Transport Costs and the Slave Trade to the Caribbean

David Eltis
Department of History
Emory University
deltis@emory.edu

Frank D. Lewis
Department of Economics
Queen's University, Ontario
lewisf@econ.queensu.ca

Kimberly McIntyre
Fiscal Policy Division
Finance Canada
kim.mcintyre@fin.gc.ca

(March 2009)

Frank Lewis, corresponding author.

The number of slaves carried off from Africa to the Americas increased fivefold between the middle third of the seventeenth century and the last third of the eighteenth century – the point at which the transatlantic slave traffic reached its all time high. In this one hundred and thirty year period captive Africans became by far the most important stream of migrants in the re-peopling of the Americas. Slaves went from less than half the transatlantic movement of people in the late sixteenth century to over eighty percent in the late eighteenth century. This dramatic shift made the sub-tropical plantation Americas the high-income core of the New World. The demand for slaves derived from the demand in Europe for sugar, sugar-related products, coffee, rice, tobacco, and indigo which increased between four and five times in the first seventy years of the eighteenth century. Historians and economists have filled out the picture of the demand side of this expanding market for slave labor quite well. Economic growth in England over the period 1700 to 1770 was modest in both aggregate and per capita terms. In this period Gross Domestic Product grew by 60 percent and population by 30 percent.[1] At the same time the consumption of sugar (by far most important plantation crop) increased 350 percent.[2] A high income elasticity of demand for plantation produce may be assumed. That, combined with secular improvements in the productivity of plantation agriculture contributed to a major expansion of the slave economy in the Americas.[3]

The supply side of the transatlantic market for slaves has received much less attention than the demand side - especially in the second half of the seventeenth century when the dramatic growth got underway. What exactly was the cost structure of the transatlantic slave market in the late seventeenth century? The issue of costs has entered the debate on the profitability of the slave trade with the more recent literature suggesting that excess profits, at least in the long run,

were unlikely because of competition.[4] And work on some eighteenth-century accounts supports the findings for the earlier period that firms involved in the slave trade were doing little more than covering their costs.[5] But the focus on profitability may obscure a more fundamental aspect of the forced migration of Africans to the Americas, namely the role of transport costs in determining the prices of slaves on both sides of the Atlantic and the number of people transported.

This paper, following on the work of Eltis, Richardson, Galenson and others, itemizes the factors that contributed to the cost of transporting enslaved Africans, and measures the contribution of these costs to the difference between the price of in the Americas and on the African coast.[6] We analyze twenty-two voyages that originated in London between 1683 and 1685. Considerable use is made of the *Transatlantic Slave Trade Database*; but our estimates rely mainly on the direct use of the manuscript records of the Royal African Company (RAC), which we combine with the *Database* to produce a close to complete picture of the various costs of each of the slave voyages. During the 1680s the RAC conducted much of its trade using hired ships, and the accounts describe the various payments made by the RAC both to the owners of the ships and the ship captains.[7] Importantly the records detail, in addition to these payments, the other expenses incurred by the RAC. The records also allow us to derive the earnings from activities related to the slave trade, most importantly the trade in gold and the transport of sugar. Although our starting point is the *Slave Trade Database*, we rely for the cost estimates primarily on the following Royal African Company records: the invoices of goods for purchasing Negroes in Africa, the accounts of the slave auctions in the Caribbean, and the RAC Copy Book of Accounts. The latter reports the amount paid to the ship owners for the transport of slaves and sugar, and includes accounts of earnings from the trade in gold and ivory.[8]

There was little variation in the cost structure of the voyages; and so to illustrate the nature of the costs, we begin by outlining the accounts of a single voyage, that of the 150-ton *Bonadventure*, which sailed from London on April 21, 1683. On board were goods valued at £1,306 (sterling) for the purchase of gold on the Windward Coast, £710 worth of supplies for Cape Coast Castle on the Gold Coast, and £1,235 for the purchase of an intended 320 Negroes at Ardra on the Slave Coast in the Bight of Benin.[9] The *Bonadventure* arrived in Barbados on January 16, 1684. Sixty-four Africans did not survive the middle passage and another seven died shortly after arrival. Of the remaining 249, the RAC sold 184 on its own account, the ship owners received 56, and the ship's captain was paid 9 slaves. On the ship's return to London, the RAC settled the account with the owners, crediting them with having delivered 256 slaves. At a rate of £5 per slave,[10] the total due the owners was £1,280 from which the RAC deducted the value of the 56 slaves the ship owners had already received as payment. These slaves, which had been sold in Barbados on the ship owners' account, were each valued at £15 or £840 in total, so the amount still owing was £440.[11] The value of the gold that had been purchased in Africa was £1,679.[12] As was typical of these voyages, the ship owners supplemented their income by participating in the gold trade. On this voyage the ship owners had contributed £350 of the £1,306 cargo sent to purchase the gold, and they received a corresponding share of the return, or £450. There were in addition some small payments and adjustments.

The returns from these voyages depended mainly on the receipts from the Caribbean slave auctions. There exist detailed reports of the auctions, many of which have been analyzed, notably by Galenson, and Burnard and Morgan.[13] The account of the *Bonadventure*'s slave auction, which took place in January 1684, is presented in Table 1. Men, women, boys, and girls, were sold

mainly in small groups, and given the detail of the accounts it is possible to compute a price for each category of slave for each sale. For example, in the second sale listed, eight men and two women sold for £180 (Barbados currency), with payment due in seven months. Applying an annual discount rate of 20 percent[14] and weighting women at .9, the prices were £16.51 for the men and £14.86 for the women.[15] Galenson found that slave prices tended to fall in the sales listed lower in the account, and although that was not generally true of the *Bonadventure* auction, the prices of slaves in the last three sales were indeed exceptionally low.[16] These slaves, who were auctioned in large lots, sold for less than half the average price of the slaves listed higher in the account.[17] The Africans in these lots must have been in very poor condition, and we attribute the low prices to morbidity.[18] Both the ship owners and the captain received most of their payment in slaves.[19] The captain's commission was five men, three women, and one girl; and the ship owners received twenty-five men, twenty-seven women, and four boys.[20] On the 184 slaves sold on its own account, the Royal African Company reported proceeds of £2,491 19s (Barbados currency).[21]

Our sample includes nine voyages to Barbados, twelve to Jamaica, and one to Nevis (see Table 2).[22] The time between the ship's departure from London and its arrival in the Caribbean averaged just over nine and a half months, and from ranged the 182-day voyage of the *Mary* to Jamaica, to the 386 days it took the *Owners Adventure* to reach Nevis.[23] Differences in the combined length of the first two legs of the voyage had less to do with the middle passage, from Africa to the Caribbean, than with the time spent sailing to Africa and purchasing and boading a full complement of slaves.[24] The average length of the voyages to Whydah and Ardra on the Slave Coast in the Bight of Benin was 286 days; while those ships that took on slaves at ports east and

south of the Bight of Benin averaged 321 days. We do not have the dates of return of these ships, but, based on when the final accounts were recorded, it appears they reached London about six months after their arrival in the Caribbean. Thus, depending on the African port where the slaves were boarded the entire voyages were between fifteen and seventeen months. The size of the ships varied from 60 tons to 320 tons; and, although larger ships tended to take on and deliver more slaves, beyond 200 tons there were sharply diminishing returns to ship size. As ship size increased from 60 tons to 200 tons, numbers of slaves increased from about 200 to 550; but beyond 200 tons there was little difference in the numbers boarded.

Mortality on these voyages was much higher than the rates typical of the later slave trade. A comparison of the number of Africans purchased and the number ultimately sold in the Caribbean shows that mortality averaged 25 percent, with more than 90 percent of all deaths occurring prior to arrival in the Caribbean.[25] There was, moreover, wide variation. Mortaility on the voyage of the 300-ton *Prosperous* to Barbados was just 5 percent; whereas the rate on the voyage of the 80-ton *Expedition* to Jamaica was more than 60 percent, possibly due to a slave insurrection.[26] Perhaps surprisingly, there was no connection between mortality and either the size of vessel or the number of slaves boarded.[27] And there was virtually no difference between mortality on the somewhat longer voyages to Jamaica and those to Barbados.[28]

Decomposing the Cost

Three factors accounted for the gap between slave prices in the West Indies and on the African coast: mortality and morbidity on the middle passage; the costs of transporting and selling the slaves; and the offsetting income from the trade in gold and ivory, as well as the return from

carrying sugar and other freight. As noted, the *Bonadventure* auction included three large groups of slaves who sold for very low prices; indeed all the slave auctions included some sales, often of large lots, where prices were much lower than the average. We attribute the low prices to morbidity; and, recognizing that any cut-off price for morbidity is necessarily arbitrary, we assume that, where the price of an adult male-equivalent slave was less than £13 (local currency) in Barbados, £14 in Nevis, and £15 in Jamaica, the shortfall was due to the slave's arriving in especially poor condition.[29] Setting aside the effect of age and gender, the relation between the African and West Indies price can be expressed as:

$$P^A = P^I(1-d-m) - \frac{C-R}{N}, \tag{1}$$

where P^A is the price in Africa, P^I is the price in the West Indies of a healthy slave, d is the mortality rate, m is the proportionate effect of morbidity on price, C is the gross cost of the voyage, R is income from the trade in gold and ivory and from the transport of sugar and other freight, and N is the number of slaves boarded in Africa. The cost of the voyage is assumed to include a normal return on capital, but it can be interpreted as allowing for excess, or possibly negative, profits. In the case of the Royal African Company its return from a voyage would have had to cover the costs of maintaining the infrastructure of forts and trading establishments in the Gambia River, Bunce Island, Sherbro, and, most of all, the Gold Coast.[30]

During this period and until the 1720s the Royal African Company hired at least some ships to transport slaves. The company's cost included, therefore, its payments to the ship owners. Not a large component, but potentially important to the net return from a voyage, was the income from activities complementary to the slave trade. The trade in gold and ivory, and the revenue from sugar and other freight, helped offset the cost of transporting the Africans. The ship and the

Royal African Company shared in the costs and in the returns from the related trade, as equation (2) reflects:

$$(2) \qquad P^A = P^I(1-d-m) - \left(\frac{C^s + C^c}{N} - \frac{R^s + R^c}{N}\right),$$

where C^s, C^c is the (gross) cost of the voyage to the ship, the Royal African Company, and R^s, R^c is the revenue earned by the ship, the Company from sources other than the slave sales. As will be apparent, the revenues from gold and ivory could have a large impact on the net return to the Royal African Company from a voyage. Finally, we make use of the detail in the slave auctions, which identify men, women, boys, and girls, to derive a price for each category of slave.[31] Since mortality and morbidity could differ by age and gender, the West Indies price is computed as a weighted average of the price of each category of slave:

$$(3) \qquad P^A = \sum_{i=1}^{4} \alpha_i P_i^I (1-d_i-m_i) - \frac{C^S + C^C}{N} + \frac{R^S + R^C}{N}$$

where i refers to the category of slave (1 - men, 2 - women, 3 - boys, 4 - girls), and α_i is the share of slaves leaving Africa in category i.[32]

Africans sold for much higher prices in the West Indies than on the African coast. The average price of healthy male adult slaves in the Caribbean was £18 sterling, with prices in Jamaica averaging £3.8 higher than those in Barbados, £19.5 as compared to £15.7 (see Table 3).[33] For a given destination there was little variation by ship in the average slave price. In Jamaica men sold for £18 to £21, and in Barbados for £14.5 to £17.[34] The average selling price of all healthy slaves was £17.7 in Jamaica, £14.6 in Barbados, and £16.4 across the entire sample.[35] These prices can be compared to the Royal African Company's cost of purchasing the slaves (see Figure 1). The African price is based on the cargo that the RAC designated for the

purchase of slaves and the number of Africans who were boarded on the ship.[36] There is a considerable gap between the lowest price of £2.61 paid on the 1685 voyage of the *John Bonadventure* and the £5.15 per slave paid on *Hopewell's* voyage,[37] but for nineteen of the twenty-three voyages the range is between roughly £3 and £4.[38] The average for the entire sample of voyages is £3.64. Notable, but entirely consistent with a competitive market, is the fact that, although the company received a higher price for slaves in Jamaica, it paid almost the same price in Africa whether the slaves were bound for Jamaica or Barbados. The price of the Jamaica-bound slaves averaged £3.56 and those going to Barbados were purchased for £3.78.[39] Across the sample, the price of the slaves in Africa, £3.64, was 22 percent of the price these slaves would have sold for in the Caribbean, £16.35, had they all arrived in relatively good condition. The absolute differential was £14.16 for Jamaica and £10.79 for Barbados.

Identifying the source of the price differentials is one of the main objectives of this paper. We begin with mortality and morbidity. Mortality averaged close to 25 percent both on the voyages both to Jamaica and Barbados; but because slave prices were higher in Jamaica the absolute effect on the return was greater, £4.47 per slave sent from Africa versus £3.57. Mortality thus accounted for about a third of gap between the slave prices in these colonies and in Africa. Less important than mortality but still significant in reducing returns was slave morbidity. Although our choice of cut-off price for morbidity is arbitrary, it seems clear that many slaves were purchased for low prices because they arrived in the West Indies in very poor condition. Often auctioned in large lots, these slaves typically sold for about half the price of "healthy" slaves. For example, the *Elizabeth* sold 97 healthy adult male slaves for an average of £21.7 (local currency). The 29 adult male slaves who we define as sick sold for £11.7. At the

auction of the *Good Fellowship* in Barbados, men sold for £17.59 (local currency) if they were healthy and £9.48 if they were sick.[40] Over the entire sample, the effect of morbidity averaged £1.3 sterling per slave transported (see Table 3). The loss was £1.7 per slave on the voyages to Barbados and £1.1 on the voyages Jamaica.[41] Combined, mortality and morbidity reduced the average return per slave from £16.35 to £10.89, and together accounted for 43 percent of the gap between the African price and West Indies price of healthy slaves (see Figure 2).

