

# The Impact of the Slave Trade on African Economies

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## Abstract

This paper has three parts. The first part presents econometric evidence showing that increases in the international demand for enslaved Africans induced a reallocation of resources in Africa towards slave production and away from other economic pursuits. In the second part, we use this evidence to help specify a theoretical model of conflict and cooperation in Africa before and after the slave trade. Our goal is to reveal the conditions under which the slave trade not only reallocated resources, but also produced several externalities thought to impede long-term development in Africa. These include constraints on the growth of African states, increases in ethnic and social stratification, and a sustained culture of violence. In the third part of the paper, we test the predictions of this model against the history of the Asante Empire (present-day Ghana). We find that the model explains Asantes origins and expansion well, including the Asante Alliance, the causes and timing of territorial expansion, and the “southern problem.”

## 1 Introduction

What was the impact of the transatlantic slave trade on African economies and societies? Traditional answers to this question have tended to focus on depopulation. Studies by Manning (1990), and McEvedy and Jones (1978) conclude that the slave trade slowed population growth in Africa and may have even reduced the aggregate population between 1700 and 1850. But the causal impact of population growth on development is difficult to assess. Instead, in this paper we focus on the impact of slave production, and the associated externalities, on the development process broadly conceived. Orlando Patterson (1982) calls the production of slaves the production of “social death.” It is a violent process where a person is brought to the brink of

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death, spared and then ritualistically put to social death, left to owe the remainder of his life to another person. One would think that centuries of producing social death would leave a mark on social outcomes and institutions, some with lasting consequences for development. First of all, slave raiding disrupts production and social life in general. Where slave raiding is frequent, ethnic boundaries and the ability to distinguish insider from outsider might proliferate as people struggle to manage the risk of being caught. Similarly, an increase in the profitability of slave raiding might induce elites to raid for slaves rather than build powerful states, further exacerbating the destabilizing effects of slave production.

How widespread was slave production in Africa? It is impossible to know with any degree of confidence, but we venture a guess. Between the 16th and 19th centuries more than 13 million slaves were produced in Africa and transported across the Atlantic. 77 percent of these slaves (10.1 million) were produced along the West and West Central coasts of Africa during the 150 years between 1701 and 1850.<sup>1</sup> In 1700, the estimated population in this region of Africa was 28 million people (McEvedy and Jones, 1978, pp. 241-249). If the average life span was 30 years, then the 10.1 million slaves were produced over five lifetimes. That yields 2.6 million slaves produced per lifetime, or 9.3 percent of the total population. If we take into account collateral damage then the probability of being a victim of slave production increases further. Slave producers killed and injured others to capture their slaves. Captives died during the long trek to the coast, in the holding pens along the coast, and during the Middle Passage. And many captives remained in Africa. The physical and social deaths needed to produce 13 million slave exports could have easily reached twice that number.<sup>2</sup> We believe it is appropriate to characterize this situation as a “reign of terror.”

What impact did this production of social death have on Africa? We are surprised there is not a larger economic literature on this topic.<sup>3</sup> Was the violence continuous and wide-spread, or was it sporadic and confined? Did slave production encourage state growth, or did it impede it? Did it increase social stratification and social conflict, or did it encourage defensive co-operation and coalition-building? Was the impact on Africa temporary and fleeting or did it persist for a long period of time? Finally, does seeing this period as a reign of terror help us understand the path of development in Africa since then? These are the questions that we begin to address in this paper.

We have no illusions of answering these complex questions in their entirety. Rather, we have two modest but important goals in mind. First, we wish to contribute to the empirical evidence that suggests that the

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<sup>1</sup>All slave trade quantities are calculated from the *Transatlantic Slave Trade Database* at [www.slavevoyages.org](http://www.slavevoyages.org).

<sup>2</sup>The experiences and observations of Olauda Equiano are instructive. Equiano was born and raised in Igboland behind the Bight of Biafra (southeast Nigeria). He was captured sometime in the 1760s, later became a leading figure in the British abolition movement and wrote the narrative of his life. In it, he recounts two attempts to capture him. The second attempt was successful. He also remembers frequent battles in the common fields where neighboring villages would fight and capture each other on a regular basis (Equiano, 1995, pp. 37-48).

<sup>3</sup>An important but overlooked article is David Eltis (1990). Eltis uses heights of Yoruba captives as a measure of Yoruba welfare and finds that “for every increase in slave departures (exports) of 1,000, mean heights of the birth cohort declined by more than one fifth of a centimeter (p. 519).”

slave trade actually altered the path of development of African economies. Nathan Nunn (2008) is the only study that we are aware of that addresses this question empirically. We contribute to this line of research by conducting a direct test, one that does not rely on the assumption that African ethno-linguistic classifications are exogenous and unchanging. We ask: Did changes in the level of demand for enslaved Africans alter the allocation of African resources, broadly conceived, away from competing uses and towards the capture and trade of people? If the international demand for enslaved Africans did not influence resource allocation within Africa then it is hard to imagine the international slave trade altering African paths of development. We find, however, that the international slave trade did alter resource allocation in Africa. As the foreign demand for enslaved Africans increased, Africans responded by capturing and exporting more people. We call this a situation of effective demand, in the sense that the international demand for enslaved Africans effectively altered the direction of economic activity in Africa.

By focusing on effective demand we do not mean to argue that “external” events caused African underdevelopment.<sup>4</sup> Nor do we mean to deny that “internal” African dynamics were part of the story.<sup>5</sup> We take demand as exogenous because Africans slave producers were price takers and we want to assess their responses to changes in price. The relative strength of supply (internal) and demand (external) in determining the nature and extent of the African response is an empirical question. In fact, as we shall see in this paper, the necessary condition for external demand to have an impact on Africa is that the supply curve be positively sloped. In other words, in order for external factors to have had an impact on African economies, Africans must have responded to the external stimulus. This is what Patrick Manning (1983) refers to as “Africa engaged.”

The second goal of the paper is to trace out the impact of effective demand on the structure of African economies and societies. When the international demand for enslaved African rises it essentially increases the value of people in trade relative to their value in production. The very first resource reallocation is the devotion of more resources towards uprooting people. In other words, there is an increase in the economic returns to slave raiding. We develop a simple model of cooperation and conflict between nations and villages in order to trace out the impact of effective demand on several institutions thought to influence economic development. The model reveals the conditions under which the slave trade reduced the size of states, increased social and ethnic stratification and created a reign of terror. The model can also roughly trace out the impact of changing slave prices and capture technology on these features of African economies and societies. One should think of these as externalities of slave production.

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<sup>4</sup>For examples of the external school see, Walter Rodney (1972), Basil Davidson (1961, 1968), William Darity (1982) and Nathan Nunn (2007, 2008).

<sup>5</sup>For examples of the internal school see John Thornton (1998), Klein (2007) and Engerman and Genovese (1975).

## 2 The Slave Trade and African Development

A discussion of the impact of the slave trade on Africa must begin with Walter Rodney's book, *How Europe Underdeveloped Africa* (1972). Rodney argues that the slave trade fundamentally altered African economies. First, the slave trade discouraged state-building and encouraged slave raiding. It encouraged the capture of slaves for sale and discouraged the capture of land and the cultivation of a citizenry for the purposes of taxation. Quoting Rodney, "...there have been times in history when social groups have grown stronger by raiding their neighbors for women, cattle, and goods, because they then use the "booty" from the raids for the benefits of their own community. Slaving in Africa did not even have that redeeming value. Captives were shipped outside instead of being utilized within any given African community for creating wealth from nature (page 100)." And, "[i]f the prisoners were to develop into a true serf class, then those prisoners would have had to be guaranteed the right to remain fixed on the soil and protected from sale (page 118)."

