Slavery, Institutional Development, and Long-Run Growth in Africa, 1400–2000

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Abstract

Can Africa's current state of under-development be partially attributed to the large trade in slaves that occurred during the Atlantic, Saharan, Red Sea and Indian Ocean slave trades? To answer this question, I combine shipping data with historical records that report slave ethnicities and construct measures of the number of slaves exported from each country in Africa between 1400 and 1913. I find the number of slaves exported from a country to be an important determinant of economic performance in the second half of the 20th century. To correct for potential biases arising from measurement error and unobservable country characteristics, I instrument slave exports using measures of the distance from each country to the major slave markets around the world. I also find that the importance of the slave trade for contemporary development is a result of its detrimental impact on the formation of domestic institutions, such as the security of private property, the quality of the judicial system, and the overall rule of law. This is the channel through which the slave trade continues to matter today.

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1 Introduction

Africa's economic performance in the second half of the twentieth century has been dismal.[1] One, often informal, explanation for Africa's tragedy is its history of extraction, which is characterized by two events: the slave trade and colonialism. Economic historian Paul Bairoch writes that "there is no doubt that a large number of negative structural features of the process of economic underdevelopment have historical roots going back to European colonization."[2] African historian Patrick Manning echoes Bairoch, but focuses on the slave trade, writing: "Slavery was corruption: it involved theft, bribery, and exercise of brute force as well as ruses. Slavery thus may be seen as one source of precolonial origins for modern corruption."[3]

A number of studies have empirically tested the link between a country's colonial history and current economic development. Bertocchi and Canova (2002), Englebert (2000a, 2000b) and Grier (1999), all find a relationship between various measures of a country's colonial heritage and post-independence economic growth. Acemoglu et al. (2001, 2002) document the strong influence that colonial institutions have on the current economic development among former colonies.

Despite a growing empirical literature on the link between colonialism and development, studies have not tested for the potential impact of the slave trade on subsequent economic development.[4] This paper is a first attempt at this. I construct measures of the number of slaves exported from each country in Africa between 1400 and 1913. Using this data, I find a robust, statistically significant, negative relationship between the number of slaves exported from a country and current economic performance, measured using either the level or growth rate of real per capita GDP. To correct for the potential problems of measurement error and unobservable country characteristics causing self-selection into the slave trade, I use instrumental

[1]See Artadi and Sala-i-Martin (2003) for a recent survey.

[2]Bairoch (1993), p. 88.

[3]Manning (1990), p. 124.

[4]There are a number of reasons to expect slavery to be as least as important, if not more important, than colonialism for the countries of Africa. One reason is that the slave trade began earlier and lasted much longer than official colonialism. In many parts of Africa, the export of slaves, during the trans-Saharan slave trade, has occurred since about 600AD. The Red Sea and Indian Ocean slave trades began around 850AD. And the Atlantic slave trade began soon after the beginning of the 15th century. In all, between 1400 and 1900, in excess of 20 million slave were exported from the continent, during 500 year of intense slaving. By comparison, official colonial rule, on average, lasted from about 1890 to 1960; a total of around 70 years.

variables (IV). As instruments I use measures of the distance from each country to the closest sales market for each of the four slave trades. The OLS results are confirmed by the IV procedure. The estimated effect of the slave trade on income remains negative and statistically significant.

I test for the chain of causality underlying the relationship. I find that the relationship between the slave trade and current economic performance works through the slave trade's effect on the quality of domestic institutions, such as the quality of the judicial system and overall rule of law. Qualitative evidence from the African history literature supports this empirical finding. The slave trades led to a large increase in warfare, banditry, and kidnapping. They weakened previously well-functioning domestic institutions, which in many cases led to a complete disintegration of the societies ravaged by the slave trade. If the resulting poor institutions persist today, then they will have a first order effect on economic development.

The results of the paper complement the recent work on slavery and paths of economic development by Engerman and Sokoloff (1997, 2000) and Sokoloff and Engerman (2000). The authors study the relationship between slavery, plantation agriculture and the subsequent evolution of institutions conducive for economic growth in the New World. They argue that slavery had adverse effects on institutional and economic development.[5] Rather than focusing on slave use in the New World, this study focuses on slave procurement in Africa and tests whether the slave trade had lasting adverse effects for countries within Africa.[6]

The paper is organized as follows. In the following section, I provide a broad description of the slave trades and their adverse effects. In Section 3, I describe the construction of the slave export data. Section 4 reports the empirical results of the paper. Section 5 concludes.

2 Historical Background

Although slavery has been common throughout history, the African slave trades are unique because of the magnitude of the trades and because they involved members of the same ethnicities and communities enslaving one another. A well documented example comes from the Balanta, of modern

[5] Also see Lagerlöf (2004), who shows that within the United States, the states that relied heavily on slavery in the past are less economically developed today.

[6] In a recent article James Robinson suggested that this may be a fruitful line of enquiry. He writes: "I would hypothesize that slavery induced predatory institutions and significant adverse influence on development paths not just in the Americas where the slaves were used, but also in Africa where the slaves originated." Robinson (2002), pp. 518–519.

day Guinea-Bissau, who "became involved in slaving, often preying on other Balanta communities" and the Minyanka, of modern day Mali, who were forced by rival states "into participation in slave-raiding and bitter conflict between [other] Minyanka villages".[7]

The best data on the manner of enslavement suggest that the majority of slaves (34–76%) were taken by slave raiders.[8] A significant proportion of slaves were taken in kidnappings (15–30%) which were carried out by state sponsored raiding parties, slave raiders, groups of bandits and other outlaws. The enslavement of individuals had a devastating impact on the institutional development of the communities. Entire communities degenerated into predatory societies. Warlords and slave raiders became the new leaders and they altered previously existing institutions to facilitate their needs.[9] Joseph Inikori writes:

> The European demand for more and more captives soon gave rise to the formation of groups of bandits all over western Africa. In places where the foundations already laid had not yet given rise to firmly established large political organization, the process was hijacked by these bandits ... Overall, the conditions created by the large-scale European demand for captives over a period of more than three hundred years severely retarded the long-term process of socio-economic development in western Africa.[10]

An additional consequence of the slave trade was the perversion of the legal system into a tool for the enslavement of others. A non-trivial proportion (4–11%) of slaves entered slavery through the judicial process. "Communities began enslaving their own. Judicial penalties that formerly had taken the form of beatings, payment of compensation or exile, for example, were now converted to enslavement."[11] Often, the leaders themselves supported, and even instigated this. One example of this perversion of the judicial system comes from the Cassanga of modern day Guinea Bissau. The judicial process became a tool for the chief to procure slaves and their former possessions, as well as a tool to eliminate potential rivals. To determine guilt the chief used a test called the 'red water ordeal'. Those accused of a crime

[7]Klein (2001), pp. 56–57

[8]The percentages reported are the range of estimates which result from the data from Lovejoy (1994) and Northrup (1978).

[9]For a historical account and formal treatment of the effects of the slave trade on institutional development see Nunn (2004).

[10]Inikori (2000), pp. 393–394.

[11]Klein (2001), p. 59.

were forced to drink a poisonous red liquid. If they did not vomit, they were deemed not guilty and freed. If they did vomit, they were judged to be guilty. Unfortunately, for those that did not vomit this usually brought death by poisoning, and their possessions were seized, including all family members and relatives, who were then sold into slavery.[12] The chief also produced slaves through the accusation of witchcraft. The chief proclaimed that any person who falls from a palm tree and dies is a witch, and all of their possessions, including wives, children and other relatives were to be seized. Because palm wine was a staple drink, people climbed trees to extract the sap and regularly fell from them.[13]

An additional consequence of the slave trade was its prevention of the formation of centralized states that could ensure a stable rule of law. The slave trade resulted in a break-down of law and order within the existing states. This resulted in large-scale political fragmentation. The best example of this comes from the Kongo state of west-central Africa. The Kongo Kingdom, with no standing army in the early decades of European contact, was unable to prevent an internal break-down of law and order, and, as a result, the kidnapping of local Kongo citizens for sale to the Portuguese became rampant. This break-down of law and order led to the eventual fall of the once powerful state.[14] The only states that were able to maintain internal law and order during the slave trade were Oyo, Dahomey and Asante, all located in Western Africa. However, these three states were the exception rather than the rule.[15]

3 Construction of the Slave Export Data

In this section, I provide an overview of the data sources and methodology used to construct the slave export figures. All of the finer details about the data construction are documented in a separate data appendix that is available from the author's web page.

To construct the slave export figures, I rely on two kinds of data. The first are data that report the total number of slaves exported from each region or port in Africa. I refer to these data as shipping data. For the trans-Atlantic slave trade, the data are from shipping records, obtained from the Trans-Atlantic Slave Trade Database[16] and from Elbl (1997). The

[12]Hawthorne (1999), pp. 105–106.
[13]Hawthorne (1999), p. 106.
[14]Inikori (2003), pp. 182–183.
[15]Inikori (2003).
[16]See Eltis et al. (1999).

data provide information on the number of slaves shipped from each port or region of Africa during the trans-Atlantic slave trade. For the Indian Ocean, Red Sea and trans-Saharan slave trades, data are from Austen (1979, 1988, 1992). For the Indian Ocean and Red Sea slave trades, aggregate exports are dissaggregated by the port or region of embarkation. For the Saharan slave trade, exports are disaggregated according to their destination city in Northern Africa.

The second kind of data that I use are records that report the ethnic identity of slaves. I refer to these data as ethnicity data. For the Atlantic and Indian Ocean slave trades, these data are from historic records that report the ethnicity of slaves that were shipped outside of Africa. The data are from records of sale, plantation inventories, slave registers, runaway notices, court records, prison records, marriage records, death certificates, baptismal records, parish records and slave interviews. Data on the ethnicity of slaves shipped during the Atlantic slave trade come from 46 different samples. In total, the aggregate sample consists of 88,616 slaves, reporting 480 different ethnicities. For the Indian Ocean slave trade, the ethnicity data are from three different samples. In total, the data include 11,651 slaves, reporting 27 different ethnicities.

