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## Evaluating the Impact of Colonialism on Economic Development: A Counterfactual Analysis

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# Evaluating the Impact of Colonialism on Economic Development: A Counterfactual Analysis

Sunny John Kaniyathu

April 2, 2008

## **Abstract**

Did colonization affect the patterns of development of the colonized territories. I draw attention to the importance of counterfactuals and claim that assessments of the colonial impact are contingent on the counterfactual employed. Paying attention to counterfactuals enables us to design an empirical strategy to assess the impact of colonialism. Inferences based on non-experimental data may suffer from various biases. Statistical models make different assumptions to identify the models and correct for likely biases. Causal effects are sensitive to these assumptions. I apply different matching methods and check for robustness of results. In the sample considered, the analysis indicates that colonialism had a negative on the economic development of the colonized but the causal effect was miniscule in economic terms.

# 1 Introduction

Prior to the industrial revolution, the distribution of world income per capita was fairly equal. With the industrial revolution, however, per capita incomes began to diverge. Some territories were able to take-off while others stagnated. Not all territories around this period, however, were politically independent: some were dependent territories of other states. Colonization was clearly a seminal event in history. What were the economic consequences of colonization for the colonized territories? Was being colonized beneficial or detrimental for the economic development of the colonized? Did lack of political independence block or delay industrialization?

The question of the impact of colonization necessarily involves a comparison between the actual course of history and a counterfactual hypothesis which posits that a particular territory had not been colonized. In other words, as Przeworski (1995) notes: “Comparisons necessarily entail counterfactuals.” This means that answering the primary question entails asking *what would have been the pace of economic development had a particular territory not been colonized*. The counterfactual can be informed by the experience of independent countries that are similar in all observable aspects to those colonized. Yet such matches may be rare. Moreover, some differences between the colonized and never colonized territories may not be systematically observable. These aspects of the problem have to be considered in any evaluation of the impact of colonialism.

The central argument of this article is that assertions about the impact of colonization are contingent on the counterfactual employed. Claims about the impact of coloniza-

tion on the economic development of the colonized have often been diametrically opposed. Such arguments have the following general structure: a claim about the independent potential for development of precolonial societies and a claim about the expected impact of colonization. Counterfactual statements in these arguments are of the form: if polity  $A$  were not colonized then polity  $A$  would *not* have developed (or would have developed). I show that claims about the expected impact of colonization depend strongly on claims about the independent potential for development of precolonial societies; that is the counterfactual.

A careful consideration of counterfactuals demonstrates that certain counterfactuals are less likely than others while some may be unrealistic and should be discarded. One can then proceed with the empirical analysis. Inference based on non-experimental data may suffer from various biases due to non-random selection of units into the colonized and non-colonized (independent) regimes. I employ matching methods to address the bias resulting from the ‘selection on observables’ and estimate the effect of colonial rule on the colonized. I find that the impact of colonialism was negative. The effect, however, was miniscule in economic terms.

## **2 Assessments of Colonial Rule**

Defenders of colonial rule argue that colonialism was good for the economic development of the colonized. The alternative to colonial rule - the counterfactual - is stagnation, that is, the territory is free but there is no development. Non-European societies are characterized, by defenders of colonial rule, as immutable and lacking

any capacity for independent economic development. John Stuart Mill, characterized such societies as savage-like where “there is no commerce, no manufactures, no agriculture, or next to none [...] there is little or no law, or administration of justice” (Mill 1973, 162) and further that “The greater part of the world has, properly speaking, no history, because the despotism of Custom is complete. This is the case over the whole East” (Mill 1989, 70). Only colonization would help such territories break out of stagnation.

Similarly, Karl Marx was explicit about the alternative state of affairs that would have prevailed in India had the British not intervened in India. Until the arrival of the British, according to him, Indian society had remained stagnant and its “social condition has remained unaltered since its remotest antiquity” (Marx and Engels 196-, 34). The cause of the stagnation was the union of handicraft and agricultural production, which Marx considered to be the basis of the self-sufficient and self-reproductive character of the typical village unit in India. British rule would destroy the obstacles to development and introduce capitalist relations of production, setting India on the path to industrialization; a path already traversed by Great Britain.