There is some empirical support for Rodney's underdevelopment thesis. Looking at the relationship between GDP per capita today and participation in the slave trade centuries ago, Nunn (2008) finds that the slave trade had a negative long-term effect on economic performance. He also presents preliminary evidence which suggests that the legacy of the slave trade operated through increased ethnic diversity and underdeveloped political structures. Studies of contemporary Africa tend to support the view that ethnic diversity and underdeveloped states have contributed to Africa's poor economic performance in the post World War II period. Easterly and Levine (1997) argue that a quarter of the difference between the post-WWII growth experiences of African and Asian economies can be explained by the greater ethnic diversity in Africa. Perhaps centuries of slave raiding increased the cultural value of being able to quickly and easily distinguish friend from foe. Bates (2008) argues that the predatory nature of the post-colonial state in Africa created political and military challenges to its authority. When the challenges intensified, ethnic stratification also intensified to the point where "things fell apart." Again, it is not difficult to imagine centuries of slave raiding producing predatory political cultures and ethnic stratification. What might at first seem "natural" or exogenous about African ethnicity and political culture may actually be endogenous when viewed within the context of centuries of slave raiding.

There are alternative views. David Eltis (1991) argues that the slave trade was a small share of Africa's economic activity and, therefore, could not have caused major social or economic disruptions. This is an empirical question on which there has been little serious quantitative research. In addition, the negative externalities of slave production could have swamped the private costs, a point we return to later in this paper.

John Fage (1969) argues that the slave trade encouraged the consolidation of political states and favored economic development in the long-run. Again, this is an empirical question. Our model predicts unambiguously that rising slave prices reduce the incentive to build states. By implication, we argue that the states

that emerged in 18th century Africa would have been larger in the absence of the slave trade. Our model also predicts the conditions under which a “Fage” effect might appear.<sup>6</sup>

John Thornton (1998) argues that the production of slaves was primarily a byproduct of internal African struggles – an outcome of Africa’s indigenous economic and political evolution rather than a product of an exogenous shock like effective demand.<sup>7</sup> This, too, is an empirical question that we address in this paper. Philip Curtin (1975) sits on the fence and calls for an empirical test to distinguish between what he calls a “political warfare” model of slave supply versus an “economic” model of slave supply. In this paper we perform precisely this test.

### 3 A Test For Effective Demand

Did changing international demand for enslaved Africans increase the production of social death in Africa? The answer depends on the elasticity of the slave supply function. Curtin (1975) calls this a test for the economic model of slave supply, as distinct from the political warfare model of slave supply. The political warfare model implies that most African slaves were by-products of indigenous political struggles that were unrelated to the international demand for enslaved Africans. According to this view, one should think of enslaved Africans as captives of wars who were exported rather than killed. They are sometimes called “joint-products of war” or “stolen goods,” but always thought of as the products of activities unrelated to the American demand for slave labor.

The political warfare model is depicted in Figure 1 by the perfectly inelastic supply curve. Supply is insensitive to price and is determined by indigenous political struggles. The level of international demand does not influence the quantity of slaves produced. It merely allocates the politically-generated supply of slaves among the competing European ships docked off-shore at any point in time. This is the supply process often pronounced by African Kings. Ose Bonsu, King of Asante proclaimed: “I can not make war to catch slaves in the Bush, like a thief. My ancestors never did so. But if I fight a king, and kill him when he is insolent, then certainly I must have his gold, and his slaves, and the people are mine too (DuPuis, 1824, p. 163).” We do not believe that Ose Bonsu was unique in his belief that capturing slaves was only a secondary goal of warfare.

On the other hand, if African producers of slaves responded to economic incentives then increases in demand should increase the number of slaves appearing on the coast for export. This is Curtin’s economic model and is depicted in Figure 1 by the positively sloped supply function. When wars and raids were carried

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<sup>6</sup>In our model, the Fage effect comes through when the people have the power to make the elites protect them, or when the elite operate to maximize the welfare of their people rather than their own welfare, or when the cost of forming alliances is small.

<sup>7</sup>Also see Klein (2007) and Engerman and Genovese (1975).

out with an eye to sell captives, private costs could be substantial. These include the lives and resources lost during incursions and the cost of transporting captives to the coast (food, guards, shackles, tolls, taxes, etc). Over time, capture and marketing activities became specialized regionally, with coastal states emerging to extract rents of location as the trade passed through to the coast (Evans and Richardson, 1995). Khan (2002, p. 56) collects estimates of these costs and finds that coastal prices exceeded interior prices by as much as 400%. The economic conception of the African supply process emphasizes these economic considerations.

The data for our test come from the British transatlantic slave trade and are described in detail in the Appendix. The British trade was primarily an 18th century trade and occurred at the height of the slave trade. Select demand-side covariates are reported in Figure 2. We take sugar production on British American colonies to be correlated with the British demand for African slaves.<sup>8</sup> The increases in the demand for slaves outstripped supply after 1750 and drove up slave prices on the coast of Africa. In 1750, the real price was a little more than five pounds sterling. By the end of the century, it was in excess of twenty-five pounds sterling. Any price effect on African economies should have intensified in the latter half of the 18th century.

To secure labor for American plantations, European ships set sail for the coast of Africa laden with manufactured goods, textiles, iron, tobacco, rum, firearms and other goods. These goods were carefully chosen to meet the preferences of African consumers, whose preferences were known to vary by location. These goods were sometimes exchanged for products like ivory, palm oil and gold, but by the 18th century the main cargo was slaves. Most British slave ships secured their slave cargoes in one or two ports, after which they set sail for the New World where the slaves were sold at auctions. From there the voyage carried plantation staples like tobacco, sugar, and cotton to Europe where the books were cleared and the process begun anew. This triangular trade took approximately one year to complete.

Below is the supply and demand system of equations that the British data allow us to estimate. The data are annual data for the British trade covering the years between 1699 and 1807. All slave transactions take place on the coast of Africa.  $SlaveQ$  is the annual quantity of enslaved Africans boarding British ships.  $SlaveP$  is the average annual real slave price paid by British slave merchants on the coast of Africa. Gunpowder is the pounds of British gunpowder imported into Africa per year. EXP is the real value of the annual British exports that are exchanged for slaves on the coast of Africa.  $SugarQ$  is the annual quantity of sugar produced in the British colonies.  $SugarP$  is the average annual price of sugar in Amsterdam or London. Supply shifters are gunpowder imports into Africa and the passage of time. Demand shifters are net British exports to Africa, sugar prices in Europe, sugar quantities produced in British America, wars

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<sup>8</sup>The use of slaves on sugar plantations goes as far back as Venetian and Genoese sugar colonies on Mediterranean possessions like Cyprus, Crete and Egypt. There, the slave force consisted primarily of enslaved Berbers from North Africa. In the hands of the Portuguese, the sugar plantation expanded into the Atlantic Ocean, first to Madeira, then down the coast of Africa, and from there across the Atlantic to Brazil. By 1650 the Dutch had successfully transplanted the technology from Brazil to Barbados, and from there it spread throughout the Caribbean, with Jamaica and Haiti becoming the largest producers of the 18th century. See Deere (1950).