On voyages where hired ships were used, the cost of transporting the slaves was shared by the Royal African Company, the ship owners, and the ship's captain. As well, the agent who conducted the slave auctions in the West Indies typically received a commission of 7 percent (see Table 4).[42] One of the costs borne by the RAC was for Negro provisions for the middle passage. The cargo, which was boarded in London, typically included flour, beef, beans, biscuits, brandy and tobacco. The cost per slave was not large; just £0.21 per slave or about 6 percent of their purchase price.[43] In addition slave vessels obtained provisions in Africa appropriate to the diets of slaves from the region where they were purchased.[44] In the West Indies the Royal African Company also incurred about £0.14 per slave on such items as supplementary provisions and the hire of canoes to ferry the slaves to shore. Deducting these costs and the agent's commissions leaves an average net return of £9.75 per slave, £10.85 on the voyages to Jamaica and £8.37 on those to Barbados. From this amount the Royal African Company had to cover the payments to the ship owners and captain, and the cost of purchasing the slaves in Africa.

The Royal African Company paid "freight" to the ship owners on all the slaves who were delivered to the West Indies. The rate was £5 (sterling) per slave in Barbados and Nevis (Leaward Islands), and £5 8s 6d per slave arriving in Jamaica. Payment was roughly two-thirds

in slaves, who were sold on the ship owners' account. The price of these slaves is reported in the auction of the *Expedition*; but for the other auctions, where no such prices are given, we assume the owners received the average price of healthy slaves at that auction.[45] The total amount paid by the Royal African Company to the ship owners, both in slaves and cash, averaged £3.71 per slave who left Africa. The ship owners received £4.00 per slave on the Jamaican voyages and £3.37 on the voyages to Barbados (see Table 4).[46] Since only part of the payment was in slaves, the owners were stilled owed a substantial credit which they received once the ship returned to London.[47] The ship's captain also was paid by the Royal African Company. His commission, received almost exclusively in slaves, was 5 percent of the number of slaves sold on the RAC's account.[48] With the exception of one voyage, we do not know the condition of the slaves paid to the captain; but, assuming they were healthy, the captain earned an average of £0.43 per slave who left Africa.[49] Healthy slaves averaged £3 higher in Jamaica than in Barbados, which meant that captains on the Jamaican voyages earned 20 percent more in commissions than those who sailed to Barbados.

The net return to the Royal African Company was its income from the slave sales less its payments to the ship owners and the captain, and the cost of the slaves in Africa. The Africans were purchased with a cargo that was loaded on the ship when it left London, but the Royal African Company did not receive any income until the ship returned to England, about sixteen months later. An additional cost then was the foregone interest on the value of the cargo over that period. Assuming a discount rate of 5 percent, the true cost of the slaves was 6.7 percent above their purchase price.[50] With this additional cost deducted along with the sales agents' commission and the company's other costs, the RAC netted on average £1.73 per slave. Notable

is the difference in net returns from the Jamaican and Barbados voyages. Because the costs on these voyages were similar and the price of slaves in Jamaica was higher, the RAC's net income per slave on the Jamaican voyages was £2 more, £2.59 versus £0.55. In fact the captains who sailed to Jamaica received almost as much in commissions, £0.47 per slave, as the Royal African Company netted from the slave sales on the Barbados route.

The RAC's net return was a residual: the difference between its revenue, mainly from slave sales and all the expenses associated with a voyage. As a result, its income from the slave voyages was highly variable (see Figure 3). Across the sample, the standard deviation of net returns per slave was £1.66, which was about equal to the mean return. By contrast, the standard deviation of returns to the ship owners and captains was just 20 percent of the mean.[51] Nevertheless, the overall risk to the RAC would have been much less, since the company could diversify across voyages to a far greater degree than the ship owners or captains.[52] The 1685 voyage of the *Friends Adventure* netted the company the highest return per slave, £4.14. In Africa the company paid nearly £4 for the slaves, but this relatively high price was offset by an unusually high Jamaican price of over £18. More important, though, was the, relatively low, 16 percent slave mortality rate and the small morbidity cost. Least successful was the *Expedition*, which also sailed to Jamaica, but experienced a slave revolt that may have contributed to its disastrous mortality of 62 percent. The high mortality greatly reduced the return of the ship owners and the captain, but it was the Royal African Company that was affected most. It lost £0.67 per slave. Losses were almost as great on the voyage of the *Robert*, which transported Africans to Barbados. Here the problem was a combination of a higher than average African price, relatively high mortality and morbidity, and a lower than average selling price, even for

Barbados.

The discussion to this point has focused on the earnings from the slave sales, and these earnings did indeed make up by far the greater part of the return from a voyage. But income from other sources also had an impact on overall returns. Most vessels stopped at ports along the Gold Coast to buy gold, and there was a trade in ivory, although this was much smaller. Another source of income was the return from carrying sugar and other freight from the West Indies to Britain.[53] The return to the Royal African Company from the trade in gold and ivory averaged £0.64 per slave, with all but four voyages generating at least some revenue from these sources (see Figure 4 and Table 5).[54] The additional income had little impact on the income from some voyages, but it may have been decisive to the viability of others, particularly those involved in the Barbados trade. On the voyages to Barbados, the income from these complementary activities averaged £0.91 per slave, nearly tripling the RAC's net return. Indeed the impact of gold, ivory, and freight may have been even greater than this. On voyages that went through Barbados, the ship owners and captain earned £0.42 per slave from trade and freight. If these sources of income had not been available and the RAC had to make up the difference by paying the ship owners and captain more in other forms, its return per slave would have fallen from £0.55 to £0.13. Another effect of the additional income was to reduce the gap in returns between the Jamaican and Barbados voyages. The Barbados ships carried more gold, and as a result the RAC's return was increased by £0.5 per slave more than on the Jamaican voyages.[55]

The revenue from gold, ivory, and freight was not as important to the ship owners and the captain. Income from these sources made up less than 10 percent of their total return. Still, the additional amounts, as just noted, may have reduced the payments the Royal African Company

had to make to the hired ships, and in that sense were a factor that helped make the slave trade viable. Overall the revenue from gold, ivory and freight accounted for nearly 25 percent of the total income from the Barbados voyages, but just 10 percent for those to Jamaica (see Table 5 and Figure 5).

The total income of the Royal African Company, the ship owners, and the captain was the net amount earned per slave times the number of slaves (see Table 6).[56] Worst-performing was the voyage of the *Expedition*. Its earnings totaled just £405 sterling and the RAC lost £139. By contrast, the 1683 voyage of the *John Bonadventure*, a 220-ton vessel that took on 550 slaves, generated £5,954, of which the RAC received £2,490 and the ship owners, £3,158, an amount that far exceeded what they earned on any of the other voyages.[57] The exceptional return was due in part to the large number of slaves boarded, but it was the low mortality of just 10 percent that mainly explains the success of this voyage. It may be surprising that a relatively small ship that took on so many slaves had low mortality; but, as we have noted, there was little relationship across our sample between the number of Africans boarded and mortality. As a result, ships that took on more slaves had proportionally greater returns (see Figure 6).[58]

Across the sample, income averaged £2,618 with the Jamaican voyages generating significantly more income than those to Barbados, £2,966 versus £2,243. This was despite the fact that Barbados-bound ships were slightly larger and carried a few more slaves. The differential was due to the higher price of slaves in Jamaica and the fact that the greater revenue from the slave sales was only partially offset by the lower returns from gold and ivory. It was the ship owners who received by far the largest share of the income from the slave trade, 56 percent or £1,562; and, although they earned more from the voyages to Jamaica than to Barbados, the

difference was small, £152. On the other hand, the Royal African Company's net income on the Jamaican voyages of £1,133 was nearly twice what the company earned from the voyages to Barbados.[59] The greater risk of piracy on voyages to Jamaica, which, as we noted, likely reduced the trade in gold, may explain part of the difference in returns. There was a greater potential threat as well from the Spanish, who would often detain foreign vessels on suspicion of illegal trading activity among their Caribbean possessions.[60]

Interpreting the Impact of Transport Costs on Slave Prices and Numbers

In the 1680s transport costs, including the cost of mortality and morbidity, accounted for about 80 percent of the price of the slaves in the Caribbean, and throughout the eighteenth century, transport costs remained central to the slave markets on both sides of the Atlantic. Here we analyze the impact of those costs on slave prices and slave numbers in the period of our study, 1684 to 1686. We also apply our approach to later years to help interpret the pattern of slave prices and numbers in the eighteenth century. Figure 7 describes a slave trade market that includes the RAC's direct costs, the cost of the hired ship, and the mortality and morbidity associated with the trade. D represents the demand for slaves in the West Indies and S the supply of slaves in Africa. Direct transport costs shift the demand curve, while mortality and morbidity reduce the absolute value of its slope. Mortality affects the supply curve as well, causing it to rotate upward.[61] Because the number of slaves arriving in the West Indies is lower than the number departing Africa, there are two equilibrium quantities as well as two equilibrium prices, both determined by the intersection of the D′ and S′ curves. At these equilibria, the price in the West Indies, P_I, exceeds the price in Africa, P_A, and slave arrivals, Q_I, are less than slave

departures, Q_A.

The effect of a change in each type of transport cost can be represented by a shift or a change in slope of the appropriate curve. We base our empirical results on constant-elasticity supply and demand curves:

(4) $$Q_A = a P_A^{\gamma}, \text{ and}$$

(5) $$Q_I = b P_I^{-\eta},$$

where γ is the elasticity of supply and η is the elasticity of demand. Letting T be transport costs per slave exclusive of mortality and morbidity, we can rewrite equation (1) as:

(6) $$P_A = P_I(1-d-m)-T.$$ [62]

In equilibrium, the number of slaves demanded in the West Indies equals the number supplied in Africa adjusted for mortality:

(7) $$Q_I = (1-d)Q_A.$$

From equations (4) to (7), the equilibrium price of slaves in the West Indies is derived as the solution to:

(8) $$P_I^{1+\frac{\eta}{\gamma}}(1-d-m) - TP_I^{\frac{\eta}{\gamma}} = [\frac{b}{(1-d)a}]^{\frac{1}{\gamma}}$$

Differentiating equation (8) with respect to T, d, and m solves for the effect of these variables on P_I, P_A, Q_I, and Q_A.[63]

Between 1684 and 1686, 32,034 Africans were boarded on ships bound for the British Caribbean, while the number disembarking was 24,316.[64] Of the total arrivals, Jamaica received 10,663 slaves and Barbados, 11,302. Results are based on annual departures and arrivals, and slave prices in the Caribbean and Africa, derived from our sample of voyages.[65] Table 7 reports

the results for Jamaica and all the British Caribbean, where for both regions the elasticity of demand, η, has been set equal to 1 or 3.[66] Because Jamaica represented a small part of the overall slave trade, changes in transport costs unique to Jamaica would have had almost no impact on prices in Africa, so we assume a perfectly elastic supply of slaves. For all of the British Caribbean an the elasticity of supply, γ, of 1 is assumed.[67] A £1 increase in transport costs, T, that applies to the Caribbean raises the West Indies price by between £0.75 and £1.13, or 5 to 7 percent, depending on the assumed elasticity of demand for slaves. A £1 increase in transport costs exclusive to Jamaica raises the Jamaican price of slaves by £1.46, or 8 percent. The magnified effect is due mortality and morbidity, and the fact that transport costs are per slave leaving Africa. For the Caribbean, where a slave supply elasticity of 1 is assumed, the increase in transport costs reduces price by £0.25 to £0.50. Given that the price of slaves in Africa averaged £3.64, these represent reductions in price of 7 to 14 percent. These results suggest changing transport costs could have a significant impact on slave prices both in Africa and the Caribbean.

The especially large transport cost effect, where Jamaica is treated in isolation, helps explain why the price of slaves in Jamaica was significantly higher than in Barbados. On the Barbados voyages, the earnings from gold, ivory, and freight averaged £0.5 more than on the voyages to Jamaica. These earnings differentially lowered the net transport cost to Barbados and hence the price of slaves in that colony. The impact on the slave price differential between Jamaica and Barbados according to the transportation effect derived here was £0.73. The greater cost of the ship and captain on voyages to Jamaica also had a magnified effect.

Changes in transport costs also had a potentially large impact on the size of the trade. For the British Caribbean an increase in costs of £1 per slave reduces annual departures from

Africa by between 733 to 1,467; the decline in arrivals to the West Indies is 395 to 1,186. Like the price effect in Africa, both represent declines of 7 to 14 percent. Limiting the analysis to Jamaica, the potential effect of transport costs is even greater. Where a (not implausible) elasticity of demand of 3 is assumed, a £1 increase in costs reduces slave flows by nearly 25 percent. As we noted, the greater perceived risks to shipping in the western Caribbean during the 1680s contributed to higher transport costs. In later years, as the threats declined, there was a marked shift in the trade to Jamaica and other western Caribbean islands.[68]

It is unlikely that changes in mortality had a major impact on the African side of the slave market. Figure 7 illustrates why. An increase in the mortality rate, d, causes the demand curve, D′, to rotate downward and the supply curve, S′, to rotate upward. The rotation in the D′ curve reduces departures, whereas the rotation in the S′ curve increases them. Thus there are offsetting effects on the African market. On the West Indies side of the market, both rotations in the curves reduce the number of slave arrivals and increase their price. Considering first the trade to the British Caribbean where the supply elasticity is put at one, a one percentage point increase in the mortality rate increases the West Indies price by between £0.10 and £0.24. Arrivals are reduced by 117 to 140 slaves, or 1.5 to 1.8 percent. The effect on departures is much less, a decline of 13 to 45; and the impact on the African price is negligible. Slave mortality on the middle passage was falling after the 1680s,[69] but it appears from these results that there may have been little impact on the African market.[70] The final variable, morbidity, has an effect very similar to mortality for the West Indies side of the trade; but, because there is no offsetting effect due to the S′curve in Figure 7, the impact on African slave prices and slave departures is greater.[71]

Beginning in the last quarter of the seventeenth century, there was great expansion in the

slave trade, especially to Jamaica and other parts of the western Caribbean. Here again we address the British trade and derive how the various components that made up the cost of transporting slaves affected both the numbers transported and the prices of slaves on both sides of the Atlantic. Figure 8 describes the pattern of slave prices over the period 1675 to 1807; and, based on equation (6), we have also derived the implied transport cost per slave leaving Africa. This transport cost is calculated as the difference between the Caribbean and African price after adjusting for mortality and morbidity, and includes therefore above-normal, or below-normal, profits in particular years. Given the large number of traders and the ease of entry and exit, it seems appropriate to assume generally normal profits over the this long period, which means trends in the series should be a good reflection of actual transport costs.

