Rethinking Africa's GDP, 1796-1950

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Abstract Has Africa always been poor? This thesis attempts to answer this question, presenting estimates of incomes in Africa from 1796 onwards. I build upon the work of Prados de la Escosura, who exploited the relationship between GDP per capita and income terms of trade to create African GDP estimates from 1870 to 1950. I produce new estimates, which are both of a higher quality and more extensive. My regional estimates go back as far as 1796 and the majority of my country estimates go back to 1830. Outside of South Africa, this is the first insight into the incomes in sub-Saharan Africa during this period. I find two interesting results. The first, that there was an economic boom in West and East Africa immediately prior to the scramble for Africa. The second, more surprising result, is that GDP per capita levels rise prior to 1840. I demonstrate how this contradicts previous literature and highlight how both of these booms were triggered primarily by the many structural changes which occurred during and shortly after the transatlantic slave trade. Finally, I make comparisons of my GDP estimates with the available estimates supporting the validity of my results.

Keywords: sub-Saharan Africa, historical economic growth, development, GDP per capita

JEL classification: E01, N17, O47, O55

1 INTRODUCTION

One might ask why we should attempt to measure the GDP of historical Africa. It is commonly accepted amongst economists that GDP per capita in a Malthusian economy gravitates around the subsistence level.[1] On the contrary, there is reason to believe that GDP per capita levels in the agricultural sector were above the subsistence level. Prados de la Escosura (2012) notes that: *"people grew taller, frequency of famines declined, markets became integrated largely because of railway infrastructure, and new production techniques enter the market."*[2]

North Africa is relatively well-known as being home to a number of historically advanced countries and empires (Tolan, 2012). On more than one occasion, the region has occupied southern-European territory in a "process fairly akin to colonialism" (Peralias, 2016); the region is often referred to as a part of the "Western agricultural core" (Borcan, 2018). It does, however, come to the surprise of many to know that numerous developed states existed in pre-colonial sub-Saharan Africa, ranging from small kingdoms to extensive empires e.g. the Kingdom of Kush, Songhai Empire and the Abyssinian Empire to name a few - suggestive of a more complex history of both wealth and poverty than the state of persistent impoverishment assumed by many. Kings and emperors in West Africa exemplify the wealth of pre-colonial sub-Saharan Africa: in the year 977 A.D., Ibn Hawqal referred to the king of Ghana as the "richest man on earth because of his gold" (Mauny, 1954), similarly Mansa Musa, emperor of Mali in the 14th Century, was identified as the richest person in history, according to Forbes.[3]

Attempts to answer the question of whether Africa has always been poor are immediately hampered by the lack of pre-colonial written sources, furthermore, of the records that do exist, they are seldom translated. For instance, in Timbuktu - a historically wealthy city in Mali - there is a large collection of historical documents. These scripts were written in *Ajami* (local languages written using the Arabic alphabet - the scholarly *lingua franca* in sub-Saharan Islamic Africa).[4] Given the lack of data, it is difficult to grasp a clear economic understanding of Africa's economic growth, or lack thereof. Indeed, much of our current understanding of historical Africa is based upon *"guesstimates"*.

In this thesis, I tackle this problem, presenting estimates of GDP per capita (and total GDP) under constant, modern-day borders.[5] I do so with the purpose of painting a clearer picture of historical Africa. To do so, I follow the methodology of Prados de la Escosura (2012), who constructed indirect GDP estimations from 1870 to 2007, making use of the most well-documented

[1] Sharp (2012) shows that productivity growth in agriculture has no effect on equilibrium income under a Malthusian framework.

[2] See data from the African Economic History Network for evidence on heights; a detailed analysis given by Moradi (2013).

[3] http://forbes.es/emprendedores/8486/asi-fue-mansa-musa-la-persona-mas-rica-de-todos-los-tiempos/

[4] Many of these manuscripts are currently being translated by the Ajami Project (2017-2029), however the primary focus is on translating amulets, poems and religious texts.

[5] My results thus related to the respective geographical region.

factor in Africa at the time: trade.[6] I combine several datasets (some of which were released in the last few years) to produce a dataset on terms of trade, covering the period between 1796 and 2000. Using this data, I estimate the relationship between income terms of trade and GDP per capita between 1950 and 1990 (as established by Manning (1982), and later formalised by Prados de la Escosura (2011a, 2011b, 2012, 2013). I then exploit this relationship to produce GDP per capita estimates from 1796 to 1900.

I improve upon the original work of Prados de la Escosura (2012) in a number of ways. Firstly, the addition of new data, most notably that of Federico (2016), have allowed me to produce yearly estimations as opposed to the decadal estimations given in Prados de la Escosura (2012). Secondly, the new dataset I create based on these sources extends further back in time (to 1796) and covers more countries. Thirdly, I adjust the estimations to take into account the transatlantic slave trade.

I find similar results to the work of Prados de la Escosura (2012) during the 20th century: that GDP per capita increased consistently across regions and countries until the slowdown in the late 1980s/1990s. Going backwards into previously uncharted territory in the 19th century I find that the evolution of GDP per capita was far more complex. There are two periods of particular interest. The estimations reveal that GDP per capita levels increased going back before the 1840s. The primary cause for this was the decrease in population and increase in export values as a result of the slave trade. The high export values implied a large inflow of money into many African economies, whilst the extraction of human capital hindered the population growth rate. Thus, the standard assumptions of the Malthusian economy - that population adjusts to GDP per capita gains, did not hold up in this case. As the slave trade came to an end the economy faced a decline and stagnation period in the mid 19th century. A large part of the continent then experienced a boom shortly prior to the "scramble for Africa". I interpret this boom as being driven by the surge in commodity prices.[7] I explain how the end of the slave trade drove this transition, from bust to boom, and how this translated into higher GDP per capita levels.

This paper deals solely with the estimation of GDP per capita at the time and not its distribution. It should be noted that the resistance of many regions and individuals might have been an impediment to growth in specific regions. Furthermore, it has been shown that the slave trade also had negative long-term economic consequences.[8] I outline the paper in the following way. In section 2, I provide a very brief overview of methodologies used to estimate GDP per capita, in particular in historical Africa. Section 3 describes the procedure I use to create the estimations. I then explain the data used and present the results in sections 4 and 5, respectively. In section 6, I demonstrate the robustness of the results and in section 7 I conclude. The appendices offer additional information which I consider secondary to the main result or to aid the reader.

[6] See Manning (2012) for a summary of historical datasets available in Africa.
[7] This provides further evidence in favour of the work of Frankema et al. (2016).
[8] See Diouf (2003) for accounts on this resistance and Nunn (2008) for an analysis of the trades lasting long-run impact.

2 MEASURING GDP IN AFRICA

In the literature there are three standard methodologies used to measure GDP, as described by Jerven (2011a):

- Measuring GDP via Income - Enumerating profits, rents, interest, dividends, salaries and wages.
- Measuring GDP via Expenditure - This corresponds to the consumption of final goods. That is the sum of: private consumption, investment, government consumption and the balance of exports and imports.

$$Y = C + I + G + (X\text{-}M)$$

- Measuring GDP via Production - Estimates of value added production (output minus intermediate consumption) per sector are summed together to equal GDP.

These methodologies, however, are often redundant in historical Africa, where there are few records and the majority of income is earned in the informal rural economy. In fact, there is a significant lack of understanding of economic change in the African continent, even the most recent official figures are criticised for their inaccuracies (Jerven (2012)). Perhaps the most well-known and most extensive world historical datasets on GDP and population is that produced by the Maddison project (2018).[9] In the original version of this dataset, Maddison presented African GDP estimates, the majority of which extending as far back as 1950. Since that time, those original estimations have been updated on several occasions - they are now more extensive and the quality of the results have been improved (Bolt, 2018). The most current version, incorporates results from other studies, which have utilised existing records in Northern Africa and South Africa to create and extend relatively accurate estimations. For instance, the data from Fourie and Van Zanden (2016)is incorporated, which use national accounts in the Cape Colony to generate relatively accurate GDP estimates from the 18th century onwards. They find the country to have been among the most economically prosperous - with an income comparable to that of Europe at the time. There are few more estimations of GDP per capita in Africa, extending before the 20th century. In North Africa, for example, Amin (1966) produced a few benchmark years from 1880 to 1955 for Algeria, Tunisia and Morocco. Similarly, in Egypt, Yousef (2002) provides a few estimations for 1886 to 1845.
In the rest of sub-Saharan Africa, the most studied country has been Ghana (due to the greater availability of historical records). By *"guesstimating"* the size of the traditional economy,

[9] See https://www.rug.nl/ggdc/historicaldevelopment/maddison/

amongst other assumptions, Szereszewski (1965), and later Jerven (2011), create estimates of the size of Ghana's economy going as far back as the 1880s. When evaluating the estimations made by Jerven, Prados de la Escosura (2012) makes the following criticism:

> *"Why should it be assumed that consumers do not react to changes in relative prices of goods or in their disposable income? Moreover, why should we assume that output per head did not grow in the "traditional" or "domestic" sector?"*

Rather than relying on the rather stringent assumptions of a lack of growth in the traditional sector, and the "guesstimate" of Szereszewski (1965), Prados de la Escosura (2012) uses a relationship between income terms of trade and GDP. This income terms of trade variable, is better thought of as the purchasing power of imports. Its relationship with GDP per capita growth was first established by Manning (1982) to proxy for economic growth in Dahomey (modern-day Benin).

A range of new and more extensive trade datasets allow me to extend and improve the work of Prados de la Escosura (2012). This data extends further back in time - permitting me to reach new conclusions about Africa's economic evolution. I am also able to produce yearly data, as opposed to the decadal data he uses, doing so I capture some of the volatility which helps to provide evidence towards the thesis presented by Jerven (2010): that Africa does not lack booms, but that those episodes of economic progression are later reversed by the following busts.

3 METHODOLOGY

This thesis is based upon the assumption that GDP can be approximated by income terms of trade. I use a relatively straightforward two-step procedure of establishing a relationship between terms of trade and GDP in modern times to create historical GDP estimations.
Several papers have noted the connection between terms of trade and GDP, for instance: Blattman (2007), Mendoza (1997), Manning (1982) and Prados de la Escosura (2011a, 2011b, 2012a & 2013). Following the methodology used by Prados de la Escosura (2012), I establish a relationship between income terms of trade and GDP per capita between 1950 and 1990, to be used later on in the computation of historical estimations from 1796 onwards.
I will start by better defining the terms of trade used. Standard terms of trade measures are generally used to measure the change in prices of exports with respect to prices of imports. The specific terms of trade variation used by Prados de la Escosura (2012) is an adjustment of income terms of trade (ITT). That is, it not only measures the price change, but it also captures the change in quantities. Income terms of trade is typically defined as the total export value over the import value. In this case, rather than using the import value, a world price index is used. By doing so, the income terms of trade effectively represent the purchasing power of imports.[10]

$$ITT = \frac{Export\ Value}{Import\ Price} = \frac{P_{x_{it}} X_{it}}{P_{m_{it}}} \approx \frac{P_{x_{it}} X_{it}}{P_{x_t}}$$

- P_{x_i} - Price of exports in country i.
- X_i - Quantity of exports in country i.
- P_{m_i} - Price of imports in country i.
- P_x - World price of exports

This terms of trade variable, referred hereon as ITT, is thought to be closely related to GDP.[11] Given that the relationship between ITT and GDP remains constant over time, ITT can be used to indirectly estimate GDP. (This would seem to be the case given that the estimation coefficients hold under the scrutiny of different specifications.) [12]

[10] As was the original intention of Manning (1982).
[11] Ibid.
[12] See figure 2 in Appendix B for a graphical representation of this relationship.