(the Napoleonic, American Revolutionary and Seven-Years wars) and the passage of time.

$$SlaveQ_t = \beta_1 SlaveP_t + \beta_2 Gunpowder_t + \beta_3 Time + \mu_{St} \quad (1)$$

$$SlaveQ_t = \phi_1 SlaveP_t + \phi_2 Exp + \phi_3 SugarQ_t + \phi_4 SugarP_t + \phi_5 War + \phi_6 Time + \mu_{Dt} \quad (2)$$

We test for a positive slope to the supply curve. To do this we estimate the reduced form quantity equation to see if year-to-year increases in demand-side covariates are correlated with year-to-year increases in slave exports.<sup>9</sup> First, we express slave price as a function of slave exports and the exogenous covariates. We then equate supply and demand prices to get equilibrium quantities:

$$D(SlaveQ^*, Exp, SugarQ, SugarP, War, t) = S(SlaveQ^*, Gunpowder, t). \quad (3)$$

We then solve for the equilibrium level of slave exports as a function of exogenous covariates:

$$SlaveQ^* = H(Exp, SugarQ, SugarP, War, Gunpowder, t). \quad (4)$$

If the supply function is perfectly inelastic, as the political warfare model predicts, then year-to-year shift in demand-side covariates should not produce year-to-year changes in equilibrium quantities.<sup>10</sup> To test for this we totally differentiate  $Q^*$ ,

$$dQ^* = \sum_i \frac{\partial H}{\partial x_i} dx_i \quad (5)$$

and estimate the function

$$dQ^* = \alpha_1(dExp) + \alpha_2(dSugarQ) + \alpha_3(dSugarP) + \alpha_4(dWar) + \epsilon \quad (6)$$

where  $dx$  denotes the year-to-year changes in variable  $x$ .

Table 2 reports regression results of year-to-year changes in equilibrium quantities on year-to-year changes in the exogenous covariates. The top panel reports results for the linear specification. The bottom panel reports results for variables measured in natural logs. They show that the equilibrium quantities of slaves

<sup>9</sup>We thank Gary Richardson for suggesting this approach.

<sup>10</sup>Refer to Figure 1.

captured and exported by Africans responded to short run fluctuations in the British demand for enslaved Africans. In other words, the short-run supply curve has a positive slope. For example, British wars reduced the level of British demand for slaves and depressed equilibrium prices on the coast of Africa. Africans responded by capturing and selling fewer slaves. Similarly, increases in the level of British exports to Africa increased the British demand for slaves and drove up equilibrium slave prices. African slavers responded by capturing and selling more slaves to the British. The average short-run elasticity of supply with respect to British exports to Africa is .43. According to the point estimate, a doubling of British exports to Africa increased the number of slaves showing up on the coast by 43 percent. We therefore conclude that the level of international demand for enslaved Africans had a large and significant impact of the allocation of resources towards slave production in Africa.

## 4 The Guns-For-Slaves Debate

These regression results also contain support for the guns-for-slaves hypothesis. Gunpowder is used in the production of slaves. More gunpowder increased capture capacity and the supply of African slaves, which depressed the equilibrium slave price. British slavers responded by purchasing more slaves from Africans. According to the regression coefficients, a doubling of gunpowder exports to Africa increased by 12.8 percent the number of slaves captured and exported.

Since the primary effect of effective demand is an increase in desired violence and raiding, one should not be surprised that firearms occupy a special place in the transatlantic slave trade. The early Portuguese were quick to display the power of their weaponry and Africans quickly realized the value of the new technology. Sales were sporadic in the early years because the Portuguese were subject to prohibitions against the sale of guns to non-Christians. When Protestant nations came to dominate the trade, the amount of guns sold increased dramatically. Inikori (1977) estimates that more than 20 million British guns were imported into Africa between 1750 and 1807.

The correlation between the growth of guns and the growth of slave exports is undeniable. The guns-for-slaves controversy revolves around causality and the social processes at the local level. Northrup (2002, pages 90-102) provides a comprehensive critical overview of the evidence. His reading of the literature leads him to conclude that the correlation exists, even at the local level, but that the evidence does not support the claim that Africans sold slaves to purchase guns. We offer an alternative interpretation, one that places the debate within the context of effective demand.

A famous study by Kea (1977) examines the import of firearms and the rise of the Asante nation along the Gold Coast of Africa in the late 17th and early 18th centuries. Kea shows that firearms imports revolutionized military strategy along the Gold Coast precisely when slave exports increased, but Kea is hesitant to support



a guns-for-slaves cycle because militarization was underway before the acceleration in firearms imports.

In the Bight of Biafra among the Aro trader group, Northrup (2002) finds firearms imports to be correlated with slave exports, but hesitates to support a guns-for-slaves cycle because state warfare was not the major source of slaves coming out of this region. Rather, “most slaves were victims of kidnapping... Coastal traders and rulers formed gun-toting entourages and sometimes engaged in raids, but there is no record of wars of state expansion or of military slave raiding as on the Gold and Slave Coasts, Senegambia and Angola (96).”

In Angola, Joseph Miller (1988) argues that firearms empowered Africans to expand their assault against their neighbors, but he hesitates to endorse a guns-for-slaves cycle because guns did not dominate military actions. Even in the case of Dahomey, where there is direct evidence that a massive export of slaves paid for the guns that permitted Dahomey to expand, Northrup (2002, p. 94) is unwilling to accept a guns-for-slaves cycle because this is not how rulers saw it.

True, guns did not create the slave trade. The effective demand for slaves is the primary motivation for slave capture, not guns. The introduction of guns, however, did result in an increase in the equilibrium level of desired aggression. Guns “lubricate” the trade (Miller, 1988). They shift the slave supply function by introducing a new technology to wealthy and organized societies that can extend their advantage over weaker societies. Placing guns within the context of effective demand can also help explain why guns seem to arrive after militarization has begun. Effective demand increases the incentive to militarize. Guns are but one way among many to accomplish this (Hawthorn, 2003).

## 5 The Impact of Effective Demand: A Model of War and Raiding

In this section, we develop a simple model showing how effective demand may impact the structure of African societies. The model is simple, but generates powerful results and insights. The players are the rulers of nations and villages who interact over an infinite time horizon in sequential play. We make this assumption because the slave trade lasted for centuries. Nations have the ability to attack villages to either conquer them or raid for slaves, but nations are unable to attack other nations. We define war as aggression for the purpose of acquiring people and territory (state-building). We define raiding as aggression for the purpose of acquiring people only (for the slave trade). Nations may decide to go to war, to raid or to do nothing. Villages may form defensive alliances against aggressive nations or offensive alliances, but there is a penalty for doing so. It reflects either the loss of independence or the cost of cooperating with outsiders. If a defensive alliance is formed the villages may not be attacked by a nation. If an offensive alliance is formed the alliance-villages may raid non-alliance villages. Villages may also choose to do nothing.

We assume that villages and nations are absolutist in the sense that the community leaders (elders, chiefs or kings) have the absolute authority to make decision for the people when it comes to war or raiding,

and that this authority derives from the elite's claim to land, be it legitimized by oral history, lineage or religion.<sup>11</sup> The assumption of absolutism has several important implications. First, decisions are made to maximize the elites' utility, not the people's utility. These are not democracies. Second, if the land of a village is captured in a war then the victor claims his right to the land by deposing of the elite. In other words, the chief is beheaded. Raiding is for slave bodies but war is for elite heads.

