

# DID COLONIES MATTER FOR GROWTH?

UNIFIED GROWTH THEORY

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## Contents

Motivation.....	2
Limitations to this study .....	2
The colonial era.....	4
Related studies .....	6
Data.....	6
The model .....	9
Analysis .....	10
Conclusion on initial regressions .....	14
Regression with lags.....	14
Conclusion on lagged regression .....	16
Discussion.....	16
Conclusion .....	17
Appendix.....	20
Colonial Empires list .....	21
List of colonies.....	22

## **Motivation**

Much has been written about how countries have been affected by their colonial past, whether this has been positive or negative for the country after their independence. Little interest has been shown as to investigate whether it has been positive or negative for the colonial powers to have these colonies. There is no doubt that controlling a vast empire is costly, but did it pay off? Was it beneficial to have access to the commodities and the land these colonies offered?

This project was originally intended to explore the correlation between access to specific commodities from colonies and growth of GDP in the great European colonial powers. As we discovered it to be quite impossible to find the desired data on European imports from the age of colonization, we decided to use location of colonies as a proxy for what commodities and type of land the empires had access to.

We will explore the possibility that the size and location of colonies, has affected the growth path of the colonial parent.

We are interested in looking at the five greatest European colonial empires, from the early colonial era in the 16<sup>th</sup> century, up until the end of the colonial era at the mid 20<sup>th</sup> century. We focus on the continental location as well as the latitude of the colonies and make various regressions to explore any significant correlation. Some colonies might have had a positive impact on the colonial parent quite fast, while other colonies have needed much more time to mature as a productive territory. This might very well influence any correlation between colonial area and growth. Therefore we not only look at what areas a colonial power control at a given time, but also introduce lagged observations, to explore the possibility that any correlation might occur after some time of maturity of the colony.

## **Limitations to this study**

This project focuses only on GDP per capita growth, and only in five different countries. There are other ways of measuring welfare gains<sup>1</sup>, but we chose not to venture beyond GDP per capita measurements.

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<sup>1</sup> As suggested by Hersch & Voth

We use Maddisons growth data<sup>2</sup>, this is generally considered useful, but since we are dealing with estimates of long past centuries, we must expect at least some inconsistencies and inaccuracies. Estimates from other sources do not cover that far back in time, so we have no choice but to accept this as the best obtainable data source.

As for our colonial powers we choose not to include Germany, Belgium and other relative small colonial powers (Sweden, Denmark, Italy, Austria etc) as the size of their colonies and/or time span of the empire is rather limited.

With regards to the colonies we chose to include in the study, we have tried hard to include as many as possible. However some colonial areas have not been accurately mapped, measured or widely recognized, and no longer exists as separate countries or regions, so we find ourselves unable to estimate the colonies size and therefore we have excluded these<sup>3</sup>

The question we try to answer in this study is whether it gave economic growth to have colonies. Only Spain seemed to have other motives than economic gains, and the predominant reason to have colonies was economic and militaristic power. We are not able to measure the latter, but focus only on the economic outcome of colonialism.

We have assumed that what matters in the colonies is the size and location. Our regressions use the size of the colonies as the explanatory variable. This is a crude simplification. A striking example would be the three colonies of Malacca, Macao and Brazil. All three were Portuguese colonies from the 16<sup>th</sup> century, and in our regressions Brazil would be considered more than five thousand times as influential as Malacca (being 5160 times larger) and even more so over Macao . This would be a very wrong assumption, since Malacca and Macao were some of the most important trade centers in Asia, while the vast majority of Brazil was undiscovered at the time.

Despite these shortcomings in our regressions we still consider our assumptions to be plausible.

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<sup>2</sup> Maddison (2003)

<sup>3</sup> Most notably the French colony of Louisiana and the British colony of British Guiana.

## **The colonial era**

The colonial era spans from 1455 with the Portuguese settlements on the Cap Verde islands. Portugal had several colonies in Africa, prior to the takeoff of American and Asian colonialism. Colonialism greatly picked up speed with the discovery of the Americas with the arrival of Columbus in 1492.

According to the treaty of Tordesillas<sup>4</sup> in 1494, the newly discovered territories outside of Europe, namely Africa and the Americas was divided between Portugal and Spain, with Spain getting everything west of Cap Verde (The Americas), and Portugal getting everything East of Cap Verde (Africa and Asia). All of these areas were then largely unknown.

This treaty made Spain and Portugal able to settle vast amounts of land rather quickly, since they no longer needed to fight each other over control. Soon other European powers also joined the rush to get colonies and expand their empires. The Netherlands had their first colony, Mauritius, in 1598, France joined the club with Benin in 1600 and the United Kingdom entered the colonial era with their thirteen colonies in North America in 1607.

The aim of the colonial powers has been quite different. Spain saw itself as the catholic guardian nation<sup>5</sup>. Their primary goal was to obtain wealth in form of precious metals for the home country and as a secondary goal they wanted to spread the catholic faith within their areas of control.

The Portuguese on the other hand sought to develop an agricultural basis for export in their colonies<sup>6</sup>. The areas that Portugal had control over was much less populated than the Spanish realms, and as the indigenous population was usually hunters or gatherers and not easy to enslave, they often relied on imported "labour" from Africa<sup>7</sup>. The United Kingdom, The Netherlands and France had much of the same goals as Portugal. Many of the areas that they came to colonize were sparsely populated, thus also dependent on import of slaves for labour<sup>8</sup>. The main goal here was in agricultural production and exports to the colonial parent.

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<sup>4</sup> Encyclopedia Britannica

<sup>5</sup> Maddison (2007)