Over the 132 years the trends in both the Caribbean and African prices of slaves were strongly positive, with Caribbean prices increasing at an annual rate of 0.82 percent and African prices at a considerably faster 1.44 percent.[72] Given declining mortality on the voyages and the fact African prices were increasing from a much lower base, implied transport costs were also trending upward, at 0.91 percent per year.[73] Transport costs did not increase steadily. During the last quarter of the seventeenth century transport costs were low, averaging £5.9 per embarked slave. During the eighteenth century there were periods, notably in the 1730s and 1750s, when sharp increases in the price of slave, possibly due to spikes in sugar prices, temporarily raised the differential between Caribbean and African slave prices, but from 1700 to 1780 there was virtually no trend in estimated transport costs. The average at £11.8 per embarked slave was, however, nearly twice the level of 1675-1699. During the last 25 years of the British slave trade, prices in the Caribbean moved sharply higher again, and although prices in Africa increased as

well, albeit with a lag, the differential averaged much higher, nearly £20 per slave leaving Africa. It was only at the end of the period that estimated transport costs returned to their earlier levels.[74] We do not break down the sources of the rising transport costs, but it seems that two factors may have been especially significant. After 1700 there was a large decline in the commodity trade from Africa, particularly in gold.[75] As we found in connection with the slave trade in the 1680s, the earnings from gold and other goods reduced the net cost of transporting slaves. Another contributor to higher transport costs during some periods of the eighteenth century was the increased length of voyages, due entirely to the greater time it took to assemble and board the slaves in Africa. Mean voyage length from the port of origin to the Caribbean was 286 days during the period 1675-1700 and 359 days from 1751 to 1775.[76]

During the hundred-year period, 1675-79 to 1775-79, the cost of transporting a slave from Africa increased by 75 percent, from £8.0 to £14.0,[77] while slave mortality fell from nearly 25 percent to just under 15 percent (see Table 8).[78] There was, at the same time, an enormous expansion of the trade. Numbers arriving in the Caribbean from 1675-79 to 1725-29 increased more that 150 percent, and between 1725-29 and 1775-79 the trade increased another 27 percent. For the hundred years, rising slave prices and numbers imply a Caribbean demand for imported slaves that shifted out by a factor of more than seven, assuming demand was unit elastic, and by a factor of nearly forty, if an elasticity of three is assumed.

We derive the impact of slave mortality, transport costs, and demand on slave prices and slave numbers by hypothetically setting them at their 1675-79 levels. For example, had the mortality in 1725-29 been 24.2 percent rather than 18.8 percent, then, assuming a demand elasticity of one, the West Indies price would have been £33.2 rather than £30.8. Thus the

decline in the mortality rate reduced West Indies slave prices by £2.4. As well, the total number of slaves arriving in the five-year period is estimated to have been increased by about 5,600, from 75,522 to 81,129. For the reasons we outlined above, the decline in mortality has virtually no effect on the African side of the market. If, however, the demand for imported slaves was more elastic, the decline in mortality may have increased the trade to the Caribbean by as much as 10,000 and the trade from Africa by close to 6,000. The effect of falling mortality over the hundred years to 1775-79 was to reduce slave prices in the Caribbean by about £5 (for a demand elasticity of one) and increase slave arrivals by close to 12,000.

We derive the impact of the increase in transport costs in the same way, that is by supposing transport costs remained at their 1675-79 level. Assuming unit elastic demand, the West Indies price of slaves in the period 1725-29 would have been £28.5 rather than £30.8, and the African price £11.9 rather than £10.9. Thus, rising transport costs dampened what would have been an even larger trade. Slave arrivals would have been 6,700 greater and 8,200 more slaves would have been sent from Africa had transport costs not increased. Over the hundred years the effect of rising transport costs was greater. In the period 1775-79, slaves prices were increased £4.8 in the West Indies (£33.4 to 38.2) and reduced by £2.2 in Africa. Slave arrivals were reduced by nearly 15,000, while the number leaving Africa was lowered by roughly 17,000.

Clearly what mainly drove the slave market in the eighteenth century was demand. At first it was the expansion of the slave economy in the western Caribbean that increased the demand for imported slaves; but once the slave population had grown, a high attrition rate in the Caribbean accounted for most of the rising demand for Africans.[79] The importance of the demand side of the market is evident in the counterfactual results, which show that, in the absence of

growing demand, the slave trade would have declined after 1675-79. For a demand elasticity of one, the number transported from 1775-79 would have been just over 25,200, which is 6,400 fewer than the number who were sent in 1675-79, and nearly 78,000 below the actual trade in 1775-79. Demand also accounted for most of the rise in the West Indies price, increasing it from £21.0 to £38.2, and demand explains nearly all of the increase in the African price to £15.0, since otherwise prices in Africa would have been very close to their 1675-79 levels. That demand was important is hardly surprising. Still the results point to the fact that the combined effect of the two main elements in the gap between West Indies and African prices, mortality and transport costs had little impact on the growth in the trade.

Conclusion

Several of the major findings in connection with our detailed analysis of the 1684-86 period have implications for the slave trade when it was at its peak in the century and a half following on from the present study. The produce traffic carried on by slave vessels, so important to the viability of some of the ventures examined here, has tended to be treated as a separate business in the later period. Studies of profits generated by the slave trade have not taken this into account or have assumed that it was of minor importance. Partly, this is because gold exports - initially the most valuable of West African commodities - declined sharply after 1700.[80] Yet this decline was offset to some extent by the increasing importance of ivory, dye woods, and, in the early decades of the 1700s, by Brazilian gold which found its way to Britain via exchange between British and Portuguese slave ships on the African coast. Second, the major contribution of slave mortality to the costs of the voyage that emerges here should be taken into account in any

reassessment of the eighteenth and nineteenth century slave trade. It is now well known that shipboard mortality declined markedly between 1700 and 1807, but the impact on long run trends in the costs and volume of the transatlantic slave trade has yet to be recognized. The fall in mortality assumed here, 24.2 percent to 14.6 percent over the period 1675-79 to 1775-79, is less than some other estimates, but the change is still estimated to have increased the number arriving in the Caribbean by between 13 percent and 24 percent. On the other hand, falling mortality likely had little impact on the African side of the market. Ultimately, it was the expanding slave economy in the West Indies that was the main factor driving prices and numbers in the seventeenth and eighteenth centuries.

Appendix

Derivation of the Impact of Transport Costs, Slave Mortality, and Slave Morbidity on the Slave Trade

The effect of transport costs, slave mortality, and slave morbidity on the slave trade is derived by differentiating equation (8) by the variable we are considering, either T, d, or m. The change in the West Indies price, P_I, is based on equation (6). The relations are:

(A1) $$\frac{dP_I}{dT} = \frac{P_I^{\frac{\eta}{\gamma}}}{\frac{\gamma+\eta}{\gamma} P_I^{\frac{\eta}{\gamma}}(1-d-m) - \frac{\eta}{\gamma} T P_I^{\frac{\eta-\gamma}{\gamma}}},$$

(A2) $$\frac{dP_I}{dd} = \frac{P_I^{\frac{\eta+\gamma}{\gamma}} + \frac{1}{\gamma(1-d)}\left[\frac{b}{(1-d)a}\right]^{\frac{1}{\gamma}}}{\frac{\gamma+\eta}{\gamma} P_I^{\frac{\eta}{\gamma}}(1-d-m) - T P_I^{\frac{\eta-\gamma}{\gamma}}}, \quad \text{and}$$

(A3) $$\frac{dP_I}{dm} = \frac{P_I^{\frac{\gamma+\eta}{\gamma}}}{\frac{\gamma+\eta}{\gamma} P_I^{\frac{\eta}{\gamma}}(1-d-m) - T P_I^{\frac{\eta-\gamma}{\gamma}}}.$$

Finally, the change in slave arrivals is derived from equation (5) the change the change in P_I. Thus

(A4) $$dQ_I = -\eta \frac{Q_I}{P_I} dP_I.$$

Slave departures are derived from slave arrivals and equation (7):

(A5) $$dQ_A = \frac{dQ_I}{1-d}, \qquad \text{for changes in } T \text{ and } m, \text{ and}$$

$$dQ_A = \frac{dQ_I}{1-d} - \frac{Q_I}{(1-d)^2}, \qquad \text{for changes in the mortality rate, } d.$$

Finally, the change in the African price, P_A, is derived from equation (4) and equation (A5).

The counterfactual analysis is also based on equation (8), but rather than taking derivatives the hypothetical values of the slave price in the West Indies, P_I^h, is calculated as the solution to:

$$(A6) \qquad P_I^{h\frac{\gamma+\eta}{\gamma}}(1-d^h-m^h)-T^hP_I^{h\frac{\eta}{\gamma}}=[P_I^{\frac{\gamma+\eta}{\gamma}}(1-d-m)-TP_I^{\frac{\eta}{\gamma}}][\frac{b^h/(1-d^h)a^h}{b/(1-d)a}] \ ,$$

where x^h is the hypothetical value of x. The hypothetical values of Q_I, Q_A, and P_A are derived by substituting the solution to equation (A6) into equations (5), (7), and (4).

References

Anderson, B.L. and David Richardson. "Market Structure and the Profits of the British African Trade in the Late Eighteenth Century: A Comment." *Journal of Economic History* 43 (1983): 713-21.

Anderson, B.L. and David Richardson. Market Structure and the Profits of the British African Trade in the Late Eighteenth Century: A Rejoinder Rebutted." *Journal of Economic History* 45 (1985): 705-07.

Anstey, Roger. "The Volume and Profitability of the British Slave Trade, 1761-1807." In *Race and Slavery in the Western Hemisphere: Quantitative Studies*, Stanley Engerman and Eugene Genovese, eds., 3-31. Princeton. N.J.: Princeton University Press, 1975.

Bean, Richard N. *The British Trans-Atlantic Slave Trade*. New York, 1971.

Behrendt, Stephen D. "Crew Mortality in the Transatlantic Slave Trade in the Eighteenth Century." In *Routes to Slavery: Direction, Ethnicity and Mortality in the Transatlantic Slave Trade*, David Eltis and David Richardson, eds., 49-71. London: Frank Cass, 1997.

Behrendt, Stephen D. "Markets, Transaction Cycles, and Profits: Merchant Decision-Making in the British Slave Trade." *William and Mary Quarterly, 3rd Series* 58 (2001): 171-204.

British National Archives (BNA). *Treasury Papers*. T70/16, T70/913, T70/963-966.

Burnard, Trevor and Kenneth Morgan. "The Dynamics of the Slave Market and Slave Purchasing Patterns in Jamaica., 1655-1788." *William and Mary Quarterly, 3rd Series* 58 (2001): 205-28.

Carlos, Ann. "Bonding and the Agency Problem: Evidence form the Royal African Company, 1672-1691." *Explorations in Economic History* 31 (1994): 313-35.

Clark, Gregory. "The Cost of Capital and Medieval Agricultiral Technique." *Explorations in Economic History* 25 (1988): 265-94.

Crafts, Nick. "The Industrial Revolution." In *The Economic History of Britain Since 1700*, 2nd Ed., R. Floud and D. McCloskey. eds., 44-59. New York: Cambridge University Press, 1994.

Curtin, Phillip D. "Africa and the Wider Monetary World, 1250-1850." In *Precious Metals in the Later Medieval and Early Modern Worlds*, J. F. Richards, ed. Durham, N.C., 1983.

Darity, Jr., William. "The Numbers Game and the Profitability of the British Trade in Slaves," *Journal of Economic History* 45 (1985): 693-703.

Daudin, Guillaume. "Profitability of Slave and Long-Distance Trading in Context: The Case of Eighteenth-Century France." *Journal of Economic History* 64 (2004): 144-71.

Davies, K.G. *The Royal African Company*. London: Longman, Green and Co., 1957.

Eltis, David. "The Relative Importance of Slaves and Commodities in the Atlantic Trade of Seventeenth Century Africa." *Journal of African History* 35 (1994): 237-49.

Eltis, David. "The Slave Economies of the Caribbean: Structure, Performance, Evolution and Significance." In *General History of the Caribbean*, vol. 3, Franklin Knight, ed. London: Unesco publishing, 1997.

Eltis, David. *The Rise of African Slavery in the Americas*. Cambridge, MA: Cambridge University Press, 2000.

Eltis, David. "The Volume and Structure of the Transatlantic Slave Trade." *William and Mary Quarterly, 3rd Series* 58 (2001): 217-47.

Eltis, David, Frank Lewis, and David Richardson. "Slave Prices, the African Slave Trade and

Productivity in the Caribbean: 1674-1807." *Economic History Review* 58 (2005): 673-700.

Eltis, David, Frank Lewis, and David Richardson. "Slave Prices, the African Slave Trade and Productivity in Eighteenth Century South Carolina: A Reassessment." *Journal of Economic History* 66 (2006):1054-65.

Eltis, David and David Richardson. "Productivity in the Transatlantic Slave Trade." *Explorations in Economic History* 32 (1995): 465-84.

Eltis, David and David Richardson. "Prices of African Slaves Newly Arrived in the Americas, 1673-1865: New Evidence on the Long-Run Trends and Regional Differentials." In *Slavery in the Development of the Americas*, David Eltis, Frank Lewis, and Kenneth Sokoloff, eds., 181-218. Cambridge, MA: Cambridge University Press, 2004.

Galenson, David. *Traders, Planters, and Slaves: Market Behavior in Early English America.* Cambridge, MA: Cambridge University Press, 1986.

Inikori, J. E. "Market Structure and the Profits of the British African Trade in the Late Eighteenth Century." *Journal Of Economic History* 41 (1981): 745-76.

Inikori, J. E. "Market Structure and the Profits of the British African Trade in the Late Eighteenth Century: A Rejoinder." *Journal of Economic History* 43 (1983): 723-28.