Finally, we assume diminishing returns to war and constant return to slave raiding, but the results hold so long as the returns to raiding decline slower than the returns to war. This is a reasonable assumption because the territory accumulated in war must be protected from outside aggressors. It must be policed and administered internally. Taxes must be collected. Communications networks and roads must be built and maintained. Rebellions in the outer provinces must be put down. The marginal cost of maintaining state territory obviously increases with the size of the territory.<sup>12</sup>

Raiding, on the other hand, is hit-and-run. There is no need to deploy an occupying force or construct infrastructure. Diminishing returns may set in as populations migrate to avoid raiders, or as victims adopt other defensive strategies.<sup>13</sup> However, it is unlikely that traveling 50 miles inland to raid for slaves will add more to the cost of acquiring surplus than does defending, integrating and administering a political outpost that is 50 miles further inland.

The complete assumptions for the model are listed in the Appendix. In the following three subsections we present the predictions generated by the model under different scenarios in the presence and absence of effective demand for slaves. The first scenario is the simplest and includes a single nation and a single village. In scenario two, we extend the first scenario to a single nation and many villages with a high alliance formation penalty. The third scenario includes a single nation and several villages with a low alliance formation penalty.

## 5.1 Scenario One: One Nation and One Village

In our first scenario, we consider the most basic possible situation in which the presence of effective demand influences the behavior of an African state. In this scenario, there is a single nation and a single village which share a common border. We define the nation's labor force as  $L_n$  and the village's labor force as

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<sup>11</sup>Again, the best description is offered by Equiano: "When a trader wants slaves, he applies to a chief for them, and tempts him with his wares. It is not extraordinary, if on this occasion he yields to the temptation with a little firmness, and accepts the price of his fellow creatures' liberty, with as little reluctance as the enlightened merchant. Accordingly he falls on his neighbor, and a desperate battle ensues (Equiano, 1999, p. 40)."

<sup>12</sup>See Wilks (1975), chapters 1-4 for a discussion of the enormous effort to build and maintain the Great Roads of Asante, and the administrative and communication cost of ruling the Asante empire.

<sup>13</sup>See the collection of articles in Diouf (2003) for examples of defensive strategies including: relocating in swamps, abandoning villages, changing crops, changing architecture, building walls around cities and organizing local militia and defensive alliances among villages.

$L_1$ . We also define the nation's labor productivity as  $b_n$  and the village's labor productivity as  $b_1$ . We have defined the ruler's utility function to be logarithmic in produced goods (where the value of produced goods in each region is labor productivity times the regional labor force) minus a fixed cost if aggressive action is undertaken ( $X$  is the cost of war, which is greater than  $S$ , the cost of slave raiding) plus an additional term  $paL_i$  if slaves are captured, which is revenue from slaves captured. Thus, the lifetime utility function if a nation does nothing in all periods, raids in all periods, or goes to war in the first period (and then does nothing) is as follows:

$$U(\text{Nothing}) = \frac{\log(b_n L_n)}{1 - \delta} \quad (7)$$

$$U(\text{Raiding}) = \frac{\log(b_n L_n) - R + paL_1}{1 - \delta} \quad (8)$$

$$U(\text{Conquest}) = \frac{\log(b_n L_n + b_1 L_1)}{1 - \delta} - X \quad (9)$$

In the absence of effective demand, which we represent as a slave price equal to zero ( $p = 0$ )<sup>14</sup> there exist two possible outcomes in equilibrium: the nation may either conquer the village in the first period or choose to take no aggressive action and simply produce goods. The nation will never choose to conquer the village after the first period because it faces the same payoff decision in each period. To determine whether the nation will choose to conquer the village or simply produce, we compare the lifetime utility derived by the rulers of the nation in the two situations (conquering the village versus producing). The nation will choose to conquer the village if the lifetime utility obtained by conquest is greater than that obtained through production:

$$\begin{aligned} U(\text{Conquest}) &\geq U(\text{Production}) \\ \frac{\log(b_n L_n + b_1 L_1)}{1 - \delta} - X &\geq \frac{\log(b_n L_n)}{1 - \delta}. \end{aligned} \quad (10)$$

Thus, the nation will conquer the village if the one-time cost of conquest, which we define as  $X$ , is less than the discounted lifetime utility added through conquest (meaning that there is a net benefit to war):

$$X \leq \frac{\log(b_n L_n + b_1 L_1)}{1 - \delta} - \frac{\log(L_n)}{1 - \delta}. \quad (11)$$

As long as there is a net benefit to war, the nation will choose to conquer the village in the first period. This results in an increase in the size of the nation, as it incorporates the village. If the inequality does not

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<sup>14</sup>Or, in other words, there is no external market for slaves. Thus, it may be appropriate to think of this model as before and after the beginning of the international slave trade. Instead of a starting slave price of zero, the results are identical if, in the absence of effective demand,  $paL_1 < R$  and in its presence  $paL_1 > R$

hold (meaning that there is not a net benefit to war), the nation will do nothing and a peaceful equilibrium will be maintained.

If we introduce effective demand into the above scenario the equilibrium may be altered if there is a net benefit to slave raiding ( $paL_1 \geq R$ ), meaning that the return to raiding is greater than the costs. If we start from a peaceful equilibrium any positive net benefit to slave raiding will generate a new slave raiding equilibrium. What does this change relative to the situation in the absence of effective demand? First, it results in increased slave capture and the associated culture of terror. Second, it results in a permanent reallocation of labor from production to slave raiding.

If we start from the conquest equilibrium, effective demand will alter the equilibrium if the lifetime utility for the ruler is greater under slave raiding than under conquest, meaning that:

$$U(Raiding) \geq U(Conquest)$$

$$\frac{\log(b_n L_n) - R + paL_1}{1 - \delta} \geq \frac{\log(b_n L_n + b_1 L_1)}{1 - \delta} - X. \quad (12)$$

If this inequality holds, the equilibrium will be altered such that the nation will choose to raid the village in each period.

Thus, for a sufficiently large value of  $paL_1$  (the return to slave raiding) or sufficiently small values of  $R$  (the cost of slave raiding) the war equilibrium will be disrupted and replaced with a raiding equilibrium. This situation is displayed in Figure 1 by the positively sloped supply curve. What are the consequences? In addition to the effects previously noted in the perturbation of the peaceful equilibrium (labor reallocation and more slaves captured) there are implications for ethnicity and state size. The village and the nation both survive in equilibrium with the nation being smaller than it was in the absence of effective demand. Since the village persists, this may be viewed as an increase in ethnic diversity in the long run.

## 5.2 Scenario Two: One Nation and Many Villages

The second scenario generalizes the first scenario to a situation with a large number of villages and a single nation. We assume that there are a total of  $N$  villages and a single nation. To keep the scenario simple, we assume that the penalty to forming an alliance (amongst the villages) is large enough to deter alliance formation. Additionally, we assume that the size of the labor force for both villages and the nation is equal to  $L$  and that regional labor productivity is equal to  $b$ . As in the first scenario, we assume that, in the absence of effective demand, the price for slaves is zero. The utility functions for the nation and villages are characterized as they were previously.