The ethnicity data for the Red Sea and Saharan slave trades are less extensive and less precise. For the trans-Saharan slave trade the data come from three sources that report 24 different ethnicities for 6,057 slaves. I combine this ethnicity data with less precise historic data. Ralph Austen has compiled a list of "all significant observations of both slave trading and the presence of African slaves and/or ex-slaves in receiving Mediterranean areas."[17] The data are from historical accounts from first-hand observers of the slave trade. The collection provides information on the destination of slaves shipped across the Saharan desert, which caravan the slaves were shipped on, and, in some cases, the ethnic identity of the slaves.[18]

The ethnicity data for the Red Sea slave trade is nearly non-existent. I have only been able to locate data on the ethnic identity of 5 slaves shipped during this slave trade. Because of this, I use the port of export as an indicator of which country slaves are from. Because slaves shipped during the Red Sea slave trade were primarily from a concentrated area that lies within the borders of modern day Ethiopia, Sudan and Northern Somalia, the port of export is a reasonable indicator of the slaves' origins. I also check that the distribution based on the port of export is consistent with other

[17] Austen (1992), p. 214.

[18] The collection is unpublished, but it is described in detail in Austen (1992).

estimates of the distribution of slave origins made by African historians.[19] In addition, as I show in Section 4.3, the results of the paper are driven by the trans-Atlantic and Indian Ocean slave trades. None of the results reported in the paper rest on the assumptions made when constructing the figures for the Red Sea slave trade.

Combining the shipping data that report aggregate slave exports with the more detailed ethnicity data that report information on the ethnic identity of slaves, I am able to construct an estimate of the total number of slaves taken from each country in Africa during all slave trades. The procedure that I use is as follows.

1. From the shipping data, I calculate the number of slaves shipped from each coastal country in Africa.

2. I map each African ethnicity to modern political boundaries and calculate a cross-country distribution of the origin of all slaves in the ethnicity samples. The distribution covers all countries, coastal and interior.

3. Using the distribution of slaves from the ethnicity samples, I estimate the fraction slaves shipped from each coastal country that would have come from countries located inland of that coastal country. I use this to estimate of the number of slaves taken from each interior country, and I adjust downward the export figures of each coastal country accordingly.

I also use the ethnicity data in two other ways. Some voyages reported in the shipping data only report broadly defined regions such as the "Bight of Benin" or the "Windward Coast". The ethnicity data are used to divide these slaves between the countries of the region. This is done in the first step of the procedure listed above.

The procedure outlined above will understate the number of slaves exported from a coastal country if much of its land is locked behind another country. This is a concern for two countries: Guinea and Zaire. Many of the slaves originally from Guinea were likely shipped from ports located in Sierra Leone and Liberia. Similarly, slaves from Zaire may have been shipped from ports in Angola, Congo or Gabon. I rely on the ethnicity data to correct for this bias in the estimates.

Overall, the procedure that I use divides the total export figures reported in the shipping data between coastal and inland countries using the cross-

[19] See for example Harris (1971).

Table 1: Total Slave Exports from Africa, 1400–1913

Slave Trade	1400–1599	1600–1699	1700–1799	1800–1913	1400–1913
trans-Atlantic	188,108	597,444	8,253,885	3,709,081	12,748,518
trans-Saharan	700,000	435,000	865,000	1,066,143	3,066,143
Red Sea	400,000	200,000	200,000	505,400	1,305,400
Indian Ocean	200,000	100,000	428,000	395,300	1,123,300
Total	1,488,108	1,332,444	9,746,885	5,675,924	18,243,361
Total/year	7,441	13,324	97,469	50,230	35,562

country distribution of slaves found in the ethnicity data. I am thus able to construct an estimate of the total number of slaves taken from each country in Africa during each of the four slave trades.

3.1 The Slave Export Data

The data set that I construct reports the number of slaves taken from each of the 52 countries of Africa in each century between 1400 and 1913.[20] The data are summarized in Table 1, where the total number of slaves taken in each slave trade are disaggregated by century. These estimates correspond closely with the general consensus among African historians regarding the total number of slaves shipped in each slave trade.[21]

Table 2 reports total slave exports from 1400 to 1913 for the 10 countries that supplied the largest number of slaves. Again, the estimates are consistent with the general view among African historians of where the primary slaving areas were. During the trans-Atlantic slave trade, slaves were taken in greatest numbers from the Bight of Biafra (Benin and Nigeria), West Central Africa (Zaire, Congo and Angola), and the Gold Coast (Ghana). All of these countries appear on the list. As well, Ethiopia and Sudan are

[20]Throughout the paper, I include Eritrea as part of Ethiopia.

[21]As an illustration, in the African history textbook *African Politics and Society*, a table very similar to Table 1 is presented (see Schraeder (2000), p. 90: Table 5.1). The table reports the total export of slaves in each of the four slave trades between 1451 and 1900. The estimated number of slaves exported are as follows: Atlantic (estimate 1) 11,698,000, Atlantic (estimate 2) 15,393,700, trans-Saharan 3,902,300, Red Sea 1,580,400, and Indian Ocean 1,666,700. Schraeder's numbers for the Saharan, Red Sea and Indian Ocean slave trades are slightly higher than my estimates. Part of this difference is because Schraeder includes Africans that died on the way to the coast, which he assumes to be 13%.

among the top 10 countries. This is because they were the primary sources of slaves for the Red Sea slave trade, and they were also a major source of slaves during the trans-Saharan slave trade.

Table 2: Total Slave Exports, 1400–1913: Top 10 countries

Country	Number Exported	Percent of total
Nigeria	2,326,526	13%
Zaire	2,184,318	12%
Angola	2,095,149	12%
Ghana	1,459,691	8%
Ethiopia	1,217,724	7%
Sudan	1,174,049	7%
Benin	928,963	5%
Mozambique	710,657	4%
Congo	706,931	4%

3.2 Testing the Precision of the Data

In calculating my estimates, I have assumed that slaves shipped from a port within a country are either from that country or from countries directly to the interior. For example, I assume that slaves shipped from Nigerian ports are either from Nigeria, Niger or Chad. Niger and Chad are both landlocked and lie inland, north and east, of Nigeria. From the ethnicity data, I calculate the ratio of slaves from Nigeria, Niger and Chad, and I use this to infer the proportion of the slaves shipped from Nigerian ports that would have come from Niger and Chad. In this manner, I construct an estimate of the number of slaves exported from Nigeria, Niger and Chad.

One problem with this procedure is that it assumes that slaves exported from a coastal country are not from another adjacent coastal country. A concern is that slaves not only moved inland to the coast, but also moved along the coast. For example, some of the slaves shipped from Nigerian ports may actually have been from Benin or Cameroon. Although, it is likely slave traders would have taken the most direct route to the coast, this may not have always been the case.

Fortunately, the recent work of historians Ugo Nwokeji and David Eltis (2002) provides data that can be used to test the margin of error of my estimates. Nwokeji and Eltis have begun to go through the Sierra Leone Liberated African Registers. They have identified a sub-sample of Africans in the registers who were shipped on six different ships from the Cameroons estuary between 1822 and 1837. From the slaves' names their ethnicities have been identified. In their sample of 886 slaves that could be identified with certainty, only 21 (2.4%) were from regions outside of Cameroon. Most of those from outside were either Igbo (from modern Nigeria) or from the Middle Belt (Niger). These numbers suggest that, at least for this region and time period, the port of embarkation is a good indicator of the country that a slave was from.

A second test of my procedure comes from data reported in Lovejoy (1994). These data report both the region of origin and route to sea for many of the slaves in the sample. A total of 54 slaves were shipped from the coast of Nigeria: 41 were from Nigeria, 6 from Cameroon, 2 each from Niger and Chad, and 1 each from Gabon, Kenya and Zaire. The procedure that I employ would assume that all slaves were from Nigeria, Niger or Chad. If I were to use this procedure on Lovejoy's sample, 83.4% of the slaves shipped from the ports would be properly identified. The slaves in the sample that were from Cameroon, Gabon, Kenya and Zaire (14.8% of the total) would not have been properly identified. The misidentification comes primarily from the port of Calabar, which is only about 25 miles from the Cameroon border. Of the 5 slaves shipped from this port, none were from Nigeria, 4 were from Cameroon, and 1 was from Zaire.

A third source of data comes from La Torre (1979), who reports data on 657 slaves imported into Asante (located in modern Ghana) between 1837 and 1842.[22] Slaves imported into the kingdom can be taken as a rough indicator of the ethnicities of slaves that were exported from the ports of Ghana at this time. Of the 657 slaves imported into the Kingdom of Asante, 152 (23%) were from areas within Ghana and 406 (62%) were from the Mossi and Gurma states of Burkina Faso. My methodology would attribute slaves exported from the ports of Ghana as coming from either Ghana or Burkina Faso. Therefore, 85% of the slaves exported from Asante ports located in Ghana would be correctly identified. In the sample 3 slaves were from northern Togo, and 96 were from the Sokoto Caliphate (located in Nigeria and Niger). Therefore, 15% of the slaves exported from Ghana would have been incorrectly identified.

These three samples provide an estimate of the precision of my estimates. They indicate that a likely lower bound on the number of slaves correctly identified is 85%. This lower bound is likely higher because movements from one coastal country to another will tend to cancel each other out. For

[22] The data are summarized in Lovejoy, (2000) pp. 161–162.

example, if the number of slaves that were from Cameroon but shipped from Nigeria equals the number of slaves from Nigeria but shipped from Cameroon, then my method of calculation provides a correct estimate for Nigeria and Cameroon. The two mis-measurements simply cancel out.

A second potential problem with the data is that slaves from the interior may be under-represented in my sample. This is because slaves are only observable in my sample if they do not die before arriving to their destination. The further inland a slave originates, the more likely he or she is to have died. Therefore, slaves from the interior may be under-represented. I describe this source of measurement error and correct for this in Section 4.4.