Critics of colonial rule argue that colonialism was detrimental for the economic development of the colonized. The alternative to colonial rule - the counterfactual - was autonomous development, that is, *all* societies possessed the capacity to develop under self-rule. Non-European precolonial societies are characterized as far from stagnant: they are portrayed as containing all the elements that were crucial to the eventual industrialization of Europe. In fact stagnation - or even worse retrogression - was a consequence of colonialism (Frank 1979, 10).

Simensen (1978) notes that arguments criticizing colonization rely on demonstrating that non-European societies were structurally at least similar - if not more advanced - than European societies at some point in the past prior to colonial contact. In the precolonial period, according to Frank (1979), the Chinese and Indians were industrially more advanced and had nothing to learn from the Europeans; in fact, Frank contends that the Middle East, North Africa, China, and India had made technological contributions to Europe's ability to achieve subsequent development. Abu-Lughod (1989), in a comparative study set in the thirteenth century, attempts to show the similarity of economic institutions among Asian, Arab, and Western forms of capitalism<sup>1</sup>.

Prominent among those that took a negative view of colonial rule during the early stages of European expansion was Adam Smith. He was highly critical of the colonial enterprise and considered it harmful for both the colonized and the colonizer. Smith's criticism of colonial rule was informed by his theory of development which emphasized the role of accident in history. Societies everywhere, he argued, could be characterized by four stages of development - hunting, pastoral, agricultural, and commercial - and they progressed naturally from one stage to the next; progress was natural and universal. Because European societies had attained the commercial stage, they were at the higher end on the scale of development; but their development, according to Smith, was not due to any innate European superiority. It was part natural and part accidental (Pitts 2005, 32).

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<sup>1</sup>Economic innovations introduced, according to Abu-Lughod, included: the invention of money and credit; mechanisms for pooling capital and distributing risk; the existence of merchant wealth independent of the state. See also Blaut (1992, 25-26).

The importance of the counterfactual for assessments of the impact of colonial rule is most starkly illustrated by Marx's position on colonialism in Ireland. Contrary to his view of the positive impact of colonialism in India, he considered the impact of colonial rule in Ireland to be negative (Chandra 1980, 409-410). Such an assessment rested on his views on Ireland's capacity for change from within. English rule in Ireland was destructive and the policies of the Crown had de-industrialized it. Ireland's development was stunted by colonial rule because it possessed an independent capacity to develop; further, development in Ireland had not only been blocked under English overrule but rather it had retrogressed under it. India, on the contrary, possessed no independent capacity to develop: consequently, colonization had not blocked industrialization in India but rather it had been instrumental in stimulating Indian development. British rule in India was expected to be *regenerative*.

### 3 Counterfactuals

I have demonstrated that evaluations of the impact of colonial rule rest crucially on the counterfactual employed. The two<sup>2</sup> possibilities considered have been autonomous stagnation and autonomous development. Those defending colonial rule consider the counterfactual of 'autonomous stagnation' as less desirable than the actual course of events and dismiss the one of 'autonomous development' as unrealistic. On the other hand, those critical of colonial rule consider the counterfactual of 'autonomous development' as not only more realistic but more desirable as well<sup>3</sup>. For the critics,

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<sup>2</sup>See Elster (1978, 193), who considers three additional alternatives. He builds on the typology suggested by Manning (1974).

<sup>3</sup>Also see, Simensen (1978, 179)

it is the counterfactual of ‘autonomous stagnation’ that is unrealistic.

In the words of Simensen (1978, 180): “What, then, makes one hypothetical alternative<sup>4</sup> more plausible than another?” One way of generating a plausible, historical process is to rely on general laws or trends<sup>5</sup> (Climo and Howells 1976; Simensen 1978). For example, Adam Smith, among others<sup>6</sup>, employs a stage theory of development. If the regularity implied by such a theory of development is true in the *realized* world, it is assumed to apply to the *plausible* world. As held by Marxist theory, if all societies inexorably step through the four stages of communalism, slavery, feudalism, and capitalism, then in an alternative world without colonialism, societies would have moved through the same stages. Others, on the other hand, such as Gann and Duignan (1967), for example, do not rely on any theory *per se* to make assertions about the counterfactual world. Instead they rely on a comparison of the colonized African territories with the actual development path of countries that remained independent such as Ethiopia and Afghanistan.

