Estimates of the Size and Direction of Transatlantic Slave Trade

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Curtin's well known 1969 book *Atlantic Slave Trade: A Census*[1] triggered a wave of research into slave trading records in Europe, Africa and the Americas. About the same time, Hebert S. Klein began to publish a series of articles based on collections of data from the Spanish, Portuguese, Brazilian, British and French archives.[2] Taking advantage of the dawning computer revolution, both scholars created punched card data sets of slaving voyages based on single sources of information, which they made available at the same time as publishing their interpretative work. Curtin's research generated sets of 783 voyages for the French eighteenth century trade and 2,313 for the nineteenth century; Klein built on these and added 3,914 voyages for other branches of the traffic though many of these were not transatlantic slave ventures. This was the beginning of forty years of data collection that has put us on the brink of a complete reconstruction of the history of the trans-Atlantic slave trade from the early sixteenth century through to its close in 1867. Not only does the Trans-Atlantic Slave Trade Database (hereafter TSTD)[3] contain an additional 30,000 voyages, each supported on average by between five and six sources; but the sources for a single voyage are often drawn from three or more national archives. The level of detail now possible was unimaginable when Curtin and Klein began to work on the slave trade.

To convert this mass of new data into new assessments of the volume and direction of the slave trade, two types of assumptions or inferences are necessary. The first relates to missing information for a given voyage and is described in the essay "Construction of the Trans-Atlantic Slave Trade Database: Sources and Methods."

Eltis, David, and Paul F. Lachance. 2009. Estimates of the size and direction of transatlantic slave trade. *Voyages: The Trans-Atlantic Slave Trade Database*, http://www.slavevoyages.org/downloads/EstimatesMethod.pdf.

Because few voyages in the historical record contain complete information on the route taken and the number of captives carried, we have often had to surmise this information. For example, we sometimes know where the voyage intended to go, but not whether it actually arrived. For other voyages we might know the numbers purchased, but not the number sold, or vice-versa. In some cases we know only the number the captain intended to buy.

The second set of inferences forms the subject of the present essay. To construct estimates of the total slave trade, we have to allow for voyages which occurred without leaving any known trace in the historical record. To put this important consideration in the form of a question, what proportion of the total slave trade is represented by voyages in the TSTD? Answering this question is virtually the same as assessing the quality of the sources. A multi-source database provides a check on errors in any single source. The Voyages Database incorporates records created at the point of organization of the slave voyage in Europe or the Americas, at the point of purchase of captives in Africa, and at the point of sale in the Americas. The existence of diverse and dispersed sources for the same voyage encourages confidence in the internal consistency of data extracted from the surviving records and reduces the incidence of missing data. Slave vessels did make voyages without leaving any historical trace of their activities, but after 1700 this did not happen very often.

A closer look at new research on some major branches of the slave trade confirms that coverage is comprehensive. The two volume Mettas-Daget catalogue of slave voyages sailing from French ports contains captains' reports of sightings of other French slave ships.[4] These sightings constitute as random a sample of French slave voyages as it

is possible to obtain. No less than 95 percent of the vessels named in these individual summaries are already in the database from other sources. We might conclude that the Catalogue is therefore 95 percent complete. A second indication of the quality of coverage is the tiny number of new voyages that newly discovered sources now add to the data set. Thus, by far the largest destination of French ships carrying slaves to the Americas in the eighteenth century was the colony of St Domingue. This traffic reached its peak between 1784 and 1791 when this colony was the principal place of landing of 750 slave ships. Since work on TSTD began, we have located 488 new references to voyages to St. Domingue in these eight years. Only seven of these turn out to have been to voyages that were not already in the Mettas-Daget catalogue. Thirdly, in the British case, Stephen Behrendt has recently combed through the Sailors'/Widows' Petitions at the Society of Merchant Venturers in Bristol, England.[5] This is a source that covers voyages from Bristol to all parts of the world, not just Africa, and is not connected in any way to the major sources of shipping movements and records of state or newspapers that support the bulk of the records in the data set. Again, it constitutes a random sample of slave trade voyages. Of forty-six references to slave ships in the records only one was to a vessel that was not already in the database.

Another indicator of the quality of coverage in the TSTD is the massive Portuguese slave trade to Rio de Janeiro between 1795 and 1830 at the height of the coffee boom. Pre-1999 databases included 1,187 voyages arriving in Rio assembled by Manolo Florentino for the years 1811 to 1830, 889 by Herbert S. Klein covering arrivals in 1795-1811 and 1825-30, and a list of 170 vessels leaving Angola for Rio between 1795 and 1808 put together by Corcino Medeiros dos Santos.[6] After integrating these separate

sources, we found that almost all vessels in the Angola list were also in the Rio de Janeiro records and that all the Klein records for 1811-30 were also in the Florentino dataset. In total, records of 1,536 slave voyages existed for Rio de Janeiro between 1795 and 1830. Since 1999, we have added new information to almost every one of these 1,536 voyages, but have found only 357 completely new voyages for this branch of the slave trade. And many of these were captured or destroyed before reaching their destination. We think it highly unlikely that significantly more slave voyages sailed to Rio de Janeiro in this period than are contained in the Voyages Database.

