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On the Trend and Variability of 18th Century British Transatlantic Slave Prices

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The purpose of this paper is to estimate the trend of 18th century British slave prices. We apply robust econometric procedures on slave price data from the west coast of Africa constructed by Richardson (1991) and Whatley (2018) over the period 1699 to 1807 as well as prices of slaves documented in South Carolina by Mancall Rosenbloom and Weiss (2001) over a shorter period from 1722 to 1809. Using the data by Whatley and Richardson we find evidence of a trend break in 1740, We estimate the trend over two regimes demarcated by the structural break, finding there is no significant trend in the first regime prior to 1740. However, in the second regime, slave prices show a significant positive trend increasing annually at around 2.4%. These results appear to be very similar for both the series from the west coast of Africa. Next, we consider the slave prices compiled by Mancall et al, 2001 derived from probate inventories in Southa Carolina. For this shorter series, while no structural break is found, we do estimate an annual increase albeit smaller in magnitude at just under 1% year on year. We document various accounts by historians that can help explain this steady increase, focusing on supply and demand side arguments.

Introduction

The purpose of this study is to estimate the trend of British slave prices and its variability over the 18th century. The question that we address is how did slave prices evolve over the 18th century? During this period of British dominance in the Transatlantic slave trade, we aim to determine whether slave prices were characterised by a secular trend, or a broken trend, where the trend may have changed slope and/or magnitude. Crucially, we address this issue by applying robust econometric procedures.

The British merchants' foray into slave trading was relatively late compared to her Portuguese counterpart. Indeed, Britain's importance in the Transatlantic slave trade was only established in the mid and late-18th century (Williams 2021

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[1944]: 29-31). Notably during this period 'the (British) slave trade was more than a means to an end; it was also an end itself.' (Williams 2021[1944]: 29). The size of the British slave trade grew with the increasing demands from the West Indian sugar plantations. In addition, the Treaties of Utrecht (1713-14) following the War of Spanish Succession gave the British traders privileged access as suppliers of slaves to the Asiento trade[1].

As the dominance of British traders increased, large supplies of slaves were sourced from new regions such as the Bight of Biafra, the Windward Coast and Sierra Leone in the mid-18th century. This was enabled by associating with the reputed and skilful Aro traders who had established themselves in these areas almost a century earlier. Also, the Asante and Dahomey gained control of the important ports of Accra and Quidah respectively and increasingly dominated the slave trade.

Economic historians have debated extensively on slave price trends. At one extreme there are the traditionalists[2] (for example, Phillips 1918) who argued that the upward trend in slave prices is due to speculation on part of the slave owners and their 'peculiar culture' of the desire to hold slaves for power and status (Yanochik et al. 2003). In contrast, the new economic historians (for example, Fogel & Engerman 1974) argue that it was the productivity of slave labour that led to high slave prices. Intuitively, one would generally take the view that slaves were profitable. After all they are unpaid, the slave owners reap the benefits of their labour and therefore, slavery should have been a lucrative business for the plantation owners. However, these debates have centred on the antebellum South of America, focused on one region and during a period after the abolition of slave trade by the British.

During the 18th-century there was a growing demand for slaves in the Americas. This may have been due to the rising real price of sugar, thereby exerting an upward pressure on the prices of slaves. Other factors such as the cost of acquiring slaves from the interiors of African nations and marching them to the coast may have also played a significant role. There is no reason to believe that the upward pressure on slave prices was constant over time. During this period there were possible improvements in the productivity of plantation labour. The increase in land devoted to the production of sugar may have increased the productivity of

[1] Edwards (1801) records that throughout the 18th century British slave traders supplied half a million African slaves to French and Spanish sugar planters establishing themselves as 'the foremost slave trading country in the world' (Williams 2021 [1944]: 30). The relative position of the British in the slave trade was best captured by the growth and importance of Liverpool. Towards the end of the 1700s, the city of Liverpool alone controlled upwards of 40% of the entire European slave trade.

[2] The traditionalists considered slaves to be sub-human as a race, and that slave-owners-maintained slavery as a conceivable system of race relations.

slave labour and therefore slave prices (Gemery & Hogendorn 1979). Other factors that may have caused the trajectory of slave prices to change could be the high death rates in slaves combined with newly arrived captives.

In the present analysis, we test whether there is any change in this trend, that is the direction and/or magnitude of slave price changes with time. Thereby, we investigate whether structural breaks exist and, if they do, we measure the underlying trends in regimes demarcated by the breaks. We consider three different price series. Two of the series focus on the port of origin in Africa and are compiled by Richardson (1991) and Whatley (2018) covering the period from 1699 to 1807. The third shorter series was compiled by Mancall et al. (2001), which focuses on the destination slave auction port in South Carolina from the period 1722 to 1809. A problem with estimating structural breaks and the underlying deterministic trend is the issue of dealing with unit roots[3] in the data. Hence, we apply robust econometric procedures that allow us to be agnostic to the presence of unit roots. The significance of the trend can be affected by the large variability around it. A companion to estimating a significant trend is assessing the presence of time varying variance, which we also do in the present analysis.