4 Empirical Results

4.1 Basic Results

The baseline equation that I estimate is

$$\mathrm{Y}_i = \beta_0 + \beta_1 \ln(\text{exports})_i + \beta_2 \ln(\text{area})_i + \mathbf{C}_i'\delta + \mathbf{X}_i'\gamma + \varepsilon_i \qquad (1)$$

where Y is the log of real per capita GDP in 1998; ln(exports) is the total number of slaves taken from a country between 1400 and 1913; ln(area) is land area measured in thousands of square kilometers; **C** is a vector of dummy variables that indicate the origin of the colonizer prior to independence, with the omitted category being for countries that were not colonized; and **X** is a vector of other control variables.

It is assumed that ε is i.i.d. and drawn from a normal distribution. Because the natural log of zero is undefined, I replace all values of slave exports that are zero with .1 before taking logs. Although I have data on slave exports for all 52 African countries, GDP data are only available for 50 countries. Data are unavailable for Libya and São Tomé and Príncipe.

I estimate (1) by OLS. The results are reported in Table 3. Column (1) reports results without a control for the size of the country included in the equation. In column (2), I control for the size of the country by including the log of land area as an additional explanatory variable. An alternative procedure is to normalize the number of slaves exported by land area. The results of this procedure are reported in column (3). Columns (4) to (6) report the same specifications as reported columns (1) to (3), except that colonial dummy variables that identify the colonial power prior to independence are included in the regression equations.[23] In each of the

[23]The results are completely robust to the use of alternative measures that define the

six specifications, slave exports are negatively correlated with subsequent economic development.

An alternative measure to land that can be used to control for the size of a country is population. The results when population is used are reported in Table 4; I use the average population between 1400 and 1800.[24] The results are robust to this alternative control for country size.

An alternative measure of development is post-independence economic growth. As a proxy for this, I consider the average growth rate of real per capita GDP between 1960 and 2000 as a measure for economic development. I re-estimate the six specifications reported in Table 3, but I use the average growth of real per capita GDP as the dependent variable. The results of this are reported in Table 5. Again, the core result holds with this alternative measure of economic development: past slave exports are negatively correlated with contemporary economic growth.

The partial regression plots for the variable ln(exports) from the regressions of column (6) in Tables 3 and 5 are shown in Figure 1. From the plots it is clear that Botswana and Tunisia are strongly influencing the results. However, if one removes these two countries, a highly significant, negative relationship still exists. I do more formal sensitivity and robustness tests in Section 4.3.

The estimated impact of the slave trade on growth is economically significant.[25] A one standard deviation decrease in total slave exports increases annual growth by 1.25%. This is a large increase given that the average growth rate among countries in the sample is only .71%. The estimated coefficient from the income regressions suggests that a one standard deviation decrease in slave exports increases income in 1998 dollars by $1,830. Again, this is large given that average income in the sample is only $2,490.[26]

The results of Tables 3 to 5 show that the relationship between slave

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origin of the colonizer during earlier periods. I have also used dummy variables based on the identity of the colonizer prior to World War I, taken from Shraeder (2000). The results are slightly stronger if these controls are used instead. For example, if I re-estimate the specification reported in column (5) of Table 3 using these colonial dummy variables, the estimated coefficient for ln(export) is $-.12$ and the t-statistic is -5.48. Similarly, for the specification of column (6) the estimated coefficient for ln(export/area) is $-.13$ and the t-statistic is -6.03.

[24] I have also used the initial population in 1400, 1450 or 1500, or the post-slave trade population in 1950, as measures. Using any of these alternative population measures produces very similar results.

[25] Of course, I have not yet established causality or ruled out the possibility that the relationship is spurious. This is done in Section 4.4.

[26] Summary statistics for all variables are reported in the data appendix.

Table 3: Income and slave exports, controlling for size with land area. Dependent variable is log real per capita GDP in 1998.

	(1)	(2)	(3)	(4)	(5)	(6)
ln(exports)	−.10	−.11		−.10	−.11	
	(−5.56)	(−4.93)		(−6.04)	(−5.11)	
ln(area)		.04			.03	
		(.74)			(.61)	
ln(exports/area)			−.12			−.12
			(−5.37)			(−5.68)
Britain				.18	.15	.15
				(.38)	(.33)	(.31)
France				.44	.44	.46
				(.96)	(.94)	(.97)
Portugal				−.08	−.07	.00
				(−.15)	(−.12)	(.00)
Belgium				−1.00	−1.00	−.94
				(−1.77)	(−1.75)	(−1.62)
Spain				.67	.72	.88
				(.89)	(.93)	(1.13)
U.N.				.71	.62	.47
				(.93)	(.79)	(.59)
Number obs.	50	50	50	50	50	50
R^2	.39	.40	.38	.57	.57	.54

Notes: t-statistics are reported in brackets.

Table 4: Income and slave exports, controlling for size with average population between 1400 and 1800. Dependent variable is log real per capita GDP in 1998.

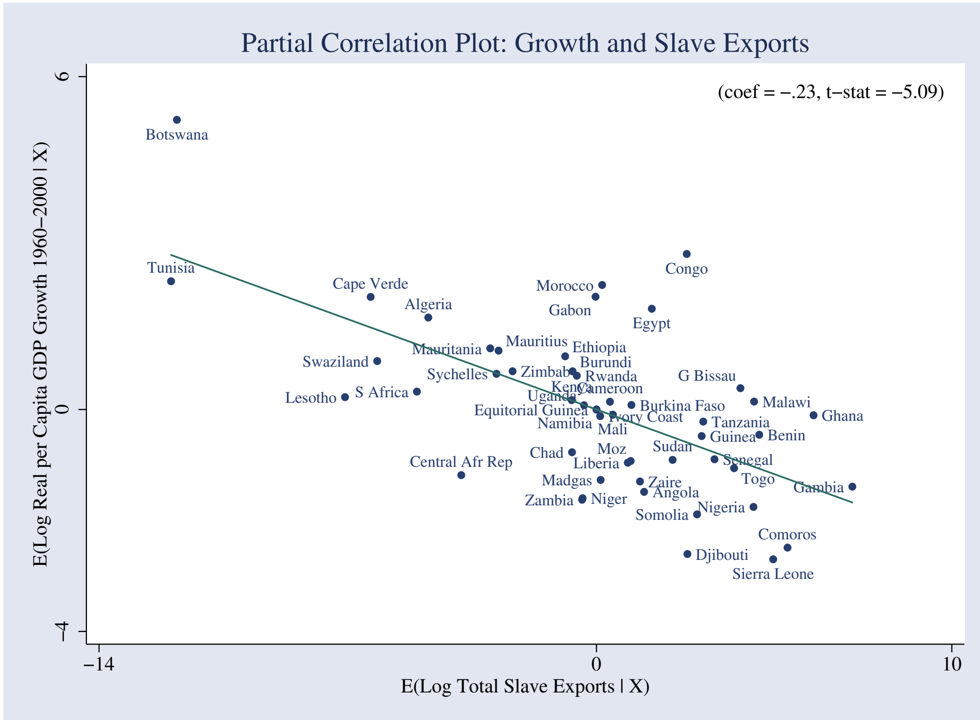
	(1)	(2)	(3)	(4)	(5)	(6)
ln(exports)	−.10	−.09		−.10	−.11	
	(−5.56)	(−3.44)		(−6.04)	(−4.26)	
ln(pop)		−.06			.02	
		(−.80)			(.27)	
ln(export/pop)			−.11			−.12
			(−5.08)			(−6.07)
Britain				.18	.16	.14
				(.38)	(.34)	(.30)
France				.44	.44	.52
				(.96)	(.95)	(1.14)
Portugal				−.08	−.08	.01
				(−.15)	(−.14)	(.02)
Belgium				−1.00	−1.03	−1.08
				(−1.77)	(−1.77)	(−1.90)
Spain				.67	.69	.94
				(.89)	(.89)	(1.24)
U.N.				.71	.71	.85
				(.93)	(.91)	(1.11)
Number obs.	50	50	50	50	50	50
R^2	.39	.40	.35	.57	.57	.57

Notes: t-statistics are reported in brackets.

Table 5: Growth and slave exports, controlling for size with land area. Dependent variable is per capita GDP growth from 1960 to 2000.

	(1)	(2)	(3)	(4)	(5)	(6)
ln(exports)	−.20	−.23		−.22	−.23	
	(−5.99)	(−5.34)		(−6.02)	(−5.09)	
ln(area)		.09			.07	
		(.81)			(.60)	
ln(exports/area)			−.25			−.25
			(−5.79)			(−5.66)
Britain				.29	.24	.23
				(.29)	(.24)	(.23)
France				.11	.11	.16
				(.12)	(.11)	(.16)
Portugal				−.18	−.15	−.01
				(−.16)	(−.14)	(−.01)
Belgium				−1.99	−1.98	−1.87
				(−1.68)	(−1.66)	(−1.54)
Spain				−.62	−.79	−.44
				(−.39)	(−.49)	(−.27)
U.N.				−.62	−.82	−1.13
				(−.39)	(−.50)	(−.68)
Number obs.	50	50	50	50	50	50
R^2	.42	.44	.41	.53	.53	.50

Notes: t-statistics are reported in brackets.