Sources explored since 1999 that *have* added significant numbers of new voyages to the TSTD usually helped fill gaps that we always suspected were there. Thus English newspapers for the period before 1750 as well as the Royal African Companies duty books for 1698-1712, neither of which were among sources included in the CD-ROM, turned up 178 new slave voyages leaving or returning to London, 1700-1750.[7] How important was this new information? In 1999 we published records of 1,117 slaving expeditions based in London, but were sufficiently aware of the gaps that we suggested that the CD was missing perhaps ten percent of the actual total.[8] In terms of actual voyages, the new information appears to have added 13.7 percent more voyages to what we knew about in 2001. Our estimate of the missing voyages was thus on the low side, but not by very much. Similarly, we suspected that the TSTD was somewhat deficient in arrivals in the US after 1782. However, Jim McMillin's careful combing of newspaper sources in the post-1782 period yielded only 147 voyages not previously known – or a nine percent increment over those already in our database in 2004 when McMillin published his work.[9] In both these cases, however, London and US newspapers turned up

many hundreds of voyages that were already in the database. The pattern of new research into independent sources uncovering relatively small increments of previously unknown voyages is now a well-established feature of new research into the slave trade.

The pattern of relatively good coverage described above does not apply to all branches of the transatlantic traffic. The pre-1700 era of the slave trade, when admittedly less than seventeen percent of the transatlantic traffic took place, is much less well documented than the periods mentioned in the preceding paragraphs. Moreover, if we seek to establish accurate estimates or chart a path for future research it is essential to point as precisely as possible to gaps in the data. Thus the starting point of any estimate of the overall size and direction of the full slave trade and not just that part of it entered in the Voyages Database is a carefully calibrated assessment of how complete the records of slave ship departures under each national flag really are. These assessments form the bulk of our multi-page downloadable spreadsheet, called "*Estimates.xls*," with one page per national carrier not counting those showing how composite estimates for the Portuguese/Brazilian slave trade are derived.[10] These pages display annual totals of captives, both embarked and disembarked, taken from TSTD[11] and then makes an allowance in each year for what we think were the number of captives on voyages for which no record currently exists. For the British slave trade, the documentation enables us to make separate calculations of the ratio of documented to estimated embarkations and disembarkations for different ports of organization of slave voyages. The nature of available documentation required us to analyze the Portuguese trade by regions where slaves on Portuguese and Brazilian ships disembarked. There is a single estimate of how complete is slave trade data for other national carriers.

The first step in formulating the total volume of the traffic from our data is the conversion of the slave trade database's annual data for each national group into an estimate of its actual volume. The units of analysis are the number of slaves embarked and disembarked rather than number of voyages. The latter could be used, but large variations in the number of slaves carried by slave ships of different rigs and tonnage make number of slaves transported a more accurate measure of the volume of the slave trade. In what follows we explain applications of this methodology to each national carrier in turn.

For the pre-1713 British trade, the database estimates are divided into four periods. Prior to the establishment of sugar in Barbados (pre-1641), the records in the database are accepted as complete. From 1641 to 1660, however, actual slave arrivals must have been well in excess of the 800 hundred a year shown in the Voyages Database. For this period estimated arrivals are taken to have been three times the level indicated by the database.[12] From 1661 to 1697 inclusive we use estimates developed in a separate publication[13]; and for 1698 to 1711 we assume that Voyages Database has some record of every slave vessel sailing under the British flag. During the high point of the British slave trade, from 1713 to 1807, a port by port assessment of the completeness of the data is possible. We provide separate estimates of the quality of the data for the three major ports of organization (Bristol, Liverpool, and London), 30 other smaller ports in Great Britain considered as a group, and voyages organized in the British Caribbean. In each year of participation in the slave trade, captives on British voyages originating in foreign ports and ones whose port of organization is unknown are distributed proportionally among four of the five categories. The exception is Bristol whose records are taken to be 100

percent complete for the simple reason that a close to complete set of port books (a record of vessels entering the port) is extant. Ratios of completeness of documentation for the other categories are 95 percent from 1713 to 1779 and 100 percent from 1780 to 1807 The estimates yield a general estimate that 95.1 percent of slaves embarked on British voyages have been documented, increasing the number from 3,101,000 in the Trans-Atlantic Slave Trade Database to an estimated 3,259,000.

For French and Dutch slave voyages, our estimates are based on the total number of slaves transported annually on ships of each nation. The ratio of completeness of French records is 90 percent from 1571 to 1715, 95 percent from 1716 to 1804, and 90 percent in 1808 and from 1814 to 1831.[14] Dutch records are evaluated to be 100 percent complete before 1650 and after 1673. For the third quarter of the seventeenth century, they are rated as 90 percent complete.[15] Overall, French records of embarkations are 94.2 percent complete. Voyages in the TSTD account for 1,302,000 of an estimated 1,381,000 slaves embarked, and 1,098,000 of an estimated 1,165,000 slave disembarked, on French ships. Dutch records of embarkation, by comparison, are 96.8 percent complete. As a result, ~~that~~ there is a smaller difference between estimated slaves embarked and disembarked, 554,000 and 475,000 respectively, and the totals for ships in the TSTD, 537,000 and 461,000 respectively.

The fourth national carrier, labeled USA, includes voyages originating in the Thirteen Colonies when they were still British.[16] From 1645 to 1729, when documented voyages on ships registered in the mainland colonies embarked 8,694 Africans, half for disembarkation in Caribbean ports, half in North America, it is assumed that records exist for 4 out of 5 voyages that actually occurred. For the remainder of the colonial period,

from 1730 to 1778, when documented American slave ships took on board over 100,000 Africans and landed two in the Caribbean for every one transported to the mainland, records are estimated to be 90 percent complete. After independence, United States ships procured almost 140,000 documented captives in Africa and landed slightly over half in American ports. Almost all this activity took place between 1782 and prohibition of the importation of foreign slaves in 1808. In this period, documented voyages are assumed to be again 80 percent of the total.