Our quantitative analysis of the two slave price series from the coast of Africa provides a key finding that is important to the ongoing debate. We detect a broken trend in slave prices over the period considered by locating the structural break in 1740. Prior to 1740, we estimate the trend in slave prices to be statistically insignificant. However, after 1740, we estimate slave prices to have a statistically significant positive trend, increasing annually at the rate of around 2.4% for the Whatley series and 2.32% for the Richardson series. This has implications for slave traders and owners as they anticipated capital gains, especially as they accumulated slaves, who were deemed as 'human chattels' and, thereby, assets[4]. Further analysis reveals a difference in the two price series. For the price series compiled by Whatley (2018) our variance profile analysis detects a change in price variability around 1740. Prior to 1740 there is time varying variance, whereas in the post-1740 regime, prices are close to constant variance. In the case of price series constructed by Richardson (1991), there is no significant time varying variance either before or after 1740. However, we note that Richardson (1991) acknowledges a weakness in his construction of the slave price data. His estimates

[3] In other words, the error term of the trend regression is serially correlated with a unit coefficient on its lagged term, thereby making the data series a non-stationary integrated process, or *I* (1) process in this case.

[4] In a recent study González et al (2017) argued that slave property rights, or wealth, were not only as source of coerced labour but also an important a source of collateral. A similar position was taken by Hodgson (2014) regarding slaves as 'human capital'.

of the export figures and number of slaves lead to exercise caution with regards to the variability of slave prices (see Richardson 1991: 33).

We conclude that 1740 would appear to be a significant year for the British African slave trade. Several demand and supply factors come to bear around this period that can provide an explanation to a steady upward trend in slave prices and the interaction of demand and supply that may have contributed to the time varying variance. This study is delimited as the model and analysis provided is based on tentative explanations to which further historical detail can be appended, for the purpose of empirical testing.

The remainder of the paper is organised as follows: the next section outlines the data and methodology, followed by a section that focusses on the empirical findings and discussion of these results. Finally, the summary and concluding remarks are considered in the last.

Empirical Strategy: Econometric Method and Data

Robust tests for presence and location of a structural break

Based on the above arguments, we choose to estimate the trend function on a general model given by:

$$p_t = \mu_0 + \beta_0 t + \sum_{i=1}^{K} \mu_i DU_{it} + \sum_{i=1}^{K} \beta_i DT_{it} + u_t, \quad t = 1,2,\dots,T \qquad (1)$$
$$u_t = \alpha u_{t-1} + A(L)\Delta u_{t-1} + \varepsilon_t, \quad t = 2,3,\dots,T, \quad u_1 = \varepsilon_1$$

where p_t denotes the logged price of slaves, $DU_{it} = I(t > T_i)$, $DT_{it} = (t - T_i)I(t > T_i)$, $i = 1,2,\dots,K$, where I is the indicator dummy, and the date(s) for any break(s) in the series and the number of breaks (K) is treated as unknown. A break in the trend occurs at time $T_i = [T\lambda_i]$, where $\beta_i \neq 0$, and λ_i is the break fraction. No assumptions are made with regards to the nature of the error term, i.e., u_t can be either $I(0)$, that is, $|\alpha| < 1$, or $I(1)$ that is, $\alpha = 1$. To determine whether structural breaks exist, we test the null hypothesis $H_0: \beta_i = 0$ against the alternative $H_1: \beta_i \neq 0$. Perron and Yabu (2009a) detect a break in the trend function based on a Quasi-Feasible (QF) Generalized Least Squares method.

To implement the Perron and Yabu (2009a) procedure to detect a structural break we estimate the autoregressive process given by the error term u_t in (1) using OLS to obtain the $\tilde{\alpha}$ estimate. In order to improve the finite sample properties of the tests, a bias-corrected version of $\tilde{\alpha}$ is used, denoted $\tilde{\alpha}_M$, proposed by Roy and Fuller (2001). Perron and Yabu (2009a) propose the super-efficient estimate given by:

$$\tilde{\alpha}_{MS} = \begin{cases} \tilde{\alpha}_M \; if \; |\tilde{\alpha}_M - 1| > T^{-0.5} \\ 1 \; if \; |\tilde{\alpha}_M - 1| \leq T^{-0.5} \end{cases}$$

The estimate $\tilde{\alpha}_{MS}$ is used to construct the following quasi-differenced regression:

$$(1-\tilde{\alpha}_{MS}L)p_t = (1-\tilde{\alpha}_{MS}L)\mathbf{x}_t'\boldsymbol{\Psi} + (1-\tilde{\alpha}_{MS}L)u_t \qquad t = 2,\dots,T \qquad (2)$$
$$p_1 = \mathbf{x}_t'\Psi^0 + u_1$$

where $\boldsymbol{\Psi}^0 = [\mu_0, \beta_0, \mu_1, \beta_1]'$ and $\mathbf{x}_t' = [1, t, DU_t, DT_t]$. We denote the estimate $\tilde{\boldsymbol{\Psi}}^{FG} = \left[\tilde{\mu}_0^{FG}, \tilde{\beta}_0^{FG}, \tilde{\mu}_1^{FG}, \tilde{\beta}_1^{FG}\right]'$ and obtain the Wald test statistic for a particular break fraction λ_1 as:

$$W_{QF}(\lambda_1) = \frac{\left(\tilde{\beta}_1^{FG}(\lambda_1)\right)^2}{\sqrt{(\tilde{h}_v(\lambda_1)[(\mathbf{X}^{\alpha\prime}\mathbf{X}^{\alpha})^{-1}]_{44})}} \qquad (3)$$