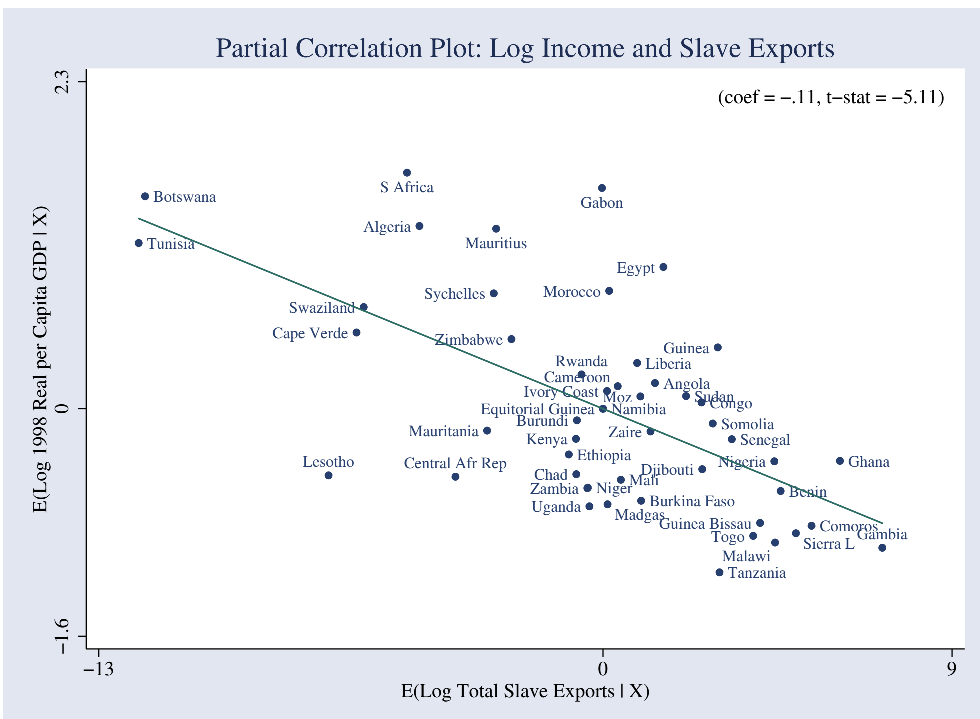


Figure 1: Partial correlation plots. Top: growth and ln(exports). Bottom: ln(income) and ln(exports). Both with ln(area) and colonial dummies included in the regression equation.

exports and economic development is not dependent on the manner in which slave exports are normalized and on the measure of economic development used. For the remainder of the paper, I use the log real GDP per capita in 1998 as the dependent variable, and land area to control for country size. None of the results that follow depend on these choices.

4.2 Including Additional Explanatory Variables

I control for a number of country characteristics that may potentially bias the estimated coefficient of slave exports if omitted. The results of this procedure are reported in Table 6. In the column (1), the specification without additional control variables is reported. In columns (2) to (7), I include groups of control variables, one at a time. I also include the set of colonial dummy variables in each regression equation.

In column (2), I report the results when controlling for the absolute latitude of each country. Latitude enters insignificantly and ln(exports) remains significant. The results of including ethnic fractionalization are reported in column (3). This variable enters with a negative, but statistically insignificant coefficient. In column (4), I include a dummy variable taking on the value of one if the country's legal origin is French rather than British. The variable enters with a positive coefficient that is statistically significant at a 10% level. Slave exports remains robust to the inclusion of this variable. In column (5), two variables that measure the proportion of population that is Islamic and Christian are included in the regression equation. Neither variable is significant and the coefficient on slave exports remains negative and significant.

In column (6), I include variables to control for each country's endowment of three key natural resources: diamonds, petroleum and gold. I use the natural log of average production per capita between 1970 and 2000. Diamond production is measured in karats, petroleum in tonnes, and gold in kilograms. The results suggest that oil has a positive and statistically significant effect. A one standard deviation increase in oil production increases income by $890.[27] Including the three measures of natural resource endowments increases the explanatory power of the regression equation significantly; the R^2 increases from .57 to .74. The t-statistic on slave exports increases significantly when the resource variables are included. Finally, in column (7), I include the length of the coastline normalized by land area,

[27]This result is consistent with the findings of previous studies. For example, Easterly and Levine (2003) find that a dummy variable for a country having oil reserves is a significant determinant of income levels among former colonies.

which is a proxy for the natural openness of a country and its ability to access foreign markets. The estimated coefficient is positive and highly significant.

Table 7 reports results when all additional control variables are included. Column (1) reports the results when only the control variables are included in the regression equation. In column (2), I add ln(exports) and ln(area). Together they provide a significant amount of additional explanatory power, increasing the R^2 from .48 to .68. I repeat the exercise, but include the colonial control variables in the regression equation. The results are reported in columns (3) and (4); the inclusion of the slave exports and area variables increases the R^2 from .68 to .80. The two variables explain a remarkable additional amount of the variation in income above and beyond the variation explained by the 15 other control variables.

Overall, the relationship between slave exports and income is robust to the inclusion of additional control variables. This is true whether the control variables are added individually or simultaneously.

4.3 Robustness and Sensitivity Analysis

I perform a number of sensitivity and robustness tests. Table 8 reports the robustness of the results to changes in the sample of countries. I omit countries that may be different from the rest of the sample to see if this influences the results. It may be that the results are being driven by a group of countries with peculiar characteristics that have nothing to do with the slave trade. The first row of Table 8 reports the results from the regression with all countries included. The first column reports the results from a regression that does not include colonial controls and the second column reports the results from a regression with colonial controls.

In the second row, I report the results when South Africa is omitted from the sample. Because this country has a large number of European settlers, economic performance may be different from other African countries for reasons unrelated to the slave trade. Omitting South Africa does not change the results. I also re-estimate the regression with North African countries omitted. It is often argued that these countries are more similar to other Mediterranean countries than to the African countries south of the Sahara. Omitting these countries does not alter the results. I also omit all island countries. Doing this does not alter the results. Next, I simultaneously omit all of the countries mentioned above. Again, this does not alter the results. In the final row, I omit all countries from which no slaves were taken. The coefficient on slave exports remains negative and statistically significant.

I test whether the results are being driven by a small number of influen-

Table 6: Income and slave exports, adding control variables. Dependent variable is log real per capita GDP in 1998.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
ln(exports)	−.11	−.09	−.09	−.11	−.11	−.11	−.13
	(−5.11)	(−3.61)	(−3.51)	(−5.17)	(−4.79)	(−6.01)	(−6.61)
ln(area)	.03	.00	.04	.04	.03	−.04	.13
	(.61)	(.03)	(.74)	(.71)	(.58)	(−.71)	(2.38)
Absolute latitude		.01					
		(1.19)					
Ethnic fractionalization			−.66				
			(−1.33)				
Legal origin=French				.76			
				(1.89)			
% of pop Islamic					.00		
					(.77)		
% of pop Christian					.00		
					(.58)		
ln(avg diamond prod/pop)						−.00	
						(−.11)	
ln(avg oil prod/pop)						.06	
						(4.76)	
ln(avg gold prod/pop)						.02	
						(1.13)	
ln(coastline/area)							.08
							(3.71)
Colonial dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number obs.	50	50	50	50	50	50	50
R^2	.57	.59	.59	.61	.58	.74	.68

Table 7: Income and slave exports, adding control variables. Dependent variable is log real per capita GDP in 1998.

	(1)	(2)	(3)	(4)
ln(exports)		−.13		−.10
		(−4.43)		(−3.68)
ln(area)		.02		−.02
		(.28)		(−.32)
Absolute latitude	.02	.01	.02	.01
	(1.80)	(.59)	(1.66)	(.86)
Ethnic fractionalization	−1.24	.24	−1.34	−.05
	(−2.44)	(.43)	(−2.75)	(−.09)
Legal origin=French	−.08	−.01	.51	.56
	(−.37)	(−.07)	(1.13)	(1.49)
% of pop Islamic	−.00	.00	−.00	.00
	(−.59)	(.09)	(−.42)	(.27)
% of pop Christian	−.00	−.01	.01	−.00
	(−.33)	(−1.19)	(.81)	(−.07)
ln(avg diamond prod/pop)	−.02	.01	.02	.01
	(1.21)	(.56)	(1.19)	(.66)
ln(avg oil prod/pop)	.03	.06	.02	.05
	(2.00)	(3.56)	(1.33)	(3.07)
ln(avg gold prod/pop)	.00	.02	.02	.03
	(.19)	(1.03)	(.93)	(1.74)
ln(coastline/area)	.05	.04	.05	.03
	(2.12)	(1.95)	(2.18)	(1.29)
Colonial dummies	No	No	Yes	Yes
Number obs.	50	50	50	50
R^2	.48	.68	.68	.80

Table 8: Income and Slave Exports: Robustness to subsamples. Dependent variable is log real per capita GDP in 1998.

	(1)				(2)			
Omitted countries	coef	t-stat	N	R^2	coef	t-stat	N	R^2
None	−.11	−4.93	50	.40	−.11	−5.11	50	.57
South Africa	−.10	−4.56	49	.39	−.10	−4.83	49	.58
North African countries	−.11	−4.55	46	.43	−.11	−4.68	46	.60
Island countries	−.10	−4.41	46	.31	−.10	−4.41	46	.51
All of the above	−.08	−3.43	41	.26	−.09	−3.56	41	.52
Zero export countries	−.11	−2.74	43	.16	−.12	−2.78	43	.42
Colonial dummies		No				Yes		

tial outliers. The results of these tests are summarized in Table 9. The first row of the table reports the results when my baseline specification, Equation (1), is estimated using the full sample. In the lower sections of the table, I re-estimate (1) after omitting potentially influential observations. I sequentially omitting one observation from the sample, and then re-estimate (1). In total, 50 regressions are estimated. The results of this are reported in the second section of the table. I perform a similar procedure, but omit two observations each time. In total, 1,225 regressions are estimated. The results of this are summarized in the third section of the table. In every regression that was estimated, the coefficient for slave exports changes very little and remains highly significant.

In the final section of the table, I identify influential observations using a number of standard rules that have been proposed in the literature.[28] I omit these outliers and re-estimate the baseline equation. Overall, the results remain robust to this procedure. Last, I calculate the studentized residual[29] for each observation and omit the observations with the largest

[28]See Belsley, Kuh and Welsch (1980) and Welsch (1982) for full details.

[29]The studentized residual is calculated from a regression line that is fitted with the observation in question removed from the sample. This avoids the problem of outliers influencing the estimated regression line, resulting in underestimated residuals for these observations.