For the years 1809 to 1820, TSTD contains seventeen voyages under the United States flag with a total of 2,687 slaves embarked and 2,218 disembarked. We assume 500 a year on average carried off from Africa in US vessels in these twelve years except for two years when observed landings exceeded 500 and are accepted in the resultant series. American ownership of slave voyages, especially to the island of Cuba in the second decade of the nineteenth century, was certainly greater than this series suggests, but such voyages are included under the Spanish flag. The 1819 Act to Amend the Act Abolishing the Slave Trade reduced voyages under the US flag even further. From 1821 to 1829 documented captives on US vessels are set equal to 80 percent of observed captives, and the post-1829 period is discussed separately below. Over the entire period from 1645 to 1829, the ratio of documented to estimated slaves embarked on U.S. ships is 81.9 percent, significantly lower than the rates for Great Britain, France, and the Netherlands.

Danish voyages are grouped together with voyages organized in Brandenburg and Sweden for purposes of estimating the participation of Baltic states in the trans-Atlantic slave trade. Brandenburg and Swedish records are assumed to be complete. The former

embarked 25,169 Africans, mostly between 1686 and 1702, with another flurry of activity between 1798 and 1802. Sweden organized four slaving expeditions in the seventeenth century, the last in 1683, and was then inactive until 1794, the year when the first of five Swedish slave ships arrived in the Americas between 1794 and 1805. Denmark accounted for over 70 percent of slaving voyages of Baltic states. For the periods 1690-97 and1734-1806, the series constructed by Hernaes[17] is used instead of the database, although the latter is still used to compute the ratio of disembarked to embarked slaves. Danish records for other years are assumed to be complete; but use of the Hernaes series increases total slaves embarked on Danish ships from 68,391 to 83,618, and total embarkations on Danish and other Baltic ships from 95,798 to 111,027. The implied ratio of documented to estimated embarked slaves is 86.3 percent.

Unlike northern European states which began to pursue an active slave trade only in the second half of the seventeenth century, Spain began to do so within decades, if not years, of its discovery of the New World. Unfortunately, the further back in time one goes, the greater the problem of documentary attrition. For the whole of the sixteenth century, we have records of only 24 Spanish slave voyages, and the first of these, in 1514, disembarked slaves from the Congo in Vigo, Spain. It is included in the database only because there is reason to believe the captives were subsequently shipped to the New World. Therefore, instead of the TSTD, we rely upon the carefully constructed series of preferred estimates of slaves landed in Spanish America between 1501 and 1641 by Antonio Mendes. These are provided in the form of totals for 5-year periods, which we divided by five for annual estimates of imports into Spanish Americas. They are based on a careful evaluation of licenses to import rather than actual arrivals.[18]

Half of the arrivals are assigned to Spanish ships. Departures are derived from arrivals using a Middle Passage survival ratio of 0.70. Estimated arrivals total 335,641, departures 479,487. The shares on Spanish voyages are 167,821 and 239,744 respectively. The TSTD contains data on only 2,176 exports and 1,652 imports on Spanish ships in this period. From 1642 to 1662, we estimate 2,000 imports and 2,677 exports (at a survival ratio of .75) annually to the Spanish Americas, for a total of 42,000 imports and 56,000 exports, with one third assigned to Spanish ships. These are again based on Mendes's figures.[19] In years in which Voyages data are higher than annual imports in his series (1651, 1654, and 1656), it is used as the estimate rather than the annual average. Thus, over the 21 years, Spanish imports are estimated at 15,125 and exports at 20,166. Without the higher number in the 3 years mentioned above, the estimates would be14,007 and 18,669 respectively.

From 1663 to 1820, estimates of slaves transported on Spanish slave ships are taken from the TSTD without adjustment. For most of these years there was no trade under the Spanish flag. There were small but well documented movements under that flag in the later 1760s and again after the Bourbon reforms from 1790, but not until British and US withdrawal from the traffic in 1808 were Spanish registered slave vessels significant and as long as the traffic was legal – till 1820 – documentation is good. Between 1821 and 1831, the TSTD totals for embarkations and disembarkations are divided by 0.90 to allow for arrivals missing from the historical record. Given the abundance of the sources for Cuba, at least, this may well be too great an adjustment. After 1830, we adopt a major shift in procedures. The analytical category "national flag" becomes less reliable as slave traders attempted to avoid international sanctions against

the slave trade by using a range of what today would be called flags of convenience. The owners of vessels disembarking slaves in Cuba continued to be overwhelmingly Spanish and we have therefore assumed that all voyages bringing slaves to Spanish colonies, regardless of flag, were .Spanish. TSTD data for Cuba are taken to be even more complete because the data set taps into both Spanish and British sources, as the source variable for vessels in Voyages database clearly shows. The divisor used to derive the estimated series rises to 0.97.

This leaves deliveries to other Spanish colonies. From 1811 to about 1842, Puerto Rico experienced a mini sugar boom, and arrivals in the island are set at five percent of those of the better-documented Cuba series.[20] Spanish and Uruguayan vessels were active in the Rio de la Plata, some were shipwrecked on British islands on their way to Cuba and Puerto Rico, and many others were captured and taken into British and international courts before reaching the Americas. For Rio de la Plata and the non-Spanish Caribbean, the TSTD is taken to be complete. For captured vessels diverted to Sierra Leone and St. Helena after 1830, it is also taken to be complete, but because we do not always know whether the captured slave ships were truly Spanish-owned, (see the discussion below), 35 percent of the captives on board are assigned to the Spanish national category. Thus total arrivals on Spanish vessels after 1830 are computed from the sum of estimated imports into Cuba, Puerto Rico, other Caribbean islands, Africa, and Rio de la Plata. Over the entire period from 1501 to 1866, we estimate that Spanish ships embarked 1,060,624 Africans and delivered 884,168 of them alive to its colonies in the western hemisphere.[21] Voyages Database documents 68.8 percent of estimated embarkations and 72.1 percent of estimated disembarkations.