Irrespective of whether such possible worlds are suggested by theories or by comparisons, any possibilities considered should “start from a world as it otherwise was” Hawthorn (1991, 158). If the counterfactuals we are willing to entertain are not disciplined in some manner then the “possibilities we would be entertaining would be possibilities not for an actual, but for what would itself be merely a possible” Hawthorn (1991, 167).

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<sup>4</sup>Counterfactual

<sup>5</sup>Or covering laws following Carl Hempel

<sup>6</sup>Also see, Rodney (1974)



### 3.1 Which Counterfactual?

The problem with the two counterfactuals of *autonomous stagnation* and *autonomous development* is that each one assumes away certain alternatives for the territories. Mill's liberal imperialism assumes that independent development was not possible for *all* colonized territories, and hence, colonization would be a civilizing force. The opposite argument, stressing the negative effects of colonization, assumes that independent development was possible for *all* of them. I argue that it is crucial to pay close attention to alternative states of the world *as they appeared at that time*. In other words, were the counterfactual states that one is considering *realizable* around the period of colonial contact? I posit that certain alternative states were not realizable for certain territories and such counterfactuals are unrealistic. If one is to assess the impact of colonization, unrealistic counterfactuals have to be removed from consideration.

To organize ideas, one may view the world in two states: the pre-colonial and the colonial. The pre-colonial world consisted of many polities of varied sizes and organization. After colonization, there were three types of territories: the colonized, the independent, and the colonizers. Thus, there are two possible counterfactuals to colonization: the territory is *independent and a colonizer*, or the territory is *independent and not a colonizer*. Henceforth, I refer to these two states of the world as *colonizer* and *independent*, respectively. I argue that the first counterfactual is unrealistic and the second one, although feasible, only applies to a restricted set of territories.

Consider first the counterfactual that posits that the territory is a colonizer. It is pertinent to ask whether it is realistic to consider an alternative state of the world

where territories that we observe as colonized in current state appear<sup>7</sup> as *colonizers*. Assessing such an alternative state of the world means asking why the territories that we observe as colonized became colonized in the first place. A prospective colonizer must not only possess the requisite military force to protect itself and remain independent, but should also be militarily superior relative to the target of its expansion, should it choose to colonize. Given the distribution of military technology *at the time*, is it possible to imagine the eventually colonized territory as a colonizer? For example, is it realistic to entertain the counterfactual of Laos as a colonizer, given its military strength? Such a counterfactual would be unrealistic.

The second counterfactual that we may consider is one where the territory is independent. Such a scenario is feasible for all territories only under a very strong assumption. The analysis that I am proposing, that is examining the impact of colonial rule on the economic development of the colonized, considers the state as the appropriate unit of analysis, as do most studies on the subject; it is the state that enacts policies that affect economic performance. Yet, the counterfactual rests on the assumption that the territories colonized *would have* evolved into the states that are actually observed. The regions that were eventually colonized, however, consisted of polities that differed in the level of centralization; from decentralized fishing communities in the Caribbean to the highly centralized Moghul Kingdom in India.

An alternative state of the world that considers India as independent seems more realistic than the Caribbean case. A centralized state with an extensive taxation structure existed in precolonial India and hence, the counterfactual seems more re-

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<sup>7</sup>In the words of Holland (1986, 946): “For causal inference, it is critical that each unit be *potentially exposable* to any one of the causes.”

alistic. In fact, a number of Marxist studies that are critical of colonial rule rest on precisely such a counterfactual. Typically, such studies have compared India and Japan; and concluded that India would have adopted capitalism independently. The justification for such a comparison is the similar level of state centralization in pre-colonial India and Japan. While comparing India and Japan may seem justified, comparing precolonial Africa and precommunist Russia, as Rodney (1974) does in his study of Africa, may not be justified, precisely for the reasons outlined.