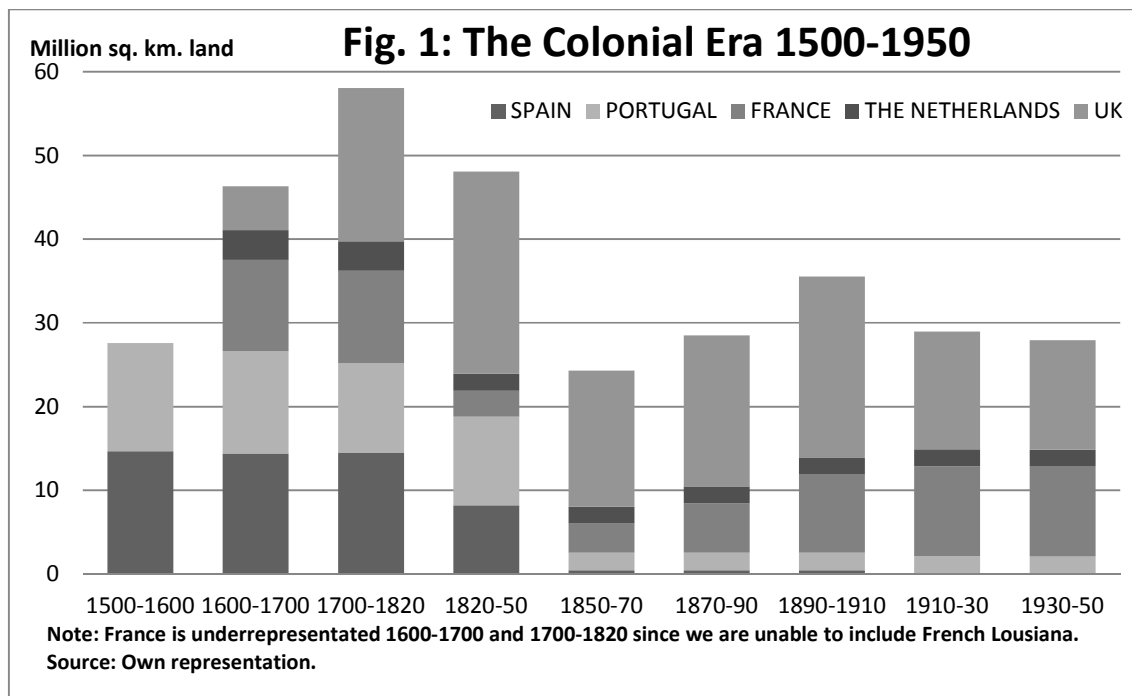
<sup>6</sup> Maddison (2007)

<sup>7</sup> E.g. there were 3.8 million Africans transported to Brazil up until 1870, compared to this the Spanish colonies of Peru and Mexico (at the time also including all of the current S/W USA) imported "only" 1.5 million African slaves. Source Maddison (2007)

<sup>8</sup> Maddison (2007)

The beginning of the end of the colonial area began in 1776, with the American war of independence. This proved to be a catalyst for other colonies to revolt against their colonial masters predominantly in the mainland of the Americas. Spain lost most of their empire before 1850, while Portugal lost its main colony Brazil in 1822. The United Kingdom managed to keep their empire well into the 20<sup>th</sup> century, and France even experienced a second colonial era starting in the later half of the 19<sup>th</sup> century. The Dutch empire never reached the size of its 4 colonial counterparts, but they managed to hold on to most of their colonies well into the 20<sup>th</sup> century.

The final end of the colonial era did not occur until well into the 1960s and 70s, where most of Africa was decolonized. A few minor colonies still exist<sup>9</sup>, but not on the terms of colonies in the past centuries (some will surely disagree).



In figure 1, we see the rise and fall of the five greatest European colonial empires. We notice how only Spain, Portugal and The Netherlands had colonies in the 15<sup>th</sup> century, and how Spain and Portugal lost all their main colonies before 1850 as stated earlier. We see that France experiences two colonial eras, the first ends with

<sup>9</sup> E.g. Aruba (a part of the Kingdom Of The Netherlands), Puerto Rico & Guam (unincorporated territories of the USA) and a few others.

the loss of Canada (and the North American territory of Louisiana that is not included in our dataset, and therefore not included in the study).

Another notable shift in the graph is how the British empire shrinks notably with the loss of the North American colonies 1776-83 (the US colonies) and in 1837 (Canada) and then grow again with the gains of the African colonies in the mid to late 19<sup>th</sup> century. Then to shrink yet again as South Africa and Australia gains independence and are no longer colonies in our graph from 1910-1920 (Australia gained independence in 1901, South Africa in 1910).

At the height of the colonial era, some 43% of the world landmass<sup>10</sup> (excluding the Antarctica) was colonized.

## **Related studies**

Many studies have been conducted on the effects of colonialism. The vast majority of these are examining the effects on the colonies, not the colonial powers. One exception is Hersh & Voth (2009) that examines how the welfare grew with the introduction of colonial goods. They conclude that the introduction of colonial goods in the European diets have significantly raised the living standards of the “average Englishman”.

Another study focusing on the European growth is Robinson, Acemoglu and Johnson (2005) that links growth with the transatlantic trade that again links directly or indirectly with the discovery of the new world and the associated colonization. The authors state that the growth originates from institutional changes within the empires, created by the growing trade and the needed institutional change that could accommodate this.

Relating to these studies, we hope to find evidence that links the colonies directly with the growth of the colonial powers.

## **Data**

We use Maddison growth data for UK, The Netherlands, France, Portugal and Spain. The dataset shows growth in per capita GDP per year, from 1500 until the present. We create a time series for each of our five colonial empires, consisting of growth data, and million square kilometers of colonial land on each continent, as well as

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<sup>10</sup> Own calculations, excluding the territories that we are unable to measure as earlier stated.

each latitude area, for 9 different periods of time from 1500 up until 1950. We could extend past this, but as the colonial period for most colonial empires ends here (in some cases even earlier) we chose not to go beyond this time.

The growth data from Maddison consists of single observations for population and GDP. We use this data to calculate the growth of GDP and population in the following time periods: 15-1600, 16-1700, 17-1820, 1820-50 and from there onwards in 20 year intervals. We have decided to use 20 year time periods to avoid extreme fluctuations. This limits our dataset to consist of 9 observations per country, covering different periods of time.

Colonies are not a homogenous group. Some colonies have already had a more or less widespread infrastructure, trade opportunities and institutions at the time of colonization.<sup>11</sup> Other colonies have been little more than sand banks in the middle of the pacific.<sup>12</sup> However we choose to treat all colonies similarly, to keep things simple. Data on colonialism has been obtained from various sources, from libraries to atlases to encyclopedias to the CIA world fact book, to official country-websites. From time to time there are inconsistencies between different sources of information, as to exactly when a country gets colonized. We have sought to use the most widely accepted dates, but we recognize that there could always be inaccuracies related to this. Another source of possible dispute is what year a country gains its independence. This could be at the time of declaration or at the time of actual widespread recognition of independence. In some cases we chose to honor the time of declaration of independence, as we recognize that this will in many cases be the time that the colonial powers lose access to the colonial goods. At other times we do not accept a country gaining independency before international recognition (e.g. Mexico, declared 1810, recognized 1821, we chose the later<sup>13</sup>). However, we have sought to make individual considerations, as to what is appropriate in different countries, as to get the most accurate data. However our decisions here could be disputed.

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<sup>11</sup>E.g. Hong Kong.

<sup>12</sup>E.g. Tuvalu.

<sup>13</sup> We accept 1821, as the year of independency despite the insurgency starting in 1810. In the following years the insurgency nearly failed several times, before gaining momentum in 1820, and finally winning independency in 1821, with the Treaty of Córdoba.