Inikori, J. E. "Market Structure and Profits: A Further Rejoinder." *Journal of Economic History* 45 (1985): 723-28.

Klein, Herbert S. *The Middle Passage: Comparative Studies in the Atlantic Slave Trade.* Princeton, N.J.: Princeton University Press, 1978.

Klein, Herbert S., Stanley Engerman, Robin Haines, and Ralph Shlomowitz. ""Transoceanic

Mortality: The Slave Trade in Comparative Perspective." *William and Mary Quarterly.* 3rd Ser. 58 (2001): 93-118.

McCusker, John. *Money and Exchange in Europe and America, 1600-1775.* Williamsburg, Virginia: University of North Carolina Press, 1978.

McIntyre, Kimberly. "Balanced - At a Cost: The Royal African Company Accounts of the Slave Trade." MA Essay, Department of Economics, Queen's University, 2006.

Mitchell, B. R. *British Historical Statistics*. Cambridge: Cambridge University Press, 1988.

Morgan, Kenneth. "James Rogers and the Bristol Slave Trade." *Historical Research* 76 (2003): 189-216.

Morgan, Kenneth. "Remittance Procedures in the Eighteenth-Century British Slave Trade." *Business History Review* 79 (2005): 714-49.

North, Douglass. "Sources of Productivity Change in Ocean Shipping, 1600 -1850." *Journal of Political Economy* 76 (1968): 953-70.

Richardson, David. "Profits in the Liverpool Slave Trade: The Accounts of William Davenport, 1757-1784." In *Liverpool, the African Slave Trade, and Abolition*, Roger Anstey and P.E.H. Hair, eds., 60-90. Liverpool, Lancashire and Cheshire Historical Society, Occasional Series, Vol. 2, 1976.

Richardson, David. "Prices of Slaves in West and West-Central Africa: Toward an Annual Series, 1698-1807." *Bulletin of Economic Research* 43 (1991): 21-56.

Schofield, Roger. "Population Change, 1700-1871." In *The Economic History of Britain Since 1700*, 2nd Ed., R. Floud and D. McCloskey. eds., 60-95. New York: Cambridge University Press, 1994.

Sheridan, Richard. *Sugar and Slavery: An Economic History of the British West Indies, 1623-1775*. Baltimore: Johns Hopkins University Press, 1973.

Steckel, Richard H., and Richard A. Jensen. "New Evidence on the Causes of Slave and Crew Mortality in the Atlantic Slave Trade." *Journal of Economic History* 46 (1986): 57-77.

Transatlantic Slave Trade Database at www.slavevoyages.org.

Thomas, Robert P., and Richard Bean. "The Fishers of Men: The Profits of the Slave Trade." *Journal of Economic History* 34 (1974): 885-914.

Van den Boogart, Ernst. "The Trade Between Western Africa and the Atlantic World, 1600-90." *Journal of African History* 33 (1992): 369-85.

Zahedieh, Nuala. "Trade, Plunder, and Economic Development in Early English Jamaica." *Economic History Review* 39 (1986): 205-22.

Endnotes

1. Crafts, "The Industrial Revolution," p. 47; and Schofield, "British Population Change," p. 64.

2. From 1700 to 1770, sugar output of the British Caribbean increased from 40,000 to 144,100 tons. Eltis, "The Slave Economies of the Caribbean," pp. 110, 113.

3. Eltis et al., "Slave Prices, the African Slave Trade and Productivity in the Caribbean," and "Slave Prices, the African Slave Trade and Productivity in Eighteenth Century South Carolina."

4. During the 1680s Galenson estimates that the Royal African Company accounted for 80 percent of net black migration to Barbados and 67 percent to Jamaica, much less in later years. He argues that, despite the its charter, the company did not have an effective monopoly, both because of competition in the African market from other countries, and because of competition from ship captains, ship owners, and independent traders. Galenson, *Traders, Planters, and Slaves*, pp. 14-17. Eltis, *Rise of African Slavery*, p.120.

5. Anderson and Richardson, "Market Structure," a "Comment" and a "Rejoinder Rebutted." In the context of the French slave trade, Daudin derives a range of profitability estimates, finding that investors in long-distance trade earned on average a somewhat higher rate of return than on private or state debt. Daudin, "Profitability of Slave and Long-Distance Trading," p. 167. There is a large literature on the profitability of the slave trade including Thomas and Bean, "Fishers of Men;" Anstey, "Volume and Profitability;" Inikori, "Market Structure" and two "Rejoinders;" and Darity, "Numbers Game." On the profitability of the Royal African Company, see Galenson, *Traders, Planters, and Slaves*, p.147, Davies, *Royal African Company*, pp. 346-47.

6. Eltis, *The Rise of African Slavery*; Eltis, "Volume and Structure of the Transatlantic Slave Trade;" Eltis et al. "Slave Prices, the African Slave Trade...in the Caribbean;" Eltis and Richardson, "Prices of African Slaves;" Galenson, *Traders, Planters, and Slaves*; Anderson and Richardson, "Market Structure;" Burnard and Morgan, "Dynamics of the Slave Market."

7. From 1680 to 1685 hired ships were used on at least 75 percent of the voyages, but this share declined as the RAC acquired its own fleet. By 1700, the RAC was hiring ships for 40 percent of its voyages. Davies, *Royal African Company*, p. 195; Galenson, *Traders, Planters, and Slaves*, p.103.

8. BNA, *Treasury Papers*. T70/913, T70/963-966. Because of the long distances, the Royal African Company put in place mechanisms to help ensure compliance with its objectives and prevent cheating by its agents. See, for example, Carlos, "Bonding and the Agency Problem."

9. As was the case with most of the voyages in our sample, the intended purchase of Negroes equalled the actual number who departed Africa.

10. All slaves who were able to walk off the ship were credited including those who died before the sale.

11. The slaves sold on the ship owners' account were valued at £16 in the Leeward Islands and £17 in Jamaica. Davies, *Royal African Company*, p. 199.

12. With the cargo valued at £1,306, the ship purchased just over 426 oz., which after firing reduced to 420 oz. At £4 sterling per ounce the value of the gold after adjustments and charges was £1679 10s. The net income from the trade in gold was thus £373.

13. Galenson, *Traders, Planters, and Slaves*; Burnard and Morgan, "Dynamics of the Slave Market." See also Eltis and Richardson, "Prices of African Slaves."

14. Although it is not evident in this slave auction because the lots are too dissimilar, in other auctions the six-month difference in payment for apparently equivalent groups of slaves was typically 10 percent.

15. The other weights are: boys, 0.75; and girls, 0.7. These weights reflect the discussion in Galenson, *Traders, Planters, and Slaves*, pp. 61-64.

16. Galenson, *Traders, Planters, and Slaves*, p. 55.

17. For all but the last three sales, the price of slave men averaged £18.5 (local currency), whereas adult male slaves, at the last three sales, sold for just £8.1.

18. There would have been some variation in productivity and price, even for relatively healthy slaves, that might have been reflected in the price paid in Africa. It is implausible, though, that a price per slave of £10 Barbados currency (£9 sterling), which was the average paid for the last three lots and about half the price of healthy slaves, was due to other than their poor condition on arrival in the Caribbean. Certainly, given the high mortality rates on the voyages, including the mortality of those who arrived in the Caribbean but died before the auction, it should not be surprising that there was morbidity on these voyages as well. In Africa, slaves who were diseased or in poor health were not boarded on the ship. See Steckel and Jensen, "New Evidence on the Causes of Slave and Crew Mortality," p. 73.

19. Beginning in 1678, The RAC required that two-thirds of its payment to the ship owners be in slaves. Davies, *Royal African Company*, p. 199.

20. The three men and four women, who arrived in Barbados but died before the sale, were credited in the ship owners' account as having been delivered.

21. This was net of the £10 in expenses associated with the sale, The RAC would have paid 7 percent of these proceeds to the sales agent. See Davies, *Royal African Company*, p. 296. Barbados currency exchanged at 90% of sterling at this time.

22. We thus have voyages to the eastern Caribbean (Barbados), the Leeward Islands (Nevis), and the western Caribbean (Jamaica).

23. The *Mary* went to Senegambia, the most northerly of the African trading regions.

24. A comparison of the length of the voyages from London to the Caribbean gives an imputed Middle Passage to Jamaica 15 days longer than to Barbados. Eltis et al. *Slave Trade Database*.

25. On the voyages of the *Daniel and Elizabeth* and the *Mary* (Captain Carter), roughly 25 percent of mortality occurred after arrival, but the average was less than 4 percent on the other voyages. Galenson, *Traders, Planters, and Slaves*, p.16, points out that there were cases, possibly common, where captains stole slaves whom they sold privately, reporting them as having died on the voyage. But on the effective monitoring of captains, see Carlos, "Bonding and the Agency Problem." In any case, the magnitude of these thefts is unknown. It might be noted that the reported mortality on these voyages is in line with other estimates for the late-eighteenth century. Klein et al., " Transoceanic Mortality," Table 5, estimate that mortality declined from 23 percent before 1700 to about 10 percent by the mid-eighteenth century.

26. The usual cause of death was dehydration due to dysentery, but it is unlikely that this cause alone would have led to such high mortality. An alternative explanation to the slave revolt, would be an outbreak of smallpox.

27. Moreover, there was also no relation between mortality and "packing" as represented by the ratio of slaves boarded to tonnage. In fact a regression of mortality on packing results in a negative (insignificant) coefficient. The relation (excluding the voyage of the *Expedition*) is:
$M = 39.3 - 6.44\,P$, $R^2 = .133$, where t-statistics are in parentheses. M is the mortality rate and
(3.94) (-1.67)
P is the ratio of Africans boarded to ship tonnage.

28. Weighted-average mortality was 24.9 percent on voyages to Jamaica and 24.5 percent on voyages to Barbados. These results are in line with what Klein et al., "Transoceanic Mortality," found for this period. From 1684 to 1686 the ratio of all disembarkations to embarkations was .742 for Jamaica and .774 for Barbados, suggesting a slightly lower mortality rate on the Barbados voyages.

29. The cut-off points reflect the difference in slave prices in the three colonies. The choice of cut-off price has little effect on the overall results. A lower price would lead imply reduced morbidity offset by a somewhat lower implied price of healthy slaves.

30. It is not at all clear what portion of these costs should be attributed to the limited number of voyages for which we have complete records. Between 1698 and 1712, when the Parliament formally permitted "private" traders into the traffic (effectively ending the company's monopoly on the African coast), the private traders were required to pay 10 percent of the total value of their trading cargoes to the RAC to help cover the costs of these establishments. When the Royal African Company was finally liquidated in 1753, the British Parliament placed the forts under the administration of a new "Company of Merchants Trading to Africa," whose primary task was to maintain the forts, aided by an annual parliamentary subsidy.

31. Galenson's *Traders, Planters, and Slaves* includes a thorough analysis of many of these records.

32. The number of slaves departing Africa is not given by category, which means we do not know mortality at sea by age and gender, although it is given for those who died after arrival. We assume mortality at sea was the same for all groups. Morbidity can be fully distinguished by age and gender because of the completeness of the Caribbean sale records.

33. Healthy adult male slaves are assumed to be those who sold for £15 (local currency) or more. The cut-off for women and children adjusted proportionally. Note that in this period local currency both in Jamaica and Barbados was worth 90% of sterling. We assume the same rate for Nevis.

34. These are the auction averages by ship. Individual slave price varied more. There were two comparative outliers among these voyages. The prices received on the *Bonadventure's* voyage were, at £18.5 well above the average for Barbados; while the slaves on the *Hopewell* sold for an average of £16.7, which was significantly below the usual prices in Jamaica. Even so, the price from the *Hopewell* auction was close to the top of the range for Barbados.

35. These prices are similar to those derived by Eltis and Richardson, "Prices of African Slaves," drawn from a much larger sample.

36. There were three voyages, those of the *Prosperous*, the *Roebuck*, and the *Susanna*, for which the information on number of slaves departing Africa is missing. In these cases we use the number that the RAC gave in its accounts as "intended" to be purchased. In most cases the number intended and the number departing are the same, and where there is a difference it is small. Only for the *Mary* (Captain Carter) was the difference more than 10 percent (11 percent fewer slaves departed than were intended to be purchased).

37. Perhaps explaining the high price on *Hopewell* voyage is the possibility that some of the cargo attributed to slaves may in fact have been provisions for Cape Coast Castle.

38. The standard deviation was £0.68.

39. In fact, the average price of slaves bound for Barbados was slightly higher, but most of the differential was due to their age and gender composition. A slightly higher proportion of men was sent to Barbados than to Jamaica. The price of the Africans boarded on the *Mary* (Captain Carter) in Senegambia was well above the average at £4.43; but otherwise there was little relation between price and port of origin.

40. These were the slaves sold on the Company's account. We do not have prices for the slaves paid to the ship owners and the captain.

41. Given the arbitrary nature of the cut-off point for morbidity, we do not place a great deal of significance on this difference in the morbidity cost.

42. Davies, *Royal African Company*, p. 296.

43. Given that the price of slaves in the Caribbean was many times the cost of providing for slaves on the middle passage, it was clearly not in the company's interest to scrimp on provisions in a way that would lead to higher mortality or morbidity. An indication that slave mortality was due to other than the sufficiency of the provisions is the comparable mortality of the crew on slave voyages. Behrendt estimates that crew mortality in the French trade during this period was about 15 percent. And in a sample of Liverpool slave voyages average crew mortality was over 20 percent. It should be noted, though, that this mortality was for the whole voyage, not just the middle passage. See Behrendt, "Crew Mortality in the Atlantic Slave Trade," pp. 51, 55. On the causes of crew and slave mortality in the 1790s, see Steckel and Jensen, "New Evidence on the Causes of Slave and Crew Mortality." Although Steckel and Jensen suggest that a poor diet both in Africa and on the ship contributed to mortality, they do not attribute mortality to insufficient provisions (p.73).

44. Thus vessels trading in Upper Guinea purchased millet and rice; on the Gold Coast, millet, and in the Bight of Biafra, yams. The cost of these provisions would have been very much less than the provisions boarded in London. Since this cost was included in what the company reported as paid for slaves, the purchase price of slaves in Africa that we derive slightly overstates what the sellers actually received.