The gist of the matter is that when we assert the second counterfactual we rely on the strong assumption that polities around the period of colonial contact would have coalesced and evolved into some other centralized political units. Such an assertion is unrealistic for territories with low levels of state centralization. Around the period of colonial contact, some polities had not achieved a certain level of centralization that would justify their existence as a centralized state as a realistic counterfactual at that point. Any claim about the impact of colonization cannot include territories that exhibited very low levels of state centralization.

### **3.2 Justification of Counterfactuals**

To make causal statements, we use counterfactuals. With reference to causal statements about the impact of colonization, I have discussed why certain counterfactuals may be unrealistic and can be discarded, while others though plausible may involve strong assumptions. We may entertain certain counterfactuals as realistic but how are such counterfactuals justified? In observational studies, counterfactuals are justified on the basis that the unit under treatment could just as likely have been under

control. But the justification for the usage of counterfactuals on data generated by history is more problematic. History rarely supplies us with natural experiments. If that were the case one could simply compare outcomes under the different treatments that were realized. By asserting counterfactuals we are suggesting that the world could have *run-on* along a different path than the one that has actually been realized. And to do so we need to understand the process by which the world as we observe it is generated. In other words, unlike in observational studies, we also need to examine the causes of effects as well as the effects of causes (Heckman 2005, 2).

By asking the question: what is the impact of colonization on the economic development of the colonized, we are also asking how territories would have developed had they not been colonized. And to do so is also to enquire into the process by which history generated a world with colonized and independent territories. Both critics and defenders, for example, suggest different selection mechanisms based on initial conditions of precolonial societies. Critics such as Rodney (1974) posit that it was the wealth of the precolonial societies, for example, India and Spanish America, that invited colonization while countries such as Japan that were resource-poor escaped colonial rule. On the other hand, defenders of colonization, such as Bauer (1969) and Gann and Duignan (1967), argue the opposite: it was the poverty of precolonial societies, according to them, that led to colonization. Moreover, there may be other reasons for colonization that one may consider besides the economic potential of a territory. For example, control over South Africa was established by Great Britain to protect the sea-route to India from the Dutch; diamond fields in the region were only discovered much later.

In studies of the impact of colonization, selection mechanisms are discussed not

because they are relevant to the problems related to the study to counterfactuals. Rather, they are typically invoked to lend additional credence to the particular assessment of colonization, itself. For example, for those stressing the initial economic conditions of precolonial societies as reasons for colonization, the selection mechanism lends credence to the idea of reversal. For critics, richer areas were colonized because they were rich and then became poor after colonization. On the other hand, defenders argue that poorer areas were colonized because they were poor and then became better off as a result of colonization. In other words, issues engendered by the use of counterfactuals have not been systematically considered in previous studies of the impact of colonization.

To study the impact of colonization on economic development of the colonized, we use the realized world to make inferences about a plausible one. But inferences based on non-experimental data, however, may suffer from various biases (Przeworski 2004). Among these are:

1. **Baseline Difference:** The territories that we observe as colonized may have exhibited different values on economic performance had they been observed as independent than the territories that we actually observe as independent. Suppose human capital affects economic performance and only areas with low human capital were colonized. If such were the case, then countries that were colonized would have grown slower had they been independent than those that were observed as independent. Our estimate of the causal effect of colonization would be biased.
2. **Effect of the treatment on the treated (Self-selection):** Those that are observed

as colonized may perform differently than those that were observed as independent had they been colonized. Suppose only territories with a high level of precolonial state centralization were colonized. Further, assume that the level of state centralization was not observable and was correlated with economic performance. Then the effect of colonization on the development of those colonized would differ from the average country.