As done by Prados de la Escosura (2012), I compute re-estimations of the regression from 1960 onwards, using this to predict GDP per capita in the 1950s (in other words I use available data to produce out-of-sample estimations). I find the OLS results to remain fairly constant, furthermore, the indirect estimations appear to be relatively robust, estimating the general trends of the 1950s well. I make a few adjustments to the specification used by Prados de la Escosura (2012): I use modern borders to identify whether a country is coastal, which means I can cover all countries appropriately; I also include the use of a trend variable. This trend, or time, variable controls for a change in the nature of the relationship between ITT and GDP per capita over time.

$$\begin{aligned} log(Y) = \beta_0 + \beta_1 log(ITT) + \beta_2 logITT^2 + \beta_3 RR * log(ITT) + \beta_4 Coast * log(ITT) \\ + \beta_5 North + \beta_6 UK + \beta_7 France + \beta_8 Trend * log(ITT) \end{aligned} \tag{3.1}$$

, where

RR - dummy variable stating whether a country is resource rich. Takes value 1 if resource rich, 0 if not.
Coast - dummy variable stating whether a country is coastal. Takes value 1 if coastal, 0 if not.
UK - dummy variable stating whether a country was a UK colony. Takes value 1 if UK colony, 0 if not.
France - dummy variable stating whether a country was a French colony. Takes value 1 if French colony, 0 if not.
North - dummy variable stating whether a country is in North Africa. Takes value 1 if situated in North Africa, 0 if not.
Trend * log (ITT) - interaction term between the year and log(ITT).

After establishing this relationship between ITT and GDP per capita, and creating the dataset on ITT (as described in the following section) GDP is then projected backwards from from 1950 Maddison (2018) levels. This is a simple procedure of simply substituting the regression with the historical ITT values. To use similar terminology to that of Prados de la Escosura (2012), I refer to the resulting estimates as "indirect estimates".

4 DATA COMPILATION

In this section, I present a descriptive analysis of the data I have used to produce my estimations. Akin to the existing literature (Prados de la Escosura 2012, 2013; Federico, 2016), I use the export values or ITT values of neighbouring regions when data is not available for the respective country. This assumes that the evolution of trade in both countries are similar.

GDP Per Capita Data

In accordance with Prados de la Escosura (2012) & (2013) I use post-1950 GDP estimates from The Maddison Project (2018).

Income Terms of Trade Data

Export Values

Like Prados de la Escosura (2012, 2013), from 1950 onwards, I use export values from the IMF (2003) CD Rom . Within the last few years the coverage and quality of historical trade estimates have improved considerably due to research from various authors (see Federico (2016), Frankema et al. (2018) and work from the African Economic History Network). This improvement has allowed me to create a dataset of income terms of trade, which, at least in terms of coverage, is far superior to that used by Prados de la Escosura (2012) - spanning over a 300 year period. While Prados de la Escosura used Hanson (1980) and Bairoch and Etemad (1985) as his primary sources of export values, I use the recent dataset on export values from Federico (2016) (in current prices and based on 1913 borders). This new dataset alone offers a deep insight into export values. I make a few adjustments to this original dataset where necessary. Firstly, I consider the assumption by Federico that export values in French Equatorial Africa go to zero prior to 1865 to be too strong. I replace the part of the time series which uses this assumption by using an average of the growth rates of Nigeria and Angola to extend these export values back in time.[13] The extrapolated export values Federico provides for Liberia are also dependant upon the transition of French Equatorial Africa. I re-extrapolated these values from 1930, using the growth rates of French West Africa. I also include the export values for Libya, given by MacGregor (1847), using a log-linear interpolation between this period and the values in 1910

[13] While neither are immediate neighbours they are very close. The choice of these countries corresponds to data availability in the surrounding region and my aim of producing a well balanced dataset.

(where Federico begins to extrapolate back). This approach of log-linear interpolation follows the methodology of the existing literature.[14] I consider these adjustments an improvement on the original dataset: this new data incorporates a broad range of literature and weakens the assumptions made.

Export values given by Federico go as far back as 1817. I make several adjustments to export values and ITT values to provide a balanced dataset for 51 African countries to 1830. I also find that the data from French Equatorial Africa is also somewhat unclear and misleading. Based on the work by Federico (2016) the export values from French Equatorial Africa correspond to slightly different geographical regions prior to 1910. In the period 1870-1885 I use the population data of only Gabon to deflate the ITT data on the basis of this export data. This implies that in this short period the ITT of Gabon is essentially used as a proxy for all of French Equatorial Africa. Before 1870, I use the population values of all regions, allowing for the inclusion of the slave data.[15]

I then attempt to extend this dataset. I use the growth rates of export values from the league of nations between 1938 and 1943 for the countries available (League of Nations (1927–1943). I also add historical data from Mitchell (1988) and MacGregor (1847). For Benin, I use the export values provided by Mitchell (1988) where available.[16] In North Africa and Abyssinia (modern-day Ethiopia), I also incorporate new data available from MacGregor (1847) and Mitchell (1988)(with the exception of Algeria).[17]) In Egypt, I include data from both MacGregor (1847) and Mitchell (1988)). Any gaps within this data are then log-linearly extrapolated. For Cameroon and Guinea-Bissau I use the growth rate of French West African export values prior to 1850. I use the growth rate of Mauritius prior to 1850 to proxy for the non-slave exports in Madagascar. Finally, for Tanzania I extend the export values back from 1850 using the average growth rates of Mauritius and Mozambique.

World Export prices

Like Prados de la Escosura (2012), I also use the British export price index as a proxy for world prices. The choice of British export prices is in line with the work of Blattman (2007), Williamson (2011) and Frankema et al. (2016). Frankema et al, also demonstrate the resilience

[14] I use log linear interpolations on a number of occasions. The same technique is used by Prados de la Escosura (2012) and Maddison (2006).

[15] This implies that all non-slave exports in French Equatorial Africa are equal to nil during this period. This is a rather strong assumption although given that slaves were by far the primary export it is unlikely to have had a large impact on the resulting GDP estimates. The main concern is that there is an increased volatility between 1870 and 1910 as a result of the border changes. Without more data there is little which can be done to resolve this. Thus, volatility in French Equatorial Africa and, as a result Central Africa, is likely to to somewhat exaggerated.

[16] Thus reducing the 'group' assumption described earlier, which was made in French West Africa

[17] In general the figures given by MacGregor(1847), Mitchell(1988), Hanson(1980) and Federico(2016) fit well. Algeria is an exception - the export values from MacGregor are significantly higher than those provided by Federico (2016). Issawi (1982) also presents export values for North Africa which differ significantly. I do not attempt to incorporate these alternative figures.

of using the British price index by making comparisons with the price index from France.[18] From 1970 onwards I use the data from the IMF (2003) CD Rom and prior to 1970 I use the price index Mitchell (1988).[19]

ITT (Income Terms of Trade) Adjustments

For regions comprised of more than one modern-day country, I use the respective ITT calculated of the allocated group to create the individual estimations.[20] For Rwanda and Burundi, I use the ITT of Tanzania when export values are no longer available; for Botswana, I use Namibia; for Equatorial guinea, I use French Equatorial Africa; for Swaziland, I use Mozambique; for the Congo, I use Angola; for Botswana and Lesotho I use the ITT of south Africa and for Rhodesia I use the ITT of Mozambique.
Prior to 1850, I use the ITT of Ethiopia to estimate: Djibouti, Eritrea and Somalia; the ITT of Egypt in Libya and Sudan; the ITT of Algeria for Tunisia and, finally, the ITT of South Africa for Namibia. I also use the grouping mentioned in the previous section on correcting for the slave trade. If data is not available for one of these countries I use the remaining data use the population for the countries covered in the respective region.

Population

From 1950 onwards I use population data from the Maddison Project (2018). My primary source of historical population is Frankema and Jerven (2014), who produce yearly estimates for the majority of the African countries between 1850 and 1960. For Cape Verde (1920-1950), Egypt(1846-1850), Mauritius (1850-1950), São Tomé and Príncipe (1921-1950) and Seychelles (1891-1950) I use data from Mitchell (1995). Missing years for the data from Mitchell are then filled in using log-linear interpolation to allow for a balanced dataset. After doing so, I assign the growth rates specified by Frankema and Jerven (2014) to each respective country, according to their respective region. Finally, whilst I have a relatively balanced dataset, any remaining gaps within variables in a period of less than 10 years is log-linearly interpolated.
In the absence of pre-1850 population data for the majority of the African continent I accept the regional growth estimates from Manning (2014) for the period between 1790 and 1890, which I use to extend my population estimates before 1850.

[18] See the African Economic History Network, African Commodity Trade Database (ACTD) 1808-1939: DESCRIPTION OF METHODS AND NOMENCLATURE.

[19] Note: in the post-1950 period Prados de la Escosura (2012) uses the "export price", rather than the "export price index" given by the IMF. I can only assume he does this given it produces a higher R-Squared, since it is theoretically inconsistent.

[20] This includes: Equatorial Guinea, French West Africa, Rhodesia, Rwanda and Burundi and Kenya and Uganda. Thus the growth rates for these countries is differentiated only by the use of the dummy variables explained later on. The countries included in these groups can be found in Federico (2016).

Correcting for the Atlantic Slave Trade

The Atlantic slave trade is likely to have had a large economic effect on the regions directly affected i.e. West and East Africa, but also for Africa as a whole.[21] Perhaps the most prevalent reasons include the impacts of changing population growth rates and export values. Firstly, the population growth was hampered by the slave trade, and in some years it is postulated that population declined as a result (Cordell, 1990; Manning, 1987, 2014; Frenkema, 2014). Secondly, by definition, exports do not include slaves, thus export values will be higher if one includes the exportation of slave labourers.[22] For both of these reasons, if not controlled for, it is likely that GDP per capita would be under-estimated in slave trade regions prior to the 20th century.

With regards to population change, the existing figures produced by the African Economic History Network already adjust for the effects of forced migration using methodology based the work of Manning (2010).[23] Hence, it remains to correct the export values by adding the value of slaves sold.[24]

Export volumes are readily available from the Atlantic Slave Trade Database. This data has long been established to have many "missing values" and several papers have attempted to correct for this (Etlis, 1987a, 1987b; Manning, 2015). Manning (2015) uses Markov Chain Monte Carlo (MCMC) analysis as an alternative method of correcting for the missing observations. The advantage of Manning's methodology is that it both corrects for the missing observations - with results similar to those predicted by Etlis (1987a, 1987b) - and covers a greater period of time. I use these MCMC estimates of embarkment as my basis for the number of slaves exported.

The issue with these estimates is that they are given by port, thus one cannot distinguish between the countries affected. It is reasonable to assume that ports can be attributed to the surrounding region. I hence create the following groups on the basis of the ports' locations and existing export value groupings:

- I assign slaves exported from the ports: Gabon and Loango to French Equatorial Africa.
- I assign the ports: Senegambia, Windward Coast, the Gold Coast, Bight of Biafra and the Bight of Benin to a new group. That group consists of: the pre-existing French West Africa group, Togo, Nigeria, the Ivory Coast, Sierra Leone and Gambia.