Table 9: Robustness Tests. Omitting observations and outliers. Dependent variable is log real per capita GDP in 1998.

	coef	t-stat	N	R^2	Omitted Observations
Baseline	−.11	−5.11	50	.57	None
	One country omitted at a time: 50 regressions				
Minimum	−.11	−4.43	49	.55	BWA
Maximum	−.12	−5.79	49	.62	LSO
	Two countries omitted at a time: 1,225 regressions				
Minimum	−.11	−3.96	48	.52	BWA, TUN
Maximum	−.12	−6.32	48	.66	LSO, GAB
	Omitting influential outliers				
DFFITS	−.12	−5.65	44	.57	ETH, GNQ, LBR, LSO, MUS, NAM
Cook's Distance	−.13	−5.82	47	.62	ETH, LBR, LSO
Welsch Distance	−.11	−5.15	47	.56	GNQ, LBR, NAM
COVRATIO	−.14	−4.48	34	.51	
omit $\|\hat{e}_i\| > 2.0$	−.13	−6.76	47	.70	EGY, LSO, GAB
omit $\|\hat{e}_i\| > 1.8$	−.12	−6.53	46	.72	+ ZAF
omit $\|\hat{e}_i\| > 1.5$	−.12	−6.83	44	.72	+ MUS, CAF
omit $\|\hat{e}_i\| > 1.0$	−.12	−8.69	37	.85	

Notes: Influential variables were omitted using the following standard rules. DFFITS: Omit if $\text{DFFITS}_i > 2(k/n)^{1/2}$ (Belsley, Kuh and Welsch (1980)). Cook's distance: Omit if Cook's distance $> 4/n$ (Cook (1977)). Welsch distance: Omit if Welsch distance $> 3/\sqrt{k}$ (Welsch (1982)). COVRATIO: Omit if $|\text{COVRATIO}_i| > 3k/n$ (Belsley, Kuh and Welsch (1980)). Where n is the number of observations, 50, and k is the number of independent variables, 8. All regressions include ln(area) and colonial dummy variables.

residuals before re-estimating the equation. I first remove observations with residuals greater than 2.0, then greater than 1.8, then 1.5 and finally 1.0. In all regressions, the results remain robust to this procedure.

The last test that I perform, checks the robustness of my results to the construction of the slave export data. As I have described in Section 3, the slave export estimates for the trans-Saharan and Red Sea slave trades use additional information from historical accounts from first-hand observers of the slave trades. Because these data tend to be estimates, rather than actual counts of slaves, they are less reliable. I test whether the results of the paper depend on the use of these less precise data. Overall, I find that the results are primarily driven by exports from the trans-Atlantic and Indian Ocean slave trades, both of which do not use these less precise data.

The results of these robustness tests are reported in Table 10. The first row reports my baseline estimates of (1), without and with colonial dummy variables. Reported in the second row are the estimates of (1) after omitting the countries that rely most heavily on the less precise data. These countries are Morocco, Comoros, Uganda, Burundi, Rwanda, Djibouti, and Somalia. The results remain robust to this. The estimated coefficient for slave exports remains statistically significant and approximately the same size. As a further test, I set the estimated number of slaves from each of these countries equal to zero. If one believes that the data for these countries is too poor to be used at all, then the estimated number of slaves exported from each country would be zero. In many ways, this is an extreme robustness test, but it serves to illustrate the robustness of the results to the use of the less precise data. The results are reported in the third row of the table. The results remain robust; the estimated coefficient remains negative and statistically significant.

Next, I test whether the results depend on the inclusion of slaves exported during the Red Sea and trans-Saharan slave trades in my cacluation of total exports. I re-estimate (1) after setting the number of slaves exported during the Red Sea and Saharan slave trades equal to zero. The results are reported in rows 4 to 6 of the table. I first set Saharan exports equal to zero, then Red Sea exports, and then both. In all three cases, the results remain robust. The estimated effect of slave exports on income is smaller, but remains negative and highly significant. In rows 7 and 8, I estimate (1) using either trans-Atlantic slave exports only or Indian Ocean slave exports only. The estimated coefficients of slave exports remains negative and statistically significant. In row 9, I set trans-Atlantic and Indian Ocean exports equal to zero, and re-estimate (1). The estimated coefficient is statistically insignificant, showing that the results depend critically on slave exports from the

Table 10: Income and Slave Exports: Robustness to data construction. Dependent variable is log real per capita GDP in 1998.

	(1)				(2)			
	coef	t-stat	N	R^2	coef	t-stat	N	R^2
Baseline	−.11	−4.93	50	.40	−.11	−5.11	50	.57
Poorest data countries omitted	−.12	−5.14	43	.50	−.11	−4.68	43	.58
Poorest data countries set to zero	−.06	−2.80	50	.22	−.07	−3.23	50	.44
Saharan exports set to zero	−.10	−5.80	50	.47	−.09	−5.73	50	.61
Red Sea exports set to zero	−.09	−4.03	50	.32	−.08	−3.89	50	.49
Saharan and Red Sea set to zero	−.07	−4.08	50	.33	−.07	−4.13	50	.50
Indian exports only	−.07	−2.91	50	.23	−.06	−2.54	50	.39
trans-Atlantic exports only	−.05	−2.60	50	.20	−.05	−3.07	50	.43
Indian and Atlantic set to zero	.00	.12	50	.09	−.01	−.28	50	.30
Colonial dummies		No				Yes		

trans-Atlantic and Indian Ocean slave trades.

Overall, these results show that the estimated relationship between total slave exports and income does not depend on the estimated number of slaves shipped during Saharan and Red Sea slave trades. As well, the results do not depend on the number of slaves exported from the countries with the poorest quality data. The results are being driven by slaves exported during the trans-Atlantic and Indian Ocean slave trades. The data for both of these slave trades are estimated from the higher quality data, and do not depend on the use of the less precise data.

4.4 Instrumental Variables: Unobservable Country Characteristics and Measurement Error

If important country characteristics are unobservable or unmeasurable, then controlling for all quantifiable country characteristics will still not result in true estimates of the effect of the slave trade on development. Examples of a country's unobservable characteristics are its culture and its proclivity towards warfare and violence. If unobservable country characteristics caused certain countries to select into the slave trade, and if these characteristics persist today, causing poor economic performance, then the size of the estimated effect of slave exports on income will be biased away from zero.

A second potential source of bias comes from measurement error in the slave export data. Classical errors-in-variables will lead to a bias towards zero. In addition, it is likely that the slave export data under-represents slaves from further inland, resulting in a form of non-classical measurement error. Because of the high rates of mortality during the slave trades, this form of measurement error may be significant.[30] In Section A.1 of the appendix, I show that the under-sampling of interior slaves will result in OLS estimates that are biased towards zero.

Given the two potential biases, unobservable country characteristics, that may cause self-selection into the slave trade, and the classical and non-classical measurement errors, it is unclear whether the estimated effects will be greater or less than the true effect.

A standard solution to both of these problems is the use of instrumental variables (IV). If a variable can be found that is correlated with slave exports,

[30]Estimates of cross-Atlantic mortality rates ranged from 7 to 20% depending on the time period and the length of the voyage (see Curtin (1969), pp. 275–286, and Lovejoy (2000), p. 63). Death rates during the trek to the coast are known with less certainty, but the best estimates suggest a death rate of 10% (see Lovejoy (2000), pp. 63–64).

but is uncorrelated with both the country's unobservable characteristics and the forms of measurement error, then the IV procedure will yield consistent coefficient estimates. As instruments, I use measures of the distance from the interior of each country to the main destinations of each of the four slave trades. The following instruments are used.

1. The minimum distance from a country's interior to the coast.
2. The sailing distance from a country's coast to the closest major market of the Atlantic slave trade. The nine largest importers of slaves were used. These, listed from north to south, are: Virginia, USA; Havana, Cuba; Haiti; Kingston, Jamaica; Dominica; Martinique; Guyana; Salvador, Brazil; and Rio de Janeiro, Brazil.
3. The sailing distance from a country's coast to the closest of the two main slave destinations of the Indian Ocean slave trade: Mauritius and Muscat, Oman.
4. The distance from a country's interior to the closest slave market or port of export for the trans-Saharan slave trade. The markets range across the full northern coast of Africa. Listed from west to east, they are: Algiers, Tunis, Tripoli, Benghazi and Cairo.
5. The distance from a country's interior to the closest port of export for the Red Sea slave trade. The ports, listed from north to south, are: Massawa, Suakin, and the Gulf of Aden (Djibouti).

The location of the demand for slaves was a primary determinant of which countries of Africa slaves were primarily taken. During the Atlantic slave trade, countries that were located closest to the western coast of Africa became the primary sources of slaves. Similarly, during the Saharan slave trade, countries close to the southern border of the Sahara desert were drawn from.

The demand for African slaves was determined by a number of factors, all unrelated to the potential location of the supply of slaves. Whether the climate and soil conditions of an area was suitable for plantation agriculture that used slave labor was a key determinant of slave demand. In the West Indies, Mauritius, Southern United States and Zanzibar, slaves were imported because of suitable climate for the growing of highly valued, globally traded commodities such as sugar and cloves. The existence of gold and silver mines was a key determinant of the demand for slaves in Brazil. In the Northern Sahara, Arabia and Persia, slaves were needed to work in salt mines and in the Red Sea area slaves were used as pearl divers. The religion of a location was also a key determinant of the demand for slavery. In the Muslim societies of North Africa and the Middle East, slaves were used as eunuchs, concubines, soldiers, government officials and servants. Because the location of the external demand for slaves is driven by these factors, this location will be uncorrelated with the unobservable characteristics of African countries, but did affect which countries were most targeted during the slave trades.

I estimate the following system of equations using 2SLS,

$$\mathrm{Y}_i = \beta_{10} + \beta_{11}\mathrm{S}_i + \mathbf{C}_i'\delta + \mathbf{X}_i'\gamma + \varepsilon_{1i} \quad (2)$$

$$\mathrm{S}_i = \beta_{20} + \mathbf{Z}_i'\beta_{\mathbf{z}} + \varepsilon_{2i} \quad (3)$$

where Y is real per capita GDP; S is ln(exports/area); **C** is the vector of colonial dummy variables; and **Z** is a vector of the distance instruments.

Table 11 reports the results of the IV estimates. In columns (1) and (4), I report the OLS estimates, with and without colonial controls. In columns (2) and (5), the IV estimates are reported. The estimated coefficients of the instruments in the second stage are of the expected sign. The further a country is from slave markets, the lower the number of slaves exported from that country. All coefficients are statistically significant.

In the second stage, the estimated coefficient for ln(exports/area) remains significant and negative. The magnitude of the coefficient does not change if colonial controls are not included in the second stage, but increases from $-.12$ to $-.15$ if colonial controls are included. In both specifications, the over-identification test rejects the null hypothesis of valid instruments at the 5% level. The results of the Hausman test cannot reject the null hypothesis that the OLS estimate of the coefficient of ln(exports/area) is consistent. This is true whether or not colonial controls are included.