where the subscript QF implies quasi-feasible, and estimated using generalized least squares; $\mathbf{X}^{\alpha} = [\mathbf{x}_1, (1-\tilde{\alpha}_{MS}L)\mathbf{x}_2, \dots, (1-\tilde{\alpha}_{MS}L)\mathbf{x}_T]'$; and $\tilde{h}_v$ is an estimate of 2π times the spectral density function of $v_t = (1-\alpha L)u_t$ at frequency zero (see Perron and Yabu (2009a) for details). Perron and Yabu (2009a) find that with the Exponential functional of the Wald test, the limiting distribution in the I (0) and I (1) cases are nearly identical, and therefore recommend the following Exponential Wald ($ExpW$) statistic to determine the structural break:

$$ExpW = ln\left[T^{-1}\sum_{\lambda_1\in\Lambda_1} exp\left(1/2\, W_{QF}(\lambda_1)\right)\right] \qquad (4)$$

where $\Lambda_1 = [\epsilon T, (1-\epsilon)T]$, and ϵ determines the level of trimming used.

Robust estimation of trends

To estimate the trends in the data, we make use of another test that allows us to be agnostic to the underlying order of integration in the data based on the Perron and Yabu (2009b) procedure. To implement this procedure, we assume the error term u_t in (1) are obtained from the regression of p_t on $\mathbf{x}_t = [1, t]'$. The super-efficient estimate $\tilde{\alpha}_{MS}$ is used to run the quasi-differenced regression given by:

$$(1-\tilde{\alpha}_{MS}L)p_t = (1-\tilde{\alpha}_{MS}L)\mathbf{x}_t'\boldsymbol{\Psi}^0 + (1-\tilde{\alpha}_{MS}L)u_t \qquad t = 2,\dots,T \qquad (5)$$
$$p_1 = \mathbf{x}_1'\boldsymbol{\Psi}^0 + u_1$$

where $\boldsymbol{\Psi}^0 = [\mu_0, \beta_0]'$. We denote the estimate of the trend by $\hat{\beta}_0$, $\mathbf{X}^{FG} = (x_1^{FG}, x_2^{FG}, \dots, x_T^{FG})'$, with $\mathbf{x}_1^{FG} = [1,1]'$, and $\mathbf{x}_t^{FG} = [1-\tilde{\alpha}_{MS}, t-\tilde{\alpha}_{MS}(t-1)]$, for $t = 2,\dots,T$. We then create a $100(1-\alpha)\%$ confidence interval for $\hat{\beta}_0$ which is given as follows:

$$\hat{\beta}_0 \pm c_{\alpha/2}\sqrt{(\tilde{h}_v)\{(\mathbf{X}^{FG\prime}\mathbf{X}^{FG})^{-1}\}_{22}} \quad (6)$$

where $c_{\alpha/2}$ is such that $P(x > c_{\alpha/2}) = \alpha/2$; $\tilde{h}_v$ and v_t being already defined. From the estimate $\hat{\beta}_0$, we denote the corresponding t-statistic due to the Perron and Yabu (2009b) test denoted as t_{PY}.

Data

Quantitative analysis of the general trend in slave prices is possible with recently discovered and compiled data. Most of the past studies have discovered new data in its original sources. Bean (1975) adjusted the raw data and constructed a time series of semi-decadal slave prices from 1660 to 1775. However, the prices relate to adult male slaves and possible significant errors can appear as a result, since the evidence on male slaves is narrower relative to other slaves (see Richardson 1991). Slave price estimates by Curtin (1975) are concentrated on Gambia between 1683 to 1688 and 1727 to 1741. Richardson extended the method by Curtin (1975) to estimate slave prices across the west coast of Africa as well as west-central Africa from 1698 to 1807. Richardson (1991) argues that particular regions on the west coast of Africa, such as the Bight of Biafra, were popular to British traders as they received a higher proportion of women and possibly children compared to other regions over the 18th century. While the slave price series compiled by Richardson (1991) would likely be different to Bean (1975), the estimates of slave prices would relate to the entire British trade as they include slaves from different regions as well as women and children. Richardson (1991) constructs the real prices of slaves as annual time series data over the period 1698 to 1807 and the prices are calculated as the value of goods traded by the British in exchange for slaves. The ratio of the export value of goods by British traders bartered for the number of slaves would yield the price of slaves. The source of the export value of slaves is from the British custom records, in particular Customs 3 and 17 held at the Public Record Office. Likewise, using original sources, Whatley (2018) compiled annual slave prices from 1699 to 1807 and is constructed by taking the ratio of cargo exported to African traders to number of slaves imported by British traders, which is sourced from the Anglo-African Trade Statistics and Transatlantic Slave Trade Database respectively. As documented by Whatley (2018), this 'cargo' is equal to the total exports of British traders less the total commodity exports of African traders, which then comprises of what is used to purchase slaves. This included items that were anticipated to be demanded by African traders, such as textiles, iron bars, metal containers, glassware, cowrie shells, beads, firearms and alcohol (Alpern 1995). Both Richardson and Whatley (2018) compile data on slave prices that are recorded on the west coast of Africa. We further investigate the price of slaves recorded after the slaves were transported to the New World. To this end, we examine continuous data that is

available over the longest period of time and with the fewest gaps, so that it can readily lend itself to time series analysis. The data we choose is from Mancall et al. (2001) which comprises of annual data over the period from 1722 to 1809 recorded from probate inventories in South Carolina[5]. To construct a time series of slave prices Mancall et al. (2001) use slave valuations contained in probate inventories from South Carolina from 1722 to 1775. The data set starts from 1722 as very few inventories are available. The data beyond 1775 is extended by making use of slave valuations collected by Fogel and Engerman (1976). For all three series that we employ in this study, the subsequent analysis is conducted using logarithms of the annual data.