45. This assumption may slightly bias upward the ship owners, since they did sell a few sick slaves from the *Expedition*. In deriving the return to the ship owners we assume the sales agent received the usual 7-percent commission. For the purpose of settling the final account with the ship owners, the RAC valued the slaves at £15, £16, and £17 depending on whether the slaves were sold in Barbados, the Leeward islands, or Jamaica. These prices were typically very close to what the ship owners would have received for the slaves had they all been healthy.

46. The difference was mainly due to the 8s 6d greater payment for slaves delivered to Jamaica.

47. Unfortunately, we do not have the double-entry accounts showing the balance owing to the ship owners. There are, however, such accounts for several voyages in the 1670s. The net owing to the ship owners for those voyages is very close to the amount based on the approach used here. See McIntyre, "Balanced - At a Cost."

48. Since the slaves paid to the ship owners were not part of the calculation, the captain's share in terms of total arrivals was somewhat less. In a few cases, the captain received, in addition to slaves, small cash payments from the RAC.

49. This was in addition to any other income he received from the voyage. We assume the usual 7-percent sales agent's commission was deducted from the auction returns.

50. The rate on British Government consols during this period was 4 percent. Clark, "Cost of Capital," p. 273.

51. The standard deviation of the ship owners' return was £0.81, and the standard deviation of the captain's commission was £0.09.

52. The *Transatlantic Slave Trade Database* shows that few individual captains made more than ten voyages in the course of a career, and while ship owners might be involved in many more voyages through part shares, and indeed in non-slave ventures as well, no other owner in the history of the slave trade came close to matching the number of voyages sent out by the Royal African Company. Between 1673 and 1732, the Company dispatched 653 slave ships to the African coast as well as at least one hundred vessels that sought African produce alone.NA

53. A potential source of income that we have not included is the return to the RAC from sugar. We have included only the income from freight on sugar paid to the ship. In later years, the Company likely received some return from this source, but in the mid-1680's the price of sugar in England was unusually low, and Davies concludes that the payment to the ship for freight, as well as duties and other costs, would have exhausted any possible return to the RAC. See Davies, *Royal African Company*, p. 341.

54. Returns, however, from the voyages of the *Expedition* and the *Friends Adventure* (1685) were very small. This income was entirely from ivory.

55. RAC voyages to Jamaica carried little gold at this time because the western Caribbean was recognized as far more prone to piracy and interference from other Europeans, especially the Spanish. Indeed, Jamaica itself was a base for pirates down to the early 1670s. See Zahedieh, "Trade, Plunder, and Economic Development." Where gold was received on Jamaican voyages it was often dropped off in Barbados to avoid the threat. Following is an account of what happened in February 1683 when Captain North of the *Thomas and William* failed to deliver the gold in Barbados: "On the 1st here arrived the 'Thomas and William' Capt North from the Gold Coast having stopt at Barbados in his way (without delivering his gold according to Charterparty) and rounding the Coast of Hispaniola was mett by Trampeaux (a French Pirate) to whom they very basely surrendered themselves." BNA, *Treasury Papers*, T70/16, Fol. 47.

56. The return to the sales agents, which averaged £288, is not included in the totals.

57. The 1685 voyage of the *John Bonadventure* generated the next highest returns to the ship owners, £2,725.

58. A linear regression of total returns on number of slaves boarded gives:
TR = -278 + 7.68 SB, R^2 = .62, t-statistics in parentheses, where TR is total return and SB is
(-.509) (5.67)
number of slaves boarded. As we have noted, Galenson, Davies and others have argued that the Royal African Company operated in a competitive market. The same was true to an even greater degree of the many ship owners.

59. The average net return to the RAC across all the voyages was £893. Offsetting this return would have been the costs of its African forts and its head office in London. The ship accounts

include an invoice for any supplies intended for Africa. It would be inappropriate to attribute these costs to the voyage on which the supplies were sent; but as a rough indication of the importance of the supplies, we have averaged their cost over the twenty-two voyages. Ten of the ships took on supplies for Africa, mainly for Cape Coast Castle. The cost per voyage was £806. If our sample is representative of the other voyages, the RAC was receiving somewhat less than £100 per voyage to cover the cost of the remainder of its operation.

60. We do not, however, wish to overstate the differential risk. Ship owners were paid £5 per slave delivered to the Barbados, and £5 6s 6d per slave delivered to Jamaica, which suggests that greater potential losses may not have been a serious concern.

61. One could interchange the supply and demand curve shifts, but this depiction seems the most straightforward.

62. The term, T, corresponds to $\frac{C-R}{N}$ in equation (1).

63. See appendix.

64. The implied mortality of 24.1 percent is slightly lower than the 25.0-percent estimate for our sample, but we include in our mortality figure those who disembarked but died before the slave auctions. Excluding two voyages, mortality after arrival averaged about 4 percent of total mortality. During this period, the British Caribbean received 65 percent of the total Caribbean trade . See the *Transatlantic Slave Trade Database*.

65. The prices from our sample of 8,300 observations are similar to other estimates for this period. See Eltis et al., "Slave Prices," p. 679; Galenson, *Traders, Planters, and Slaves*, pp. 56-57; and Eltis, *Rise of African Slavery*, p. 296.

66. Equation (1) should be interpreted as the excess demand for slaves, being the difference between total demand and the existing supply of slaves in a region. Assuming the supply is perfectly inelastic, the elasticity of this excess demand function is $\eta_T (Q_T/Q)$, where η_T is the elasticity of total demand and Q_T is the total demand for slaves in the region. In the mid-1680s annual slave arrivals to Jamaica and to the Caribbean as a whole were about 10 percent of the slave populations in those regions. So even if the total demand for slaves was inelastic, the elasticity of the demand for imported slaves may have been quite high. See Eltis et al., "Slave Prices," pp. 690-91 for population; *Transatlantic Slave Trade Database* for slave flows.

67. During this time, the British Caribbean accounted for two-thirds of the Caribbean trade and more than 40 percent of the total slave trade to the Americas.

68. See Eltis, *Rise of Slavery*, pp. 206-07.

69. Klein et al., "Transoceanic Mortality."

70. The results for Jamaica have less significance to our understanding of the trade. Reductions in Middle Passage mortality and morbidity tended to apply throughout the Caribbean, and were not confined to voyages to particular islands.

71. To the extent, however, that slaves who arrived sick had higher subsequent mortality or were unable to work and thus had to be replaced, our assumption that the supply curve did not rotate would have to be modified.

72. The estimated trend equations are $P_I = 16.35e^{0.0082(t\text{-}1674)}$, $R^2 = 0.78$; and $P_A = 2.79e^{0.0144(t\text{-}1674)}$, $R^2 = 0.81$.

73. The estimated equation is $T = 5.92e^{0.0091(t\text{-}1674)}$, $R^2 = 0.53$.

74. Eltis and Richardson have derived total factor productivity in the slave trade using measures of output and inputs. They estimate much higher productivity in the last quarter of the seventeenth century than in the third quarter of the eighteenth century, which is consistent with our findings, but their results especially for the period 1700 to 1730 are hard to reconcile with ours. See Eltis and Richardson, "Productivity in the Transatlantic Slave Trade," p. 475.

75. Eltis, "Relative Importance of Slaves;" and Richardson, "Prices of Slaves," pp. 28-29.

76. Eltis and Richardson, "Productivity in the Transatlantic Slave Trade," p. 477. We would not want to overemphasize this factor. In the last quarter of the eighteenth century, when our estimate of transport costs is considerably higher, mean voyage length returned to the levels of the late seventeenth century.

77. Our approach to transport costs is certainly no substitute for making direct estimates; but our finding that transport cost were higher in the eighteenth century is in line with other evidence. Richardson has estimated the cost of late eighteenth-century slave voyages using the accounts of William Davenport, a Liverpool merchant. On nine voyages that left Britain from 1775 to 1779 the average cost was £19.8 (1700/01), based on the number of slaves that the ship intended to purchased. The average cost was somewhat higher per slave embarked. See Richardson, "Profits in the Liverpool Slave Trade," pp. 82-85; *Transatlantic Slave Trade Database*; Mitchell, *British Historical Statistics*, p.720.

78. The eighteenth mortality rates that we obtain from the number of slaves embarking and disembarking is somewhat higher than the rates derived by others from a samples of voyages. This may be because much of the slave trade to the British Caribbean went through the Bight of Biafra, a region of especially high mortality. See *Transatlantic Slave Trade Database*, Klein et al., "Transoceanic Mortality."

79. See Eltis et al., "Slave Prices, the African Slave Trade and Productivity in the Caribbean."

80. Van den Boogart, "Trade Between Western Africa,;" Eltis, "Relative Importance of Slaves;" Curtin, "Africa and the Wider Monetary World."

Table 1
Account of the Slave Sales of the Bonadventure
Barbados: January 22, 1684

Months[a]	Men	Women	Boys	Girls	Pounds[b]	Shillings
	11		1		248	
7	8	2			180	
6	2	1	1		70	
5	5				97	
6	5	2	8	3	306	
6			1	1	26	
6	6	1	1		146	
5	4		1		92	
3	1		3	2	84	
	1				18	10
2	15	1			320	
6	1	1			32	
12	2	2			70	
		1			17	
3		1			16	10
	1				17	
				1	11	
6	2	1			51	
4	13	27			400	
8	6	14			200	
12	8	16			100	
	91	70	16	7	2502	
Captain	5	3		1		
Ship	25	27	4			
Died[c]	3	4				
Total	121	100	20	8		
Expenses					10	1
Net Proceeds					2491	19

[a] Months to payment.

[b] Barbados currency (.9 sterling)

[c] Died after arrival.

Source: BNA, *Treasury Papers*, T70/913, 963-966.

Table 2
Royal African Company Voyages with Hired Ships:
London Departure, 1683 and 1685

Ship	Departure - London	Major Buying	Arrival - Caribbean		Tonnage	Slaves	
	month/day/year	Port - Africa		Days (from London)		Purchased	Sold[a]
Bonadventure	4/21/1683	Whydah	Barbados	271	160	320	249
Daniell and Elizabeth	6/1/1683	Ardra	Barbados	273	200	530	410
Elizabeth	6/30/1685	Whydah	Jamaica	299	320	600	344
Expedition	4/8/1685	Calabar	Jamaica	332	80	220	84
Friends Adventure	8/151683	Calabar	Jamaica	317	120	280	215
Friends Adventure	5/5/1685	Angola	Jamaica	297	105	330	277
Good Fellowship	6/12/1685	Ardra	Barbados	267	157	400	226
Hopewell	2/6/1683	Whydah	Jamaica	267	120	260	175
John Bonadventure	7/10/1683	Ardra	Jamaica	351	220	550	495
John Bonadventure	9/26/1685	na	Jamaica	255	220	550	431
Mary (Captain Gilbert)	11/14/1685	Gambia	Jamaica	182	60	200	185
Mary (Captain Carter)	10/14/1685	Whydah	Barbados	261	300	535	354
Owners Adventure	3/18/1685	Ardra	Nevis	386	na	218[b]	145
Oxford	8/20/1685	Cabinda	Jamaica	346	100	420	360
Pellican	8/6/1683	New Calabar	Jamaica	257	80	170	131
Prosperous	2/21/1683	Angola	Barbados	353	250	610	579
Return	7/31/1685	Ardra	Jamaica	298	195	340	211
Robert	2/22/1683	Whydah	Barbados	329	100	343	235
Roebuck	7/13/1685	Ardra	Barbados	261	70	180	156
Saint George	8/25/1685	Ardra	Jamaica	252	300	586	463
Susanna	8/4/1685	Ardra	Barbados	203	120	260	198
Unity	5/8/1683	Angola	Barbados	348	140	397	298

[a] Sold or paid to the ship owners and captain.

[b] Two underage Africans not included.

Sources: *Transatlantic Slave Trade Database*; and BNA, *Treasury Papers*, T70/913, 963-966.

Table 3

Slave Prices in the Caribbean and the Revenue per Slave Purchased in Africa:
Royal African Company Voyages with Hired Ships, 1683 and 1685

	Slave Price, £ sterling			Mortality		Morbidity	Average Revenue
Voyage*	Africa	Caribbean (healthy)[a]		percent	loss	loss	£ per slave
		Men	All		£ per slave	£ per slave	purchased in Africa
Bonadventure	3.86	16.64	15.34	22.2	3.41	2.13	9.81
Daniell and Elizabeth	4.17	15.55	14.47	22.6	3.28	2.22	8.97
Elizabeth	3.43	19.52	18.11	42.7	7.73	0.72	9.66
Expedition	3.22	20.52	17.69	61.8	10.94	1.33	5.43
Friends Adventure (1683)	3.45	18.78	16.97	23.2	3.94	0.93	12.09
Friends Adventure (1685)	3.98	21.29	18.21	16.1	2.93	0.39	14.90
Good Fellowship	3.25	15.83	15.21	43.5	6.62	1.07	7.52
Hopewell	5.15	16.74	15.40	32.7	5.03	0.54	9.83
John Bonadventure (1683)	4.18	18.19	17.00	10.0	1.76	0.90	14.34
John Bonadventure (1685)	2.61	20.24	18.45	21.6	4.00	1.69	12.77
Mary (Captain Gilbert)	4.43	19.42	18.69	7.5	1.43	1.95	15.31
Mary (Captain Carter)	3.11	15.16	14.13	33.8	4.78	1.07	8.28
Owners Adventure	2.92	17.89	17.23	33.5	5.81	0.38	11.04
Oxford	3.72	20.71	18.44	14.3	2.63	1.83	13.98
Pellican	3.89	20.35	18.15	22.9	4.16	1.51	12.48
Prosperous	4.91	15.63	14.48	5.1	0.74	2.17	11.57
Return	2.95	18.86	17.95	37.9	6.81	1.06	10.08
Robert	4.14	16.43	14.52	31.5	4.83	1.38	8.30
Roebuck	3.03	16.89	15.78	13.3	2.12	1.39	12.26
Saint George	3.07	19.75	17.31	21.0	3.63	1.16	12.52
Susanna	2.89	15.60	14.31	23.8	3.42	0.97	9.92
Unity	3.48	14.54	13.84	24.9	3.42	1.99	8.42
AVERAGE[b]							
All	3.64	17.83	16.35	25.04	4.12	1.34	10.89
Jamaica	3.56	19.54	17.72	25.19	4.47	1.14	12.11
Barbados	3.78	15.68	14.57	24.33	3.57	1.66	9.33

* Voyages to Barbados in italics; voyage to Nevis in bold type; others to Jamaica.