In the absence of effective demand, the nation will choose to conquer at least one village if the ruler's

lifetime utility associated with the conquest of a village is greater than his utility when no villages are conquered. The nation, however, may conquer more than a single village, although we assume that it is only able to conquer one village each period. The nation will continue conquering villages until the marginal lifetime benefit of conquering another village is less than the one-time penalty associated with war ( $X$ ). We may use this condition to define the total number of villages conquered ( $n$ ) in equilibrium. The nation will conquer villages as long as the marginal benefit of conquest is greater than the marginal cost. The nation will continue conquering villages as long as the below inequality holds, where  $X$  is the marginal cost of conquering one more villages and the right term is the marginal benefit of conquering 1 more village (the benefit of conquering  $n$  villages - the benefit of conquering  $n - 1$  villages) :

$$X \leq \frac{\log(nbL)}{1 - \delta} - \frac{\log((n - 1)bL)}{1 - \delta} \quad (13)$$

Thus, the nation conquers  $n$  villages where  $n$  is the largest value such that the above inequality holds. Under optimizing behavior, the nation achieves a size of  $nL$  while the number of independent villages in equilibrium is reduced to  $N - n$ .

If we introduce effective demand into the scenario the equilibrium condition will be altered. Assuming that  $N$  is a very large number (meaning that it is implausible for the nation to conquer all villages), the marginal condition now includes the opportunity cost of not raiding for the period in which the final village is conquered (meaning that had the nation chosen to not go to war it would have had the option to raid for slaves). Thus, the nation will now conquer villages as long as the marginal cost of war is less than the marginal benefit (this inequality closely mirrors the previous inequality):

$$X - R + paL \leq \frac{\log(nbL)}{1 - \delta} - \frac{\log((n - 1)bL)}{1 - \delta} \quad (14)$$

As before, the above condition determines the number of villages that are conquered in equilibrium,  $n$ . If there is a net benefit to raiding it is necessarily the case that the size of the nation will be smaller than in the absence of effective demand: the left hand term is greater than it was before the slave trade arrived. This is depicted in Figure 3 for the general case of an increase in the marginal net economic return to slave raiding. The effects are similar to those presented in the first scenario. As the economic return to slave raiding increases, nations will generally be smaller in equilibrium and greater ethnic diversity will persist. Again, there is a permanent reallocation of labor rather than a temporary one, as war occurred over a finite number of periods while raiding occurs indefinitely. Furthermore, if we imagine a continuum of nations playing this game, an increase in the price of slaves will produce more raiding. Thus, this simple model can generate an positively sloping supply curve like the one depicted in Figure 1.

As an extension, we may imagine this scenario with the villages and the nation located spatially along a

line that runs from the African coast towards the interior. We may then contrast cases in which the nation is located (at the start of the game) either adjacent to the coast or deep within the interior. When a nation that is located along the coast conquers villages, it will be expanding towards the interior. When an interior nation conquers villages it pushes towards the coast. This scenario is interesting if we assume that prices vary by village according to their proximity to the coast. Net slave prices are higher the closer a village is to the coast because transport costs to the coast are smaller. For example, if in equilibrium the nation raids a village near to the coast the return is higher than if it raids a village deep in the interior. For a nation in the interior, this pricing situation translates into a lower opportunity cost of war for any value of  $n$  (where  $n$  is the number of villages conquered) relative to a nation on the coast. Additionally, the nation in the interior has an incentive to push towards the coast as it will result in a higher slave price when it decides to halt conquest and begin slave raiding. The coastal nation has the exact opposite incentives. Thus, the introduction of a price gradient discourages expansion for coastal nations and encourages expansion towards the coast for interior nations.

### 5.3 Scenario Three: One Nation and Three Villages with the Possibility of Alliances

In our third and final scenario, we suppose that we are in a situation with a single nation and three villages arranged along a line with the nation at one end. We again assume that the nation and all villages have the same population  $L$  and regional labor productivity  $b$ . Unlike scenario two, we assume that the penalty for alliance formation is not so large that it necessarily rules out alliance. Thus, we will need to examine villages' alliance decisions.

We start by assuming that, in the absence of effective demand, the parameters of the model are such that the nation will conquer all three villages. In other words, the utility increase from conquering the third village must be greater than the conquest penalty. Thus, all three villages are conquered if the marginal benefit of conquest is greater than the marginal cost:

$$X \leq \frac{\log(4bL)}{1-\delta} - \frac{\log(3bL)}{1-\delta} \tag{15}$$

As long as this inequality holds, the nation will conquer all three villages. However, it is possible that the villages may choose to voluntarily form an alliance. In order to determine whether this occurs, we must compare the utility of the village rulers if they are conquered with their utility if they form a defensive alliance. If no villages form an alliance and they are all conquered, the rulers of the villages will have utility as follows, where village 1 is the village next to the nation, village 2 is next on the line, followed by village 3:

$$U_1 = 0 \tag{16}$$

$$U_2 = \log(bL) \tag{17}$$

$$U_3 = \log(bL) + \delta \log(bL) = (1 + \delta)\log(bL) \tag{18}$$

Since the nation is only able to conquer a single village in each period, the third village is in the “best” situation of the three. The only possibility for alliance formation is a joining of villages two and three, as we assume that the nation gets to play first in the sequential game. Since village three has a higher utility if no alliance is formed, the binding constraint for alliance formation falls on village three.

Village three will voluntarily enter into an alliance with village two if the utility from the alliance is greater than remaining independent and being conquered. Thus, villages two and three form an alliance if the discounted continuous utility stream provided by survival is greater than the utility from independence and being conquered:

$$\frac{\log(bL) - \epsilon}{1 - \delta} \geq (1 + \delta)\log(bL) \tag{19}$$

If the alliance penalty is greater than  $\delta^2 \log(bL)$  village three will not enter into an alliance with village two, resulting in an equilibrium in which the nation conquers all three villages.

If we assume that the alliance penalty is indeed large enough to prevent alliance formation the introduction of effective demand will alter the equilibrium outcome in a particular manner. With a positive slave price, the nation only desires to conquer all three villages if the persistent value of conquering the first and the second villages is greater than the opportunity cost (not raiding for slaves in each period) of war and the value to conquering the third village is greater than the value of raiding the third village for all remaining periods. This reduces to the second scenario in which there is less conquest, greater ethnic diversity, a permanent reallocation of labor, and more slaves produced.

If the penalty for alliance formation is sufficiently low, villages two and three may choose to form an alliance in the presence of effective demand. If we assume that the parameters of the model are such that the nation conquers village one (in the event that villages two and three ally) then villages two and three will form an alliance if the utility to allying for village three is greater than remaining independent (but being raided forever). This may be expressed as the following inequality:

$$\frac{\log(bL) - S}{1 - \delta} \leq \frac{\log(bL) - \epsilon}{1 - \delta} \tag{20}$$

Thus, it is apparent that our equilibrium condition for alliance formation is different than it was in the absence of effective demand. If we imagine a certain distribution over values of  $S$ , it is now more likely

that village three will not make an offer of alliance to village two. This is a result of our assumption of an absolutist state governed in the sole interests of the nation's (or village's) ruler. The logic is that the ruling elite in village three will maintain their status while their village is raided, but would lose that status (and perhaps their lives) if conquered. Thus, in this scenario, the introduction of effective demand decreases state size, as village three is not conquered and results in a long term reallocation of labor from productive purposes towards raiding. Ethnic diversity is also greater and persists.<sup>15</sup>

All three scenarios suggest several stylized facts. Effective demand (or an increase in slave prices) should produce smaller states with more slave raiding, greater ethnic diversity and more alliances for the purpose of raiding. Effective demand (or price increases) should also result in fewer defensive alliances and decreased production. Increases in the productivity of labor should increase state building (and as such, decrease raiding and ethnic diversity).<sup>16</sup>