Of the five instruments, there is particular concern that the distance from a country's interior to its coast may be correlated with ε_{1i} in equation (2). For example, it may be that easy access to the coast allows countries to trade more, import more technology, specialize in specific goods, and, as a result, these countries tend to grow faster. In addition, this variable may be correlated with the measurement error resulting from the under-sampling of slaves from the interior. The results of the over-identification test also suggests that the instrument may not be valid. To correct for this possibility, I omit the distance to the coast instrument and re-estimate the equations. The results are reported in columns (3) and (6). The coefficients of the remaining four instruments remain negative. However, the coefficient

Table 11: IV Regressions. Dependent variable is log real per capita GDP in 1998.

	OLS (1)	IV (2)	IV (3)	OLS (4)	IV (5)	IV (6)
Second Stage. Dependent variable is Income						
ln(exports/area)	−.12	−.12	−.18	−.12	−.15	−.21
	(−5.37)	(−3.79)	−(4.56)	(−5.68)	(−4.97)	(−5.06)
Colonial dummies	No	No	No	Yes	Yes	Yes
F-stat	28.9	13.8	20.0	7.1	5.4	4.8
Number obs.	50	50	50	50	50	50
First Stage. Dependent variable is ln(exports/area)						
Interior distance		−.004			−.004	
		(−2.79)			(−2.80)	
Atlantic distance		−.002	−.001		−.002	−.001
		(−4.86)	(−3.78)		(−4.68)	(−3.50)
Indian distance		−.001	−.001		−.001	−.001
		(−3.58)	(−2.78)		(−3.25)	(−2.42)
Saharan distance		−.003	−.002		−.003	−.002
		(−3.55)	(−2.92)		(−3.09)	(−2.41)
Red Sea distance		−.002	−.001		−.002	−.001
		(−2.14)	(−1.18)		(−2.34)	(−1.33)
F-stat		7.4	6.3		3.3	2.5
Over-id test (p-value)		.01	.16		.04	.55
Hausman test (p-value)		.90	.08		.98	.49

for minimum distance to Red Sea ports becomes insignificant. Removing the distance to the coast instrument results in much higher p-values for the over-identification test. The null hypothesis of valid instruments is no longer rejected, suggesting that the subset of four instruments is preferable to the full set of instruments. The Hausman test, at the 5% level, cannot reject the null hypothesis that the OLS coefficient for slave exports is consistent. But, if colonial controls are not included, the null hypothesis can be rejected at the 10% level. The magnitude of the estimated effect of slave exports increases when the distance to coast instrument is removed. The new estimated coefficients are $-.18$ and $-.21$, with and without colonial controls included. The coefficients remain statistically significant.

The magnitude of the IV estimates are significantly larger than the OLS estimates. One explanation for this is that the attenuation bias, resulting from both the classical and non-classical measurement errors, overwhelms the bias resulting from unobservable country characteristics. Thus, the OLS estimates are slightly biased towards zero, and instrumenting slave exports results in an increase in the estimate magnitude of the coefficient.

An alternative explanation for the increased magnitude of the coefficient is that the instruments are still positively correlated with the distance to the coast and the non-classical measurement error present in the data. In Section A.2 of the appendix, I show that under these circumstances, the IV estimate of the slave export coefficient will be biased away from zero. If the instruments are uncorrelated with unobservable country characteristics, but are possibly correlated with the non-classical measurement error, then the IV estimates provide an upper bound for the effect of slave exports on income.

4.5 Channels of Causality

4.5.1 The Slave Trade and the Formation of Domestic Institutions

In an initial attempt to determine the channels of causality between the intensity of the slave trade across countries and their current level of development, I correlate ln(exports/area) with various measures of institutions, corruption and rent-seeking. Table 12 reports the results of regressions estimated with different measures of institutional quality used as the dependent variable. I regress each dependent variable on ln(exports/area). I also estimate each regression with the set of colonial controls included. For all variables the sign of the coefficients suggest that past slave exports are neg-

Table 12: ln(exports/area) and various institutional measures.

	(1)				(2)			
Dependent Variable	beta coef	t-stat	N	R^2	beta coef	t-stat	N	R^2
				Political Stability				
Military coups/year, independence to 2000	.32	2.39	52	.10	.32	2.19	52	.16
Avg number of revolutions per decade 1960–1990	.22	1.54	50	.05	.19	1.32	50	.15
Political Stability 2002	−.37	−2.80	52	.14	−.34	−2.57	52	.34
				Quality of Government				
Government Effectiveness 2002	−.59	−5.21	52	.35	−.58	−5.10	52	.49
Regulatory Quality 2002	−.50	−4.08	52	.25	−.49	−4.28	52	.49
Control of Corruption 2002	−.57	−4.91	52	.33	−.62	−5.58	52	.53
				Property Rights				
Average protection against expropriation risk	−.32	−2.18	43	.10	−.38	−2.42	43	.34
Rule of Law 2002	−.53	−4.39	52	.28	−.53	−4.41	52	.44
				Accountability of Government				
Constraint on Executive 1990	−.31	−2.18	46	.10	−.30	−1.93	46	.21
Voice and Accountability 2002	−.37	−2.85	52	.14	−.34	−2.66	52	.38
Democracy Level in 1994 (1=low, 7=high)	−.42	−3.08	47	.17	−.44	−3.25	47	.41
Colonial Dummies		No				Yes		

atively correlated with 'good' institutions, and positively correlated with corruption, conflict and rent-seeking behavior.

As a more direct test of the hypothesis that the slave trade affects economic performance today through its effect on the past formation of domestic institutions, I estimate the following system of equations:

$$\mathrm{Y}_i = \beta_{10} + \beta_{11}\mathrm{Q}_i + \mathbf{C}_i'\delta + \mathbf{X}_i'\gamma + \varepsilon_{1i} \quad (4)$$

$$\mathrm{Q}_i = \beta_{20} + \beta_{21}\mathrm{S}_i + \varepsilon_{2i} \quad (5)$$

where, as before, Y is log income; Q is a measure of the quality of domestic institutions – the rule of law in 1998; **C** is a vector of colonial dummy variables; **X** is a vector of other control variables; S is ln(exports/area).

I estimate the system of equations by 2SLS. Results are reported in Table 13. Columns (1) and (4) report estimates when (4) is estimated by OLS, without and with colonial controls. Columns (2) and (5) report the results of estimating the equations by 2SLS. The results support the hypothesis of the slave trade affecting development through the quality of domestic institutions. In the first stage, ln(exports/area) is found to be negatively correlated with the rule of law and the estimated coefficient is highly significant. The estimated coefficient for the instrumented rule of law tends to be about twice the magnitude of the estimated coefficient when OLS is used. An alternative strategy is to use the distance measures as instruments for the rule of law. The results of doing this are reported in columns (3) and (6). Again, the results show that the distance measures are correlated with the rule of law. The further a country is from export markets, the better the rule of law is. However, only the distance to the trans-Atlantic and Red Sea markets are consistently significant.

To test the robustness of the results, I re-estimate the system of equations reported in column (3), but I include control variables in the income equation. I use the same set of controls that were previously used: latitude, ethnic fractionalization, legal origin, religion, natural resource endowments (diamonds, gold, and oil), and coastline. The results, reported in Table 14, indicate that the instrumented rule of law measure continues to affect income when other factors are controlled for. I add each group of control variables, one at a time. Individually, the variables do not qualitatively alter the impact that institutions have on growth. The rule of law variable remains significant, and the estimated coefficient remains positive.

Table 13: IV Regressions. Dependent variable is log real per capita GDP in 1998.

	OLS (1)	IV (2)	IV (3)	OLS (4)	IV (5)	IV (6)
Second Stage. Dependent variable is log income 1998						
Rule of law 1998	.66	1.30	1.36	.69	1.50	1.59
	(4.50)	(4.32)	(3.90)	(3.91)	(4.06)	(3.42)
Colonial dummies	No	No	No	Yes	Yes	Yes
F-stat	20.2	26.6	15.2	4.11	3.63	2.86
Number obs.	50	50	50	50	50	50
First Stage. Dependent variable is rule of law 1998						
ln(exports/area)		−.09			−.08	
		(−4.94)			(−4.67)	
Atlantic distance			.02			.02
			(3.30)			(2.98)
Indian distance			.01			.01
			(1.93)			(1.38)
Saharan distance			.02			.01
			(1.38)			(.68)
Red Sea distance			.03			.03
			(2.14)			(2.30)
F-stat		4.0	24.4		3.4	7.16
Hausman test (p-value)		.03	.02		.73	.51
Over-id test (p-value)			.47			.27

Table 14: Adding controls to the income equation. Dependent variable is log real per capita GDP in 1998.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Rule of law 1998	1.30	1.64	1.08	1.36	1.22	1.29	1.71
	(4.32)	(2.89)	(3.08)	(4.31)	(4.53)	(4.63)	(4.69)
Absolute latitude		−.03					
		(−1.05)					
Ethnic fractionalization			−.60				
			(−1.07)				
Legal origin=French				.29			
				(1.08)			
% of pop Islamic					.01		
					(1.19)		
% of pop Christian					.01		
					(1.39)		
ln(avg diamond prod/pop)						.01	
						(.72)	
ln(avg oil prod/pop)						.06	
						(3.54)	
ln(avg gold prod/pop)						−.02	
						(−.89)	
ln(coastline/area)							.05
							(1.71)
Number obs.	50	50	50	50	50	50	50
F-stat	26.6	7.4	12.1	9.3	7.1	8.5	13.4

Table 15: Slave Exports, Institutions and Development. Dependent variable log real per capita GDP in 1998.

	(1)	(2)	(3)
Rule of law 1998	.67		.34
	(4.50)		(2.11)
ln(exports/area)		−.12	−.09
		(−5.37)	(−3.31)
Number obs.	50	50	50
R^2	.30	.38	.43

4.5.2 The Slave Trade and other Channels

I have found that the slave trade affects economic development through the quality of domestic institutions. However, I have not tested whether this is the only channel through which the slave trade continues to influence current development. I do this here.