[a] Price per healthy slave.

[b] Weighted by the number of slaves purchased in Africa.

Sources : text; and BNA, *Treasury Papers* , T70/913, 963-966.

Table 4

Returns from Slave Sales distributed by Recipient: Royal African Company, Ship Owners, and Captain

(pounds sterling per slave purchased in Africa)

Voyage*	Income	Slave	Net Income	Payments to Ship Owners		Captain's	Net Return
	Slave Sales[a]	Provisions[b]	Slave Sales[c]	In Slaves[d]	Total[e]	Commissions[f]	RAC[g]
Bonadventure	9.12	0.35	8.74	2.50	4.03	0.41	0.19
Daniell and Elizabeth	8.34	0.26	8.06	2.28	3.58	0.38	-0.35
Elizabeth	8.99	0.36	8.60	2.11	3.16	0.41	1.38
Expedition	5.05	0.35	4.68	1.03	1.67	0.24	-0.67
Friends Adventure (1683)	11.24	0.44	10.77	2.53	4.16	0.41	2.52
Friends Adventure (1685)	13.85	0.48	13.33	2.97	4.41	0.54	4.14
Good Fellowship	6.99	0.33	6.64	1.76	2.68	0.30	0.20
Hopewell	9.14	0.33	8.79	1.97	3.44	0.38	-0.53
John Bonadventure (1683)	13.33	0.31	13.01	3.20	4.65	0.56	3.34
John Bonadventure (1685)	11.88	0.38	11.48	2.80	4.34	0.55	3.81
Mary (Captain Gilbert)	14.24	0.44	13.77	2.73	4.40	0.26	4.38
Mary (Captain Carter)	7.70	0.28	7.40	1.90	2.53	0.32	1.24
Owners Adventure	10.27	0.36	9.88	2.20	3.32	0.36	3.08
Oxford	13.00	0.46	12.52	3.07	5.46	0.58	2.51
Pellican	11.61	0.53	11.04	2.69	4.10	0.48	2.31
Prosperous	10.76	0.39	10.34	2.84	4.05	0.49	0.57
Return	9.38	0.31	9.04	2.15	3.61	0.39	1.90
Robert	7.72	0.35	7.35	2.05	3.18	0.36	-0.60
Roebuck	11.41	0.21	11.18	2.94	4.24	0.49	3.21
Saint George	11.65	0.40	11.21	2.68	3.74	0.50	3.70
Susanna	9.23	0.24	8.97	2.28	3.60	0.40	1.88
Unity	7.83	0.34	7.47	2.14	3.00	0.36	0.39
AVERAGE[h]							
All	10.13	0.36	9.75	2.43	3.71	0.43	1.73
Jamaica	11.26	0.39	10.85	2.57	4.00	0.47	2.59
Barbados	8.68	0.31	8.34	2.28	3.37	0.39	0.55

* Voyages to Barbados in italics; voyage to Nevis in bold type; others to Jamaica.

[a] Total revenue from slave sales less the selling agents' commissions which are put at 7 percent. Davies, *Royal African Company*, p. 296. The commission is applied whether the slaves were sold on the account of the RAC, the ship owners, or the ship captain.

[b] The cost of "negro provisions" taken on board in London for the middle passage, which averaged £.21. To this cost has been added additional expenses incurred in the Caribbean associated with selling the slaves. In a few cases, where a payment to a factor is reported, it is included.

[c] Income from slave sales less provisions and selling costs. The imputed interest on these costs (5 percent for 16 months) has been included.

[d] The value of slaves based on the prices of healthy slaves, unless the actual sale prices are given. The 7-percent sales agent's commission is deducted.

Table 4 (continued)

[e] The ship was credited for each negro delivered to the Caribbean (including those who died before the sale). The amount was £5 per slave for Barbados and the Leeward Islands and £5.33 for Jamaica. The slaves paid as commissions were valued in the accounts at £15, £16, and £17 for Barbados, the Leewards, and Jamaica, respectively. There were small adjustments both positive and negative for expenses incurred by the ship or the RAC; although where the Charter was violated, the (negative) adjustment could be significant.

[f] The captain's commission was paid almost entirely in slaves.

[g] Net income from slave sales less payments for freight (ship)and commissions, and the price of slaves in Africa. Imputed interest on the cargo used to buy slaves is also deducted.

Sources : text; and BNA, *Treasury Papers* , T70/913, 963-966.

Table 5
Total Income distributed by Source of Income and Recipient
(pounds sterling per slave purchased in Africa)

Voyage*	Royal African Company			Ship Owners and Captain		
	Gold and Ivory[a]	Slaves	Total	Gold, Ivory and Freight[a]	Slaves[b]	Total
Bonadventure	0.65	0.19	0.84	0.24	4.44	4.68
Daniell and Elizabeth	0.86	-0.35	0.51	0.34	3.96	4.30
Elizabeth	0.69	1.38	2.07	0.50	3.57	4.07
Expedition	0.04	-0.67	-0.63	0.56	1.91	2.47
Friends Adventure (1683)	0.13	2.52	2.65	0.11	4.56	4.67
Friends Adventure (1685)	0.02	4.14	4.16	0.01	4.95	4.96
Good Fellowship	0.84	0.20	1.03	0.43	2.98	3.42
Hopewell	0	-0.53	-0.53	0.31	3.83	4.14
John Bonadventure (1683)	1.19	3.34	4.53	1.09	5.21	6.30
John Bonadventure (1685)	0.56	3.81	4.36	0.62	4.89	5.50
Mary (Captain Gilbert)	0	4.38	4.38	0.14	4.66	4.81
Mary (Captain Carter)	1.25	1.24	2.49	0.44	2.85	3.29
Owners Adventure	0.64	3.07	3.71	0.93	3.69	4.61
Oxford	0	2.51	2.51	0.28	6.03	6.32
Pellican	0	2.31	2.31	0.45	4.58	5.03
Prosperous	0.68	0.57	1.25	0.31	4.54	4.84
Return	0.52	1.90	2.42	0.19	4.00	4.19
Robert	1.11	-0.60	0.51	0.46	3.53	4.00
Roebuck	1.05	3.21	4.26	0.75	4.74	5.48
Saint George	0.52	3.70	4.22	0.21	4.24	4.44
Susanna	1.84	1.88	3.72	1.09	4.01	5.10
Unity	0.32	0.39	0.72	0.14	3.36	3.50
AVERAGE[c]						
All	0.64	1.73	2.37	0.43	4.14	4.57
Jamaica	0.42	2.59	3.02	0.42	4.46	4.88
Barbados	0.91	0.55	1.47	0.42	3.76	4.18

* Voyages to Barbados in italics; voyage to Nevis in bold type; others to Jamaica.

[a] The revenue from gold and ivory less the cost of the cargo, which includes the imputed interest. Freight (mainly sugar) paid by the RAC to the ship owners or captain.

[b] Income from the transport of slaves.

[c] Weighted by the number of slaves purchased in Africa.

Sources : text; and BNA, *Treasury Papers* , T70/913, 963-966.

Table 6
Total Income per Ship distributed by Recipient: Royal African Company, Ship Owners, and Captain
(pounds sterling)

Voyage*	Slaves[a] (number)	Royal African Company	Ship Owners	Captain	Total
Bonadventure	320	269	1,365	138	1,773
Daniell and Elizabeth	530	271	2,076	204	2,551
Elizabeth	600	1,242	2,197	246	3,684
Expedition	220	-139	490	54	405
Friends Adventure (1683)	280	742	1,194	117	2,053
Friends Adventure (1685)	330	1,372	1,460	181	3,013
Good Fellowship	400	413	1,247	119	1,780
Hopewell	260	-138	975	100	938
John Bonadventure (1683)	550	2,490	3,158	306	5,954
John Bonadventure (1685)	550	2,399	2,725	302	5,427
Mary (Captain Gilbert)	200	877	909	53	1,838
Mary (Captain Carter)	535	1,331	1,590	176	3,097
Owners Adventure	218	809	926	80	1,815
Oxford	420	1,055	2,411	242	3,708
Pellican	170	393	773	82	1,248
Prosperous	610	763	2,658	296	3,717
Return	340	822	1,291	133	2,246
Robert	343	174	1,249	123	1,546
Roebuck	180	768	900	89	1,757
Saint George	586	2,475	2,313	291	5,078
Susanna	260	967	1,221	105	2,293
Unity	397	284	1,247	143	1,674
AVERAGE[c]					
All	377	893	1,562	163	2,618
Jamaica	375	1,133	1,658	175	2,966
Barbados	397	582	1,506	155	2,243

* Voyages to Barbados in italics; voyage to Nevis in bold type; others to Jamaica.

[a] Slaves purchased in Africa.

Source: Tables 2 and 5.

Table 7
The Effect of Transport Costs, Mortality, and Morbidity:
Slave Prices and Numbers, 1684-1686

	Jamaica		British Caribbean	
	η=1	η=3	η=1	η=3
Price -West Indies[a]	17.72		16.42	
Transport Costs[b]	1.46	1.46	1.13	0.75
Mortality[c]	0.26	0.26	0.24	0.10
Morbidity[d]	0.26	0.26	0.19	0.07
Price-Africa[a]	3.56		3.64	
Transport Costs[b]	0	0	-0.25	-0.50
Mortality[c]	0	0	-0.005	-0.015
Morbidity[d]	0	0	-0.041	-0.049
Annual Slave Departures	4,788		10,678	
Transport Costs[b]	-395	-1,186	-733	-1,467
Mortality[c]	-6	-146	-13	-45
Morbidity[d]	-70	-210	-120	-144
Annual Slave Arrivals[e]	3,554		8,105	
Transport Costs[b]	-296	-887	-550	-1,100
Mortality[c]	-52	-157	-117	-140
Morbidity[d]	-52	-157	-90	-108

[a] Based on the sample of voyages.

[b] Effect of a £1 per slave increase in transport costs.

[c] Effect of a one percentage point increase in mortality.

[d] Effect of a one percentage point increase in the morbidity cost.

[e] Not adjusted for mortality after arrival.

Note : The elasticity of supply of slaves is infinite for Jamaica and 1 for the Caribbean

Sources : *Transatlantic Slave Trade Database* and text.

Table 8
The Impact of Mortality, Transport Costs, and Demand on the Slave Trade:
British Caribbean, 1675/79-1775/79

	P_I	P_A	Slaves Transported		d	T
	1700/01 £		disembarked	embarked		1700/01 £
1675-79	16.86	2.73	31,670	41,254	0.2420	7.97
1725-29	30.81	10.97	81,129	98,939	0.1875	10.64
d^h: η=1	33.22	10.91	75,522	98,377		
η=3	32.22	10.29	71,194	92,739		
T^h: η=1	28.46	11.88	87,837	107,120		
η=3	29.46	12.56	92,847	113,230		
b^h: η=1	19.97	3.60	26,643	32,492		
η=3	19.04	2.97	21,933	26,748		
1775-79	38.22	14.98	102,939	119,776	0.1464	14.03
d^h: η=1	43.34	14.88	91,293	118,920		
η=3	41.19	13.48	82,724	107,758		
T^h: η=1	33.42	17.14	117,721	136,975		
η=3	35.51	18.68	128,309	149,296		
b^h: η=1	21.03	3.67	25,243	29,372		
η=3	19.91	2.78	19,110	22,235		

Notes: The variables are defined in the text. The hypothetical values are based on 1675-79. b is the level of demand. The mortality implied by the numbers departing Africa and arriving in the West Indies is augmented by 4 percent to allow for mortality prior to the slave auctions. Arrivals in the Caribbean are adjusted appropriately. In deriving transport costs, T, as the residual, the 1684-86 ratio of the (proportionate) morbidity cost to the mortality rate is assumed. West Indies price is based on healthy adult male slaves in Jamaica adjusted downward to reflect the age-sex composition of the trade in each year. The assumed weights are: women - .9, boys - .75, girls - .7.

Sources: *Transatlantic Slave Trade Database* and Figure 8.