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<sup>15</sup>Finally, in a permutation of scenario three, we may consider another possible equilibrium in which villages two and three form an alliance (and the nation does not conquer village one) in order to raid the remaining village. This occurs if the value of conquest (of village one) for the nation is less than the value of raiding that village forever:

$$\frac{\log(bL) + paL - R}{1 - \delta} \geq \frac{\log(2bL)}{1 - \delta} - X \quad (21)$$

The necessary constraint on villages 2 and 3 to form an alliance is altered such that they will only form an alliance if the benefit to allying (and then subsequently raiding village 1) is greater than remaining independent:

$$\frac{\log(L) - \epsilon - R + paL}{1 - \delta} \geq \frac{\log(L)}{1 - \delta} \quad (22)$$

Additionally, it must be the case that they do not wish to conquer village one. They do not conquer village one if the utility provided by raiding village one forever is greater than conquering the village and then doing nothing for all future periods:

$$\frac{\log(L) - \epsilon - R + paL}{1 - \delta} \geq \frac{\log(1.5L) - \epsilon}{1 - \delta} - X \quad (23)$$

If these inequalities hold we have an equilibrium in which the nation raids village one, and villages two and three form an alliance which in turn raids village one. This outcome is more likely to occur for larger values of  $p$  and, as such, helps generate an upward sloping supply curve. In addition, it generates greater ethnic diversity and smaller states. Again, there is a significant reallocation of labor from productive purposes.

<sup>16</sup>A priori, the impact of guns and other capture technologies in this model is ambiguous. If nations are strong enough to control access to guns then guns reduce the cost of war and raiding. The result is more aggression, but we cannot predict more or less raiding. It is an empirical question, but the strong prior is that state and raiders have the resources, credit and contacts with Europeans to get all the guns they need to stay ahead of villagers. To the extent that guns and weapons reach the villages then they will be used for defensive purposes, increasing the cost of raiding and war, and producing fewer captives. Asante, for example, prohibited to sale of firearms to the northern provinces for fear that they would be used against them (Wilks, 1975, p. 20). In the Bight of Biafra (southeast Nigeria), everyone had access to weapons and a kind of "arms race" ensued. The Aro traders, who organized the slave trade in this region, also organized the gun trade. They carried guns at all times. Villagers had access to all kinds of weapons. In Equiano's village: "We have fire-arms, bows and arrows, broad two-edge swords and javelins. We have shields also which cover a man from head to foot. All are taught to use these weapons; even our women are warriorsOur whole district is a kind of militia (1995, p. 40)." Oriji (2003) reports for the late nineteenth century that "the alertness of the Ngwa (in this region) and the weapons they used in defending their communities are affirmed by Major A.



## 5.4 Historical Interpretation: The Case of Asante

We have presented evidence in this paper that increases in the international demand for enslaved Africans induced a reallocation of resources in Africa towards slave production and away from other economic pursuits. Our simple models reveal the conditions under which increases in the international demand for enslaved Africans constrained the growth of states, increased ethnic and social stratification and produced a reign of terror. In the spirit of future research, we wish to take a first pass at using this model to interpret the political and economic developments along the Gold Coast of West Africa during the 18th century, the height of the slave trade. We believe our model helps explain the origins and evolution of the Asante Empire.

Asante was a large militarized and bureaucratic state that emerged behind the Gold Coast of Africa (present-day Ghana) at the beginning of the 18th century. Eventually, all roads led to Kumasi, the capital city located about 200 miles inland and encircled by an efficient farming sector that supported the military and bureaucratic classes that resided in the capital city. The Asante were so powerful that they were able to defend successfully against British invasion for more than 100 years. They were the largest and most powerful state in West Africa.<sup>17</sup>

Our model predicts that the slave trade discouraged state building. How, then, could Asante have grown and developed into such an impressive state during the height of the slave trade? Ivor Wilks refers to this as the enigma of Asante: “The importance of Asante is most apparent from its sheer geographic extent. At the height of its power in the early nineteenth century, Asante’s empire extended not only over all of present day Ghana with the exception of the far northwest, but also over large parts of what is now Ivory Coast and smaller parts of what is now Togo (1996, p. 27).” What were the incentives to conquer so much territory in the era of the slave trade?

Part of the answer has to do with the common Akan ancestry of the Asante. In our model, this would reduce the penalty for alliance, making alliance formation more likely. And Asante did emerge out of an alliance of chieftaincies brought together to defeat Denkyira, the dominant power of the region in the late 17th and early 18th centuries. According to Wilks, “Asante was not, then, a creation of an Asante tribe, There was no Asante tribe. Asante was a creation of the Kumasis, Dwabens, Nsutas, and so forth, all of whom became Asantes under the new dispensation (p. 28).” In our model,  $\epsilon$  was low enough to allow the formation of the Asante alliance for the purpose of conquest and slaving. Our model also predicts the timing of the Asante alliance. It predicts that such an alliance was more likely to be successful if it was attempted before the rise in slave prices that began in the mid-18th century.

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Leonard, an adventurous British military officer who had penetrated the Ngwa region by the late 19th century: Although the people [Ngwa] who en route turned out in thousands to look at us appeared to be very friendly and peacefully disposed, not a man apparently moved a step without carrying a naked sword in one hand and a rifle at full lock in the other. Even the boys, some of them not higher than an ordinary man’s knee walked out armed with bows and pointed arrows (pp. 128-9).”

<sup>17</sup>Ivor Wilks (1975; 1993) is the leading authority on Asante history and we rely heavily on his work.

But what explains the geographic expanse of Asante? We believe the key factor can be seen in Figure 4 which depicts the military campaigns that produced territorial Asante during the first half of the 18th century. These campaigns are placed on top of a late 19th century geological map of gold fields in the region. The answer to the question is obvious: Asante was interested in territorial expansion because there was gold in the land. All of the early military campaigns followed the gold. The northern expansions beyond the gold fields resulted not in annexation of territory but in tributaries, where elites retained semi-autonomy if they made annual tribute payment, most often in captives.<sup>18</sup>

Common heritage may explain the alliance, and gold may explain the impulse to conquer land, but our model also predicts that Asante, while large, would have been larger in the absence of the slave trade. Our model predicts that increases in the price of slaves should forestall political expansion and encourage slave raiding. This appears to be precisely what happened in the case of Asante. According to Wilks (1975, p. 18), “the campaign which destroyed the independent power of Asante’s neighbors to the north, south, east and west occurred for the most part in the half-century 1700-1750.” We believe that Asante expansion halted after 1750 because the price of slaves started a sharp upward trend such that by the end of the 18th century the price had increased by 500%.