The first documented slaving voyage to the Americas took place on a Portuguese vessel that landed 213 of 300 captives from São Tomé in Hispaniola in 1525. It was the first of many slave voyages to the Spanish Americas in the sixteenth and early seventeenth centuries organized in Portugal. We again follow Mendes in attributing half the slaves he estimated being carried to Spanish colonies to Portuguese ships through 1641, representing 168,000 of 356,000 imports After the separation of the Portuguese from the Spanish crown in 1640, Portuguese involvement in supplying captives to the Spanish Americas fell sharply, but is unlikely to have disappeared before the Dutch Curacao-based intra-American slave trade became the source of captives for the Spanish Americas in 1663. TSTD documents 8,958 departures from Africa, and 6,944 arrivals on Portuguese vessels, which is accepted as the actual Portuguese contribution. Beyond 1662 and down to 1830, except for an intra-Americas traffic between Rio de Janeiro and Bahia on the one hand and the Rio de la Plata on the other, the Portuguese carried relatively few slaves into the Spanish Americas. The brief period at the end of the seventeenth century, when the Spanish assigned *Asiento* rights to the Portuguese once more – that is, an exclusive contract to supply captives to the Spanish Americas – does not contradict this assessment; nor does the few hundred a year on average carried into Cuba between 1791 and 1830 in Portuguese vessels (or ostensibly Portuguese vessels). Except in the small traffic to the Rio de la Plata, the Portuguese did not play a major role in supplying the Spanish Americas with captives after 1642.

It is the Brazilian traffic, beginning about 1560, that accounts for by far the largest share of the Portuguese slave trade and also presents the most problems in terms of estimating the overall volume. Voyages operating out of Brazilian ports conducted a

bilateral trade with Africa in a largely self-contained system with the least exposure to international record-generating institutions of any branch of the slave trade. There were four branches, the first beginning in Pernambuco in 1561, the traffic to Bahia and Rio de Janeiro both of which ~~in~~ are thought to have started about twenty years later at least in terms of direct arrivals from Africa, and then the traffic to Amazonia, a continuous direct slave trade to which began only after 1760. As the estimates for the traffic into Amazonia and Pernambuco are developed in separate publications, we will focus our attention on the Bahia and southeast Brazil branches here, but it should be noted that much of our estimate for the traffic to Brazil before 1684 is built on our series for Pernambuco and readers will need to bear that in mind as they follow the construction of the series for Bahia and Rio de Janeiro.[22]

For Bahia, sugar exports started later than in Pernambuco, and the number of engenhos – sugar mills – is thought to have been 80 percent of those in Pernambuco prior to the Dutch invasion in 1630.[23] We therefore set the level of slave arrivals into Bahia in the 1620s at four-fifths of the Pernambuco estimate. Between 1580 and 1620 we know that the labor force on the sugar estates, which had been almost entirely indigenous, became almost entirely African. Estimated arrivals in this period are regressed from 80 percent of the Pernambuco level in 1620 to 100 in 1580. The Dutch attempted to capture Bahia in 1624, but after turning their attention to Pernambuco their chief impact on the Bahia plantation economy stemmed from harassment of shipping and, particularly after their invasion of Portuguese Angola in 1641, reduction of the captive inflow to plantation owners in both Bahia and Rio de Janeiro.[24] We assume average arrivals in Bahia to have continued at the level of the 1620s through the following decade, before declining to two-

thirds of this level from 1641 to 1648. Slave inflows are assumed to have returned to pre-1642 levels when the Dutch were forced out of Angola in 1649 and Pernambuco five years later. The next benchmark of slave arrivals comes from a series for departures from Angola provided for 1666 to 1672 by a Governor of Angola.[25] By this time there was a massive Northern European slave trading presence in West Africa, including the Dutch who were attempting to exclude the Portuguese from West Africa. Angola was thus almost the only source of slaves for Portuguese slave ships heading to Brazil prior to the late 1670s. Bahia was at this stage the major sugar producer in Brazil. An arrival series is derived by subtracting 15 percent of departures estimated by the Governor of Angola, the assumed mortality rate, and apportioning the remainder 0.45, 0.35 and 0.20 among Bahia, Southeast Brazil and Pernambuco respectively. Average arrivals into Bahia for 1666-72 are adopted as our estimates for 1650 to 1665 and 1673 and 1677.

After a peace treaty with the Netherlands was signed in 1669, Portuguese vessels from Bahia began looking for slaves in West Africa and in the process began to generate records that have survived to the present. They found a market on the Gold Coast and the Bight of Benin for third grade tobacco leaf rolled and coated in molasses which could be exchanged for slaves. This product was never traded in Angola. The Portuguese state recognized tobacco's importance by relaxing the requirement that all Brazilian produce be shipped to Portugal first on its way to its ultimate destination, and began issuing licenses allowing a direct trade in tobacco to Africa from Brazil. This decision created a valuable record of slave ship movements from Brazil to the Costa da Mina (as the Portuguese termed the Gold Coast and Bight of Benin). The Dutch in West Africa interacted with Bahia merchants and in the process created an independent set of

records.[26] From 1684 to 1689 we think Bahia slave traders gradually switched from Angola to West African slave markets though we have no hard data for Angola in these years. Our estimates of arrivals in Bahia assume that equal numbers came in from Angola and West Africa from 1684 to 1689. From 1690 Angolan records become available in the TSTD, and from here until 1810 the records are sufficiently diverse and consistent that we assume that they provide some coverage of 90 percent of all voyages. From 1811 to 1830 and from 1839 to 1851 – the period when the records are at their most dense – this coverage ratio rises to 100 percent. This leaves the early period of the illegal slave trade to Brazil, from 1831 to 1838 for which we adopt a series derived from British observers.[27]