We have chosen to accept a colony being a part of a colonial empire in a given time period, when at any time during the period the colony has been part of the empire. This however means that a colony can be part of various empires during a single time period<sup>14</sup>. This way a single colony can be correlated with the growth of several colonial empires in one time period, this should preferably be avoided, but as the growth data spans long time periods, and as some colonies have changed hands several times, we find no way of avoiding this.

For our “latitude” regressions, we have divided the world into 5 latitude areas<sup>15</sup>. We could divide into more or less areas or chose the borders differently, but we have parted this way to keep things rather simple. Given more geographical or meteorological insight, one might chose to alter these areas, but as we are merely economists we lack this insight.

The latitude location of each colony has been decided from the latitude of the capital of the colony, this might not prove to be perfectly accurate for some large countries. However it is often seen that the capital of former colonies are also the main port of trade, so we accept this as the best indicator for the location of the country as a whole. Colonies where this may indicate inaccuracy could be Chile, Peru, Argentina, Malaysia, Vietnam etc, which are countries that stretch far from north to south, but not far from west to east. These countries might offer a very varied range of commodities and type of soils, as the climate varies significantly from north to south. Colonies spanning over several of our latitude areas, are only represented in the area covered by their capital, it might prove advantageous to part these colonies into different regions, which could then provide a more accurate account of the possibilities of the colony.

To account for different time periods, we have included time dummies, to filter out any time dependent growth (e.g. the 1920s), where most colonial powers have had extra ordinary growth. These dummies might not in themselves be significant, but they will still help create more accurate estimates.

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<sup>14</sup> E.g. Mauritius has been part of the Portuguese and Dutch empires in the 16th century, the Dutch empire in the 17th century, the Dutch and French empires in the 18th century and finally part of the French and British empires in the 19th century, ending its colonial history as a British colony in the 20th century.

<sup>15</sup> Se appendix

## The model

In our model we will estimate the correlation between the amount of colonial land in different areas, and the growth experienced by the colonial powers. Our dependent variable is GDP growth per capita, taken from Maddison.

As explanatory variables we use the initial relative GDP per capita<sup>16</sup> to account for convergence, as well as the sq. km. of colonial land in our different areas divided by continental location (model 1) or latitude (model 2). A last explanatory variable is population growth, which can explain some of the GDP growth experienced in our colonial powers. Hence our two base models are as follows:<sup>17</sup>

$$(1) \quad \Delta \text{GDP} = \beta_0 \text{GDP}_0 + \beta_1 \text{POPULATION GROWTH} + \beta_2 \text{AFRICA} + \beta_3 \text{ASIA} + \beta_4 \text{CONTINENTAL NORTH AMERICA} + \beta_5 \text{SOUTH AMERICA} + \beta_6 \text{OCEANIA} + \delta_1 \text{TD}_1 + \delta_2 \text{TD}_2 + \delta_3 \text{TD}_3 + \delta_4 \text{TD}_4 + \delta_5 \text{TD}_5 + \delta_6 \text{TD}_6 + \delta_7 \text{TD}_7 + \delta_8 \text{TD}_8 + u$$

$$(2) \quad \Delta \text{GDP} = \beta_0 \text{GDP}_0 + \beta_1 \text{POPULATION GROWTH} + \beta_2 \text{LATT}_1 + \beta_3 \text{LATT}_2 + \beta_4 \text{LATT}_3 + \beta_5 \text{LATT}_4 + \beta_6 \text{LATT}_5 + \delta_1 \text{TD}_1 + \delta_2 \text{TD}_2 + \delta_3 \text{TD}_3 + \delta_4 \text{TD}_4 + \delta_5 \text{TD}_5 + \delta_6 \text{TD}_6 + \delta_7 \text{TD}_7 + \delta_8 \text{TD}_8 + u$$

Later in our report, we will divide the continents into other regional or cultural areas, E.g. Latin-America, Indian subcontinent etc. This is to pursue a theory that cultural differences might matter as well as geographical differences.

We use Ordinary Least Square (OLS) regressions, and Whites heteroskedasticity resistant standard errors. This is done in recognition that having a colony in one area is probably correlated with having colonies in other areas. Using Whites standard errors to calculate t-values, accounts for this possible correlation in the error terms.

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<sup>16</sup> Initial GDP per capita, relative to that of the other colonial powers.

<sup>17</sup> For list of variables and time periods see appendix.

## Analysis

We first conduct our two base regressions, to see if we find any significant correlation.

LABEL	PARAMETERVALUE	STD. ERROR	T-VALUE
INTERCEPT	0,005705	0,005505	1,04
POP GROWTH	0,176320	0,312310	0,56
INITIAL RELATIVE GDP	-0,003115	0,011037	-0,28
AFRICA	0,0005602	0,0004852	1,15
ASIA	0,0001554	0,0004894	0,32
CONTINENTAL NORTH AMERICA	0,0000021	0,0001480	0,01
SOUTH AMERICA	-0,0003324**	0,0001513	-2,20
OCEANIA	0,0002027	0,0004510	0,45
TD <sub>1</sub>	-0,001847	0,003564	-0,52
TD <sub>2</sub>	-0,003487	0,003239	-1,08
TD <sub>3</sub>	-0,004329	0,002993	-1,45
TD <sub>4</sub>	-0,000290	0,003115	-0,09
TD <sub>5</sub>	0,000515	0,003511	0,15
TD <sub>6</sub>	0,002902	0,003036	0,96
TD <sub>7</sub>	-0,001578	0,002738	-0,58
TD <sub>8</sub>	0,003232	0,004257	0,76
* = Significant at the 10% level ** = Significant at the 5% level *** = Significant at the 1% level <b>White heteroskedasticity-consistent standard errors are used</b>			

The only significant correlation we find is a negative correlation (5% level) on the growth of the colonial parent, from colonies located in South America. In general we do not find the size of the colonial land located outside of the South American continent to be significantly correlated with the growth in the colonial empires. We now look at continents divided by their latitude location instead, and hope for better results. This would more specific show if a certain type of climate in the colonies, affects whether having colonies is at all correlated with growth.