Empirical Results and Discussion

Before considering the estimation of a secular trend, we test for a structural break to ascertain the need for estimating broken trends.[6] We apply the structural break test using the exponential Wald $ExpW$ test statistic due to Perron and Yabu (2009a) on the three slave price data series and report the results in table 1 below.

Table 1. Robust estimation of the deterministic trend break

	Exp-W Statistic	Trend Break Location
P_t^{Slave} (Whatley data)	1.47*	1740
P_t^{Slave} (Richardson data)	9.81***	1740
P_t^{Slave} (Mancall et al. data)	– 0.14	n/a

Note: * and *** denote rejection of the null hypothesis of no trend break at the 10% and 1% significance levels.

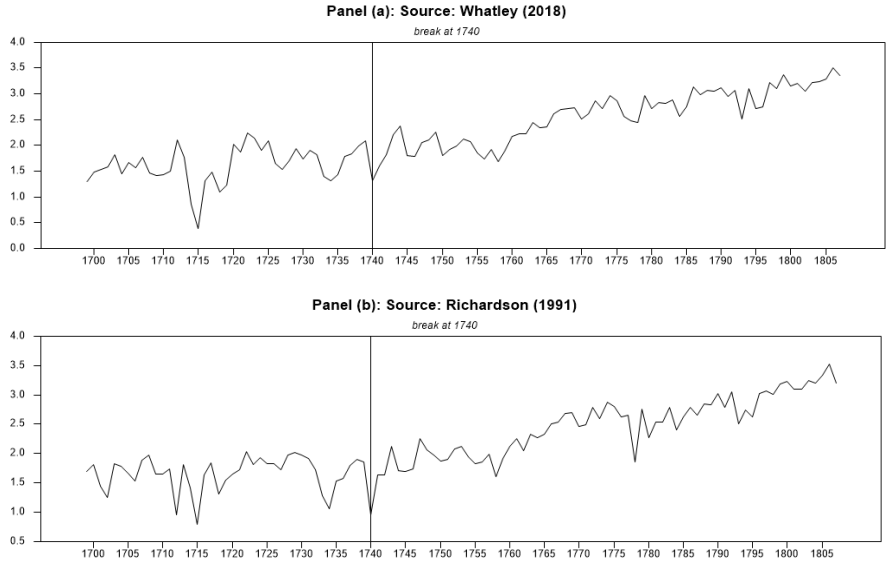
We can reject the null hypothesis of no deterministic trend break for the data compiled by Whatley (2018) where we estimate the $ExpW = 1.47$ which is greater than the critical value of 1.13 at the 10% significance level (see Perron & Yabu 2009a); we can also reject the null hypothesis in the case of the data constructed by Richardson (1991) in a more compelling way at the 1% significance level. Therefore, for slave prices documented from the African coast, we reject the null hypothesis of no break and conclude the presence of a single trend break in the

[5] There is no data between 1774 to 1783, so we used ARMA modelling to make a forecast of the data.

[6] As mentioned before, we also consider the sequential procedure due to Kejriwal and Perron (2010) that allows for more than one break (i.e., $i = 1,2$) . The results show that allowing for the maximum possible breaks to be equal to two, the sequential test settles on the number of breaks to be equal to one. We do not report the results for brevity but are available from the authors on request.

data. For both the data series, we find the endogenously determined trend break to occur in the year 1740. In the case of the slave price data recorded by Mancall et al. (2001) in South Carolina, we find no evidence of any structural break. This result may not seem surprising, as there are insufficient observations prior to the break point estimated for the other two series. As stated previously, this series is not comparable as the number of observations are relatively lower, especially prior to any robust estimation of a possible break at 1740.

Given our location of the break point for the slave price series from the west coast of Africa, we proceed to estimate whether a significant trend exists before and after this break date. We demarcate the sample period into two regimes. We assign the period 1699 to 1740 as Regime I; and 1741 to 1807 as Regime II. In Figure 1, panels A and B show the location of the break point in the slave price data series for Whatley (2018) and Richardson (1991) respectively, and thereby the demarcation of the two regimes before and after the break. In the case of the Mancall et al. (2001) data, shown in panel C of Figure 1, we estimate a secular trend as well as a trend post-1740 to facilitate a comparison with the slave price series compiled by Whatley (2018) and Richardson (1991).



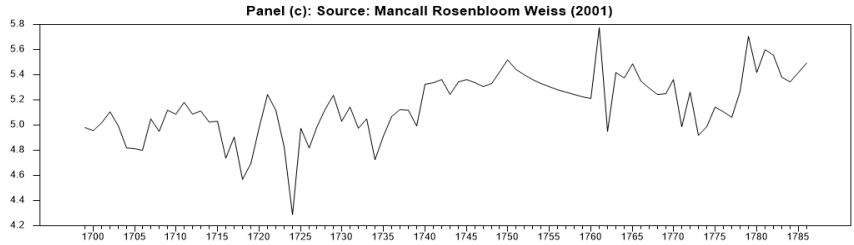


Figure 1. Slave prices.
Notes: The gridline where present, gives the position of the structural break in the deterministic trend of the data.