For the branch of the Portuguese slave trade that supplied Southeast Brazil, mainly the port of Rio de Janeiro, records are weaker than for any Brazilian port prior to 1794, but they are among the most profuse thereafter. Few indications of the size of the trade of any kind may be found prior to 1710, and our series is built on contemporary estimates of sugar production relative to Pernambuco and Bahia. Sugar exports began in Espírito Santo and São Vicente in the southeast in the later sixteenth century and arrivals of slaves are set at 70 percent of Bahian levels from 1580 to 1665.[28] From 1666 to 1672, as explained above, the series for the region derives from Angolan departures adjusted for mortality, after which, and through to 1709, arrivals are again pegged at 70 percent of Bahian levels.

From 1710 to 1793 a quite different strategy is adopted for estimating slaves disembarked in Southeast Brazil. Slaves arrived from two distinct parts of Africa in these years. The majority came from Portuguese Angola, and a smaller flow came from Costa

da Mina. We treat these two streams separately. For Angola, several series of departures exist from 1710 to the whole of Brazil. All these series are extracted from annual summaries prepared by Portuguese officials rather than voyage-based data. These have been recovered, discussed at length, and integrated by Jose Curto.[29] Curto's preferred series comprises the highest annual totals for those years with multiple values and to these we have added some interpolations for missing years (see the spreadsheet for 18thCAngola in *Estimates.xls*). Portuguese Angola dispatched captives to only four Brazilian regions, and three of these, Amazonia, Pernambuco and Bahia, are discussed above. An annual series for southeast Brazil, effectively Rio de Janeiro from 1718, is derived by subtracting annual estimated departures for each of these three regions from total departures and adjusting for shipboard mortality. The series of arrivals into Rio de Janeiro from Angola for 1710 to 1793 is thus a residual, the reliability of which is only as good as the parallel series for the three Brazilian regions.

Estimates for arrivals from Costa da Mina, which forms much the smaller part of our annual totals from Africa into Rio de Janeiro, hinges on a breakdown of the origins of captives brought into the port for each of the four years 1731 to 1735.[30] The average for the four years is just under six percent and this is used for the full period 1710-1793. While drawing on hard data for just four years to infer an 83 year series may seem audacious, it is worth noting that when the data improve after 1793, they show Costa Mina captives making up between two and three percent of arrivals in Southeast Brazil. There is nothing in the literature to suggest a large Costa da Mina influx into eighteenth century Rio de Janeiro. Finally, from 1794 to 1830 the database is accepted as providing 100 percent coverage of arrivals, and for the 1831 to 1851 period, a series based largely

on British sources is used except for 1840 to 1842, when the new database generates annual totals that are in excess of those estimated by the British Foreign Office.[31]

During the last thirty years of the trans-Atlantic slave trade, two treaties and two British Acts of Parliament resulted in the national affiliation of slave vessels becoming much more difficult to discern, making the analytical framework we have followed so far in this essay more difficult to apply. In 1835 Spain at last assented to the so-called "equipment clause" which allowed British cruisers to capture Spanish slave ships that were equipped for the slave trade, but had no slaves on board. Spanish vessels thereupon began sailing under Portuguese and US registration. In response the British Parliament passed an act in 1839 that authorized the British navy to capture Portuguese vessels on the basis of the equipment they carried as well. The captured vessels were adjudicated in British Vice-Admiralty courts. The Portuguese at this point signed a new treaty with Britain (in 1842) that paralleled the 1835 Anglo-Spanish agreement. By contrast, Brazil never did assent to an equipment clause; and in 1845 a further British law applied the terms of the 1839 act to Brazilian vessels, as well as to vessels that carried no registration papers whatsoever. The effect of these four initiatives was that slave traders began sailing under a wide range of flags and typically used more than one flag on the same voyage. The US flag was particularly favoured on outbound voyages because British naval cruisers were reluctant to interfere with US vessels and the harsh provisions of the US anti-slave trade legislation applied for the most part only to vessels found with slaves on board.[32] Thus from 1836 to the end of the trade, the sources that we have relied on to identify the national affiliation of a slave ship for the first three centuries of the trade often yield misleading information.

Nevertheless, during its last three decades there can be little doubt that trans-Atlantic slave trade ventures continued to be organized and owned, in Brazil and Cuba and that the true owners of slave vessels that set sail from the USA to Africa, particularly in the later 1850s, were often citizens of Portugal, Brazil or Spain.[33] For the purpose of calculating the volume of the slave trade we have made a set of assumptions to deal with this problem. After 1830 all voyages arriving in the Spanish Americas are counted as Spanish, and all voyages arriving with slaves in Brazil are counted in the category "Portugal/Brazil." For slave vessels captured and taken into African ports, essentially Sierra Leone and St. Helena, the flag of the vessel is accepted as reflecting the true nationality of the vessel down to 1835, but thereafter 35 percent of all captives removed from slave vessels are counted under the Spanish flag and 65 percent are assigned to the Portuguese/Brazilian category (see the Africa > 1830 sheet in *Estimates.xls*). Thus the flags of very few post-1830 voyages arriving in regions other than Brazil, Cuba and Africa are accepted at face value.