FIGURE 1
Slave Prices: Africa and West Indies ("healthy" slaves)
(pounds sterling)

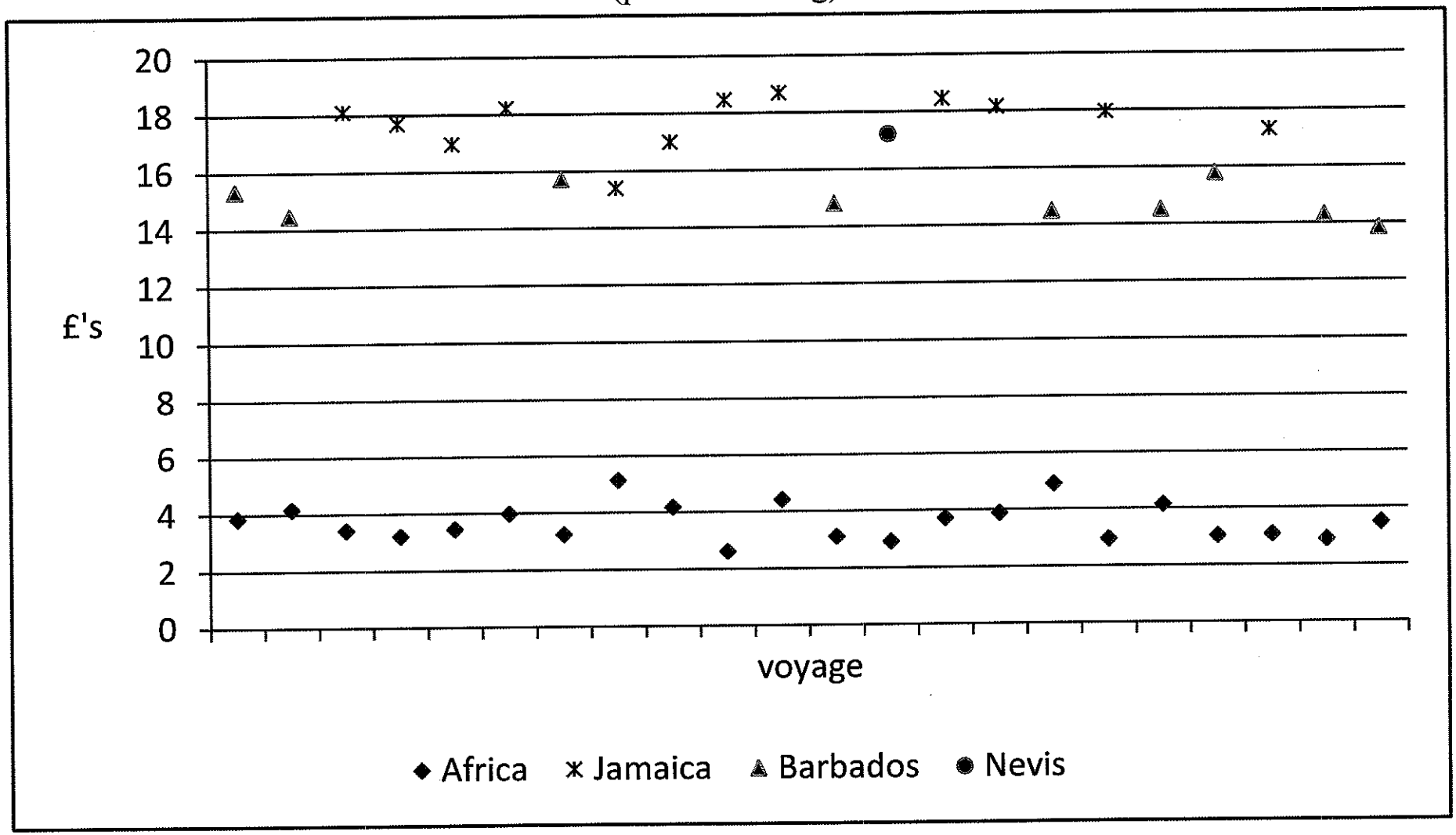


FIGURE 2

Average Revenue and the Effect of Mortality and Morbidity
(pounds sterling per slave purchased in Africa)

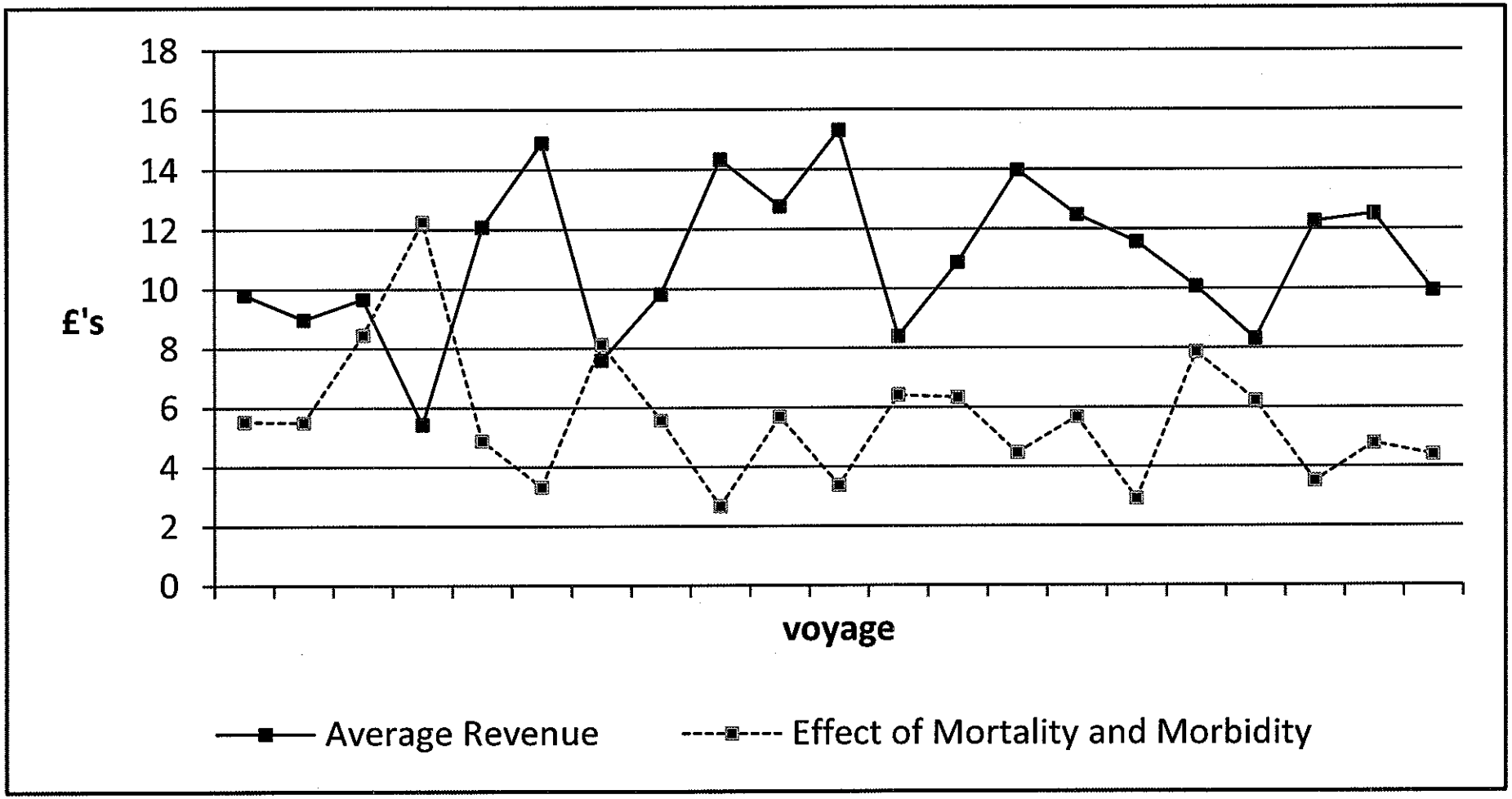


FIGURE 3

Return from Transporting Slaves: Royal African Company, Ship Owners and Captain
(pounds sterling per slave purchased in Africa)

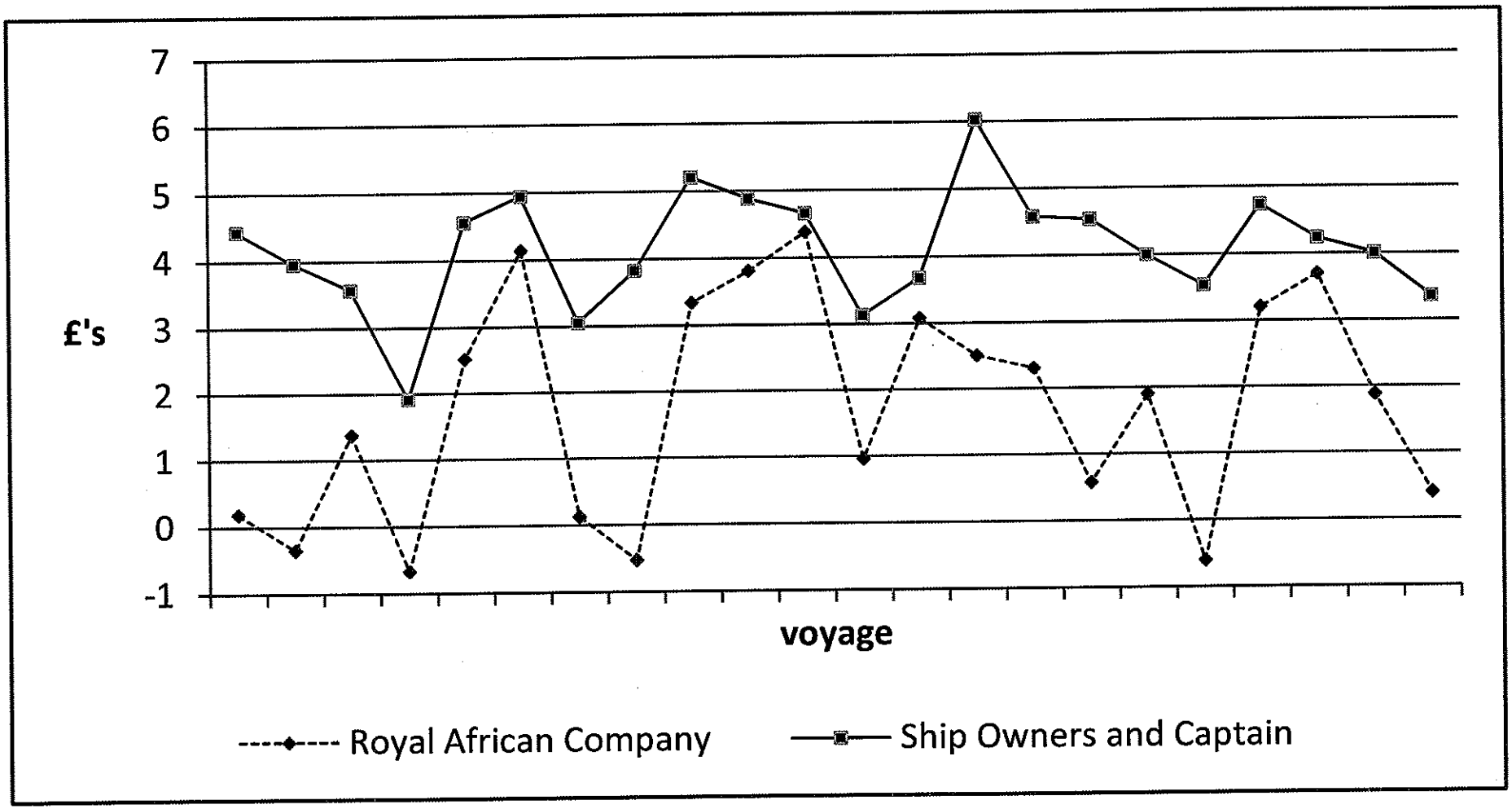


FIGURE 4

Return to the Royal African Company from Gold and Ivory
(pounds sterling per slave purchased in Africa)

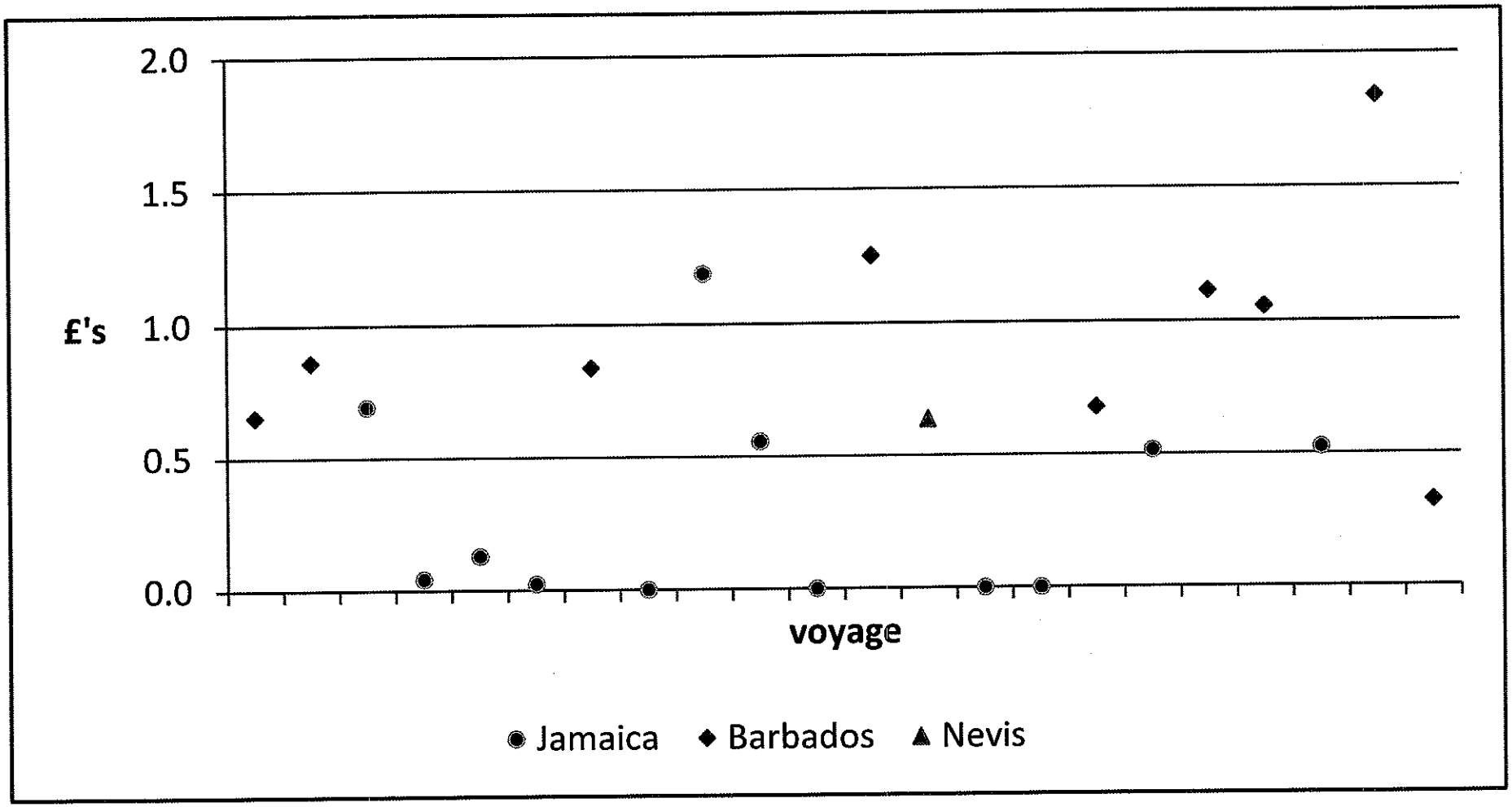


FIGURE 5
Return from Slaves, Gold, Ivory, and Freight
(pounds sterling per slave purchased in Africa)