Table 2 below reports the results of robust trend estimation for all three series. Starting with the data compiled by Whatley (2018), the estimated trend coefficient in Regime I to be positive, (that is 0.72%), but it is statistically insignificant (t-ratio 0.91)[7]. The insignificance of the trend in Regime I, is indicated by the 90% confidence interval around the estimated trend coefficient. Between the lower bound and upper bound of the confidence interval, the trend estimate contains the value of zero, thereby rendering the estimate as being insignificant. In Regime II, however, the trend estimate is positive (2.4%) and statistically significant (t-ratio 9.59). A similar conclusion is drawn from the Richardson (1991) data series. Prior to the break, the estimated trend coefficient is negative, but is statistically insignificant. However, post 1740 the trend estimate is positive (2.32%) and significant. For both the data series, the trend estimate in Regime II is relatively more precise with a tighter confidence interval compared to the trend estimate in Regime I. Therefore, we can conclude, the slave prices in the 18th century did not increase or decrease until 1740. Thereafter, the price of slaves increased at the rate of around 2.3 to 2.4% every year until 1807. Our result of rising slave prices since 1740 lends support to the observations by Jones (1983), Johnson (1966) for West African slaves between 1762 and 1775.

[7] This estimate of the deterministic trend was re-estimated allowing for nonstationary volatility following the procedure by Yang and Wang (2017) and the conclusion is the same. The results are available from the authors on request.

Table 2. Robust estimation of deterministic trend

Whatley data	$\hat{\beta}$ (%)	90% Confidence Interval	Lag	t-stat
P_t^{Slave} (Regime I)	0.72	(–0.58, 2.03)	1	0.91
P_t^{Slave} (Regime II)	2.40	(1.99, 2.81)	2	9.59
Richardson data	$\hat{\beta}$ (%)	90% Confidence Interval	Lag	t-stat
P_t^{Slave} (Regime I)	–0.32	(–1.73, 1.09)	3	–0.37
P_t^{Slave} (Regime II)	2.32	(1.90, 2.74)	2	9.06
South Carolina data	$\hat{\beta}$ (%)	90% Confidence Interval	Lag	t-stat
No break – from 1740	0.91	(0.42, 1.41)	3	3.05
No break – from 1722	0.59	(0.29, 0.88)	2	3.30

Notes: The regimes are set up by the structural break found to be 1740 in the case of slave price data used by both Whatley and Richardson. The lag length is chosen according to the modified Akaike Information Criterion. 't-stat' denotes the robust t-statistic due to Perron and Yabu (2009b).

Richardson (1991) notes that the general trend in cargo outlays per slave varied between £4.4 to £6 over the first half of the 18th century. However, in the second half of the 18th century the outlays per slave increased to £11 and continued to increase further up to £21 per slave. This may have contributed to the rising price of slaves since 1740 onwards. Our finding of broken trends in the price of slaves supports Richardson's (1991) observation that the costs of acquiring slaves were relatively constant in the first half of the 18th century. Nevertheless, as further increases of slave exports took place, the latter half of the 18th century resulted in higher costs of slave acquisition.

The slave price series compiled by Mancall et al. (2001) is shorter, from 1722 to 1809. These are the slave prices that are documented in South Carolina instead of the west coast of Africa and therefore plausibly brings up different results. The slope estimate is lower in magnitude, but statistically significant and positive in sign. This is true for both trend estimates – from the start of the sample at 1722 and from 1740 for comparison with Whatley and Richardson post-1740 trends. The sign is positive, but the magnitude is much lower. From the trend estimates for all three data series, the overall conclusion is that since 1740 the price of slaves increased over time and we estimate this increase to be approximately just under 1% to approximately 2.4% year on year.

A note of caution needs to be made when comparing the data by Mancall et al. (2001) with those of Richardson (1991) and Whatley (2018). Slave traders would factor in the transport costs, as these are landed prices in South Carolina. Arguably these prices would be higher but not necessarily have a higher slope than the prices at the port of origin in West Africa. Furthermore, Eltis et al. (2006) have raised concerns with the compilation of the data set of Mancall et al. (2001) and have

detailed their version. However, their proposed data contains many more missing observations that make time series analysis questionable. For this reason, we are unable to make use of the alternative data set made available by Eltis et al. (2006). Having conducted the econometric analysis of price trends, the following sections document the possible demand and supply side arguments that may have contributed to the underlying trend.

Supply side arguments

Manning (1990) documents that the rising slave exports during the 18th century was accompanied by a decline in the natural population growth of West and West-Central Africa. This decline was particularly acute during the latter half of the 18th century, between 1750 to 1790 (see Manning 1990: 135); a time that is close to the structural break we find in the trend of slave prices. A detailed study of the impact of the slave trade on population decline was undertaken by Price and Whatley (2023). They found that the Transatlantic slave trade reduced African population around 25 percent in comparison with other Africa countries that were not subject to the trade[8].