Finally, our model predicts that Asante, an inland nation, would expand towards the coast to raid for slaves in the villages along the coast, but that the coastal nations would not expand inland but would instead focus on defend their territories. This is because low transportation costs near the coast effectively increase the net revenue from slave production along the coast. In Asante history this is called the “southern problem,” where peace was elusive and where rebellion and re-conquest were the recurrent pattern (Wilks, 1975, p. 26-28). In the 1750s, for example, Dutch and English merchants interested in attaining peaceful trade to the coast tried to initiate a peace treaty between Asante and the coastal nations of Wassa, Twifo, Denkyira and Akyem. The negotiations fell apart. The Asante conquered the coastal city of Accra from the Akyem, but the Akyem continued to revolt (p. 28). Wilks argues that the case of Akyem was not unique. He argues that the southern coastal nations were able to resist Asante aggression because the gold they possessed gave them the resources they needed to resist and because the forest offered them military cover against Asante forces (p. 28). Our model predicts that the rising price of slaves after 1750 provided an incentive for the coastal nations to resist Asante and for Asante to attempt to conquer them. The border between Asante and the coastal states became a “catchment zone” where no state conquered territory, but everyone raided for slaves. The coastal states rebelled, but their posture was always defensive, never offensive. Why? They had gold like the Asante and so had the resources to stage an attack. They also had a better position in the trade with Europeans by virtue of their coastal location. Our model predicts their defensive posture: the marginal return to slave raiding declines faster when expanding inland than it does when expanding towards the coast. Asante wanted to get to the coast and the coastal nations wanted to defend the coast. This was

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<sup>18</sup>In eastern Gonga, the tribute was 1,000 slaves annually. The same arrangement was achieved with Dagomba and Gyaman (Wilks, 1975, pp. 20-23).

the pattern along the entire Guinea Coast from the Gold Coast (Ghana) to the Bight of Biafra (southeast Nigeria).<sup>19</sup>

## 6 Conclusion

In this paper we have argued that the slave trade had a large and significant impact on African economies and societies. We have taken a decidedly balanced approach to this question because we wish to take the debate beyond the “external” versus “internal” dichotomy. Rather, we confirm that the supply of slaves was *not* exogenous to the price and that African economies likely underwent significant transformation in response to growing foreign demand for slaves. We have established this empirical fact in the paper. Now that this fact has been established, the next step is to understand the sources of African responsiveness and how African development was impacted. In our simple model, we have suggested some potential responses to changing demand. Both the model and our empirical results suggest that there was a reallocation of labor from agricultural and industrial work towards the slave trade.<sup>20</sup> Second order effects, however, may have been even more important. We show the conditions under which the African response discouraged political development and encouraged violence, social hierarchy, and ethnic diversity. In addition, the evidence in favor of a guns-for-slaves cycle indicates that there may have been a prisoners’ dilemma style arms race among small African states that would help explain regional trends in the African response to the slave trade (Gemery and Hogendorn, 1974; Inikori, 2003). As we mentioned at the outset, when placed within the context of the slave trade, many features of today’s Africa once thought to be exogenous or “African” in nature (like political culture and ethnic diversity) turn out to be more endogenous than previously thought. We can think of no better reason why the era of the slave trade deserves its place in the periodization of African history. Pre-colonial, colonial and post-colonial is just too colonial.

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<sup>19</sup>The term “catchment zone” is often used in studies of the slave trade, as are the term “stateless” and “decentralized” societies. These are often characterized as areas without a centralized political power strong enough to protect the people against slave raiders. See Gemery and Hogendorn (1974) and Klein (2001) for efforts to generalize these concepts. We do not want to argue that all such zones were buffers between interior and coastal states, but many of them were. They were sources of captives between Asante and the coastal states along the Gold Coast; between Dahomey and the coastal states along the Slave Coast (Lovejoy, 1983, chapters 6 and 7); and between the Aro network and the coastal trading towns in the Bight of Biafra (Oriji, 2003; Lovejoy and Richardson, 2003). The relentless conflict in this area just behind the coast interrupted the trade to and from the coast, and was the subject of frequent comments by Europeans.

<sup>20</sup>Similar results are found in Darity (1982) and Nunn (2007).

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## Appendix - Figures

Table 1

Arithmetic Sample Means					
Variable	units	Obs	Mean	95% Confidence Interval	
African slave exports	number	109	25,937.40	23,824.62	28,050.18
British slave price	pounds sterling	107	11.32	9.91	12.73
Lbs. of British gunpowder exports	pounds	107	504,493.90	417,401.00	591,586.70
European sugar price	shillings per cwt	108	1.95	1.86	2.04
British sugar imports	pounds	106	1,336,939.00	1,169,915.00	1,503,963.00
Total net British exports to Africa	pounds sterling	107	345,235.10	281,569.90	408,900.20
Net exports minus gunpowder	pounds sterling	107	328,208.40	267,120.60	389,296.20
British cottons exports	pounds sterling	107	73,465.66	53,966.93	92,964.40
Gunpowder exports	pounds sterling	107	17,026.67	14,087.28	19,966.05
British military expenditures	thousand pounds sterling	102	12,311.00	10,367.20	14,256.20

Table 2

Reduced Form Quantity Equation				
Dependent Variable = Dslaves				
Linear				
Independent Variable	Coefficient	t-stat	Coefficient	t-stat
Dlbsgunpowder	0.018**	6.43	0.006*	2.09
DsugarP	1144.35	0.69	410.40	0.29
DsugarQ	0.00	1.63	0.00	0.81
Dwar_7years	1673.32	0.43	1079.77	0.32
Dwar_American	-5936.65	-1.47	-3633.34	-1.05
Dwar_Napoleon	-14957.47*	-2.31	-4585.99	-0.79
Dnetexports			0.02**	5.93
_cons	-93.99	-0.17	-194.91	-0.41
Adj. R-squared	0.519		0.6461	
N	102		102	
F stat	19.16		27.34	
Natural Log				
Independent Variable	Coefficient	t-stat	Coefficient	t-stat
DLNlbsgunpowder	0.3977**	7.27	0.1279*	2.19
DLNsugarP	0.0493	0.35	0.0592	0.51
DLNsugarQ	0.1023	0.82	-0.0064	-0.06
Dwar_7years	0.1046	0.62	0.0597	0.44
Dwar_American	-0.2294	-1.35	-0.1579	-1.14
Dwar_Napoleon	-0.4510	-1.81	-0.1225	-0.59
DLNnetexports			0.4318**	7.09
_cons	-0.0074	-0.31	-0.0076	-0.39
Adj. R-squared	0.4426		0.633	
N	102		102	
F stat	14.37		25.89	