Consider the following equation,

$$\mathrm{Y}_i = \beta_0 + \beta_1 \mathrm{Q}_i + \beta_2 \mathrm{S}_i + \varepsilon_i \tag{6}$$

where as before Y is log income; Q is the rule of law; and S is slave exports per km^2 of land area. Assume that the true relationship between income, institutions and past slave exports takes this form. I want to test whether S affects Y through other channels beyond its affect through Q. A simple test of this is to estimate (6) by OLS, and test whether $\hat{\beta}_2 = 0$.[31] I report the results of this in Table 15. In columns (1) and (2), I include rule of law and slave exports individually in the regression equation. On their own both variables are significant. In column (3), both variables are included. Both remain statistically significant, although the estimated coefficients of both variables drop significantly. The coefficient for the rule of law drops to half its original value (from .67 to .34), while the drop in the magnitude of the coefficient of slave exports is less dramatic, decreasing from −.12 to −.09.

As a second test, I follow a procedure used by AJR (2001) and Easterly and Levine (2003) (henceforth EL), and estimate by 2SLS the following

[31] The validity of this test relies on the assumptions that $E(Q'\varepsilon) = 0$ and $E(S'\varepsilon) = 0$.

equations.

$$\begin{aligned} \mathrm{Y}_i &= \beta_0 + \beta_1 \mathrm{Q}_i + \varepsilon_i && (7) \\ \mathrm{Q}_i &= \gamma_0 + \mathbf{S}_i' \gamma_s + u_i && (8) \end{aligned}$$

where all variables are defined as above, except now I generalize and allow for a vector of slave export measures, **S**. Here, slave exports are used as instruments for institutions. The test suggested by AJR (2001) and EL (2003) is an over-identification test. They argue that the test addresses the question of whether **S** is able to explain Y beyond the ability of **S** to explain Y through Q.[32]

To see the logic of using an over-identification test, consider the following over-identification test.[33] The test statistic is $nR^2_\varepsilon \overset{a}{\sim} \chi^2_G$, where G is the number of over-identification restrictions (instruments less endogenous variables), N is the number of observations and R^2_ε is the R-squared from the following regression

$$\hat{\varepsilon}_i = \beta_0 + \mathbf{S}_i' \beta_s + \nu_i$$

where $\hat{\varepsilon}$ are the 2SLS residuals from the regression of Y on the instrumented endogenous variable. Intuitively, if one observes a high correlation between $\hat{\varepsilon}$ and **S**, then the null hypothesis of **S** not having a direct effect on Y, $E(\mathbf{S}'\varepsilon) = 0$, can be rejected. The interpretation of the procedure is that it tests whether slave exports are correlated with economic development once their correlation with development through institutions is taken into account.

The results of this test are reported in Table 16. In column (1), the results from estimating the second stage by OLS is reported for comparison. In column (2), I report the 2SLS results with ln(exports/area) serving as the instrument for rule of law. The coefficient on rule of law increases slightly and remains statistically significant. The Hausman tests rejects the null hypothesis of consistency of the OLS estimates at a 2% significance level, suggesting that rule of law is endogenous. Because the number of instruments equals the number of endogenous variables, I am unable to test the over-identification restrictions. Because of this, I disaggregate ln(exports/area) and use the number of slaves exported in each of the four slave trades as instruments. This results in the following four instruments:

[32] In their paper, the authors are concerned with whether endowments are able to explain economic development beyond their ability to explain institutional development. See Easterly and Levine (2003), p. 30.

[33] See Davidson and MacKinnon (1993), pp. 232–237, and Wooldridge (2002), pp. 122-124.

Table 16: IV Regressions: Testing channels of causality using over-identification tests. Dependent variable log real per capita GDP in 1998.

	OLS (1)	IV (2)	IV (3)	IV (4)	IV (5)
Second Stage. Dependent Variable is log Income in 1998					
Rule of law 1998	.67	1.30	1.09	1.63	1.36
	(4.50)	(4.32)	(2.92)	(3.53)	(4.50)
F-stat	20.2	18.7	8.53	12.5	20.23
Number obs.	50	50	50	36	50
First Stage. Dependent variable is Rule of law in 1998					
ln(exports/area)		−.09		−.06	−.08
		(−4.94)		(−1.87)	(−3.80)
ln(Atlantic/area)			−.05		
			(−3.12)		
ln(Indian/area)			−.004		
			(−.20)		
ln(Saharan/area)			.004		
			(.22)		
ln(Red Sea/area)			−.05		
			(−1.80)		
ln(mortality)				−.14	
				(−1.55)	
ln(density 1500)					−.07
					(−1.02)
F-stat		24.4	2.56	5.70	12.7
Over-id test (p-value)			.30	.79	.34
Hausman test (p-value)		.02	.22	.03	.01

ln(Atlantic/area), ln(Indian/area), ln(Saharan/area), and ln(Red Sea/area). The 2SLS estimates using the four instruments are reported in column (3). The over-identification test cannot reject the null hypothesis of valid instruments. Or interpreting the test as AJR and EL do, the test cannot reject the null hypothesis that slave exports do not explain economic development beyond their ability to explain institutional development.

I repeat the test using a second source of instruments, which have been shown to be key determinants of institutions. I use the aggregate measure of slave exports ln(exports/area) and log mortality from AJR (2001). The results of this are reported in column (4). In a second specification, I use log slave exports and log population density in 1500.[34] The results of this are reported in column (5). For both specifications, the over-identification test cannot reject the null hypothesis that mortality and slave exports, and density and slave exports do not explain economic development beyond their ability to explain institutional development.

I perform a final test that follows AJR (2001, 2002). The authors include the instrument of interest as an exogenous regressor in the second stage of the 2SLS procedure. When the set of instruments is the log of exports per area in each of the four slave trades, I sequentially include exports from one of each of the four slave trades as an additional explanatory variable in the second stage. The results of this are reported in columns (1) to (4) of Table 17. For each of the four variables, the included slave trade measure is statistically insignificant. This suggests, that each of the slave export variables do not have a direct effect on economic development once its effect through institutions is taken into account. In column (5), I report results when the set of instruments are ln(exports/area) and log mortality from AJR (2001), and ln(exports/area) is included in the second stage. The coefficient of ln(exports/area) in the second stage is insignificant, again suggesting that slave exports do not have an effect on economic development beyond their effect through the quality of domestic institutions. In column (6), I repeat this procedure, but use population density in 1500 as the additional instrument in the first stage. Again the coefficient for ln(exports/area) is statistically insignificant in the second stage equation.

As stressed by EL, "these experiments are for illustrative purposes only".[35] However, the tests do provide evidence of the channels through which the slave trade affects economic development. It appears to be primarily through

[34]The measure of population density that I use is created from McEvedy and Jones (1978). I use my data rather than the data from AJR (2002) because my data are complete for the full sample of African countries.

[35]Easterly and Levine (2003), p. 32.

Table 17: 2SLS Income Regressions: Testing channels of causality using over-identification tests.

	(1)	(2)	(3)	(4)	(5)	(6)
Second Stage. Dependent Variable is Income in 1998						
Rule of law 1998	.85	1.04	1.11	1.12	1.39	2.77
	(1.38)	(2.88)	(2.89)	(2.92)	(1.50)	(1.05)
ln(Atlantic/area)	−.01					
	(−.46)					
ln(Indian/area)		−.03				
		(−1.62)				
ln(Saharan/area)			−.01			
			(−.33)			
ln(Red Sea/area)				.02		
				(.55)		
ln(exports/area)					−.02	.13
					(−.30)	(.55)
F-stat	4.89	5.86	4.19	4.27	7.45	3.36
First Stage. Dependent variable is Rule of law in 1998						
ln(Atlantic/area)	−.05	−.05	−.05	−.05		
	(−3.12)	(−3.12)	(−3.12)	(−3.12)		
ln(Indian/area)	−.004	−.004	−.004	−.004		
	(−.20)	(−.20)	(−.20)	(−.20)		
ln(Saharan/area)	.004	.004	.004	.004		
	(.22)	(.22)	(.22)	(.22)		
ln(Red Sea/area)	−.05	−.05	−.05	−.05		
	(−1.80)	(−1.80)	(−1.80)	(−1.80)		
ln(exports/area)					−.06	−.08
					(−1.87)	(−3.80)
ln(mortality)					−.14	
					(−1.55)	
ln(density 1500)						−.07
						(−1.02)
F-stat	2.56	2.56	2.56	2.56	5.70	12.7
Number obs.	50	50	50	50	36	50

the quality of domestic institutions; once one controls for the impact of the slave trade through institutional quality, the slave trade does not effect economic development through other channels.

5 Conclusions

Combining shipping data that report the number of slaves shipped from the regions and ports of Africa and historical records that report slave ethnicities, I have constructed estimates of the number of slaves exported from each country in Africa between 1400 and 1913. I find the number of slaves taken from each country to be an important determinant of subsequent economic development. This result is robust to a number of sensitivity tests, including the addition of a number of explanatory variables that previous studies have found to be important determinants of economic development.

To address the potential problems of measurement error and unobserved country-level heterogeneity, I use instruments that are uncorrelated with unobservable country characteristics, but correlated with the number of slaves taken from a country. The instruments that I use are measures of the distance from each country to the closest slave market in each of the four slave trades. The IV results support the findings from OLS. The estimated effect of the slave trade on income remains negative and statistically significant.

I find that the relationship between the slave trade and current economic performance is through the slave trade's effect on the quality of domestic institutions, such as the quality of the judicial system and the overall rule of law. Once this relationship is accounted for, the slave trade does not exert an influence on economic development through other channels.

A Measurement Error: Undersampling of slaves from the interior

A.1 OLS

Denote the true number of slaves taken from each country i by S_i^*. The measured number of slaves is given by S_i. Denote the distance from country i to the coast by D_i and economic development by Y_i. Denote deviations from means by lower case letters: s_i^*, s_i, d_i and y_i.