LABEL	PARAMETERVALUE	STD. ERROR	T-VALUE
INTERCEPT	0,009137	0,003773	2,42
POP GROWTH	-0,129044	0,302960	-0,43
INITIAL RELATIVE GDP	0,002721	0,014358	0,19
LATT1	0,000751	0,003125	0,24
LATT2	0,000076	0,001488	0,05
LATT3	-0,000237	0,000274	-0,87

LATT4	0,000188	0,000229	0,82
LATT5	0,000056	0,000181	0,31
TD1	-0,006048	0,003338	-1,81
TD2	-0,007701	0,003441	-2,24
TD3	-0,008380	0,003315	-2,53
TD4	-0,002559	0,003462	-0,74
TD5	-0,001754	0,003253	-0,54
TD6	0,001319	0,002871	0,46
TD7	-0,002108	0,002653	-0,79
TD8	0,002470	0,004506	0,55
* = Significant at the 10% level ** = Significant at the 5% level *** = Significant at the 1% level <b>White heteroskedasticity-consistent standard errors are used</b>			

Unfortunately we did not find any significant correlation between the latitude location of the colonies and the growth of the colonial parent. This surprises as the latitude location would seem to be a good indicator of what a colony has to offer. Our estimates are far from being significant, and as earlier mentioned that might be a result of our latitude borders.

We now try to divide the colonies into smaller regional areas, as a division into continental locations might not represent the most plausible way to differentiate our colonies. A colony like India could provide much different commodities and possibilities than a colony like Indonesia, and a colony like Canada is very different from a colony like Mexico. To accommodate this we divide the North American continent as well as Asia into smaller areas, more precisely into North America, Central America and The Caribbean, and into the Indian Subcontinent and Asia excluding India. North America will then only contain colonies within the current continental United States of America<sup>18</sup> and Canada. Central America will contain all colonies from Mexico in the north to Panama in the south. The Caribbean will contain all island colonies in the Caribbean. The Indian Subcontinent will contain the colonies now inside the borders of India, Pakistan, Bangladesh and Sri Lanka.

Our model is now as follows:

$$(3) \quad \Delta \text{GDP} = \beta_0 \text{GDP}_0 + \beta_1 \text{POPULATION GROWTH} + \beta_2 \text{AFRICA} + \beta_3 \text{ASIA WITHOUT INDIA} + \beta_4 \text{INDIAN SUBCONTINENT} + \beta_5 \text{NORTH AMERICA}$$

<sup>18</sup> Therefore excluding Puerto Rico

$$\begin{aligned}
& + \beta_6 \text{SOUTH AMERICA} + \beta_7 \text{CENTRAL AMERICA} + \beta_8 \text{CARIBBEAN} + \\
& \beta_9 \text{OCEANIA} + \delta_1 \text{TD}_1 + \delta_2 \text{TD}_2 + \delta_3 \text{TD}_3 + \delta_4 \text{TD}_4 + \delta_5 \text{TD}_5 + \delta_6 \text{TD}_6 + \delta_7 \text{TD}_7 \\
& + \delta_8 \text{TD}_8 + u
\end{aligned}$$

LABEL	PARAMETERVALUE	STD. ERROR	T-VALUE
INTERCEPT	0,007062	0,006495	1,09
POP GROWTH	0,438643	0,425418	1,03
INITIAL RELATIVE GDP	-0,059329**	0,023274	-2,55
AFRICA	0,001191	0,000725	1,64
NORTH AMERICA	-0,000282*	0,000154	-1,83
CENTRAL AMERICA	-0,001823	0,005575	-0,33
SOUTH AMERICA	-0,000934***	0,000287	-3,26
CARRIBEAN	0,032875	0,028299	1,16
OCEANIA	0,000408	0,000391	1,04
INDIAN SUBCONTINENT	-0,000090	0,000456	-0,20
ASIA WITHOUT INDIA	0,005550**	0,002295	2,42
TD1	0,006611	0,005981	1,11
TD2	0,004069	0,005404	0,75
TD3	0,003685	0,005303	0,69
TD4	0,003920	0,004122	0,95
TD5	0,002728	0,003996	0,68
TD6	0,003954	0,002914	1,36
TD7	-0,001749	0,002311	-0,76
TD8	0,004632	0,003393	1,37
* = Significant at the 10% level ** = Significant at the 5% level *** = Significant at the 1% level <b>White heteroskedasticity-consistent standard errors are used</b>			

We now get much more significant results. We notice the existence of convergence, as the relative level of GDP pr. capita has a negative (5% level) impact on the growth of the colonial powers.

We have a much more significant result for South America (now on a 1% significance level), where the colonies still shows the surprising negative correlation with the GDP of the colonial parent. Similarly surprising is the negative correlation from the colonies located in North America (10% level), while Asia excluding India has a very nice positive correlation (5% level) with growth of the colonial parent.

We are also interested in exploring whether the cultural basis in a region might affect the growth of the colonial parent. Could it be that Latin American colonies show a

more significant correlation with the colonial powers growth? We check this by introducing Latin America, consisting of Central America, The Caribbean and the South American colonies. With these changes our model is as follows:

$$(4) \quad \Delta \text{GDP} = \beta_0 \text{GDP}_0 + \beta_1 \text{POPULATION GROWTH} + \beta_2 \text{AFRICA} + \beta_3 \text{ASIA WITHOUT INDIA} + \beta_4 \text{INDIAN SUBCONTINENT} + \beta_5 \text{NORTH AMERICA} + \beta_6 \text{LATIN AMERICA} + \beta_7 \text{OCEANIA} + \delta_1 \text{TD}_1 + \delta_2 \text{TD}_2 + \delta_3 \text{TD}_3 + \delta_4 \text{TD}_4 + \delta_5 \text{TD}_5 + \delta_6 \text{TD}_6 + \delta_7 \text{TD}_7 + \delta_8 \text{TD}_8 + u$$

LABEL	PARAMETERVALUE	STD. ERROR	T-VALUE
INTERCEPT	0,012634	0,004658	2,71
POP GROWTH	-0,009980	0,275019	-0,04
INITIAL RELATIVE GDP	-0,056321**	0,025426	-2,22
AFRICA	0,000546	0,000445	1,23
NORTH AMERICA	-0,000057	0,000145	-0,39
OCEANIA	0,000478	0,000352	1,36
LATIN AMERICA	-0,000574***	0,000168	-3,41
INDIAN SUBCONTINENT	0,000128	0,000447	0,29
ASIA WITHOUT INDIA	0,005529**	0,002601	2,13
TD1	0,001923	0,004644	0,41
TD2	-0,000737	0,003662	-0,20
TD3	-0,001323	0,003569	-0,37
TD4	0,001215	0,003217	0,38
TD5	0,000715	0,003413	0,21
TD6	0,002972	0,002836	1,05
TD7	-0,001643	0,002459	-0,67
TD8	0,003603	0,003799	0,95
* = Significant at the 10% level ** = Significant at the 5% level *** = Significant at the 1% level <b>White heteroskedasticity-consistent standard errors are used</b>			

We notice that Latin America is now more significant (t-value of -3,41), than South America alone (t-value of -3,26) and now has a less negative parameter value. Asia remains significant (5% level) and the parameter value hardly changes. However we no longer find North America to be significant (t-value changes from -1,83 to -0,39). All in all our idea of dividing into cultural areas in America did not provide much nicer results.