The default display on the Estimates page of the Voyages website, incorporates these various assessments and summarizes the number of captives embarked by national carrier by 25 year periods over the full period of the slave trade (http://slavevoyages.org/tast/assessment/estimates.faces?yearFrom=1501&yearTo=1866). Overall the national totals sum to 12.5 million departures from Africa and 10.7 million arrivals in the Americas. Readers are referred to the Introduction of *Extending the Frontiers*.[34]

Having estimated the volume of the slave trade, the next step is to use the estimates of national involvement as a basis of establishing the structure of the slave trade at both ends of the Middle Passage. On the African side we adopt Philip Curtin's schema

of eight coastal regions in Africa to show the distribution of slaves at point of embarkation: Senegambia, Sierra Leone, the Windward Coast, the Gold Coast, the Bight of Benin, the Bight of Biafra, West Central Africa, and Southeast Africa. Places of disembarkation are grouped into thirty-six different regions, including Africa and Europe, facing the Atlantic Ocean or the Gulf of Mexico. They range from the thirteen mainland British colonies in North America to the Rio de la Plata estuary in South America.[35]

One can obtain an approximate idea of the number of captives transported on a given route by multiplying the percentage of total estimated embarkations from a region in Africa by the percentage of total estimated disembarkations in a region of arrival and multiplying total embarkations or total disembarkations by the product. However, such a procedure does not take into account the extent to which movement along certain routes was greater or less than what one might expect from the overall distributions of regions of departure and arrival.

Consider, for example, the region of Bahia. We estimate that it received 2,016,993 captives transported on Portuguese ships, 47.7 percent of total Portuguese imports of 4,224, 730 into the four regions of Brazil. We also estimate that the Bight of Benin furnished 1,471,532 captives exported from Africa by the Portuguese, 25.2 percent of 5,848,323 slaves transported by this national carrier. If that were also the proportion exported to Bahia, it received 507,516, or 25.2 percent of its 2,016,993 captives from the Bight of Benin. The 507,516 captives transported from the Bight of Benin to Benin would represent 12 percent of total Portuguese exports. This is considerably less than the proportion of slaves travelling this route on Portuguese voyages to Brazil for which we

have information on both region of departure and arrival: 22.4 percent (717,043 of 3,206,972).

In order to take into account larger and smaller movements of captives from particular regions in Africa to particular regions in the Americas, we combine the 8 regions of embarkation with the 32 regions of disembarkation to identify 256 possible paths of slave ships. Our objective is to estimate, by national carrier, the routes of slaving expeditions organized each year between 1501 and 1861 and how many slaves began and ended the journey along each route. Rather then just viewing breakdowns of regions of departure, or of regions of arrival, users can now track the trans-Atlantic connections between Africa and the Americas.

The downloadable SPSS file *Estimates.sav* contains the transformation of data from the TSTD used to arrive at these results. A new variable for route was created, combining region of embarkation with region of disembarkation including values for cases where the information is missing. The data on number of slaves embarked and disembarked (slaximp and slamimp in TSTD) was then aggregated by national carrier, year of arrival, and route. This produces for a national carrier, in any given year, a set of cases describing information on routes: voyages for which both region of embarkation and disembarkation are known, voyages where only region of embarkation is known, voyages where only region of disembarkation is known, and voyages which are known to have taken place but for which neither region of embarkation nor region of disembarkation captives is known.

We first multiply the percentage of slaves embarked and disembarked on each route, including those with only partial or no geographical information, by the estimate of

total exports and imports in *Estimates.xls*. Then we distribute slaves on routes with missing information among routes where both region of embarkation and disembarkation are known. The pattern for routes that are only partially or not at all documented are inferred from routes that are fully documented.

For voyages for which the place of embarkation of captives is identified, but not the place of disembarkation, the latter is inferred to be the same as for voyages where both are identified. For example, it has been documented that the Danish West Indies were the destination of 63 of 436 captives from the Gold Coast embarked on Danish ships in 1797. The place of disembarkation of the other 373 captives is not known. It is inferred that they also landed in the Danish West Indies.

In years when voyages leaving a region in Africa disembarked slaves in two or more different identified regions in the Americas, slaves on voyages to unidentified places of disembarkation are distributed proportionately among known routes. The place of disembarkation is not documented for 367 of 2,192 captives from the Bight of Benin embarked on British ships in 1722. Adjusting for incomplete coverage, they represent 382 of 2,281 estimated captives. These 382 captives are distributed among three known places of disembarkation: 301 to Jamaica, 25 to Barbados, and 55 to Antigua. Total estimated slaves embarked on the route from the Bight of Benin to Jamaica increases from 1,498 to 1,799, on the route from the Bight of Benin to Barbados from 125 to 150, and on the route from the Bight of Benin to Antigua from 276 to 331.

Once slaves on all voyages with partial or no information on itinerary are distributed among voyages with complete information on itinerary, the proportion of captives for each route in a year is computed and multiplied by estimates of total

embarkations and disembarkation for the national carrier in the year to obtain estimates of the number from each place of embarkation and to each place of disembarkation. Embarkations and disembarkations for voyages where neither place of embarkation nor place of disembarkation are known are distributed among voyages whose complete route is identified.