Let the true relationship between the number of slaves exported and distance to the coast is given by

$$S_i^* = \alpha_0 - \alpha_1 D_i + \varepsilon_i \qquad (9)$$

where $\alpha_1 > 0$ and ε_i is i.i.d. drawn from a normal distribution.

Assume that the relationship between the observed number of slaves exported, S_i, and the distance to the coast is given by

$$S_i = \gamma_0 + \gamma_1 S_i^* - \gamma_2 D_i + \nu_i \tag{10}$$

where $\gamma_1 > 0$, $\gamma_2 > 0$ and ν_i is uncorrelated with ε_i.

The true relationship between slave exports and development is given by

$$Y_i = \beta_0 - \beta_1 S_i^* + \omega_i \tag{11}$$

where $\beta_1 > 0$ and ω_i is uncorrelated with all other variables.

The following equation is estimated by OLS, with development regressed on observed slave exports

$$Y_i = a - bS_i + z_i$$

The estimated relationship between S_i and Y_i is given by

$$\hat{b} = \frac{\sum_i s_i y_i}{\sum_i s_i^2} \tag{12}$$

Substituting (9) into (10) and writing the expression in terms of deviations from means gives

$$s_i = -(\gamma_1 \alpha_1 + \gamma_2) d_i + \gamma_1 \varepsilon_i + \nu_i \tag{13}$$

Similarly, (9) and (11) give

$$y_i = \beta_1 \alpha_1 d_i - \beta_1 \varepsilon_i + \omega_i \tag{14}$$

Substituting (13) and (14) into (12), and taking the plim of $\hat{b}$ gives

$$\text{plim } \hat{b} = -\beta_1 \left[\frac{(\gamma_1 \alpha_1^2 + \gamma_2 \alpha_1)\sigma_d^2 + \gamma_1 \sigma_\varepsilon^2}{(\gamma_1^2 \alpha_1^2 + 2\gamma_1 \gamma_2 \alpha_1 + \gamma_2^2)\sigma_d^2 + \gamma_1^2 \sigma_\varepsilon^2 + \sigma_\nu^2} \right] \tag{15}$$

If $\gamma_1 = 1$ and $\gamma_2 = 0$, then the measurement error is classical errors-in-variables, and (15) reduces to

$$\text{plim } \hat{b} = -\beta_1 \left[\frac{\alpha_1^2 \sigma_d^2 + \sigma_\varepsilon^2}{\alpha_1^2 \sigma_d^2 + \sigma_\varepsilon^2 + \sigma_\nu^2} \right] = -\beta_1 \left[\frac{\sigma_{s^*}^2}{\sigma_{s^*}^2 + \sigma_\nu^2} \right]$$

where the last equality follows because $\sigma_{s^*}^2 = \alpha_1^2 \sigma_d^2 + \sigma_\varepsilon^2$. This is the standard formula for attenuation bias.

Next, I continue to assume that $\gamma_1 = 1$, but relax the assumption that $\gamma_2 = 0$ and allow for $\gamma_2 > 0$. This allows for the possibility that the greater the distance of the origin from the coast, the greater the under-estimation of slave exports. Equation (15) becomes

$$\text{plim } \hat{b} = -\beta_1 \left[\frac{\sigma_{s^*}^2 + \gamma_2 \alpha_1 \sigma_d^2}{\sigma_{s^*}^2 + 2\gamma_2(\alpha_1 + \gamma_2)\sigma_d^2 + \sigma_\nu^2} \right]$$

Because $\alpha_1 > 0$ and $\gamma_2 > 0$, it follows that $2\gamma_2(\alpha_1 + \gamma_2) > \gamma_2\alpha_1$ and the presence of non-classical measurement error reinforces the attenuation bias resulting from errors-in-variables. Asymptotically, $\hat{b}$ is further biased towards zero because of the under-sampling of slaves from the interior.

A.2 IV

Next consider the use of an instrument Z_i. I make one change to allow for the relationship between the instrument and the true number of slaves exported. Equation (9) is replace with

$$S_i^* = \alpha_0 - \alpha_1 D_i + \alpha_2 Z_i + \varepsilon_i \tag{16}$$

Substituting (16) into (10) and expressing this in terms of deviation from means gives

$$s_i = -(\gamma_1\alpha_1 + \gamma_2)d_i + \gamma_1\alpha_2 z_i + \gamma_1\varepsilon_i + \nu_i \tag{17}$$

Similarly, (16) and (11) give

$$y_i = \beta_1\alpha_1 d_i - \beta_1\alpha_2 z_i - \beta_1\varepsilon_i + \omega_i \tag{18}$$

The IV estimate of β_1 is

$$\hat{b}_{iv} = \frac{\sum_i z_i y_i}{\sum_i z_i s_i} \tag{19}$$

Substituting (17) and (18) into (19), and taking the plim of $\hat{b}_{iv}$ gives

$$\text{plim } \hat{b}_{iv} = -\beta_1 \left[\frac{\alpha_2\sigma_z^2 - \alpha_1\sigma_{zd}}{\gamma_1\alpha_2\sigma_z^2 - (\alpha_1\gamma_1 + \gamma_2)\sigma_{zd}} \right] \tag{20}$$

where it is assumed that $\text{plim}\frac{1}{n}\sum_i z_i\omega_i = 0$, which follows if the instrument is uncorrelated with unobservable country characteristics, and that $\text{plim}\frac{1}{n}\sum_i z_i\nu_i = 0$, which follows if the instrument is uncorrelated with the classical measurement error.

Assume that $\gamma_1 = 1$. If the instrument is uncorrelated with distance, $\sigma_{zd} = 0$, then $\hat{b}_{iv}$ is consistent. But, if the instrument is positively correlated with distance, $\sigma_{zd} > 0$, then

$$\text{plim } \hat{b}_{iv} = -\beta_1 \left[\frac{\alpha_2 \sigma_z^2 - \alpha_1 \sigma_{zd}}{\alpha_2 \sigma_z^2 - (\alpha_1 + \gamma_2)\sigma_{zd}} \right]$$

and because $\alpha_1 < \alpha_1 + \gamma_2$, $\hat{b}_{iv}$ is inconsistent and asymptotically biased away from zero.

B Data

Real per capita 1998 GDP. From PWT Mark 6.1, with missing countries filled in with data from Maddison (2001).
Average real per capita GDP growth, 1960–2000. From PWT Mark 6.1, with missing countries filled with data from Maddison (2001).
Land Area. From Parker (1997). Total land area in thousands of km^2.
Population. Author's calculations using McEvedy and Jones (1978). Population in 1,000s. Simple average of the estimated population in the following years: 1400, 1500, 1600, 1700 and 1800.
Colonial Dummy Variables. From the Political Regimes and Regime Transitions in Africa, 1910–1994 data set. Name of the colonial power immediately prior to independence.
Rule of Law. From Kaufmann et al. (2003). An index ranging from -2.5 to 2.5 that measures the extent to which agents have confidence in and abide by the rules of society. These include perceptions of the incidence of crime, the effectiveness and predictability of the judiciary, and the enforceability of contracts. In all, the variable is a measure of the success of a society in developing an environment in which fair and predictable rules form the basis for economic and social interactions, and importantly, the extent to which property rights are protected. A higher number indicates a better rule of law.
Distance Instruments. Author's calculations. The calculated distances used are the great circle distance between two locations. The formula used is

$$d_{ij} = \arccos\{\sin(L_i)\sin(L_j) + \cos(L_i)\cos(L_j)\cos(Lo_i - Lo_j)\} \times 111.12$$

where d_{ij} is the distance in kilometers between location i and j, L_i is the latitude of location i in degrees, and Lo_i is the longitude of location i in degrees. In calculating the shortest sailing distances it is assumed that the Suez canal was unavailable. The canal was not completed until 1869, which is near the end of the slave trade.

Democracy Index. From the Political Regimes and Regime Transitions in Africa, 1910–1994 data set. The index ranges from 1 to 7, with 7 being the most democratic and 1 being the least democratic.

Military Coups. From Thomson (2000). The average number of coups per year, from 1950 to 2000 or independence to 2000. The shortest of the two periods is used.

Number of Revolutions. From Easterly and Levine (1997). This is the average number of revolutions per decade for the period from 1960 to 1990.

Protection Against Expropriation Risk. From Englebert (2000a). This is an index that measures the average protection against expropriation risk.

Constraint on the Executive. From Acemoglu et al. (2001). This is an index that measures the constraint on the executive in 1990.

Production of Diamonds, Crude Petroleum and Mined Gold. From the British Geological Survey's *World Mineral Statistics* and *World Mineral Production* various years. Measure is the average production from 1970 to 2000. Diamonds include both gemstones and industrial diamonds and are measured in 000s of carats. Crude Petroleum is measure in thousands of tonnes. Mined Gold is measured in kilograms.

Legal Origin. From La Porta et al. (1999). A dummy variable indicating the legal origin of the country. The variable takes on a value of one if the legal origin is French and zero if it is British.

Coastline. From Parker (1997). A measure of the total coastline of the country, reported in kilometers.

Religion. From Parker (1997). Two measures: the fraction of the population that are Christian, and the fraction that are Islamic.

Ethnic Fractionalization. From Alesina et al. (2003).

Average Latitude. From Parker (1997). The absolute value of the country's average latitude measured in degrees.

Table 18: Summary Statistics

Variable	Mean	std. dev.	Min	Max	N
Total exports	351,357	593,764	0	2,326,526	50
ln(exports)	9.11	5.32	−2.3	14.66	50
ln(area)	5.27	2.01	−.69	7.83	50
ln(exports/area)	3.85	4.46	−8.67	9.01	50
Growth 1960-2000	.71	1.73	−3.37	6.17	50
Real per capita GDP 1998	2,490	2,672	289	12,590	50
ln(real per capita GDP 1998)	7.41	.87	5.66	9.44	50
Rule of law 1998	−.55	.70	−1.97	1.14	50
ln(avg diamond prod/pop)	−18.0	6.34	−25.1	−4.7	50
ln(avg oil prod/pop)	−17.6	6.45	−24.4	−4.3	50
ln(avg gold prod/pop)	−14.3	5.95	−24.5	−3.8	50

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