## Conclusion on initial regressions

Our regressions so far are not impressive. We do find some significant location dependent correlation between the amount of colonial area, and the growth experienced in the colonial parent. However this correlation is only seen in some colonial areas and often shows a negative correlation.

These initial results are surprising. General economic theory would suggest that colonialism would only occur if it is advantageous for the colonial power. Our study suggests that far from all colonies have had a positive correlation with the growth in the parent country. There is little doubt that it has been costly to conquer and maintain a vast colonial empire, however we would still expect it to be positively correlated with growth due to the access to the colonial land and various commodities.

## Regression with lags

Our regressions so far has assumed total control of all land area in the colonies from the first moment of settlement. Often these first settlements have been little more than outposts and might often not have provided any kind of resource-access or widespread control over the colonial area as a whole. We now lag our colonies by one period, this way a colony which was settled between 1500 and 1600, counts as a colony between 1600 and 1700 and so forth. Many of the colonies have been colonized for very long time periods, and in these cases this should provide a more accurate account of the control of the colony. In the cases where a colonial power has lost control of the colony in the previous time period, we find it reasonable to assume that trade and some influence is often still present in the following time period.

We do recognize that this in some cases proves to be a doubtful assumption, some colonial powers influence came to an abrupt end with the end of the colonial presence.<sup>19</sup> Our final model is as follows:

$$(5) \quad \Delta \text{GDP}_t = \beta_0 \text{GDP}_t + \beta_1 \text{POPULATION GROWTH}_{t-1} + \beta_2 \text{AFRICA}_{t-1} + \beta_3 \text{ASIA WITHOUT INDIA}_{t-1} + \beta_4 \text{INDIAN SUBCONTINENT}_{t-1} + \beta_5 \text{NORTH}$$

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<sup>19</sup> E.g the portuguese presence in Malacca. The Portuguese power were completely destroyed with the fall of Malacca in 1641. It's very doubtful if they managed to keep any significant influence in this area after the Dutch took control.

$$\begin{aligned} & \beta_5 \text{AMERICA}_{t-1} + \beta_6 \text{SOUTH AMERICA}_{t-1} + \beta_7 \text{CENTRAL AMERICA}_{t-1} + \\ & \beta_8 \text{CARIBBEAN}_{t-1} + \beta_9 \text{OCEANIA}_{t-1} + \delta_1 \text{TD}_1 + \delta_2 \text{TD}_2 + \delta_3 \text{TD}_3 + \delta_4 \text{TD}_4 + \\ & \delta_5 \text{TD}_5 + \delta_6 \text{TD}_6 + \delta_7 \text{TD}_7 + \delta_8 \text{TD}_8 + u \end{aligned}$$

TABLE 5: GROWTH REGRESSION WITH LAG			
LABEL	PARAMETERVALUE	STD. ERROR	T-VALUE
INTERCEPT	-0,014425	0,006978	-2,07
POP GROWTH	1,209242***	0,456147	2,65
INITIAL RELATIVE GDP	0,015619	0,017371	0,90
AFRICA	0,002300***	0,000721	3,19
NORTH AMERICA	0,000379*	0,000192	1,97
CENTRAL AMERICA	-0,011283***	0,004268	-2,64
SOUTHAMERICA	-0,000796***	0,000290	-2,74
CARRIBEAN	0,074355***	0,021678	3,43
OCEANIA	-0,000490	0,000398	-1,23
INDIAN SUBCONTINENT	-0,000595	0,000600	-0,99
ASIA WITHOUT INDIA	-0,001219	0,001443	-0,84
TD1	0,009398	0,004839	1,94
TD2	0,005791	0,004260	1,36
TD3	0,007359	0,003468	2,12
TD4	0,010130	0,003644	2,78
TD5	0,010773	0,003616	2,98
TD6	0,004822	0,003280	1,47
TD7	0,011718	0,003079	3,81
* = Significant at the 10% level ** = Significant at the 5% level *** = Significant at the 1% level <b>White heteroskedasticity-consistent standard errors are used</b>			

What we now find is that most areas having been colonized turn out significant, only the Pacific and Asia (both the Indian subcontinent, and the rest of Asia) turn out insignificant, especially Asia being insignificant is surprising, as it was significant in the previous regression.

We interpret the results of our lagged regression as there being some kind of transition period, before the colonial powers benefit from having a colony. Africa (1% level), North America (10% level) and the Caribbean (1% level) all have a positive correlation with the growth of the colonial parent, whilst South America (1% level) and Central America (1% level) has a negative correlation. It still surprises how a colony could have a negative impact, but as we are limited in our study, we are only able to speculate why this is so.

One possible explanation is that South- and Central America has had large, relatively strongly developed and advanced civilizations before the arrival of the European colonists.<sup>20</sup> It might have proven yet very expensive to deal with the natives, while less developed areas like Africa and North America might have seen much less opposition to the colonial expansions.

We notice that Central America has a much stronger negative correlation (approximately 15 times stronger) with the growth of the colonial parent, than South America. This seems to support our hypothesis that already established civilizations have made exploitation harder and more expensive. In South America there has only been one large civilization, namely the Incas, which predominantly covered the Andes mountain range. The rest of South America has more or less been uncivilized, and inhabited of smaller tribes, making it much easier to exploit. Central America was at the time of the colonization home to two large civilizations. This might have made it much harder for the colonial powers to conquer, control and exploit the area.

## **Conclusion on lagged regression**

We did not find a general positive correlation between the size of the colonial land and the growth in the colonial parent in our initial regressions. However when lagged some areas do provide a positive correlation with the growth in the colonial power. These areas are Africa (1% level), North America (10% level) and the Caribbean (1% level). The areas that significantly have a negative correlation with the growth in the parent colonial power are South America (1% level) and Central America (1% level). This is very different from our results without lag where very little was found significantly correlated with growth in the colonial parent. We notice one change for the less significant. Asia is no longer significantly correlated with growth, which it was (5%) in our prior regressions.

## **Discussion**

We have found some very interesting results in this study. Most significantly we find that having colonies in most areas is significantly correlated with growth in the following time period. The limitations in our study leave us at doubt as to why this

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<sup>20</sup> E.g. the Mayan, Inca and Aztec civilizations.

correlation exists, but it could be that the colonial parent has access to a wider range of commodities which could provide a base for growth. High nutritive foods might make people more productive, and they might be willing to work for longer hours to gain access to new and exotic commodities<sup>21</sup>. The reasons for the negative correlation from some areas could be the presence of strong civilizations as seen in especially Central America.

We have not been able to take account of the many wars being fought between the colonial powers. This might give us better results, as wars are costly and might have affected the growth in the colonial powers quite substantially both positively and negatively.

