables for each age group, we introduce a linear relationship between the servitude's duration and age (results are robust for

[49] Galenson, *White Servitude*, pp. 104–05.

[50] Galenson suggests two possible reasons for the wage premium received by women. The first is that the demand for them was higher due to shortage of wives for colonists (women constituted less than 6 percent of emigrants in this sample), and the second is that women might have been more productive in certain household jobs (such as nursing and cooking) that were demanded by colonists.

[51] Galenson, *White Servitude*, pp. 104–05.

[52] The subdivision that Galenson makes of colonial destinations is the following: Antigua, Barbados, Jamaica, Other West Indies, Maryland, Virginia, Other mainland.

[53] In another specification, we divide American mainland between Northern colonies and Southern colonies. Our results are robust to this specification.

including age squared). Despite the differences, our results of the estimation of the returns to human capital are qualitatively similar to Galenson's. That is, in both colonial destinations and in both the seventeenth and eighteenth centuries, we find that older servants had to serve a shorter period to repay their debt, women served shorter periods than men, and whereas literate individuals served a shorter period in the seventeenth century, literacy did not have a substantial effect on servitude duration in the eighteenth century.

DISCUSSION AND CONCLUSIONS

During the seventeenth century, the West Indian colonies were considered the richest regions of the Americas. At the beginning of the eighteenth century, Barbados's per capita income was 50 percent higher than the per capita income of the American mainland.[54] By the beginning of the nineteenth century, however, the situation was reversed with the mainland colonies overtaking the Caribbean colonies.

The current research attempting to explain this different patterns of economic development has focused on the role of factor endowments and institutions. The debate has concentrated on which of the two factors has played a more important role. One perspective emphasizes that geography is the principal factor determining economic development.[55] A second perspective lays emphasizes that institutions are the determinants of long run economic development.[56] The geographic and institutional views are not mutually exclusive: geographical location can shape institutions, which, in turn, affect economic performance. In the context of the British colonies in the New World, Stanley Engerman and Kenneth Sokoloff describe how the different geographical environments of the American colonies, by favoring one type of crop over another, determined the degree of inequality displayed by each colonial society and the quality of institutions constituted.[57]

In contrast, by emphasizing the different quality of human capital arriving in various colonies, this article points out the possible importance of migrants' human capital in explaining the different patterns of eco-

[54] Engerman and Sokoloff, "Institutions."

[55] Diamond, "Guns"; Gallup, Sachs, and Mellinger, "Geography"; and Sachs, "Tropical Underdevelopment."

[56] North, Structure; North, Summerhill, and Weingast, "Order"; Hall and Jones, "Why Do Some Countries"; Acemoglu, Johnson and Robinson, "Colonial Origins" and "Reversal"; Acemoglu, Johnson, Robinson and Thaicharoen, "Institutional Causes"; and Rodrick, Subramaniam and Trebbi, "Institution Rule."

[57] Engerman and Sokoloff, "Factor Endowment," "Institutions," and "Colonialism." Acemoglu, Robinson, Johnson, "Colonial Origins" and "Reversal," also account for the effects of geography on institutions.

nomic development in the two regions.[58] More specifically, our analysis indicates that both in the seventeenth and in the eighteenth centuries, migrants to the West Indies were negatively selected and migrants to the mainland were positively selected in terms of their unobservable characteristics such as ability, motivation, ambition, physical strength and health. These features were associated with half a year reduction of servitude in the mainland and half a year increase of servitude in the West Indies. If the type of destination selectivity by unobserved (to us) human capital characteristics that we found for indentured servants can be generalized to other migrants, then this process may have contributed to the relative difference in economic development across regions in the Americas. In this sense, our analysis provides further support to the work of Glaeser et al., who have studied economic growth performance for a set of developed and developing countries between 1870 and 2000 and have shown that human capital is a fundamental determinant of the development of good institutions and a strong predictor of economic growth.[59]

Although the extent and size of the importance of human capital in explaining the different patterns of economic development in the two regions is a topic for future research, we suggest here three possible channels through which human capital may have affected the divergence between the economic development of the mainland and the West Indies.

First, human capital and education have a direct impact on economic growth and an indirect impact on economic development through their effect on institutions.[60] The only observable measures of skill that survived to our times are whether or not a servant could sign his contract and his occupation. The unobservable qualities detected by our analysis capture aspects of servants' education and general skills observed by the master that could have an important influence on economic activities. Under this perspective, better unobservable characteristics might have affected differently the economic growth and the development of institutions of the West Indies and the mainland.