The continued capture of slaves in a single region could lead to a fall in population for that region, causing a negative shock in the supply of slaves. A King selling his own people to outsiders could threaten his rule. Since his military power is diminished by selling his own people (Thomas & Bean 1974), this would have led to the capturing of slaves becoming more difficult. The supply of slaves from any specific area was becoming increasingly inelastic with respect to price as the capture of slaves increased over time (Thomas & Bean 1974).

Furthermore, neighbouring areas with strong monarchies such as Asante and Oyo were able to gather significant numbers of slaves during this time to supply the New World with higher prices in exchange (Manning 1990: 135). Overall, there appears an overlap between internal conflict in these regions and the increases in slave exports with continuing high prices during the post-1740 period.

During the 18th century, Africa underwent a process of political consolidation, that is, the size of the state expanded[9]. While engaging in slave trade, African princes charged rent from the inland traders in the form of tolls. If the toll charge was high, the inland traders would have to take a longer route to the coast to avoid paying the toll. Nevertheless, in the process higher transportation costs would be incurred, depending on the size of the state and its provisions. A case in point is the King of Whydah, who charged a port fee of approximately 20 to 30 slaves per slave

[8] They also report that the ensuing disruption constrained technological progress and living standards.

[9] It must be noted that African political consolidation did not imply political stability. Whatley (2020) argues that it did create both stability and instability.

ship (Astley 1968). In return for the payments, the King provided storage facilities and military protection. European slave traders would have preferred a quick turn-around time, to save the lives of both crew and cargo. Slave traders preferred to pay this port fee to minimise the time spent on the coast as they feared the outbreak of disease and uncertainty. If storage costs and military protection costs increased over time (post 1740), this would have contributed to the increasing trend in the price of slaves.

From 1750 onwards, there was an increase in the demand for guns manufactured in England for European traders travelling to West Africa. This demand was largely due to the strong preference of slave sellers, intended to capture slaves and march them to the coast or exchange slaves for guns; that is, the gun-slave cycle (see Lovejoy 1982). While guns were imported for slave-gathering (Inikori 1977), it should also be noted that guns purchased for slave-gathering and/or military purposes may also have been put to alternative uses, such as hunting for ivory, or food, or firing during ceremonial occasions (Northrup 1978, White 1971). But for these cases, the demand for guns was much weaker compared to the demand from slave traders (Inikori 1977). As noted by Roberts (1987), the increase in arms after the mid-18th century was the result of people requiring these weapons to enslave and the price of slaves steadily increased, which is also approximately around the time we identify increasing prices.

A more recent assessment of political consolidation is found in Diouf (2004). A number of essays in the edited volume argue that part of the political consolidation was to resist the European slave traders. Access to guns had contrary consequences. On the one hand, it enabled raiding and kidnapping as a form of protection and self-preservation. While, on the other hand, the free people used these weapons to attack slave ships. It inevitably reduced the number of slaves that would have been traded.

Here it is important to emphasize the recent findings of Whatley (2018) in relation to the British slave trade in the 18th century. Whatley (2018) notes that from around 1740 there was a remarkable growth in slave exportation. New regions further west and to the interior of Africa, notably the Bight of Biafra, the Windward Coast and Sierra Leone, increasingly became an important source of slaves for the British traders with the help of the Aro incursion into the densely populated Igbo centre (see Nwokeji 2010). As noted by Whatley (2018), the expansion into the new regions meant that from around 1740 there was an 'explosive growth [in slaves], with British traders leading the way' (Whatley 2018: 100). The increasing demand for slaves from 1740 also led to the expansion of the Asante and Dahomey kingdoms to the coast. Their control of the ports of Accra and Quidah meant these kingdoms also played an important role in the supply of slaves.

Therefore, it could be argued that a clearer structure of supply had emerged in Africa, where strong states raided weaker decentralized villages[10].

In summary, a combination of the decline in population and strategic resistance increased the cost to the European slave traders. Despite a fall in population from selected regions along the west coast of Africa, by venturing into new regions in the hinterland the supply of slaves for the British traders would have increased, albeit at an increased cost. Indeed, there is a strong argument that it was also the strategic resistance resulting from political consolidation and newly acquired weaponry that forced European slave traders further inland and, thereby, increasing costs (see Diouf (2004), pp. xvi). Furthermore, political consolidation also meant that there was a clearer structure of slave supply. The increasing importance of the gun-slave cycle and the dominant role played by Aro traders, who were considered powerful oligarchy traders with access to slaves in the interior and Igbo centre, along with the Asante and Dahomey kingdoms control of slave supply from 1740 would have crucially exerted an upward pressure on slave prices.

Demand side arguments

Manning (1990: 88) notes that slave populations were never able to maintain themselves and this resulted in a continuous demand for new slaves. The majority of slaves were supplied along an approximately 200 miles deep belt along the west coast of Africa (Curtin & Vansina 1964). These belts were populated by scores of different political entities comprising of states and sub-states (Fortes 2018 [1945]). The dense concentration of forts and lodges owned by Europeans along the coast of Africa (which alternated between different nationalities) led to competition among European slave traders thereby precluding any monopsony power as buyers (Thomas & Bean 1974). The number of ships arriving on the African coast was substantial with British slave traders having to bid against other European traders (Thomas & Bean 1974). Our results suggest the arrival of large