We have no doubts that our regressions have many shortcomings. Our explanatory variables are few, and we would gain better understanding of the mechanisms that influence growth in the colonial era if we had access to better data. However growth data from our earliest time period (1500-1600) and even beyond that is very scarce, and often at best based on assumptions that might easily lead to very different estimates if these underlying assumptions are modified. We also only have 4 data points namely 1500, 1600, 1700 and 1820 covering more than three centuries of GDP and population. It reduces our data to only cover 9 observations per country, which ideally could be expanded with a better dataset and provide more accurate estimates.

We find it impossible to find data on basic socio-economic factors as unemployment, poverty, income distribution etc that may very well have influenced growth. Other factors such as infrastructure or exogenous factors as the weather<sup>22</sup> might also influence the growth-path, but we are unable to include this in our model.

## **Conclusion**

We set out to explore the correlation between colonial area and growth of colonial powers. We have looked at data from 1500 until the mid 20<sup>th</sup> century, and found some significant evidence that the size of the colonial empires have affected the growth of the colonial parent.

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<sup>21</sup> E.g. Sugar, tobacco, tea and coffee.

<sup>22</sup> E.g. The "little ice age" that reached its peak (minimum) around the 1650s.

In our initial regressions we found no evidence that the latitude location of colonies had any significant correlation with the growth of the colonial parent. This is surprising as we had anticipated that this would be a good proxy for the commodities that the colonies granted access to.

Our other initial regression was parting our colonial land by continents. This showed little correlation as only South America (5%) had any significant correlation with the growth of colonial parent.

We moved on to part our colonies by smaller regions. We parted the Asian and North American continents into smaller areas, recognizing that a continent is not a homogenous region. We therefore introduced the Indian sub continent, as well as North- and Central America and the Caribbean. We found North America (10%), South America (1%) and Asia (5%) excluding India to be significantly correlated with the growth of their colonial parents.

This was a much better result than what we saw in the earlier regressions. We then decided to explore whether cultural influence might also affect the correlations. We introduced Latin America as the combined areas of South- and Central America and the Caribbean. We again found some significant correlation (Asia 5% level and Latin America 1% level) with the growth in the colonial powers. We lost the significance of North America, which surprised us.

In our final regression we introduced lagged values of the colonial areas, in acceptance of the fact that it might take a while before a colony turns into a productive area.

Our final results showed a surprisingly significant correlation between several of our colonial areas and the growth of the colonial parent. On a 1% significance level we found Africa, Central America, South America and the Caribbean to be correlated with the growth in their colonial parents, and on a 10% level North America was correlated as well.

Central America (1% level) and South America (1% level) had a negative correlation with the growth of the colonial parent, whilst North America (10% level), Africa (1% level) and The Caribbean (1% level) showed a significant positive correlation with the colonial parent.

We speculated as to why we saw a negative correlation from some areas and positive correlation from others, but also recognize that the limits of our study leave us only speculating.

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## Appendix

List of variables	Description
$\Delta$ GDP	Annual GDP per capita growth
GDP0	Initial GDP per capita
POP	Annual growth in population
AFRICA	All colonies located on the African continent
ASIA	All colonies located on the Asian continent
NAMERICA	All colonies located in North America
CAMERICA	All colonies located in Central America
SAMERICA	All colonies located on the South American continent
CARRIBEAN	All colonies located in the Caribbean
OCEANIA	All colonies located in the Australia and Oceania
LATINAMERICA	All colonies located in Latin America
INDIAN SUBCONTINENT	All colonies located on the Indian Subcontinent
ASIA WITHOUT INDIA	All Asian colonies not located on the Indian Subcontinent
CONTINENTAL NAMERICA	All colonies located on the North American continent
LATT1	All colonies located between the 5th degrees north and the 5th degrees south parallel
LATT2	All colonies located between the 5th and the 10th degrees north or between the 5th and the 10th degrees south parallel
LATT3	All colonies located between the 10th and the 25th degrees north or the 10th and the 25th degrees south parallel
LATT4	All colonies located between the 25th and the 45th degrees north or the 25th and the 45th degrees south parallel
LATT5	All colonies located between the 45th and the 90th degrees north or the 45th and the 90th degrees south parallel
TD1	Time dummy covering 1500-1600
TD2	Time dummy covering 1600-1700
TD3	Time dummy covering 1700-1820
TD4	Time dummy covering 1820-1850
TD5	Time dummy covering 1850-1870
TD6	Time dummy covering 1870-1890
TD7	Time dummy covering 1890-1910
TD8	Time dummy covering 1910-1930
TD9	Time dummy covering 1930-1950

## Colonial Empires list

COUNTRY	YEAR	GROWTH	GROWTH PER YEAR	INITIAL GDP	INITIAL GDP RELATIVE	POP GROWTH
FRANCE	1600-1700	8,20%	0,08%	841	17,56%	0,15%
FRANCE	1700-1820	24,72%	0,18%	910	15,26%	0,31%
FRANCE	1820-50	40,68%	1,14%	1.135	17,17%	0,51%
FRANCE	1850-70	17,47%	0,81%	1.597	19,24%	0,28%
FRANCE	1870-90	26,68%	1,19%	1.876	18,75%	0,20%
FRANCE	1890-1910	24,80%	1,11%	2.376	19,07%	0,15%
FRANCE	1910-30	52,82%	2,14%	2.965	20,47%	0,05%
FRANCE	1930-50	14,44%	0,68%	4.532	22,93%	0,11%
NETHERLANDS	1600-1700	54,20%	0,43%	1.381	28,84%	0,24%
NETHERLANDS	1700-1820	-13,71%	-0,12%	2.130	35,72%	0,17%
NETHERLANDS	1820-50	28,99%	0,85%	1.838	27,81%	0,95%
NETHERLANDS	1850-70	16,28%	0,76%	2.371	28,56%	0,77%
NETHERLANDS	1870-90	20,54%	0,94%	2.757	27,55%	1,15%
NETHERLANDS	1890-1910	14,02%	0,66%	3.323	26,67%	1,34%
NETHERLANDS	1910-30	47,87%	1,97%	3.789	26,15%	1,44%
NETHERLANDS	1930-50	7,03%	0,34%	5.603	28,34%	1,25%
UK	1600-1700	28,42%	0,25%	974	20,33%	0,33%
UK	1700-1820	36,44%	0,26%	1.250	20,97%	0,76%
UK	1820-50	36,61%	1,05%	1.706	25,81%	0,83%
UK	1850-70	36,91%	1,58%	2.330	28,08%	0,72%
UK	1870-90	25,65%	1,15%	3.190	31,89%	0,89%
UK	1890-1910	15,02%	0,70%	4.009	32,17%	0,91%
UK	1910-30	18,00%	0,83%	4.611	31,82%	0,10%
UK	1930-50	27,54%	1,22%	5.441	27,53%	0,45%
PORTUGAL	1600-1700	10,68%	0,10%	740	15,45%	0,60%
PORTUGAL	1700-1820	12,69%	0,10%	819	13,74%	0,42%
PORTUGAL	1820-50	0,06%	0,00%	923	13,96%	0,49%
PORTUGAL	1850-70	5,58%	0,27%	923	11,13%	0,63%
PORTUGAL	1870-90	15,68%	0,73%	975	9,75%	0,75%
PORTUGAL	1890-1910	8,87%	0,43%	1.128	9,05%	0,79%
PORTUGAL	1910-30	27,92%	1,24%	1.228	8,48%	0,71%
PORTUGAL	1930-50	32,83%	1,43%	1.571	7,95%	1,10%
SPAIN	1600-1700	0,00%	0,00%	853	17,81%	0,06%
SPAIN	1700-1820	18,15%	0,14%	853	14,31%	0,28%
SPAIN	1820-50	7,03%	0,23%	1.008	15,25%	0,67%
SPAIN	1850-70	11,90%	0,56%	1.079	13,00%	0,42%
SPAIN	1870-90	34,55%	1,49%	1.207	12,06%	0,46%
SPAIN	1890-1910	16,69%	0,77%	1.624	13,03%	0,56%
SPAIN	1910-30	38,27%	1,63%	1.895	13,08%	0,83%
SPAIN	1930-50	-16,46%	-0,90%	2.620	13,26%	0,90%