[21] Despite the abolishment of the slave trade by the British empire in 1807, slave exports remained a large share of African exports for the rest of the century. Although the peak occurred in the 1760–1808 era (Frankema et al. (2016), according to my data slave exports accounted for over 50% of exports in French Equatorial Africa in the early 19th century.

[22] This is pointed out by Federico (2016). This does not apply to all historical data, however, for example MacGregor (1847).

[23] See Frankema et al.(2016) - This new dataset considers alternative proxies for the growth rate of African population, as opposed to the work of Manning (2010). They also make use of the existing census data.

[24] Note that the population data will be further updated by Manning *(Forthcoming)* and my results can be easily updated following the release of this data.

- The port Angola is assumed to be representative of Angola.
- The ports: South-east Africa and Indian ocean islands are assigned to Mozambique and Madagascar, also forming a new group.

This adjustment occurs prior to 1870, thus individual countries are more linked together by their ITT values. Since large areas of West Africa are grouped together, it should be noted that the GDP per capita estimates provide a close approximation in estimating the region as a whole, although individual country variations are less well captured.
It then remains necessary to attribute a price to those slaves. The work of Lovejoy (2015) presents estimates for several different regions. He demonstrates that there is no price decrease following the abolition of the slave trade. I use these prices, according to the respective regions provided by Lovejoy (2015).[25]

[25]Since his prices stop in 1850, and show a constant trend in the last couple of decades, I assume that prices remain constant until 1870.

5 RESULTS

Step 1: Estimation of the relationship between income terms of trade and GDP (1950 - 1990)

I begin this section by presenting the results of my estimation period, which are then used in step 2 to create the indirect GDP estimations. The regression results below are variations of the equation 3.1 in the period chosen by Prados de la Escosura (2012), from 1950 to 1990.[26] There are some subtle differences between my regression data and that of Prados de la Escosura (2012). My export values are the same, however I use new data from the Maddison Project (2018) and use a different import price index to deflate exports (see the previous section).

Regression Results

The first, most parsimonious, specification illustrates the significance of the quadratic relationship between ITT and GDP per capita. In accordance with the work of Prados de la Escosura (2012), as well as the adjustments I mention in the methodology (section 3), I then include additional dummy variables, as found in specifications 2-4. Specifications 2 and 3 provide an insight into the effect improvement in the fit of the model as a result of dummy variables and specification 4 includes country fixed affects to control for country specific variations. Comparing specification 3 and 4, it is clear that the inclusion of country fixed effects results has a significant improvement upon the fit of the model. It is important to recognise that the addition of this fixed effects element controls for all of the between country variation. Thus, the remainder of this variation occurs through the time variation. (In the summary statistics in Appendix A, it is demonstrated that around half of the variation in ITT is made up of the variation in time, the other half is comprised of the country variation.)[27] Unlike the time fixed effects included by Prados de la Escosura (2012), country fixed effects can be used in the pre-1950, "out-of-sample" period. Given, the improved explanatory power of the fixed effects model (and that the colonial dummy variables are redundant in the pre-colonial period) I choose the fourth specification, which controls for all country individual variation. This fixed element essentially uses current average GDP per capita as an instrument of historical GDP per capita. Despite the adjustments to the original model by Prados de la Escosura (2012), and that I take advantage of all available data (my observation number is 1690 compared to 301) I find similar results to those of Prados de la Escosura (2012). All of the variables remain

[26] The estimation period was limited to 1990 to avoid the change in regime following the widespread onset of aids (Prados de la Escosura, 2012).

[27] I owe this note to Vicente Royuela Mora.

Table 5.1: OLS Regression Results

	OLS Specifications			
	(1)	(2)	(3)	(4)
log(ITT)	-0.420***	-1.347***	-1.429***	-1.080***
	(0.052)	(0.054)	(0.054)	(0.042)
$\log(ITT)^2$	0.068***	0.066***	0.074***	0.038***
	(0.005)	(0.003)	(0.004)	(0.004)
RR * log(ITT)		-0.046***	-0.035***	-0.047*
		(0.005)	(0.004)	(0.022)
COAST * log(ITT)		0.050***	0.042***	0.084***
		(0.005)	(0.004)	(0.022)
TREND * log(ITT)		0.004***	0.003***	0.003***
		(0.000)	(0.000)	(0.000)
NORTH			0.428***	
			(0.031)	
British Colony			0.516***	
			(0.031)	
French Colony			0.326***	
			(0.030)	
Country Fixed Effects	No	No	No	Yes
R-squared(Adj)	0.484	0.644	0.721	0.928
N	1690	1690	1690	1690

All estimations use robust standard errors. Standard errors are given in parentheses. $*p < 0.1$, $**p < 0.05$, $***p < 0.01$.
Data sources/Definitions GDPPC: GDP per capita ((2011 $ US Dollars - as given by the Maddison Project (2018)) (in logs).
ITT: Income Terms of Trade per Head (in logs). Data sources: IMF (2003) CD Rom and Maddison Project (2018).
RR data source: United Nations [World Economic Situation and Prospects (WESP)] - Statistical Annex (2014)).
NORTH: see regional definitions in Appendix A.
Colony (British/French) data source: (Bertocchi and Canova 2002).

statistically significant (using robust standard errors) with the same signs found by Prados de La Esosura. This is consistent even after controlling for country fixed effects (with the exception of the dummy variable for French colonies). Like Prados de la Escosura I test this regression specification using different variations e.g. different estimation periods (1960-1990 and 1950-2000), and the inclusion of time fixed effects. Results do not change and the model produces good estimates in the out-of-sample period.

Finally, given that this regression is not concerned with econometric issues, such as endogeneity, I do not attempt to control for this factor. The regression merely establishes the best fit to the creation of the indirect estimations.

Step 2: Estimating GDP Per Capita

Having established the relationship between income terms of trade and GDP I am able to use my historical ITT values to create GDP estimates. This is a straightforward process in which I plug ITT into the corresponding regression. Doing so generates GDP per capita estimates on the basis of ITT and the respective dummy variables.

Given the data and adjustments described thus far, I am able to produce regional results as far back as 1830. Prior to 1830 there is information for only a few individual countries. My GDP per capita estimates in Egypt and Libya, for example, extend back until 1796. I make use of this last data by extending my North African GDP per capita estimates back another 34 years based on the average growth rates of these two countries. This might be justified based on the fact that Egypt contributed to a large part of North Africa's total GDP. This remains, of course, a relatively strong assumption. I identify later on the use of a VECM time series procedure to produce forecasts back in time from 1830. This is done, mainly, to support my arguments regarding the trend in GDP per capita prior to 1880. These forecasts can also be seen test of robustness of these final indirect estimations in North Africa.[28]

Main Findings

I find two periods of elevated GDP per capita in Africa - one occurring prior to 1890, and the other prior to 1840. The decadal results for each country are presented in Appendix B and in the figure 5.2 I present the evolution of regional GDP per capita. (In the excel file mentioned country estimates are provided on a yearly basis.)

From figure 5.2, it is clear to see that during the 20th Century, GDP per capita growth rates remained relatively stable until the 1980's, when GDP Per capita began to decline.[29] A slight peak can be identified in Central, West and Southern Africa during the First World War period. This was primarily the result of a change in the world prices. Given the small size of this peak I consider it as somewhat negligible, although this could be representative of a shift towards African produces when European production was impeded by the war efforts.

One of the more notable results is that between 1860 and 1890 there was a boom in Central, West and East Africa. This coincided with the short-lived commodity price increase observed by Frankema et al. (2016). The cause of these circumstances is explained by the authors as being the result of a shift in the structural change of Africa after the end of the transatlantic slave trade. The authors state that:

[28] As shown in the time series procedure in Appendix B, the trend of the North African indirect estimations and forecasts are similar.

[29] According to Maddison (2011), using my regional definitions, this decline occurred at a rate over just over 1% per year.

"The gradual abolition of the African slave trades and the transition to commodity exports halted the continuous drain on already-scarce labor and spurred land-extensive tropical agriculture engaging smallholder family farms, communal farms, and large estates."

This peak in economic prosperity in late 19th century, resulting from the boom in commodity prices, can be considered the main driving factor of the land-grab of European powers in the so-called "scramble for Africa".[30] In fact, Frankema et al. (2016) suggest that this increase in relative prices between 1853 and 1885 "accounted for one-third of the export value growth to Britain" and "55 percent of the export value growth to France". This export value growth in turn resulted in the short run period of high GDP per capita levels in the sub-Saharan Africa (relative to the early 20th century).

In almost all parts of the African continent, within the 1830s, when exports were more oriented towards the trade of slaves, GDP per capita levels were also found to be higher. Since slave export volumes, and more specifically the value of slave exports, continued to rise going further back in time, the continuation of this trend is to be expected.[31] And, given the extraction of human capital, GDP per capita did not revolve around subsistence rates, as occurs in a typical Malthusian economy. I support this surprising result from the 1830s by forecasting back in time - extending the regional estimations another 34 years. To do so, I take advantage of the non-stationary cointegrated nature of the GDP per capita estimates and I use a vector error correction model to generate forecasts (see Appendix B). The forecasts indicate the continuation of this trend, most notably in West Africa and East Africa (the regions most heavily impacted by the slave trade).[32][33] Even regions which were not directly affected by the slave trade might have indirectly benefited from the higher income of neighbouring regions. The higher GDP per capita levels in Southern Africa were also, in part, driven by the higher incomes in South Africa (Fourie and Van Zanden, 2016).

I have argued that both of these periods of elevated GDP per capita levels might have stemmed from the rise and fall of the slave trade in Africa. This is not the first case in which this has been proposed. The high GDP per capita growth approximations from Manning (1982), in Dahomey (present-day Benin), were also attributed to increasing export values resulting from the slave trade. Similarly, this would not be the first time in which population decline, due to external factors, has increased growth. For instance, the Black Death crisis is well established

[30] As is argued by Frankema et al.(2016). The authors also explain that world trade was also accelerated by the revolution in transport, a transition to more liberal trade policy in Europe, and the expansion in world GDP growth associated with the industrial revolution.

[31] See, for instance, Frankema et al. (2016), price data from the Lovejoy (2015) and export volumes from Manning (2015) and Etlis (1987a, 1987b)

[32] I include these forecasts in table 5.2 and figure 5.2 - as indicated.

[33] It should also be noted that some of the early statistics from MacGregor (1847) also include some slave exports. Given I use this source for much of North Africa's early export data, this might help to explain the slightly higher level of GDP per capita estimations in North Africa prior to 1840.

to have instigated the strong growth levels within England (Broadberry, 2010).