Although this methodology produces annual estimates that can be displayed on the Estimates page of our web site, the distribution for any given year should be treated as hypothetical. Results for five-year periods or longer are more credible. Indeed, there is little difference in the distribution of captives by regions of disembarkation and embarkation estimated independently from that implied by estimates of routes. As far as we know, there is no other interactive device that allows users to view transatlantic connections, or distributions of arrivals in the Americas by regions of departure from Africa, and vice-versa for any given time period.

Notes

[1] Philip D. Curtin, *The Atlantic Slave Trade: A Census* (Madison, Wisconsin, 1969).
[2] These essays were later republished as *The Middle Passage: Essays on the Transatlantic Slave Trade* (Princeton, NJ, 1978).
[3] We reserves the term "TSTD1" for references to the 1999 CD-ROM version (David Eltis, Stephen D. Behrendt, David P. Richardson and Herbert S. Klein, *The Transatlantic Slave Trade: A Database on CD-ROM* (New York, 1999). However, users should note that because of time and resource restraints, the procedures described in this essay were applied to the database as it existed in October, 2007. The current Voyages database incorporates some changes made since October, 2007. In this essay the October, 2007 version is referred to as "TSTD." It should be possible in the future to synchronize the voyages database with the estimates page, but even when this happens, changes to the database thereafter will probably not be reflected immediately in the estimates.
[4] Jean Mettas, *Rèpertoire des Expéditions Nègriers Françaises au XVIIIé Siécle*. 2 vols. (Paris, 1978-84), see vol 1 for the Nantes vessels.
[5] Bristol Record Office, SMV/9/3/3.
[6] Described in Florentino, *Em Costas Negras: Uma Historia do Trafico de Escravos entre a Africa e o Rio de Janeiro (seculos XVIII e XIX)* (Sao Paulo, 1997), pp. 12-13; Klein, *The Middle Passage: Comparative Studies in the Atlantic Slave Trade* (Princeton, 1978), pp. 51-94; Eduardo dos Santos, "Relaçtes de Angola com o Rio de Janeiro (1736-1808)," *Estudos Historicos*, 12 (1973): 7-68
[7] The duty books recorded all departures to Africa from every British port in the Atlantic world between 1698 and 1712. They were a direct result of the 1698 Act that destroyed the Royal African Company's monopoly by allowing all British investors access to the slave trade on payment of a duty worth ten percent of the outgoing cargo. They may be found in the British National Archives, series T70, vols 349-358.
[8] David Eltis, "Volume and Direction." *William and Mary Quarterly* , (2001):
[9] James A. McMillin, *The Final Victims: Foreign Slave Trade to North America, 1783-1810* (Columbia, 2004). McMillin`s database comprises 1,764 voyages, but does not distinguish between intra-American vessels and transatlantic expeditions. Our own database is concerned only with the latter and we have attempted to separate the two categories in the McMillin collection. A larger problem with *Final Victims* is the extensive double and triple counting of voyages. Among the transatlantic voyages alone, 254 voyages are entered twice (in most cases once when the vessel left port and once when it returned), a further 22 are entered three times, and a single voyage appears as five separate entries. If the intra-American data in the set have the same problems, then this is not a minor problem. Though not always recognized as such by their authors, duplicate entries are the largest single problem with any multi-source database (which historians are now creating in increasing numbers) and for our own database - both first and second editions – elimination, or at least reduction of such double counting absorbed more resources than the initial collection of the data. We cannot claim to have eliminated all.
[10] Overall, Voyages Database identifies the national affiliations of 25,473 or 73 percent of the voyages in the set. For a further 7,711, the context of the voyage and the name of the ship, owner, or captain make possible inferences about place of registration. An

imputed variable of national flag which contains national affiliations for 33,208 voyages, or 95 percent of the voyages in the database was accordingly created. Almost all the 1,600 voyages or so that are without an indication of the flag they sailed under, plied their trade either at the very beginning of the slave trade, where the probability that the vessel was Spanish or Portuguese was very high, or at the very end, when the slave trade was illegal. Illegality meant that owners and captains went to great lengths to avoid or to change national affiliation as part of an attempt to avoid detention.

[11] Users should note that development of the estimates page began two years ago, and that the version of TSTD on which the current estimates draws dates from August, 2007. The SPSS version of this is called "Basecoy67.sav." By contrast, the database on the "Search the database" interface of the current site dates from June, 2008 and differs slightly from its predecessor. We intend to update the estimates in the future, but users are warned that without substantial additional resources it will likely never be possible to have the estimates and the Voyages search interface drawing on exactly the same database at a given point in time.

[12] Tripling the actual data on arrivals is derived from an assessment of population trends in Barbados. The slave population grew from a few hundred in 1641 to 40,000 in at the time of the first reliable population count in 1672 – or a projected 27,000 in 1660. How many arrivals were required to sustain this growth? We use the equation:

$$M = \frac{P_1 - P_0 - P_0 R}{(1 - S)\frac{2 + R}{2}}$$

where M = Net number of arrivals, P1=Population at end of the period, P0=Population at the beginning of the period, S=Proportion of arrivals dying during the first year after arrival, and R = the rate of natural increase over the interval between the population counts to derive an independent estimate of arrivals. R is assumed to have been -3.5%, and S, 10%, and the population in 1641, 400. It should be noted that both the Voyages Database (for 1662-72) and contemporary observers point to a close to balanced sex ratio among early arrivals – an unusual pattern in the transatlantic slave trade.