[10] Whatley and Gillezeau (2011) purports an interesting hypothesis; the increasing demand for slaves, due to the global demand for sugar, generates greater economic rents for the supply of slaves. Thereby, increasing slave raiding and the desire to control ports that where crucial to slave trading. They maintain that this hypothesis is largely able to explain the expansion of the Asante kingdom from its hinterland origins to the control of the coastal port of Accra and consequently a dominant supplier of slaves to European traders. Lindsey (2014) considered the role of 'extraversion' and the Atlantic slave trade, specifically in the context of large-state predation. Essentially, leaders of a centralised state tried to control important trading sites. Therefore, for example, the kingdom of Dahomey's eventual control of the coastal port of Quidah allowed her leaders to closely supervise and control external trade with Europeans. Likewise, the Aro traders who established an extensive trading network in the Bight of Biafra.

numbers of ships on the African coast may have accelerated after 1740 and this increased demand for slaves contributed to the upward trend in prices. Europeans were not allowed defensible coastal forts and no monopoly rights were given to any European nationality (Akinjogbin 1963) as African rulers were aware that high prices for their slaves depended upon the bidding between Europeans (Thomas & Bean 1974).

The staple crop industries in colonial America increased in size but was largely competitive as there were large number of producers, with easy entry and exit from the market producing a homogenous good (i.e., sugar, tobacco).[11] However, Manning (1990: 96) describes the competitive model to be 'anarchic' as the entry and exit was transitory and erratic. Sugar production mostly took place in Barbados in the early 18th century. However, the number of plantations increased significantly when the largely undeveloped Jamaica accounted for a significant number of plantations by the late 18th century (Long 1774). The number of slaves working in tobacco plantations grew from a few hundred to several thousand (Thomas & Bean 1974). Over the 18th century as tobacco and sugar plantations grew, so did the demand for land to grow these crops. For example, Jamaican land was free from 1655 to 1670 but gradually increased to £4 to £5 per acre by the end of the 18th century (Dunn 2012). In 1700, the value of sugar plantation output in the whole Caribbean stood at an estimated £1.7 million and over the next 70 years it quadrupled in real terms. By 1850 it had increased by ten times (Eltis et al. 2005). From 1674 –1699 to 1780–1807, real sugar prices increased by 54 per cent, while the price of newly-arrived male slaves rose by 141 per cent (Eltis et al. 2005).

Demand and Supply Interaction and the variability of prices

Having analysed the sign and magnitude of the trend in slave prices for Regime I and Regime II, we now proceed to consider the variance profile for these two regimes.

The procedure due to Cavaliere and Taylor (2007) provides a graphical approach to establish whether there exists time varying variance in the data series. The variance profiles for slave prices for both regimes are shown in Panels A and B for the Whatley series, and Panel C and D for the Richardson series in Figure 2 below:

[11]Our findings contradict Thomas and Bean (1974) inference. They argue that the competitive nature of staple crop production, planters were only able to secure normal profits and, therefore, the slave price would only increase up to the point where supernormal profits were eliminated.

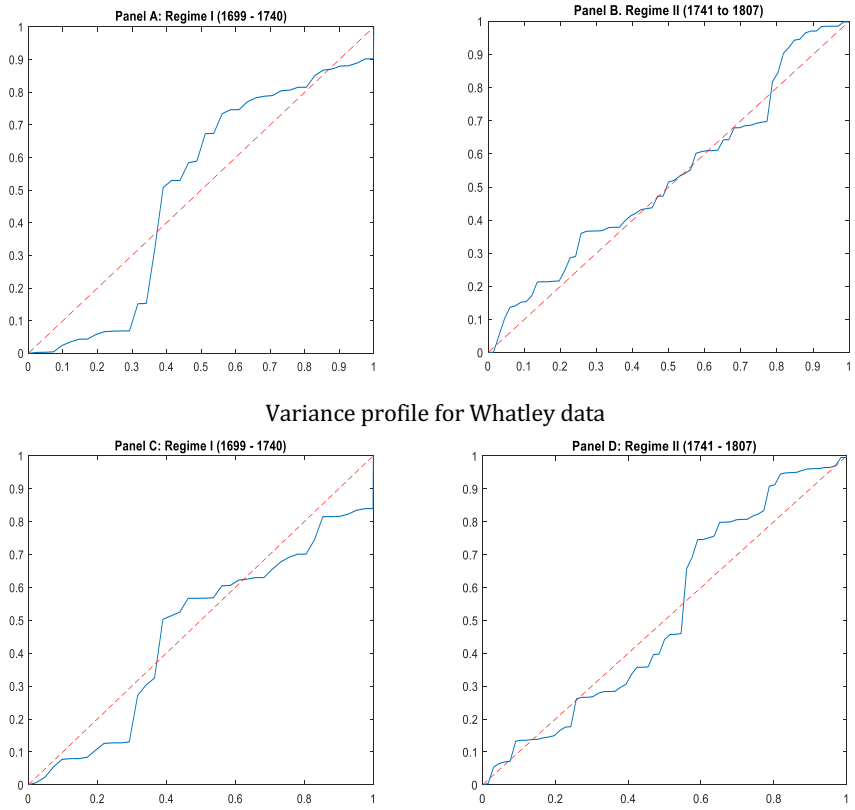


Figure 2. Variance Profile. Notes: The dashed diagonal line in the figures represents the constant variance process. For slave prices in Regime I, we find the variance profile shows persistent deviation from this dashed line which signals time varying variance. In comparison, the slave prices in Regime II are closely aligned to the dashed line showing near constant variance.