The intermediate period between 1840 and 1860 might be consider a stagnation period, in

Table 5.2: Regional GDP per Capita Indirect Estimations

YEAR	North Africa	West Africa	East Africa	Central Africa	Southern Africa	Total Africa
1800	1574	1390*	1038*	603*	1118*	1150*
1810	1559	1302*	976*	605*	1052*	1092*
1820	1446	1213*	914*	607*	987*	1024*
1830	1340	1082	850	614	921	938
1840	856	791	668	543	822	725
1850	745	839	671	544	710	707
1860	665	811	601	670	634	671
1870	743	1145	635	581	658	763
1880	825	1123	601	574	703	766
1890	965	1211	657	729	778	861
1900	1153	1043	702	708	851	881
1910	1416	1067	651	720	1114	972
1920	1547	1344	800	871	1250	1160
1930	1936	1413	839	984	1444	1313
1938	2223	1575	916	1091	1663	1490
1950	2679	1898	979	1373	3105	1970
1960	3025	2176	1120	1653	4244	2384
1970	4187	2640	1297	1966	4469	2900
1980	6206	3903	1445	2146	6097	4047
1990	6065	3662	1552	2136	5734	3876
2000	5239	4460	2109	3046	7672	

Full results can be found in the Excel file at https://sites.google.com/site/lukeamcleary/home.
*FORECASTS - based on the VECM procedure outlined in Appendix B. The alternative VECM forecasts for North Africa can be found in the Excel file mentioned. Prior to 1830, Total Africa refers to the indirect estimations from North Africa and the forecasts of the other countries. estimations.

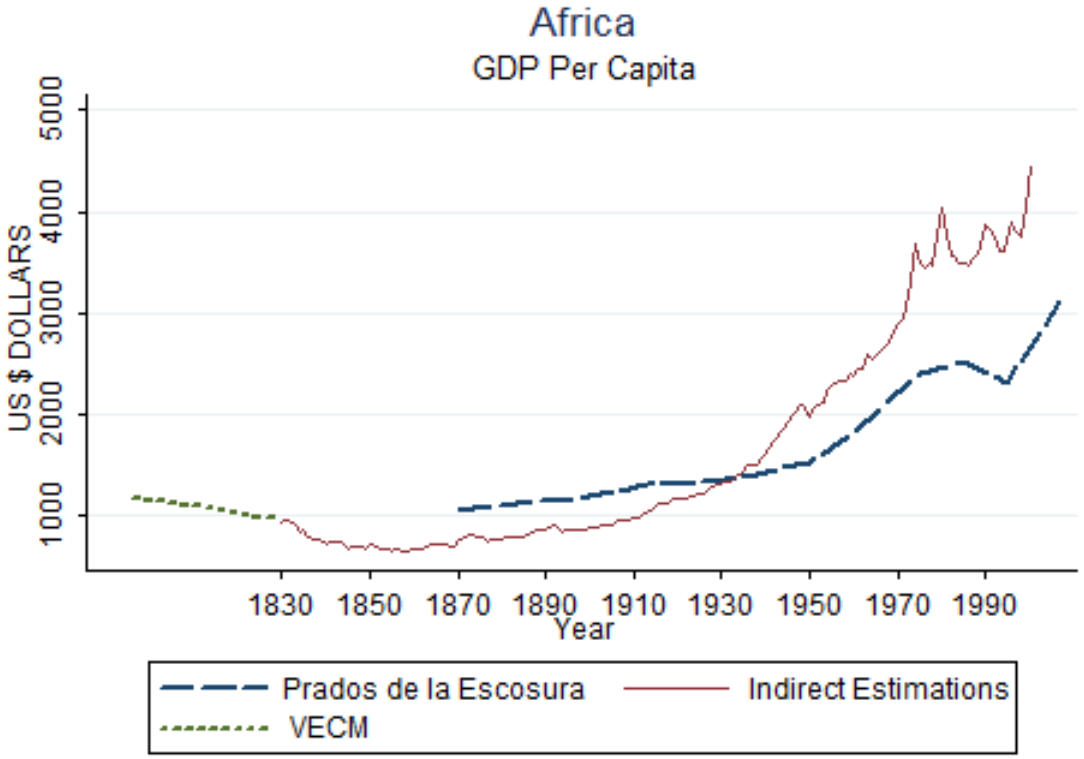
which structural adjustment occurred. During this period the economies had to adjust to higher population growth rates as the extraction of human capital came to a halt and workers had to acquire new skills to take on the challenge of of meeting means with a denser population and a reduction in slave revenue.[34] [35] A similar explanation for this stagnation is suggested by Hopkins (1973), and later Jerven (2010), namely that the end of the slave trade resulted in a loss of state power and centralisation, referred to as the "the crisis of adaptation".

Within Central Africa, figure 5.2 would suggest that there were two peaks. As I have noted in the data compilation section, border changes lead to misleading results, This first boom is likely of little significances - the result of the border changes, the effect of which cannot be controlled for further given current data availability. It is the second boom which is of interest. This second boom occurred slightly after that of West Africa, around the same time as it occurs in East Africa. Given that Frankema et al. (2016) states that the rise in commodity prices occurred slightly later in these regions than in West Africa, this seems to confirm the relationship between these growth estimations and the commodity boom. The trend of pre-1840 East Africa is also notably steep a result of the unprecedented rise of incomes in the British

[34] The change in population growth rates in my dataset occurs in 1850 as I switch between growth rates provided by Manning (2010) and Frankema et al. (2016) (as described in the previous section).

[35] A relevant discussion is the work of Dalrymple-Smith (2017), who shows that need for slave provisions had a minimal demand-boosting effect on the demand for agriculture in West Africa, particularly over time.

Figure 5.1: Indirect Estimates vs Prados de la Escosura (2012)



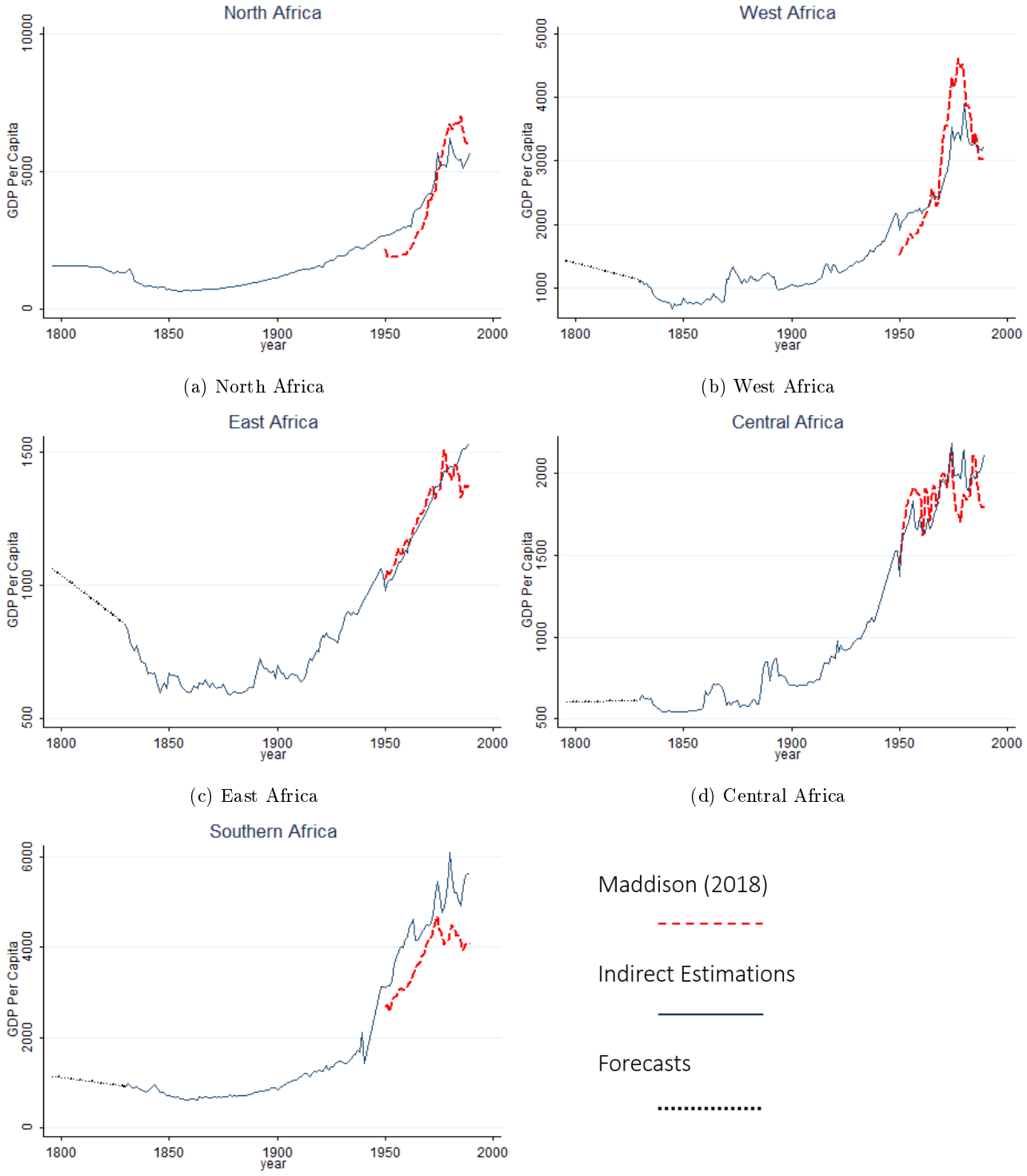
See Appendix A for the exchange rate conversion

colonies in Eastern Africa - this in turn can be attributed to the thriving trade in Mauritius.[36] which, for reasons I explain later on, was relatively prosperous during this period.

To summarise these findings, as would be expected, my historical estimates show a general upwards trend throughout the 20th century until the late 1980s, in line with Prados de la Escosura (2012) (see figure 5.1). The differences between the estimations in recent years can be primarily attributed to the update in Maddison data used. I am also better able to capture volatility. Prior to 1930, I predict a lower GDP per capita than that of Prados de la Escosura (2012) as a result of the trend variable that I have included. However, by the early 1830s it is clear that my GDP per capita estimates start to surpass the downwards trend one might expect from the results of Prados de la Escosura (2012). It should be also be noted that whilst GDP per capita is a measure of living standards this is certainly not suggestive that living standards of the general populations improved.

[36]The export values from Mauritius are used by Federico (2016) to extrapolate the export values of British East Africa i.e. Kenya and Uganda, from 1895 to 1828.

REGIONAL GDP PER CAPITA (1796-1990)



(a) North Africa

(b) West Africa

(c) East Africa

(d) Central Africa

(e) Southern Africa

Figure 5.2: Regional GDP Per Capita

6 ROBUSTNESS CHECKS

Prados de la Escosura (2012) uses real wages to test his results. Using data on real wages and "welfare ratios" (a labourers earnings deflated by the costs of sustaining a family) from Frankema and van Waijenburg (2012), Prados de la Escosura (2012) generates what might be considered the cost of living within British Africa. Under the standard framework of a Malthusian economy one might expect the indirect estimates from Prados de la Escosura (2012) to follow a similar long-run trend to that of this cost of living. And, indeed, this is the case. Since the wage data is only available from 1880, within the time frame of Prados de la Escosura's estimations, and since my results are similar to his, I do not repeat the same tests in vain. Instead, I embark on performing my own robustness checks: data comparisons (post-1950 and pre-1950) and historical verifications.