Second, as already discussed, health may be an important part of the unobservable characteristics in our analysis. Recent research suggests that between 10 percent and 29 percent of the share of the actual cross

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[58] Our analysis does not reveal whether good servants may have been attracted to the mainland because of its geography and natural endowment or because the mainland already had better institutions early on. Nevertheless, given our findings, the various explanations of the divergence of the two regions should take into account the divergence in the quality of human capital these regions attracted.

[59] Glaeser, La Porta, Lopez-de-Silanes, and Shleifer, "Do Institutions."

[60] For the direct impact, see Becker, Murphy, and Tamura, "Human Capital"; Galor and Weil. "Population"; Lucas, "On the Mechanism"; and Mankiw, Romer, and Weil, "Contribution." For the indirect impact, see Glaeser, La Porta, Lopez-de-Silanes, and Shleifer, "Do Institutions."

country variance in log-income per workers is explained by variation of health.[61] It is reasonable to conjecture that similar results would hold in seventeenth- and eighteenth-century economies mainly characterized by agricultural production, where the health of human actors played an important role in determining performance.

Third, the unobservable characteristics may consist of servants' entrepreneurial skills, which can contribute to facilitate the adoption of new technologies and the construction of good institutions. Starting from the work of Lowell Ragatz, an important stream of historiography on the British Caribbean colonies depicts the West Indies as a technologically conservative environment.[62] Planters were overcommitted to crops that exhausted the soil, and they would not adopt best practice techniques when available. Many of them did not live any more in the islands and left the management of the plantations to incapable and dishonest managers. Historians also recognized the West Indies as a system incapable of organizing institutions that contributed to economic growth.[63] In particular it was noticed that being "the white settlers, mostly young male, and drawn from a low grade set of people," with only a few gentlemen leaders and "no substantial number of those middling Englishmen and Chesapeake societies" constructed bad institutions and a general lifestyle that lacked moral and intellectual values. The extent of the failure of West Indian planters is still an object of debate, but the historiography on the matter points out that Caribbean colonies were an environment technologically more conservative than the mainland colonies.[64]

In contrast, American mainland colonies had an environment more receptive of technology adoption. Alan Olmstead and Paul Rhode, for instance, show how cotton planters in the early nineteenth century were actively engaged in matching the technology and the environment.[65] They were engaged in systematic research for better seed varieties capable of producing high crops yields. This activity was conducted by the planters themselves and required an enormous amount of curiosity, motivation, and entrepreneurial skills.[66]

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[61] Shastry and Weil, "How Much"; and Weil, "Accounting for the Effect."

[62] Ragatz, *Fall*.

[63] Bridenbaugh and Bridenbaugh, *No Peace*; and Dunn, "Sugar."

[64] For a re-evaluation of the role of the planters in the West Indies see Green, "Planter"; Sheridan, *Sugar*; and Ward, "Profitability."

[65] Olmstead and Rhode, "Wait a Cotton Pickin' Minute!"

[66] Notice, however, that this example may be a consequence of the good people arriving a century earlier, or simply another outcome of whatever it was that made good people want to go to the mainland.

Appendix: Variable Definitions

Variable	Description
Gender	Woman = 1; Man = 0
Ability to write	Sign = 1; Mark = 0
Winter, spring, summer, fall	Indicated season = 1; otherwise = 0
American colonies	
Mainland	Pennsylvania, New Jersey, New York, New England, Georgia, Maryland, North Carolina, South Carolina, Virginia
West Indies	Antigua, Barbados, Jamaica, St. Christopher, Santa Lucia
English counties	
Northern	Yorkshire, Cheshire, Northumberland, Cumberland, Westmorland, Durham, Lancashire, Derbyshire, Nottinghamshire
North Central	Northamptonshire, Leicestershire, Norfolk, Rutland, Hintingtonshire, Lincolnshire
Central	Buckinghamshire, Norfolk, Suffolk, Cambridgeshire, Surrey, Bedfordshire, Middlesex, Kent, Hertfordshire, Warwickshire, Essex, Oxfordshire, Berkshire
Western	Gloucestershire, Shropshire, Herefordshire, Wales, Staffordshire, Worcestershire
Southern	Dorset, Cornwall, Hampshire, Sussex, Somerset, Wiltshire, Devonshire
"Skilled" occupations	Carpenter, blacksmith, spinster, weaver, shoemaker = 1; otherwise = 0
No Occupation	No occupation indicated = 1; otherwise = 0

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