[13] David Eltis, "The British Transatlantic Slave Trade Before 1714: Annual Estimates of Volume and Direction," in Robert L. Paquette and Stanley L. Engerman (eds.), *The Lesser Antilles in the Age of European Expansion* (Gainesville, Florida, 1996), pp. 191-215

[14] For a discussion of the pre-1716 period, see David Eltis, James Pritchard and David Richardson, "The Significance of the French Slave Trade to the Evolution of the French Atlantic World before 1716," in David Eltis and David Richardson (eds.), *Extending the Frontiers: Essays on the New Transatlantic Slave Trade Database* (New Haven, 2008), pp. 205-27.

[15] For an assessment of the Dutch traffic, see Jelmer Vos, David Eltis and David Richardson, "The Dutch in the Atlantic World: New Perspectives from the Slave Trade with Particular Reference to the African Origins of the Traffic," in *Extending the Frontiers*, pp. 228-48.

[16] See David Eltis, "The US Transatlantic Slave Trade, 1644-1867: An Assessment," *Civil War History* (forthcoming in 2008), and the discussion in David Eltis and David Richardson, "Introduction" in *Extending the Frontiers*

[17] Per O. Hernaes, *Slaves, Danes, and African Coast Society: The Danish Slave Trade from West Africa and Afro-Danish Relations on the Eighteenth Century Gold Coast* (Trondheim, 1995), pp. 193-96, 198-227.
[18] António de Almeida Mendes, "The Foundations of the System: A Reassessment of the Slave Trade to the Spanish Americas in the Sixteenth and Seventeenth Centuries," in Eltis and Richardson (eds.), *Extending the Frontiers*, pp 63-94.
[19] Ibid, 82-83.
[20] Francisco A. Scarano, *Sugar and Slavery in Puerto Rico: The Plantation Economy of Ponce, 1800-1850* (Madison, 1984), pp. 7-8; David Eltis, "The Nineteenth Century Transatlantic Slave Trade: An Annual Time Series of Imports into the Americas broken down by Region," *Hispanic American Historical Review*, 67 (1987): 134. Users should note that while pre-1831 Puerto Rican arrivals are counted under the Spanish flag, most of the ten vessels arriving in Puerto Rico in the TSTD sample for these years are Portuguese or French.
[21] As discussed below in the paragraph on Portuguese involvement, departures and arrivals of captives in Spanish vessels going to Brazil are counted as Portuguese and thus excluded from the totals for the Spanish trade.
[22] Daniel Barros Domingues da Silva and David Eltis, "The Slave Trade to Pernambuco, 1561-1851," in Eltis and Richardson (eds.), *Extending the Frontiers*, pp 95-129: Daniel Barros Domingues da Silva, "The Atlantic Slave Trade to Maranhão, 1680-1846: Volume, Routes And Organization," *Slavery and Abolition* (forthcoming in 2008)
[23] Stuart B. Schwartz, "A Commonwealth within itself: The early Brazilian Sugar Industry, 1550-1670," in Stuart B. Schwartz (ed.), *Tropical Babylons: Sugar in the making of the Atlantic World, 1450-1680* (Chapel Hill, NC, 2004), pp. 158-200.
[24] In the 1620s, the Dutch captured one in five of the Portuguese vessels sailing between Africa and Brazil (Ibid, 164).
[25] Luiz Felipe de Alencastro, *O Trato dos viventes: Formação do Brasil no Atlântico Sul séculos XVI e XVII* (Sao Paulo, 2000), p. 378.
[26] Johannes Postma and Stuart B. Schwartz, "Brazil and Holland as Commercial Partners on the West African Coast iduring the Eighteenth Century," *Arquivos do Centro Cultural Calouste Gulbenkian*, 34 (1993): 399-437.
[27] David Eltis, "The Direction and Fluctuation of the Transatlantic Slave Trade, 1821-43: A Revision of the 1845 Parliamentary Paper," in H.A. Gemery and Jan S. Hogendorn (eds.), *The Uncommon Market: Essays in the Economic History of the Atlantic Slave Trade* (New York, 1979), pp. 271-97.
[28] Schwartz, "Commonwealth within itself."
[29] Jose C. Curto, "A Quantitative Reassessment of the Legal Portuguese Slave Trade from Luanda, Angola, 1710-1830." *African Economic History* 20 (1992): 1-25; idem, "The Legal Portuguese Slave Trade from Benguela, Angola, 1730-1828: A Quantitative Reappraisal," *Africa*, no 16 (1993):
[30] Nireu Cavalcanti, "Comércio de escravos novos no Rio Setecentista", (Unpublished essay, March, 2003), table VIII.
[31] Eltis, "The Nineteenth Century Transatlantic Slave Trade."
[32] This pattern is partly responsible for scholars from W.E.B. Bu Bois to Ernest Obadele-Starks greatly exaggerating the size of the US slave trade after 1807 (*"Freebooters and*

Smugglers": The Foreign Slave Trade in the United States after 1808 (Fayetteville, 2007)). For a fuller consideration of this issue see David Eltis, "The U.S. Transatlantic Slave Trade."

[33] David Eltis, *Economic Growth and the Ending of the Transatlantic Slave Trade* (New York, 1987), pp. 145-63. See especially the evidence of James Kennedy before a House of Commons select committee on slave trade treaties in 1853. Kennedy was the British Commissioner at the Havana Mixed Commission court from 1837 to 1851 and believed that US ownership of slaving ventures was very rare (Parliamentary Papers, 1852-53, vol. 39. p. 109).

[34] Eltis and Richardson, "Introduction," *Extending the Frontiers*, pp. 5-8, 37-44. For an excellent summary of the earlier debates on the volume of the traffic see Per O. Hernaes, Slaves Danes, and African Coast and Society (Trondheim, 1997), 129-71.

[35] For definitions of the regions see "Geographic Data" in the "Understanding the Database" essay.