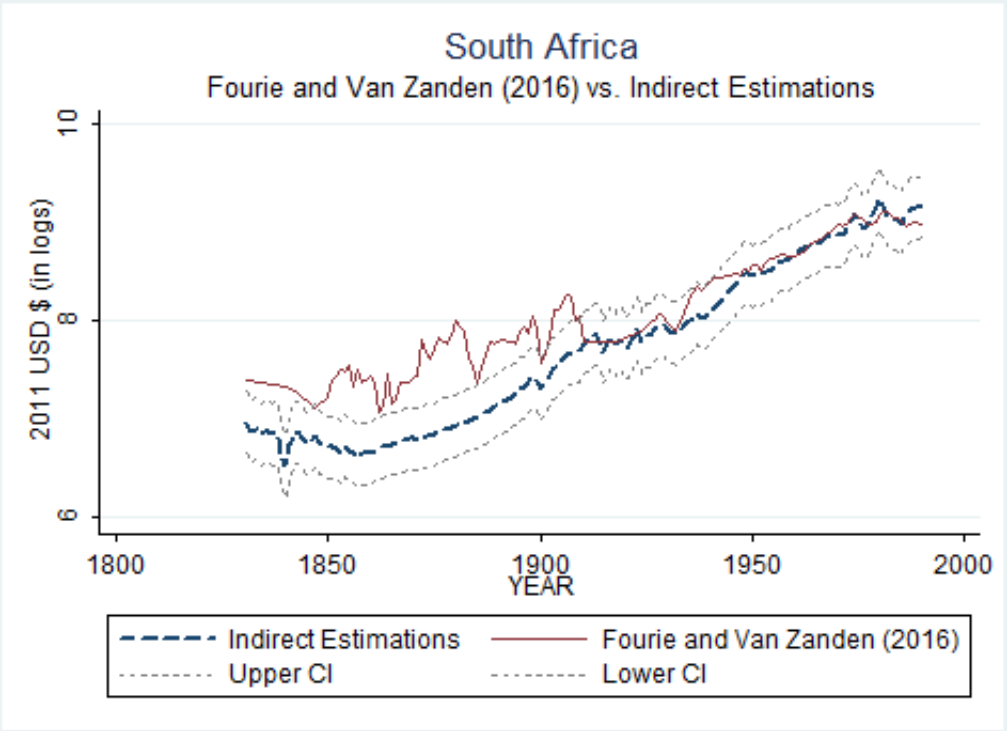
Comparison with available data

It remains questionable whether the assumptions of the GDP-ITT relationship remain constant outside of the estimation period. This is difficult to prove, since there are few reliable historical estimates prior to 1950 (other than those produced by Prados de la Escosura (2012)). The most reliable estimates available in Africa are those produced by Fourie and Van Zanden (2016) in South Africa. They use a combination of national accounts and other estimates to produce these GDP estimates, which are the highest quality estimations available in Africa prior to 1950. I compare my estimates with those of South Africa in figure 6.1 to judge the predictive power of my model throughout time. I find that my estimates are relatively robust. My estimates follow the general trend of the estimations from Fourie and Van Zanden (2016) rather well. However, in the 18th century their results are slightly higher than my 95% confidence intervals. It should be noted that whilst South African estimates are not necessarily perfect, they are the best existing estimates in 19th century Africa. Thus, the slight under-prediction might not necessarily be indicative of a downwards bias in my own results. In general, I take this result as evidence in support of my own estimates.

Comparison with historical events

This thesis has shown the possibility of a pre-1900 boom in sub-Saharan Africa. This would seem to concur with other economic analyses, such as Frankema et al. (2018), who have

Figure 6.1: Comparisons with other estimations in South Africa



Data taken from Maddison (2018), which incorporates the work of Fourie and Van Zanden (2016). I compute confidence intervals computed based on the RMSE from the regression results.

suggested that there was a boom in export prices. I provide a few case studies of countries which seem to coincide and support my findings of the income booms which occurred during the 19th century. In some cases they do, however, question the strength of these estimates on a country basis.

The first example of an economy which grew rich from slavery is Dahomey (modern-day Benin). Manning (1982) and Jerven (2010) point out that, during the 18th century, export revenues in Dahomey were similar to those in Great Britain at the time. In fact, to give a somewhat anecdotal example of its wealth, the kingdom built the worlds largest earthworks prior to the mechanical era. [37] Manning also shows that this export revenue dwindles during the early 19th century, its export revenue grow did not pick up again until the end of the century. This is a clear example of a region which had capitalised upon the slave trade directly benefited from the slave trade. This supports the strengths of the high levels of regional GDP per capita in the 18th and early 19th century, however, it also highlights the fragility of my country based estimates in the pre-1870 slave trade era. Export values in Benin, most importantly its export revenue from slaves, are included in the total export values of French West Africa, amongst other countries (see the data section for details). Thus, the export values, and henceforth GDP

[37] See https://www.theguardian.com/cities/2016/mar/18/story-of-cities-5-benin-city-edo-nigeria-mighty-medieval-capital-lost-without-trace which quotes the Guinness Book of World Records (1974).

per capita levels presented in Benin can be considered undervalued.[38]
Mauritius was another country which had a robust slave trade long prior to slavery. Whilst other African countries were slow to adjust after the transatlantic Slave Trade as they moved away from a slave-based society, Mauritius, had been a trading island for a long time, it is likely then that it had the prerequisites necessary to switch to indentured labourers and increase its agricultural production.[39] The island was also "offered generous terms of capitulation" by the British colonizers at the time.[40] As a result of these factors, the island quickly adjusted to the decline in slave demands by switching to the production of other products. Between the years 1825 and 1835 sugar production increased threefold (Suzuki, 2017). Again, this supports the evidence of higher income levels during the peak of the transatlantic slave trade.
An example of the trade boom have a positive economic impact in the late 19th century is the cocoa boom, which impacted Ghana, the Ivory Coast and Nigeria (Jerven, 2010). Austin (2005) develops the idea of how part of Ghana's growth after the slave trade could be attributed to the Cocoa boom in Ghana.[41]

Discussion

I would argue that this approach to indirectly measuring GDP per capita is certainly preferred to previous guesses, however, the very much stringent assumption remains - the assumption that the relationship between income terms of trade and GDP holding over time.
I expect, based on theory and results, that any bias is likely to be downwards, my estimations are more likely to under-estimate than over-estimate going back in time. This is supported by the comparisons made earlier in this thesis. I also present a number of hypothetical reasons for this, including:

- Commerce with immediate neighbours might have had more importance as a proportion of total trade when trade costs were higher. The historical trade statistics are typically derived from colonial records, thus focus on the sea-bound Afro-European trade.(Federico, 2016; Frankema et al, 2018)
- Data scarcity might become a problem towards later years. This problem originates in the original historical sources, but also assumptions made in the aggregation of these

[38] Tadei (2017) shows how extractive institutions in French Africa depressed the prices of African trade below what would have been paid in a counter-factual competitive market. This, implied undervalued exports of other members of this group. Given this undervaluation the large export values from Benin should "cancel out" to some extent.
[39] Arab sailors first began trading with the island in 900 AD. Since that period, Portuguese, Dutch, French and British colonisers each established institutions on the island. (https://sites.stanford.edu/MauritianArchaeology/history)
[40] Ibid.
[41] See Austin (2007) which provides a more in-depth insight of the economic structural change which occurred in Ghana following end of the Atlantic slave trade.

sources can be problematic.[42] The data from Federico, for example, at times makes strong assumptions.[43]

These speculations are supported by my findings. Comparisons, which I have presented with previous historical estimates in South Africa prior to 1900 suggest that my indirect estimations are too low, particularly prior to 1850. (I present my comparison with South Africa in the next section). Secondly, it is apparent based on my individual country estimates in Appendix B that the estimations of many of the countries fell below the subsistence level for a prolonged period (GDP per capita levels are truncated by the subsistence level, $515). I conclude from this that any bias would most likely act downwards. Despite this potential downwards bias, one can assume that any under-prediction increases going further back in time, thus the conclusion of the thesis, most notably, the economic booms early and late 19th century should hold.

[42] E.g. colonial blue books and historical abstracts - see Frankema et al. (2016) Excel file for examples of raw data sources

[43] One such assumption (which I correct for) is that the export values of French Equatorial Africa goes to zero in a 15 year period.

7 CONCLUSION

In this thesis, I have made a significant contribution to the existing literature which aims to bridge together a deeper understanding of historical Africa and address the question of whether Africa has always been poor. Using new data, the inclusion of the transatlantic slave trade and through the use of time series techniques, I have been able to produce regional estimates and forecasts of GDP and GDP per capita Africa from 1796 to 2000. I have also produced country based estimates from 1830 onwards (these decadal estimations are available in Appendix B).
My results overall show during the 20th century the most disappointing period of economic growth occurred in the last 1980's/early 1990's. In the 19th century, however the growth story was very different, consisting of two periods of high GDP per capita levels. I endeavour to explain these booms based on the structural changes at the time. The first, occurring near the peak of the slave trade period (pre-1840) and, the second, in the 1850-1890 period. I explain that this first boom was caused by the higher export levels and lower population resulting from the slave trade. As the slave trade grinded to a halt the drain on labour came to an end the economy shifted to a more land-intensive agricultural based economy. This was accompanied by a stagnation in economic growth. After a couple of generations, this in turn resulted in a commodity boom, triggering an economic boom in West, East and Central Africa. I argue that the rise in commodity prices made way for a second economic boom during this period.
Finally, based upon the trend in slave exports, my estimates for North Africa and the time series estimates produced in Appendix A, I expect a higher level of GDP per capita in the late 18th century than that of Africa in the mid 19th century. Overall, I demonstrate that Africa's economic history has been far from the flat GDP per capita progression encompassed under the assumptions generally assumed of a Malthusian economy. The conclusion can be drawn from this that Africa has not always been poor. I show that different regions and countries exhibited years in which GDP per capita far exceeds subsistence levels.
In a final note, throughout this paper, I do not discuss the distribution of these elevated output levels amongst Africans and, indeed, the Europeans population in Africa. Furthermore, the lucrative nature of transatlantic slave trade should be considered as a rent-seeking activity. When considering the potential benefits derived from the slave trade one also ought to consider the long lasting negative impacts. (Nunn, 2008).

Possible Extensions

In an attempt to continue to build a clearer picture of GDP Estimates in historical Africa, and indeed, in any region where estimates are not available there are a range of possibilities.

The results have also demonstrated a dynamic regional evolution within Africa during the 19th century. Moving forward, this research can be developed in various ways: the inclusion of more dummies, for instance, dummies considering war/conflict and political instability would seem to improve the quality of the estimates.[44] It is also possible to develop new techniques to estimate GDP per capita. This thesis, for instance, has utilised trade data. There is, however, a wealth of trade data extending as far back as 1699 (Johnson, 1990). The type of data, however, was not directly useful in computing the income terms of trade variable used. Future studies might be able to calculate alternative specifications of terms of trade and other variables to create a new indirect technique of measuring GDP per capita. This poses another question. How far back can/should one estimate back in time by extending current data?

An alternative to extending data backwards would be the use of creating historical benchmarks (much like those used by the Maddison Project). I mentioned in the introduction that work was being done in the way of translating manuscripts. Whilst, the manuscripts which are currently being translated are more in the way of poems and stories, it is possible that with time more historical records become available. I also considered exploring the use of the cross-sectional data connecting the value of "state-hood" with GDP.[45]

Finally, it seems relatively clear to me that GDP and population should be measured together (rather population being exogenous), since it is clear that both are interlinked. The occurrence of these economic booms found in my estimations should be considered when calculating population growth rates. (One would expect this to have increased the rate of population growth, this in turn might have reduced the duration of the periods of economic prosperity.) This might be done through the creation of a simple simultaneous equation in which population change was determined by GDP per capita. On this occasion, the statistical significance of GDP on population was too low for me to justify this procedure.