## List of colonies

NAME OF COLONY	COLONIAL PARENT	YEAR ON	YEAR OFF	SIZE IN SQ KM	LATITUDE
ALABAMA	FRANCE	1702	1763	135765	33
ALABAMA	SPAIN	1780	1814	135765	33
ALABAMA	UK	1763	1780	135765	33
ALGERIA	FRANCE	1830	1962	2381741	36
ANGOLA	PORTUGAL	1483	1975	1246700	-8
ANTIGUA & BERBUDA	UK	1632	1981	442	17
ARGENTINA	SPAIN	1542	1810	2766890	-34
ARIZONA	SPAIN	1540	1821	295254	34
ARUBA	SPAIN	1508	1636	180	13
ARUBA	THE NETHERLANDS	1636	2010	180	13
BAHAMAS	UK	1648	1964	13943	25
BAHRAIN	PORTUGAL	1521	1602	750	26
BAHRAIN	UK	1861	1971	750	26
BARBADOS	PORTUGAL	1550	1610	430	13
BARBADOS	UK	1625	1966	430	13
BELIZE	UK	1638	1954	22956	17
BENIN	FRANCE	1600	1900	112622	6
BHUTAN	UK	1910	1947	38394	28
BOLIVIA	SPAIN	1524	1825	1098581	-19
BOTSWANA	UK	1885	1966	581730	-26
BRAZIL	PORTUGAL	1534	1822	8514877	-16
BRITISK INDIA	UK	1612	1947	4223654	29
BRUNEI	UK	1888	1984	5755	5
BURMA	UK	1824	1948	676578	20
CALIFORNIA	SPAIN	1540	1821	423970	38
CAMBODIA	FRANCE	1863	1953	181035	12
CAMEROON	UK	1822	1961	475442	4
CANADA	FRANCE	1604	1763	9984670	45
CANADA	UK	1763	1837	9984670	45
CAP VERDE	PORTUGAL	1460	1975	4033	15
CENTRAL AFRICAN REPUBLIC	FRANCE	1903	1960	622984	4
CHAD	FRANCE	1900	1960	1284000	12
CHILE	SPAIN	1540	1818	756102	-33
COLORADO	SPAIN	1540	1821	269837	39
COLUMBIA	SPAIN	1513	1810	1141748	5
COMOROS	FRANCE	1841	1909	2235	-12
CONGO	FRANCE	1880	1910	342000	-4
CONNECTICUT	UK	1607	1776	14356	41
COSTA RICA	SPAIN	1502	1821	51100	10
CUBA	SPAIN	1511	1898	109886	23
DELAWARE	UK	1607	1776	6452	39
DJIBOUTI	FRANCE	1862	1977	23200	12
DOMINICA	UK	1763	1831	751	15
DOMINICAN REPUBLIC	SPAIN	1496	1844	48671	19
EGYPT	UK	1914	1922	1002450	30
EL SALVADOR	SPAIN	1524	1821	21041	14
EQ. GUINEA	PORTUGAL	1472	1778	28051	4
EQ. GUINEA	SPAIN	1778	1827	28051	4
EQ. GUINEA	SPAIN	1843	1968	28051	4
EQ. GUINEA	UK	1827	1843	28051	4
EQUADOR	SPAIN	1553	1809	256369	0
FJI	UK	1874	1970	18272	-18
FLORIDA	FRANCE	1690	1763	170304	28
FLORIDA	SPAIN	1559	1561	170304	28
FLORIDA	UK	1763	1783	170304	28