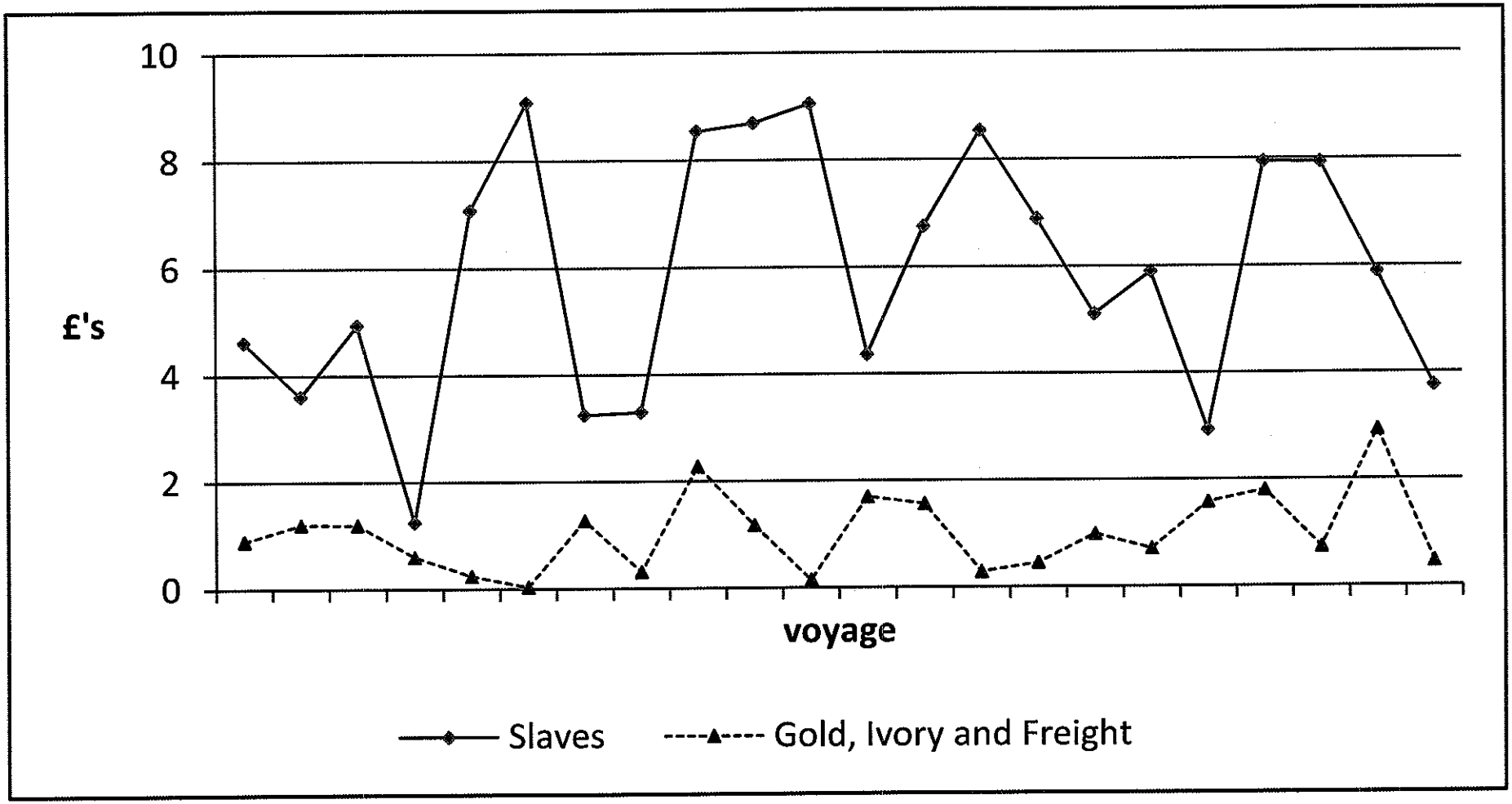


FIGURE 6
Total Return per Voyage and the Number of Slaves Boarded
(pounds sterling)

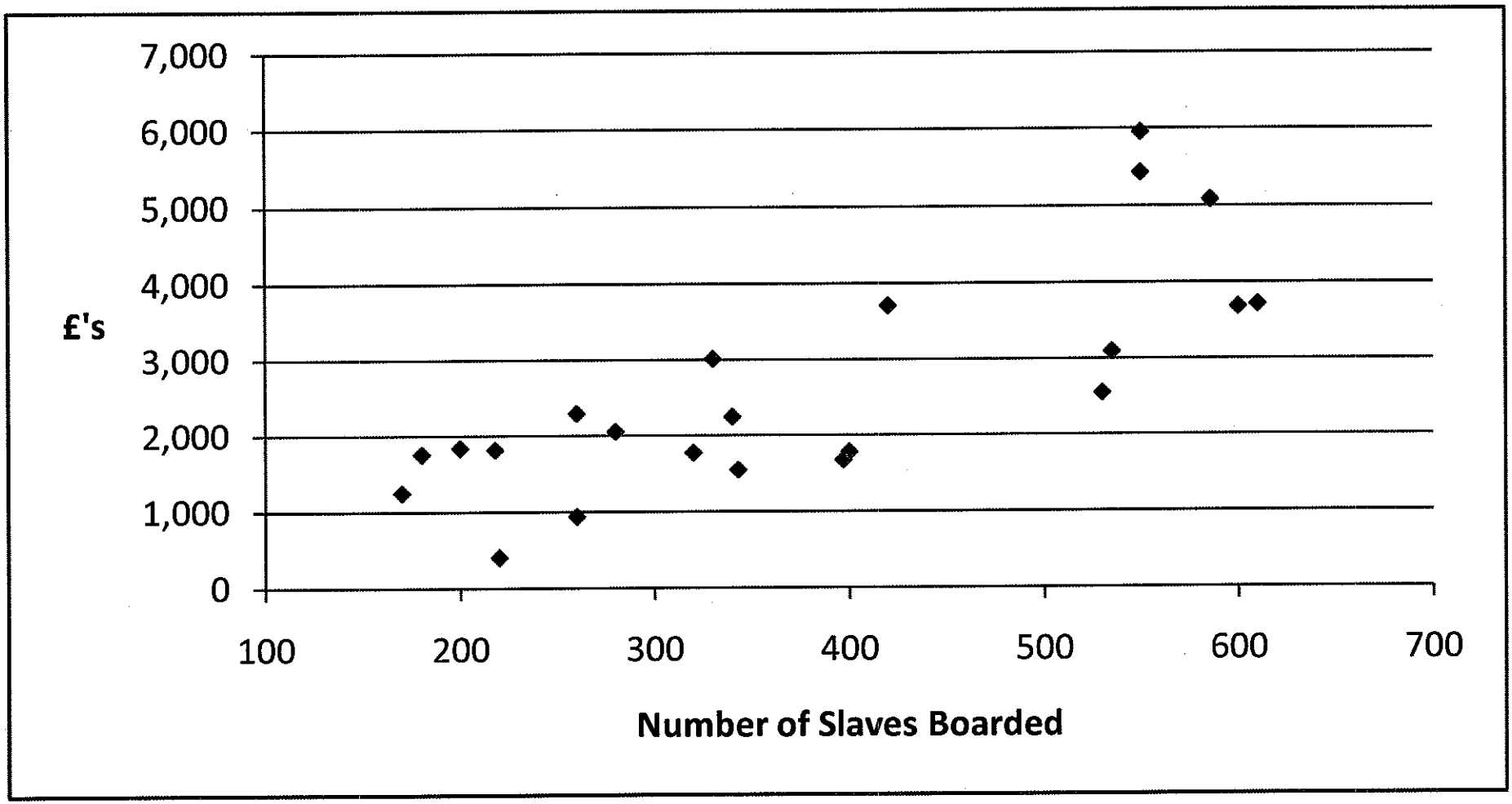


Figure 7
The Slave Trade Market in the Caribbean and Africa

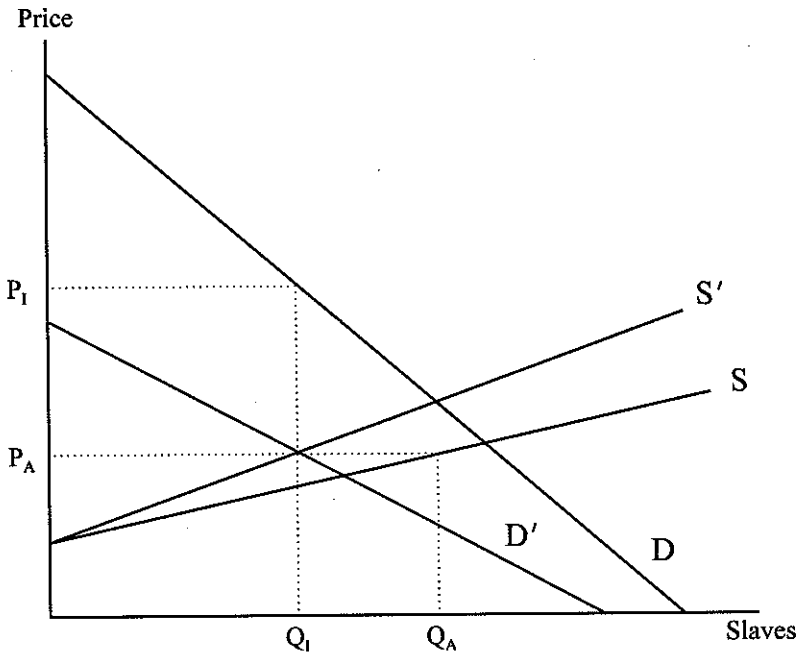
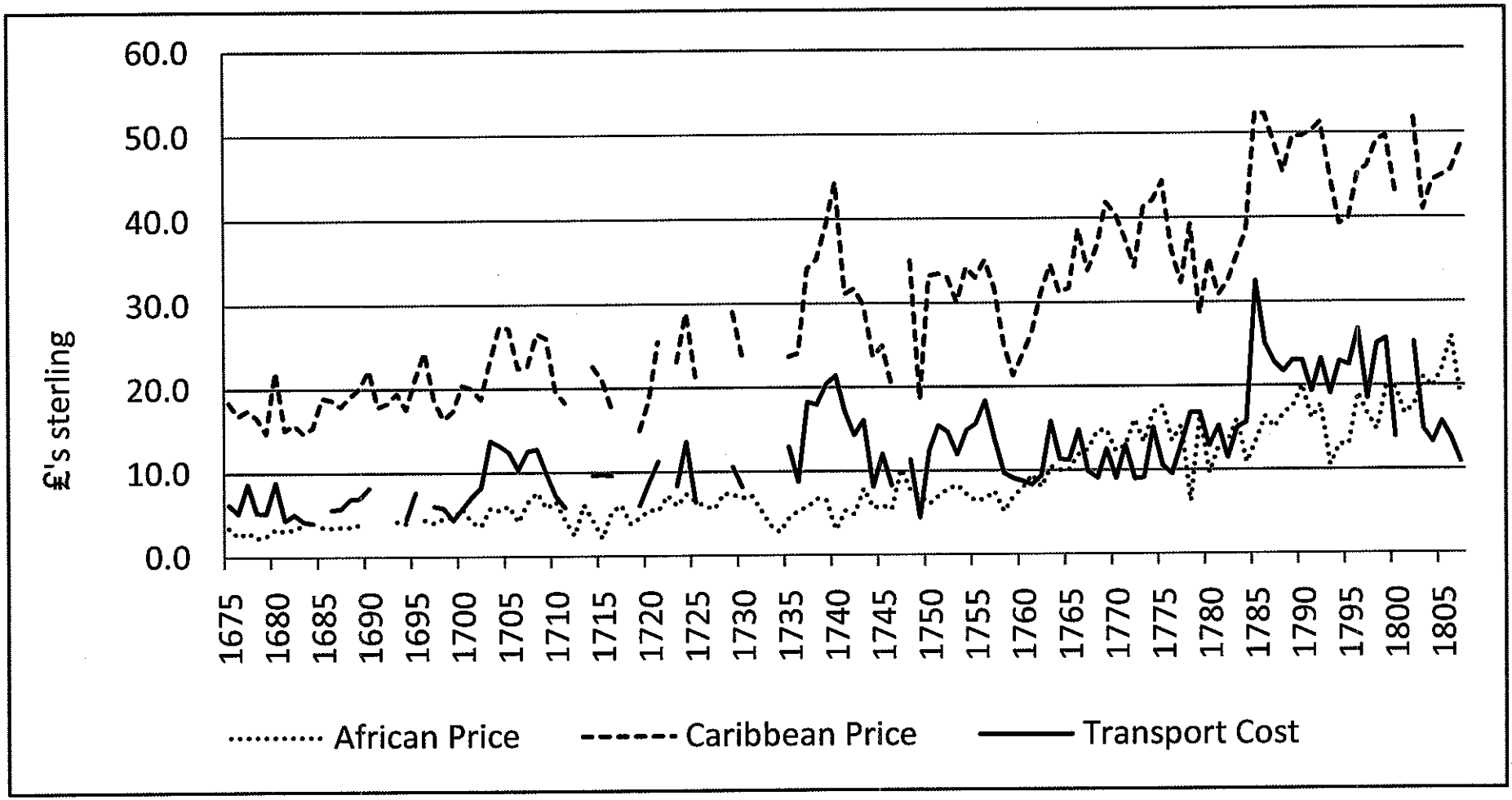


Figure 8
Slave Prices and Transport Costs, 1675-1807
(1700/01=100)



Notes to Figure 8: Price of slaves in Africa for 1675-1698 is from Eltis, *Rise of African Slavery*, p. 296; for 1699-1807 from Richardson, "Prices of slaves," pp. 52-56. The price of slaves in the Caribbean is from data underlying Eltis et al., "Slave Prices, the African Slave Trade and Productivity in the Caribbean," Table 2. Prices are converted from one based on healthy adult males to all healthy slaves as described in the notes to Table 8. For the derivation of the transport cost per slave see text and notes to Table 8. Mitchell, *British Historical Statistics*, pp.719-20 for the price index.