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[44] This would be appropriate in Africa given the number of atrocities and degree political stability during the estimation period of this paper. And, based on my preliminary attempts this would seem to improve the fit of the relationship.

[45] See Borcan (2018).

REFERENCES

Amin, S. (1966). LÉconomie Du Maghreb. Paris: Editions De Minuit, (Alençon, Impr. Corbiére Et Jugain).

Austin, G. (2005). Labour, Land, and Capital in Ghana: From Slavery to Free labour in Asante, 1807-1956, Tochester Studies in African Histofy and the Diaspora, [V.18]. Rochester, NY: University of Rochester Press.

Austin, G. (2007). "Labour And Land In Ghana, 1874-1939: A Shifting Ratio And An Institutional Revolution." Australian Economic History Review 47, no. 1 (2007): 95-120. doi:10.1111/j.1467-8446.2006.00198.x.

Bairoch, P. & Etemad, B. (1985). Structure par produits des exportations du Tiers-Monde 1830– 1937. Geneva: Libraire Droz.

Baltagi, B. (2005). Econometric Analysis of Panel Data. 3rd ed. London, United Kingdom: Wiley; 3 edition (July 18, 2005).

Bertocchi, G., & Canova, F. (2002). Did colonization matter for growth? An empirical exploration into the historical causes of Africa's underdevelopment" European Economic Review 46: 1851–1871.

Blattman, C, Jason H, & Williamson, J. (2007). The Impact of the Terms of Trade on Economic Development in the Periphery, 1870-1939: Volatility and Secular Change. Journal of Development Economics 82 (January 2007): 156–79.

Bohlin, J. (2010). From appreciation to depreciation – the exchange rate of the Swedish krona, 1913–2008", Historical Monetary and Financial Statistics for Sweden, Volume I: Exchange rates, prices, and wages, 1277–2008

Bolt, J., Inklaar, R., Herman de Jong & van Zanden, J, L (2018) Rebasing "Maddison": New Income Comparisons and the Shape of Long-run Economic Development. University of Groningen.

Borcan, O., Olsson, O. & Putterman, L. (2018). State history and economic development: evidence from six millennia. Journal of Economic Growth, vol. 23, issue 1, 1-40

Broadberry, S. N., Campbell, B. M. S., Klein, S, Overton, M & Leeuwen. (2010). British economic growth : 1270 - 1870. Working Paper. Coventry, UK: Department of Economics, University of Warwick. CAGE Online Working Paper Series, Volume 2010 (Number 35)

Collier, P. & O'Connell, S, A. (2008). Opportunities and choices. In The Political Economy of Economic Growth in Africa, 1960–2000, 2 vols., ed. Ndulu, B, J., O'Connell, S.A., Azam, J, P. Bates, R, H., Fosu, A, K., Gunning, J, W., & Njinkeu, D. 76–136. Cambridge: Cambridge University Press.

Dalrymple-Smith, A. & Frankema, E. (2017). Slave Ship Provisioning in the Long 18th Century: A Boost to West African Commercial Agriculture?, European Review of Economic History, 21, 2, 185-235

Diouf S, A. Fighting the Slave Trade: West African Strategies. (2003). Ohio. Ohio University Press

Eltis, D. (1987a). Economic Growth and the Ending of the Atlantic Slave Trade. New York: Oxford University Press.

Eltis, D. (1987b). The Nineteenth-Century Transatlantic Slave Trade: An Annual Time Series of Imports into the Americas Broken down by Region. Hispanic American Historical Review 67: 109-138.

Federico. G. & Tena, J. A. (2016), "Federico-Tena World Trade Historical Database : World Trade". Working Papers 0093, European Historical Economics Society (EHES).

Frankema, E. & Williamson, J. & Woltjer. (2018). In : Journal of Economic History. 78, 1, p. 231-267 37 p.

Frankema, E. & Jerven, M. (2014). Writing history backwards or sideways: towards a consensus on A frican population, 1850–2010. The Economic History Review 67 (4), 907-931.

Frankema, E., Williamson, J., & Woltjer, P. (2018). An Economic Rationale for the West African Scramble? The Commercial Transition and the Commodity Price Boom of 1835–1885. The Journal of Economic History, 78(1), 231-267.

Hanson II, J, R. (1980). Trade in Transition. Exports from the ThirdWorld, 1850–1900. New York: Academic Press.

Hopkins, A, G. (1973). An Economic History of West Africa. New York: Colombia University Press.

International Monetary Fund [IMF] (2003). International Financial Statistics, CD-Rom.

Issawi, C, P. (1982). An economic history of the Middle East and North Africa. New York: Columbia University Press.

Moradi A, Gareth, A & Jorg, B. (2013). "Heights and Development in a Cash-Crop Colony: Living Standards in Ghana, 1870-1980," Working Papers 325, Economic Research Southern Africa.

Jerven, M. (2010). African Growth Recurring: An Economic History Perspective of African Growth Episodes, 1690–2010. Economic History of Developing Regions, 25:2, 127-154.

Jerven, M. (2011). Comparing colonial and post-colonial output: Challenges in estimating African economic change in the long run, Center of Global Economic History Working Paper Series, No. 10, Utrecht University.

Jerven, M. (2011a). Comparing colonial and post-colonial output: Challenges in estimating African economic change in the long run. CGEH Working Paper Series 10.

Jerven, M. (2012). Comparability of GDP estimates in sub-Saharan Africa: the effect of revisions in sources and methods since structural adjustment.

Johnson, M., Lindblad, T.J., Robert, R. (1990). Anglo-African Trade in the 18th Century: English Statistics on African Trade, 1699–1808. Centre for the History of European Expansion, Leiden.

League of Nations. 1927–1943. Statistical yearbook. Geneva: League of Nations.

Lobell, H. (2010). 'Foreign exchange rates 1804–1914', in Historical Monetary and Financial Statistics for Sweden, Volume I: Exchange rates, prices, and wages, 1277–2008 (eds. Edvinsson, R. Jacobson, T.)

Lovejoy, P.E. & Richardson, D. (2015), "British Abolition and its Impact on Slave Prices Along the Atlantic Coast of Africa, 1783-1850". The Journal of Economic History, Vol. 55, No. 1 (Mar., 1995), pp. 98-119

Macgregor, J. (1847) Commercial statistics. A digest of the productive resources of all nations.

Maddison, A. (2006), The World Economy, Paris, OECD Development Centre.

Maddison, A. (2007), Contours of the World Economy, 1–2030 AD: Essays in Macro- Economic History, Oxford, Oxford University Press.

Manning, P. (1982). Slavery, Colonialism & Economic Growth in Dahomey, 1640–1960. Cambridge University Press, Cambridge.

Manning, P. (1987). "Local versus Regional Impact of Slave Exports on Africa." Dennis D. Cordell & Joel W.Gregory, eds., African Population and Capitalism: Historical Perspectives (Boulder: Westview), 35-49.

Manning, P. (2010). African population. Projections 1850-1960. In K. Ittmann, D. D. Cordell & G. Maddox, eds., The demographics of empire: the colonial order and the creation of knowledge (Athens, 2010) pp. 245-75.

Manning, P. (2012). "Historical datasets on Africa and the African Atlantic," Journal of Comparative Economics, Elsevier, vol. 40(4), pages 604-607.

Manning, P. (2014). "African Population, 1650–2000: Comparisons and Implications of New Estimates," in Akyeampong, E., Bates, R. H., Nunn, N., & Robinson, J. (eds) Africa's Development in Historical Perspective. Cambridge: Cambridge University Press, pp. 131–150. doi: 10.1017/CBO978113

Manning, P., Zhang, Y. & Yi, B. (2015). Volume and Direction of the Atlantic Slave Trade, 1650s-1870s: Estimates by Markov Chain Monte Carlo Analysis, JWHI 2-3

Manning, P. & Nickleach, S. *(forthcoming)* African Population, 1650–1950: The Eras of Enslavement and Colonial Rule.

Mauny, R, A. (1954). "The Question of Ghana." Journal of the International African Institute 24/3: 200–213.

McWhirter, N. & McWhirter, R. A. (1974). Guinness Book of Records. Bantam Books Inc., 666 Fifth Avenue, New York, N.Y. 10019

Mendoza, E. (1997). Terms-of-trade uncertainty and economic growth. Journal of Development Economics, 1997, vol. 54, issue 2, 323-356

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

Mitchell, B.R. (1995) International Historical Statistics: Africa, Asia and Oceania 1750-1988. Palgrave Macmillan.

Nunn, N. (2008). The long-term effects of Africa's slave trades. Quarterly Journal of Economics 123(1): 139-176.

Officer, L., (2016). Exchange Rates Between the United States Dollar and Forty-one Currencies, MeasuringWorth, 2016. URL: http://www.measuringworth.com/exchangeglobal/

Officer, L. & Williamson, S. (2016). 'The Price of Gold, 1257 - Present', MeasuringWorth. URL: http://www.measuringworth.com/gold/

Peralias, O.D. & Romero-Ávila, D. (2016). 'The economic consequences of the Spanish Reconquest: the long-term effects of medieval conquest and colonization' Journal of Economic Growth, vol 21, no. 4, pp. 409–464.

Prados de la Escosura, L. (2011a). Human development in Africa : a long-run perspective. IFCS - Working Papers in Economic History.WH wp11-09, Universidad Carlos III de Madrid. Instituto Figuerola.

Prados de la Escosura, L. (2011b). "Human Development in Africa: A Long-Run Perspective," Working Papers 0008, European Historical Economics Society (EHES).

Prados de la Escosura, L. (2012). "Output Per Head In Pre-Independence Africa: Quantitative Conjectures," Economic History of Developing Regions, Taylor & Francis Journals, vol. 27(2), pages 1-36, December.

Prados de la Escosura, L. (2013). "Human development in Africa: A long-run perspective," Explorations in Economic History, Elsevier, vol. 50(2), pages 179-204.

Shah, M. S. & Williamson J. G. (2003): "Freight Rates and Productivity Gains in British Tramp Shipping 1869-1950," NBER Working Papers 9531.

Sharp, Paul, Strulik, Holger & Weisdorf, Jacob. (2012). The determinants of income in a Malthusian equilibrium, Journal of Development Economics, Elsevier, vol. 97(1), pages 112-117.

Szereszewski, R. (1965). Structural Changes in the Economy of Ghana, 1891-1911, London: Weidenfeld & Nicolson.

Federico, T. (2017). Measuring Extractive Institutions: Colonial Trade and Price Gaps in French Africa. Working paper.

Tolan, J., Laurens, H. & Veinstein, G (2012) Europe and the Islamic World A History. Princeton University Press

UN: World Economic Situation and Prospects [WESP] - Statistical Annex (2014)

Williamson, J, G. (2011). Trade and Poverty: When the Third World Fell Behind. Cambridge, MA: MIT Press.

Yousef, T, M. (2002), 'Egypt's Growth Performance Under Economic Liberalism: A Reassessment With New GDP Estimates, 1886–1945,' Review of Income and Wealth, Volume 48, Issue 4, December 2002, Pages: 561–579.