The dashed diagonal line in each of the figures represents a constant variance process. The solid line moving around the dashed line is the variance profile of the data. If slave prices straddle around the dashed line very closely, that would be an indication of prices being close to constant variance. Using the data from Whatley (2018), we find evidence of persistent deviation from this dashed line in Regime I, which signals time varying variance. In contrast, the deviation from the dashed line is much lower in Regime II, reflecting a much closer to constant variance. Besides, the calculated variance in Regime I is found to be 0.13 compared to 0.04 in Regime

II.[12] In contrast, the Richardson data shows no significant difference in the variance profile for the two regimes. We contend that this is primarily due to the construction of the data series. As we have alluded earlier, Richardson (1991) has acknowledged that the estimates of the export figures and number of slaves would need to be treated with caution with regards to the variability of slave prices (see Richardson 1991: 33).

The growing importance of guns and weaponry, that is the 'guns-for-slaves in exchange' and 'guns for slaves in production' (see Whatley 2018), had two effects, that may have contributed to the lower variability since 1740. Firstly, as Whatley (2018) points out, is the share of weaponry in British cargo increased steadily in the mid and late 1700s. The type of goods exchanged for slaves narrowed with weaponry playing an increasingly significant role. The second effect, as the demand for slaves increased in the mid-18th century, a clearer structure of slave supply to European traders emerged. As a result of the 'guns-for-slaves in exchange' and 'guns-for-slaves in production', the supply was increasingly controlled by the highly militarised Asante and Dahomey kingdoms and Aro traders, who were able to exercise monopoly powers causing slave price to increase.

As the British expanded their trade further interior, especially into the Bight of Biafra, they increasingly relied on the Aro for trading in human cargo. The fearsome reputation and position of the Aro traders in this region had already been well established (see Njoku, 2016: 31). The Aro traders soon became the dominant supplier of slaves to British traders. They also accelerated the importance of gunpowder as an exchange for slaves (once again, see Njoku, 2016: 37). Hence, the increasingly importance of gunpowder in exchange of slaves, may have reduced price variability post-1740.

The interaction of slave demand and supply since 1740 increased the impact of the guns-for-slaves in exchange as well guns-for-slaves in production. As the global demand for sugar increased over this period, the derived demand for slaves increased too. Consequently, the importance of guns for slaves in exchange as well as production increased. This, in turn, changed the supply structure of slaves resulting in monopoly power leading to increasing prices over time; the increasing share of guns in the interaction of demand and supply may have contributed to reduce slave price variability.

[12] The correlation coefficient between slave price and quantity of slaves can be used to make inferences about the variance in slave prices. For example, the correlation coefficient is low, equal to 0.157 in the period prior to 1740; and then relatively higher, equal to 0.484 in the period post-1740. However, this observation needs to be treated with caution as the quantity of slaves is used in the construction of slave prices.

Concluding Remarks

The present analysis makes a few important findings with significant contributions to the ongoing debate pertaining to the British Transatlantic slave trade. The year 1740 appears to be a significant point for the British slave trade. We find that the price of slaves from the west coast of Africa was roughly constant with large variability from the start of the 18th century to around 1740. Thereafter, the price of slaves grew steadily at the rate of approximately 2.4% year on year with near constant variance. When compared with the price of slaves landed in South Carolina, we find that post-1740 the trend is positive, but the magnitude of price increase is much lower being just under 1% year on year.

This increase in slave prices post-1740 can be inferred from various accounts by historians. Though the interpretation of historians may differ, a variety of reasons support this steady increase in prices. Some of the key reasons discussed earlier are that while the African population in some regions declined dramatically, around this period the British increased its slave imports by expanding further west into the interior. Therefore, it is not obvious that the source of human cargo necessarily declined. Regardless, the cost associated with 'slave production' increased as fees and tolls were imposed. To understand why the price of slaves increased by 2.4% annually since 1740, one might consider the capture cost of slaves, which may have risen, and possibility that the productivity of African slaves increased too. It is unlikely that productivity increased by the rate of 2.4%, rather the costs of capturing slaves are more likely to have contributed to the increase in slave price.

In addition, with regards to the British slave trade, the oligarchic Aro traders became dominant suppliers of slaves from the new regions and the use of weaponry as a form of exchange gained more significance. The overall supply of slaves to European traders were also dominated by the Asante and Dahomey kingdoms. It is worth noting that the Dahomey kingdom had an extensive and long-standing relationship with Portuguese traders, which included embassies in Bahia, Brazil, and Portugal (see, Araujo (2012) for a detailed account). This would have reduced price variability and increased the price of slaves. Probably, the most important element in the post 1740 period is the demand for slaves. There was an increased demand for slave labour to work on plantations that were expanding with increasing demand of crops such as sugar and tobacco, and the anticipated capital gain from buying increasing numbers of slaves; all of which contributed to the increasing trend in slave prices.

It is worth noting that the average price for slaves included groups that were mixed in terms of age and sex composition which varied over time (e.g., the ratio of men to women on the west coast of Africa declined as the export of slaves grew; (see Manning 1990). This could have contributed to the price increase as female slaves were taken off the export market by African slave traders. Indeed, the prices

of slaves could have varied significantly along the west coast of Africa. A further investigation of slave prices based on age and sex composition as well as geographical location, would be an area of future research.

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