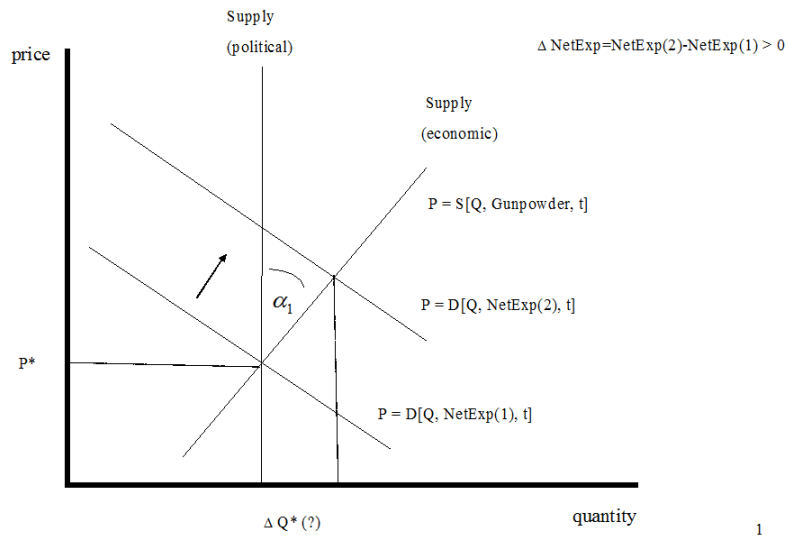


Figure 1: Political Warfare Hypothesis vs Rational Economic Hypothesis

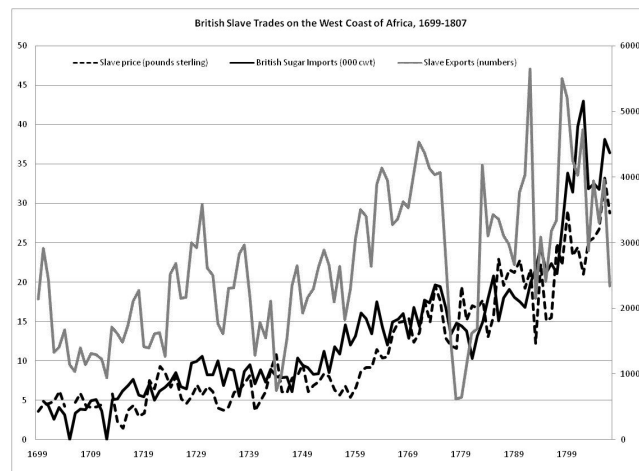


Figure 2: Time Series of Demand-side Covariates

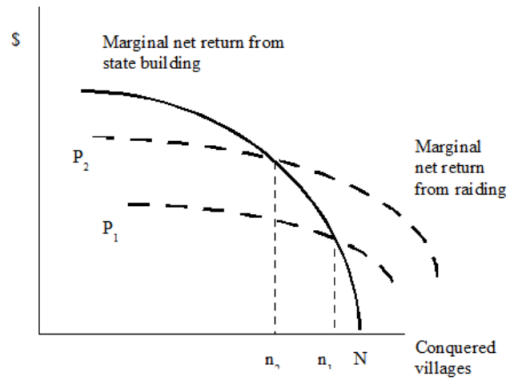


Figure 3: The Impact of Effective Demand

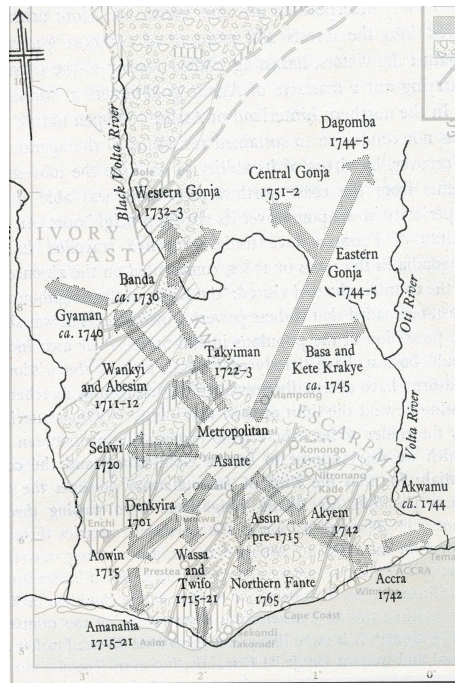


Figure 4: The Formation of Asante. Sources: Dumett (1998). P. 30 and Wilks (1975). P. 39.

## Appendix - Data

Below, we discuss how we construct the variables used in this paper.

**SlaveQ.** The quantity variable is the annual number of enslaved Africans leaving Africa on British ships. These are constructed from the Revised Transatlantic Slave Trade Database. The year assigned to each ship is the year the ship left Britain, not Africa. This allows us to match slave purchases found in the Transatlantic Slave Trade Database with the British net export used to purchase them, as recorded in the Anglo-African Trade Statistics.

**Gunpowder.** The annual real values for British gunpowder exported to Africa are also taken from the Anglo-African Trade Statistics compiled by Johnson (1991). The series does not track other weapons nearly as well, probably because of the broad range of knives, swords and firearms in the trade. Johnson speculates that they are hidden in the series for iron products, but this is just a guess. The gunpowder series is homogeneous and continuous. Like the other commodities in the series, gunpowder is valued at 1699 prices. We translate the gunpowder series into physical pounds of gunpowder by dividing through by the 1699 price for gunpowder. Inikori (1977) reports annual data on the quantity of gunpowder exported from Britain to Africa between 1750 and 1807. Dividing the real value of Gunpowder found in the Anglo-African data by the pounds of Gunpowder reported by Inikori yields a price of .03375 pounds sterling per pound of gunpowder for every year between 1750 and 1807. We take this to be the 1699 price of gunpowder used in the British Customs Office. The Anglo-African gunpowder series is then divided by .03375 to get the quantity of gunpowder (measured in physical pounds) exported from England to Africa for the years between 1699 and 1807. The estimated coefficient on Gunpowder can now be read as the number of enslaved Africans exported per pound of gunpowder imported.

**SugarQ.** The scale of sugar production is measured by annual British sugar imports, and is taken from the British trade statistics reported in Schumpeter (1960) and Deerr (1950). The scale of sugar production is a proxy for replacement demand – demand for newly enslaved Africans to replace losses in the stocks of slaves on British sugar plantations.

**SugarP.** These are the annual retail prices paid for sugar in London and Amsterdam, taken from Deerr (1950, pp. 530, 531). They are converted to real prices using the deflators for London.

**WARS.** To control for the affect of European wars on the effective demand for African captives, we construct dummy variables for the Seven Years War (1756-63), the American Revolution (1775-83) and the Napoleonic Wars (1792-1815). I also construct a dummy variable to capture the affects of British access to the Asiento (the Spanish slave trade). Between 1713 and 1733, Britain had a monopoly on the Spanish slave trade. After 1789, the Asiento was thrown open to all takers.

Table 1 reports sample means for these time series.

## Appendix - Model

1. The game has an infinite number of periods and is played sequentially
2. Each nation and village is located on an ordered line
3. A nation may choose to do nothing, to raid a neighbouring village, or conquer a neighbouring village. A village may choose to do nothing or form an alliance with another village.
4. The actual player is the king or chieftain of the nation or village. Payoffs reflect the utility stream of the king or chieftain.
5. The pre-existing nation always moves first, followed by the villages. If we assume that the nation is located on the far left of the ordered line then play proceeds from left to right along the line
6. The discount rate is equal to  $\delta$
7. Each nation and village has a labor force equal to  $L_i$ , which also defines the size of the nation
8. Each nation and village has a level of labor productivity equal to  $b_i$
9. The labor force may be used in production, raiding, or warfare. This reallocation is modeled abstractly through the cost of raiding or war
10. Raiding results in a cost of  $R$ , which encompasses reallocated labor and military losses
11. Warfare requires  $X$ , which encompasses reallocated labor and military losses
12. Raiding results in a one period payoff equal to  $paL_i$  where  $p$  is the price of slaves and  $a$  is the fraction of the village's population enslaved.
13. If a village is conquered utility stream of its chieftain is 0 for all future periods
14. The chieftan of a raided nation is subject to a one period utility penalty equal to  $S$
15. Conquest results in the conquered nations labor force being added to the conquerors
16. If two villages choose to ally each chieftain will maintain a separate payoff stream and split any rewards from conquest or raiding
17. Raiding, conquest, and alliance formation may only occur between neighboring villages or nations
18. A nation is able to raid a village, but is unable to raid other nations
19. Two villages may choose to join together and form an alliance with each taking a penalty equal to  $\epsilon$
20. An alliance between two villages is equivalent to them forming a nation. Once allied, these villages may conquer or raid villages. Additionally, they may not be conquered by a nation.

The above framework is not ideal for presenting a single all-encompassing description for the effect of the introduction of the slave trade. Rather, we present three scenarios based upon different initial conditions and explore the impact of the introduction of the slave trade.