APPENDIX A

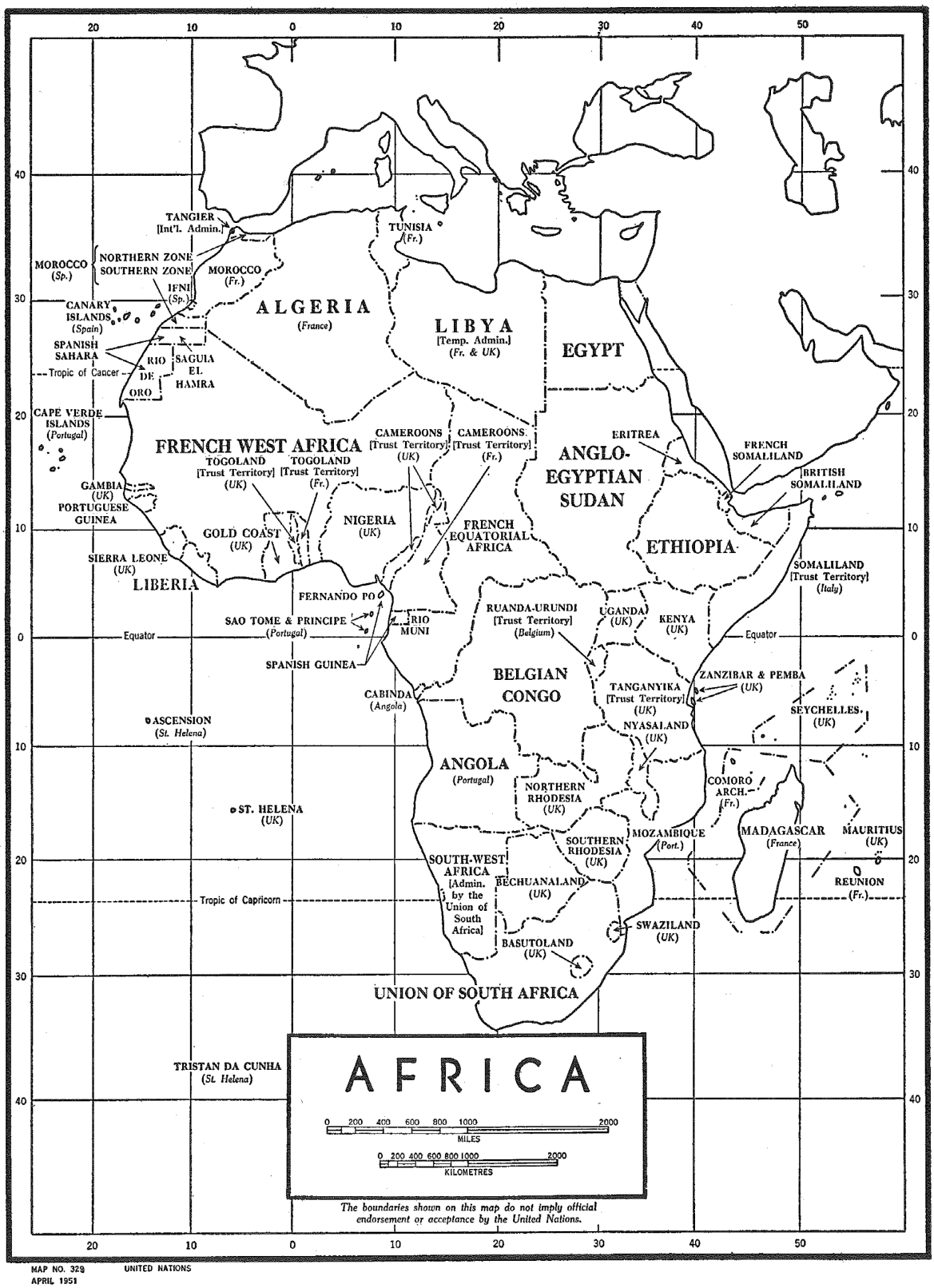
Defining Regions

Following the work of Prados de la Escosura (2012), I define North, Central, East and Southern Africa in accordance with the **African Development Bank**.
North Africa: Algeria, Egypt, Libya, Morocco and Tunisia.
Central Africa: Cameroon, Central African Republic, Chad, Congo, Democratic Republic of Congo, Equatorial Guinea, and Gabon.
East Africa: Burundi, Comoros, Djibouti, Eritrea, Ethiopia, Kenya, Rwanda, Seychelles, Somalia, Sudan, Tanzania, and Uganda (Ethiopia includes Eritrea and Sudan includes South Sudan, since these regions have only gained independence in recent years).
West Africa: Benin, Burkina Faso, Cape Verde, Côte d'Ivoire, The Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Mauritania, Niger, Nigeria, Senegal, Sierra Leone, and Togo. I do not have data to include São Tomé and Príncipe.
Southern Africa: Angola, Botswana, Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Namibia, South Africa, Swaziland, Zambia, and Zimbabwe.

Exchange Rates

When adjusting export prices from pounds sterling or francs I use the rates given by Federico (2016). These conversion rates are in line with the work of Bohlin (2010) and Lobell (2010).
I convert the data from Prados de la Escosura (2012) from 1990 $ US dollars to 2011$ US dollars using data from the Bureau of Labor Statistics' Consumer Price Index (CPI). I find the physiological subsistence level of $300 used by Prados de la Escosura (2012) to be equivalent to $516.31 in 2011. I use the value $515 as an approximation.

Figure 1: Historical Map of Africa



APPENDIX B

Figure 2: Log GDP per capita and the log of terms of trade

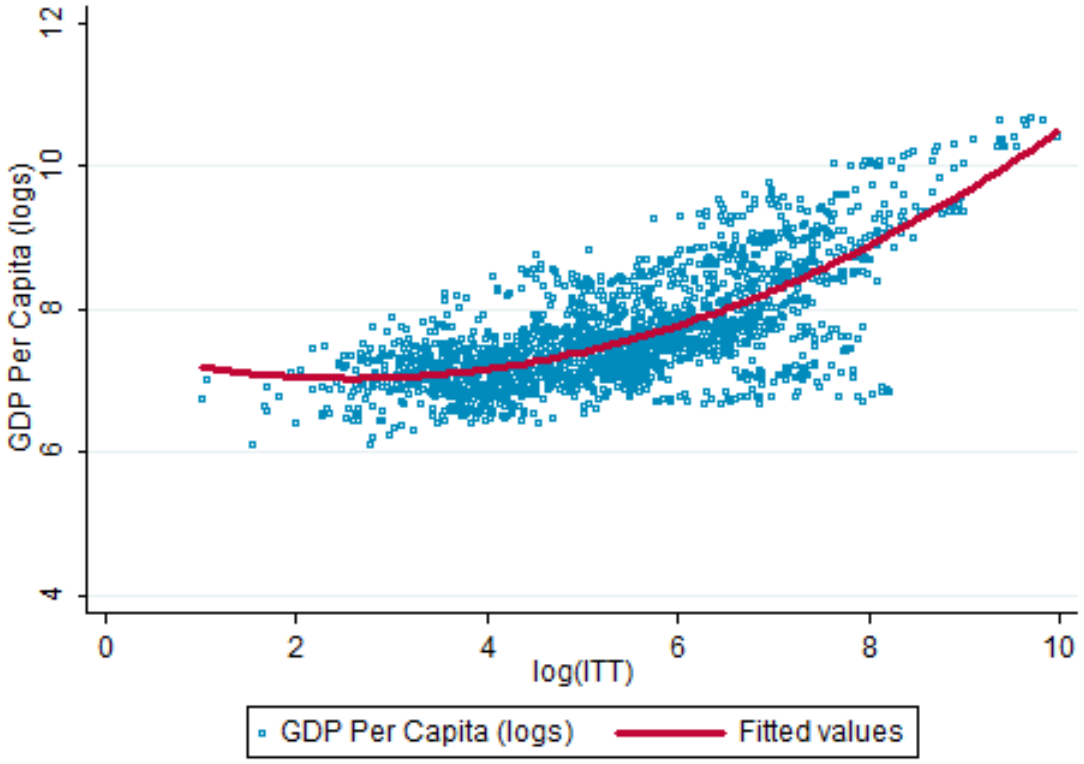


Table 1: Summary Statistics

Variable	Obs	Mean	Standard Deviation			Min	Max
			Overall	Between	Within		
GDP	2046	2778	3868	3326	084	373	43624
ITT	1857	626	1488	1087	989	7	21088
COAST	2460	0.6	0.5	0.5	0	0	1
RR	2255	0.3	0.5	0.5	0	0	1
British Colony	2460	0.5	0.5	0.5	0	0	1
French Colony	2460	0.3	0.5	0.5	0	0	1
TREND	1857	270	12	0	12	250	290

TIME SERIES PROCEDURE (1796-1830)

To extend the regional estimates outside of Africa I use time series techniques to create forecasts. I use the period 1830-1870 as the estimation period on the basis that the introduction of slave exports might cause a structural change. Based on the following tests I conclude that all regions follow an order of integration of order 1 and are cointegrated.

Table 2: Augmented Dickey-Fuller unit-root test

Variable	ADF Test Level	Critical Value 5%	Order of Integration
North Africa	-0.842	-3.536	
First difference	-5.201	-3.536	I(1)
West Africa	-2.636	-3.536	
First difference	-7.643	-3.536	I(1)
East Africa	-0.500	-3.536	
First difference	-7.419	-3.536	I(1)
Central Africa	-1.242	-3.536	
First difference	-5.805	-3.536	I(1)
Southern Africa	-2.495	-3.536	
First difference	-6.067	-3.536	I(1)

All tests include a trend.

Table 3: VECM Lag Selection

Sample years: 1830 - 1870							Number of obs: 40	
lag	**LL**	**LR**	**df**	**p**	**FPE**	**AIC**	**HQIC**	**SBIC**
0					3.0e+17	54.4221	54.4989	54.6398
1	-868.346	266.93	25	0.000	8.6e+14	48.5592	49.0197*	49.8654*
2	-842.247	52.199	25	0.001	8.7e+14	48.4998	49.344	50.8944
3	-815.836	52.822	25	0.001	1.0e+15	48.4235	49.6515	51.9066
4	-777.397	76.877*	25	0.000	7.7e+14*	47.6971*	49.3088	52.2687

Endogenous: westafrica eastafrica southernafrica northafrica centralafrica
Exogenous: _cons
I choose the most parsimonious model: a lag of 1 based on the HQIC and SBIC selection criteria.

Table 4: Johansen Test for Cointegration

Trend: Constant					Lags=1
Sample years: 1830 - 1870					Number of obs: 40
Maximum Rank	**Parms**	**LL**	**Eigenvalue**	**Trace Statistic**	**5% Critical Value**
0	5	-992.33178	.	109.7523	68.52
1	14	-952.80532	0.86142	30.6994*	47.21
2	21	-943.03055	0.38660	11.1499	29.68
3	26	-939.17375	0.17539	3.4363	15.41
4	29	-937.54456	0.07823	0.1779	3.76
5	30	-937.45561	0.00444		

Endogenous: westafrica eastafrica southernafrica northafrica centralafrica
Exogenous: _cons

Table 5: Vector Error Correction Model

Sample: 1830-1870				No. of obs = 41	
				AIC = 49.5789	
Log likelihood = -1002.367				HQIC = 49.79197	
Det(Sigma_ml) = 1.18e+15				SBIC = 50.16402	
Equation	Parms	RMSE	R-Squared	Chi2	P>Chi2
D_westafrica	2	53.7023	0.4105	27.15918	0.0000
D_eastafrica	2	19.9771	0.0835	3.555326	0.1690
D_southernafrica	2	33.2878	0.0415	1.68757	0.4301
D_northafrica	2	62.6566	0.0569	2.351131	0.3086
D_centralafrica	2	24.0114	0.0130	.5145572	0.7732

Table 6: Vector Error Correction Model Cont.