NAME OF COLONY	COLONIAL PARENT	YEAR ON	YEAR OFF	SIZE IN SQ KM	LATITUDE
FRENCH GUINEA	FRANCE	1894	1958	245857	10
GABON	FRANCE	1910	1960	267668	0
GAMBIA	UK	1758	1965	11295	13
GEORGIA	UK	1607	1776	153909	32
GOA	PORTUGAL	1505	1961	3702	16
GRENADA	FRANCE	1650	1763	344	12
GRENADA	UK	1763	1958	344	12
GUAM	SPAIN	1565	1898	541	14
GUATEMALA	SPAIN	1519	1821	108889	15
GUINEA-BISSAU	PORTUGAL	1455	1973	36125	12
GUYANA	THE NETHERLANDS	1616	1814	214999	7
GUYANA	UK	1814	1966	214999	7
HAITI	FRANCE	1697	1804	27750	19
HAITI	SPAIN	1496	1697	27750	19
HONDURAS	SPAIN	1502	1821	112492	14
HONG KONG	UK	1841	1997	1104	22
INDONESIA	THE NETHERLANDS	1603	1945	1785855	-6
IVORI COAST	FRANCE	1880	1960	322463	7
JAMAICA	SPAIN	1534	1655	10991	18
JAMAICA	UK	1655	1962	10991	18
JORDAN	FRANCE	1925	1946	89342	38
KENYA	UK	1888	1963	580367	-1
KIRIBATI	UK	1892	1976	726	1
KUWAIT	UK	1899	1961	17818	29
LAOS	FRANCE	1893	1949	236800	18
LEBANON	FRANCE	1920	1941	10452	34
LESOTHO	UK	1884	1966	30355	-29
LOUSIANA	SPAIN	1540	1821	135382	30
MACAU	PORTUGAL	1557	1999	29	22
MADAGASCAR	FRANCE	1666	1960	587041	-19
MAINE (TILHØRER MASS)	UK	1607	1776	91646	45
MALACCA	PORTUGAL	1511	1641	1650	2
MALACCA	THE NETHERLANDS	1641	1824	1650	2
MALACCA	UK	1824	1942	1650	2
MALAWI	UK	1891	1964	118484	-14
MALAYSIA	UK	1786	1957	329153	3
MALI	FRANCE	1880	1959	1240192	13
MALUKU ISLANDS	PORTUGAL	1512	1546	74505	1
MALUKU ISLANDS	SPAIN	1546	1599	74505	1
MALUKU ISLANDS	THE NETHERLANDS	1599	1950	74505	1
MARSHALL ISLANDS	SPAIN	1556	1884	181	7
MARYLAND	UK	1607	1776	32133	38
MASSACHUSSETS	UK	1607	1776	27336	42
MAURETANIEN	FRANCE	1901	1960	1025520	18
MAURITIUS	FRANCE	1710	1810	2040	-20
MAURITIUS	PORTUGAL	1507	1598	2040	-20
MAURITIUS	THE NETHERLANDS	1598	1710	2040	-20
MAURITIUS	UK	1810	1968	2040	-20
MEXICO	SPAIN	1520	1821	1964375	19
MICRONESIA	SPAIN	1600	1899	702	7
MOZAMBIQUE	PORTUGAL	1498	1975	801590	-26
NEVADA	SPAIN	1540	1821	286367	39
NEW HAMPSHIRE	UK	1607	1776	24217	44
NEW JERSEY	UK	1607	1776	22608	40
NEW MEXICO	SPAIN	1540	1821	315194	34

NAME OF COLONY	COLONIAL PARENT	YEAR ON	YEAR OFF	SIZE IN SQ KM	LATITUDE
NEW SOUTH WALES	UK	1788	1901	809444	-34
NEW YOURK	UK	1607	1776	141299	43
NEW ZEALAND	UK	1840	1854	268021	-41
NICARAGUA	SPAIN	1520	1821	130373	13
NIGER	FRANCE	1922	1960	1267000	14
NIGERIA	UK	1901	1960	923768	9
NORTH CAROLINA	UK	1607	1776	139509	35
OMAN	PORTUGAL	1508	1648	309550	24
PALAU	SPAIN	1885	1898	459	7
PALESTINA	UK	1920	1948	28092	32
PANAMA	SPAIN	1538	1821	75517	9
PAPAY NU GUINEA	UK	1884	1904	462840	-10
PARAGUAY	SPAIN	1537	1811	406752	-25
PENNSYLVANIA	UK	1607	1776	119283	40
PERU	SPAIN	1542	1821	1285216	-12
PHILIPPINES	SPAIN	1565	1898	299764	15
PORTUGESE TIMOR	PORTUGAL	1702	1975	14874	-9
PUERTO RICO	SPAIN	1508	1898	8870	18
QUEENSLAND	UK	1859	1901	1852642	-22
RHODE ISLAND	UK	1607	1776	4002	42
SAINT HELENA	PORTUGAL	1502	1658	122	-16
SAINT HELENA	UK	1658	1981	122	-16
SAINT KITTS & NEVIS	FRANCE	1625	1783	261	17
SAINT KITTS & NEVIS	UK	1623	1625	261	17
SAINT KITTS & NEVIS	UK	1783	2000	261	17
SAINT LUCIA	FRANCE	1660	1814	539	14
SAINT LUCIA	UK	1814	1979	539	14
SAINT VINCENT & THE GRENADINES	FRANCE	1719	1763	389	13
SAINT VINCENT & THE GRENADINES	FRANCE	1779	1783	389	13
SAINT VINCENT & THE GRENADINES	UK	1763	1779	389	13
SAINT VINCENT & THE GRENADINES	UK	1783	1979	389	13
SÃO TOMÉ & PRINCIPE	PORTUGAL	1485	1975	964	0
SENEGAL	FRANCE	1850	1960	196722	15
SEYCHELLES	UK	1609	1976	455	-5
SIERRA LEONE	UK	1827	1951	71740	8
SINGAPORE	UK	1819	1940	705	1
SOLOMON ISLANDS	UK	1890	1976	28896	-9
SOMALILAND	UK	1888	1960	137600	10
SOUTH AFRICA	PORTUGAL	1487	1652	1221037	-29
SOUTH AFRICA	THE NETHERLANDS	1652	1795	1221037	-29
SOUTH AFRICA	UK	1795	1910	1221037	-29
SOUTH AUSTRALIA (&NORTHERN TERRITORY)	UK	1836	1901	2464484	-35
SOUTH CAROLINA	UK	1607	1776	82932	34
SRI LANKA	PORTUGAL	1505	1657	65610	7
SRI LANKA	THE NETHERLANDS	1657	1796	65610	7
SRI LANKA	UK	1802	1948	65610	7
SUDAN	UK	1899	1956	2505813	16
SURINAM	THE NETHERLANDS	1667	1975	163820	6
SYRIA	FRANCE	1920	1946	185180	34
TASMANIA	UK	1803	1901	90758	-43
TEXAS	SPAIN	1540	1821	696241	31
TOGO	FRANCE	1916	1960	56785	6
TRINIDAD & TOBAGO	SPAIN	1498	1797	5130	11
TRINIDAD & TOBAGO	UK	1797	1962	5130	11
TUNESIA	FRANCE	1881	1956	163610	37

NAME OF COLONY	COLONIAL PARENT	YEAR ON	YEAR OFF	SIZE IN SQ KM	LATITUDE
TUVALU	UK	1916	1978	26	-9
UGANDA	UK	1888	1962	241038	0
URUGUAY	SPAIN	1516	1825	176215	-35
UTAH	SPAIN	1540	1821	219887	39
VANUATU	FRANCE	1906	1980	12189	-18
VANUATU	UK	1906	1980	12189	-18
VENUZUELA	SPAIN	1522	1811	912050	11
VICTORIA	UK	1851	1901	237629	-34
VIETNAM	FRANCE	1884	1941	331212	21
VIRGINIA	UK	1607	1776	110786	38
WESTERN AUSTRALIA	UK	1826	1901	2645615	-32
YEMEN	PORTUGAL	1513	1548	527968	15
YEMEN	UK	1839	1967	527968	15
ZAMBIA	UK	1911	1964	752612	-15
ZIMBABWE	UK	1911	1964	390757	-18