	Coefficient	Standard Error	Z	P>|Z|	[95% Confidence Interval]	
D_westafrica						
L1.	-.5216953	.1001385	-5.21	0.000	-.7179632	-.3254274
Constant	-.3088797	8.38833	-0.04	0.971	-16.7497	16.13194
D_eastafrica						
L1.	-.0208208	.0372512	-0.56	0.576	-.0938317	.0521902
Constant	5.650707	3.120429	1.81	0.070	-.4652218	11.76663
D_southernafrica						
L1.	-.0479133	.0620717	-0.77	0.440	-.1695715	.0737449
Constant	5.506385	5.199573	1.06	0.290	-4.684591	15.69736
D_northafrica						
L1.	.0142333	.1168356	0.12	0.903	-.2147603	.243227
Constant	14.93466	9.787003	1.53	0.127	-4.247513	34.11683
D_centralafrica						
L1.	.0319265	.044774	0.71	0.476	-.055829	.119682
Constant	.2433843	3.750599	0.06	0.948	-7.107654	7.594422

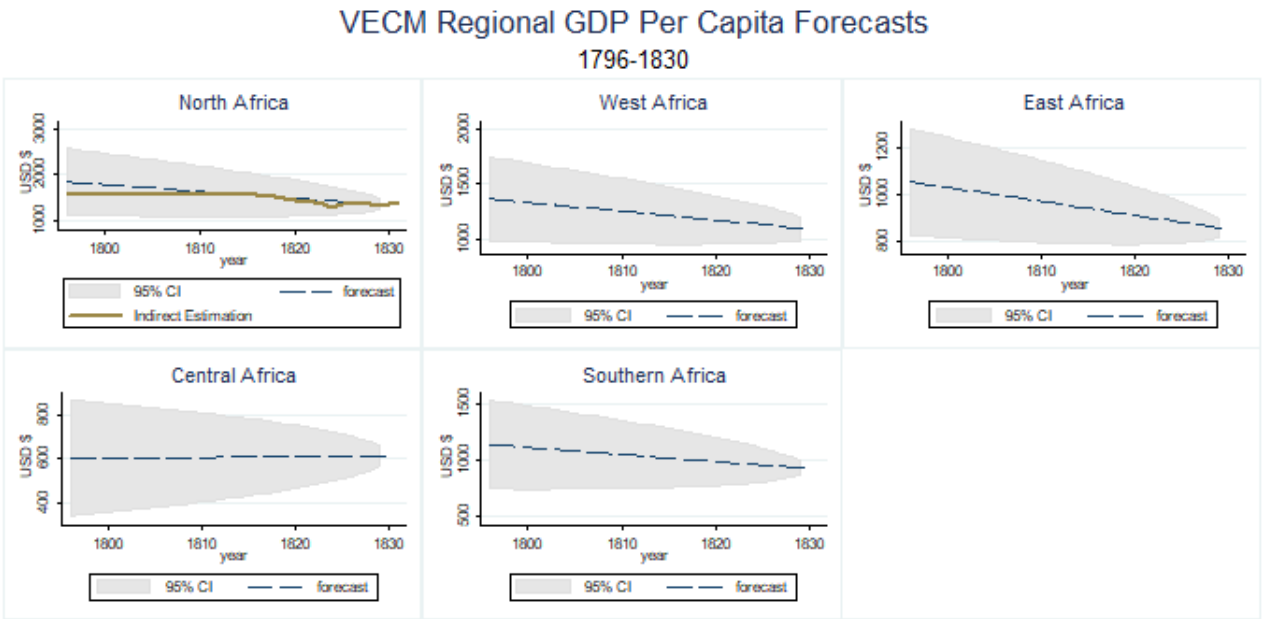
Table 7: Cointegrating Equation

Equation	**Parms**	**Chi2**	**P>chi2**
_ce1	4	43.63556	0.0000

Table 8: Johansen normalization restriction imposed

beta	Coefficient	Standard Error	Z	P>|Z|	[95% Confidence Interval]	
_ce1						
West Africa	1	.	.	.	.	.
Eastern Africa	-1.309248	.4879218	-2.68	0.007	-2.265557	-.352939
Southern Africa	.0665138	.2273371	0.29	0.770	-.3790587	.5120864
North Africa	-.0483495	.15826	-0.31	0.760	-.3585334	.2618345
Central Africa	-.692243	.2649145	-2.61	0.009	-1.211466	-.1730202
Constant	428.1429	.	.	.	.	.

Figure 3: VECM Forecasts



INDIRECT GDP PER CAPITA ESTIMATIONS

Table 9: Indirect GDP Per Capita Estimations

YEAR	1890	1900	1910	1920	1930	1938	1950
ALGERIA	1532	1857	2370	2572	3520	4039	4732
ANGOLA	515	515	527	720	716	807	
BENIN	708	604	700		912	1020	1230
BOTSWANA	528	583	625	744	939	1145	1344
BURKINAFASO	836	650	685	861	918	1033	1378
BURUNDI	515	515	515	580	979	789	790
CAMEROON	651	643	603	708	805	886	860
CAPE VERDE	563	695	810	781	1035	1100	1138
CENTRAL AFRICAN REPUBLIC	548	601	539	701	704	786	1163
CHAD	541	593	532	692	695	775	1240
CONGO	611	670	628	788	820	911	1181
DJIBOUTI	1036	1334	2782	2708	4726	3408	4255
DRC	762	699	774	916	1083	1201	1674
EGYPT	695	841	1059	1178	1412	1593	1983
EQUATORIAL GUINEA	863	823	690	838	957	1039	832
ERITREA	515	615	712	783	938	1118	
ETHIOPIA	515	515	515	745	697	752	665
GABON	2187	2396	2030	2762	2656	2975	3968
GAMBIA	629	766	991	1179	1424	1335	1829
GHANA	602	673	780	909	1201	1378	2322
GUINEA	749	543	555	726	746	845	1222
GUINEA-BISSAU	515	515	555	637	752	835	486
IVORY COAST	770	678	755	880	1006	1117	1737
KENYA	1084	1167	723	827	929	1067	1372
LESOTHO	515	515	515	515	601	685	398
LIBERIA	515	515	515	515	515	515	761
LIBYA	2594	3097	3524	3043	3274	3786	2976
MADAGASCAR	515	515	515	548	650	772	947
MALAWI	771	619	515	544	575	639	907
MALI	515	515	515	515	515	515	1264
MAURITANIA	783	568	580	759	780	884	770
MAURITIUS	1007	1251	1612	1856	2087	2613	3192
MOROCCO	911	1065	1177	1368	1593	1863	2712
MOZAMBIQUE	632	666	689	919	892	993	466
NAMIBIA	663	747	1008	1138	1468	1819	3258
NIGER	670	521	549	689	736	827	1148
NIGERIA	1717	1451	1445	1828	1885	2093	1503
REUNION							
RWANDA	515	515	515	515	808	651	607
SÃO TOMÉ & P	667	957	1399	847	1171	1213	1142
SENEGAL	736	648	721	841	961	1067	2325
SEYCHELLES	1916	2394	3286	3131	4440	4398	4932
SIERRA LEONE	568	656	730	856	992	1158	1757
SOMALIA	515	582	678	821	891	1008	
SOUTH AFRICA	1266	1495	2368	2261	2719	3045	5278
SUDAN	738	858	981	1040	1064	1191	1770
SWAZILAND	515	515	515	515	515	529	738
TANZANIA	569	619	680	803	904	1036	1263
TOGO	515	515	541	631	721	800	907
TUNISIA	681	805	987	1117	1451	1635	1619
UGANDA	1059	1150	564	659	671	754	1185
ZAMBIA	643	653	515	683	715	841	1042
ZIMBABWE	1187	1222	1050	1333	1467	1823	1967

Table 10: Indirect GDP Per Capita Estimations Continued

YEAR	1800	1810	1820	1830	1840	1850	1860	1870
ALGERIA				3232	1897	1334	985	1122
ANGOLA				515	515	515	515	515
BENIN				640	515	515	515	572
BOTSWANA				552	515	515	636	515
BURKINAFASO				816	564	603	573	666
BURUNDI				515	515	515	515	515
CAMEROON				631	515	515	515	682
CAPE VERDE						515	515	515
CENTRAL AFRICAN REPUBLIC				652	515	515	778	515
CHAD				643	515	515	767	515
CONGO				687	515	515	819	545
DJIBOUTI				1653	1348	560	610	732
DRC				515	515	515	579	515
EGYPT	995	696	515	515	515	515	515	515
EQUATORIAL GUINEA				911	605	645	603	954
ERITREA				792	646	515	515	515
ETHIOPIA				622	515	515	515	515
GABON				2787	1870	1932	3331	1993
GAMBIA				796	591	634	620	515
GHANA				708	526	564	551	522
GUINEA				763	515	540	515	592
GUINEA-BISSAU				515	515	515	515	515
IVORY COAST				696	517	554	542	622
KENYA				2212	1468	1262	954	1072
LESOTHO				515	515	515	515	515
LIBERIA			515	515	515	515	515	515
LIBYA	2613	1828	1184	1025	1315	1398	1725	2068
MADAGASCAR				515	586	515	515	515
MALAWI				2247	1221	1053	743	825
MALI				515	515	515	515	515
MAURITANIA				798	529	565	528	619
MAURITIUS				515	515	515	521	640
MOROCCO				1104	587	644	605	762
MOZAMBIQUE				684	835	629	562	546
NAMIBIA				590	515	515	695	564
NIGER				653	515	515	515	533
NIGERIA				1447	1033	1105	1063	1678
REUNION				625	515	515	515	
RWANDA				515	515	515	515	515
SÃO TOMÉ & P						515	515	515
SENEGAL				665	515	529	518	594
SEYCHELLES				1073	1001	1083	1045	1274
SIERRA LEONE				790	563	603	580	515
SOMALIA				792	646	515	515	515
SOUTH AFRICA				1032	677	823	781	900
SUDAN	1120	737	515	515	515	755	629	694
SWAZILAND				515	515	515	515	515
TANZANIA				569	515	515	515	515
TOGO				515	515	515	515	515
TUNISIA				1412	515	515	515	576
UGANDA				2480	1554	1302	930	1063
ZAMBIA				850	1081	735	615	568
ZIMBABWE				1461	1831	1291	1107	1041

All GDP estimates are truncated using the same physiological subsistence level used by **Prados de la Escosura (2012)**. ($300 US 1990 DOLLARS is approximately equal to $515 2011 DOLLARS.)
Full results can be found in the Excel file at: https://sites.google.com/site/lukeamcleary/home. This Excel file also includes GDP estimations.