3. Post-treatment effect: It may be impossible to conceive of a world where the only variable that changes is whether a country was colonized or not, without affecting any other variable that could possibly have an effect on economic performance. For example, some scholars have argued that colonial rule was associated with increases in the labor force in colonized territories because colonizers forced subsistence farmers into wage labor in the industrial sector (Arrighi and Saul 1973; Hilferding 1981). In turn if labor force grew faster under colonial rule, controlling for it would result in post-treatment bias.
4. Non-independence bias (SUTVA<sup>8</sup>): Refers to the violation of the assumption that there is no interference between units under study (Rosenbaum 2002). Suppose certain territories that we observe as colonized were independent, then it is likely that economic performance in the countries that are observed as independent would change as well. A possible channel may be through trade. The type of trade restrictions imposed by different colonial powers in the realized world on colonized territories may not exist in the counterfactual world. Colonized territories had they been independent would have been more likely to trade with independent countries; possibly affecting the economic performance

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<sup>8</sup>Stable Unit Treatment Value Assumption

of countries observed as independent. In other words assuming that the realization of the counterfactual does not change the values already observed is not valid.

Although several statistical techniques exist to correct for these biases, no method corrects for all the biases. The statistical models include instrumental variables, Heckman selection models, and propensity matching. In each of these models, different assumptions are made in order to identify the models and correct the likely biases. In turn, causal effects are sensitive to these assumptions. In other words, the results one obtains may differ depending on the estimator - that is, assumptions - employed. Herein, I consider only matching estimators. Matching procedures differ in the algorithms used to search for the counterfactual observations. I apply different matching procedures and check for robustness of the results.

## 4 Data and Empirical Analysis

As discussed in the theoretical section, explicitly considering the counterfactual states around the time of colonial contact enables one to select the appropriate set of counterfactuals. I had argued that unrealistic counterfactuals should be discarded. Once such cases have been removed, we can proceed with the empirical analysis.

Causal inference based on observational data suffers from several biases resulting from the fact that assignment to treatment - in our case, colonization - may not be random. If such is the case, then we cannot separate the effect of the conditions under which we

find colonized countries from the effect of being under colonial rule. In other words, we need to understand how the group of colonized and independent countries was generated. I use matching methods to correct for the bias engendered by selection on observable conditions. After matching on political and geographic conditions, I find the causal effect of colonialism on income per capita and growth to be statistically significant and negative. The magnitudes of the coefficients, however, are too small to be economically important.

The empirical analysis is constrained by the sparsity of data on income per capita on territories during the colonial period. Prior to 1950, barring a few dependencies, data on income per capita as reported by Maddison (2003) is non-existent. Yearly income per capita for nearly all countries of the world, however, is available, beginning in 1950. I consider the mean income per capita (log) and the mean growth rate over the period 1950-1959 as measures of economic performance for dependencies and always independent countries<sup>9</sup>.

I list the sample of countries in Table 1. Not all territories for which we have data on income per capita are included in the sample. Ideally one would like to remove those countries with a low value of state centralization. Previously, I had argued that the counterfactual of always independent is not realistic for countries with low levels of state centralization. Around the period of colonial contact certain polities had not achieved a certain level of centralization that would justify their existence as a centralized state as a realistic counterfactual at that point.

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<sup>9</sup>The year 1960 witnessed the single biggest act of decolonization with almost all French African possessions receiving independence. Consequently, using data beyond 1960 would reduce the set of colonies significantly



< Table 1 here >

In order to eliminate the cases of low state centralization, I use the data from Gennaioli and Rainer (2006) on precolonial centralization in sub-Saharan Africa. They measure the level of centralization on a scale from 0 to 1. Using their measure I drop those territories with a score below 0.25. This results in the removal of ten dependencies<sup>10</sup>. Further, the island territories of Cape Verde, Seychelles, Sao Tome and Principe, and Mauritius were uninhabited before the arrival of the Europeans and are consequently dropped. Algeria<sup>11</sup> which is not included by the authors is left in the sample because we know that it had a government above tribal level at the time of colonization.

Gennaioli and Rainer (2006) report data only for sub-Saharan Africa. But a high proportion of the dependencies in my sample are also in sub-Saharan Africa. Among those dependencies in my sample outside the continent are the oil-rich protectorates of Kuwait, Qatar, and the United Arab Emirates. These are extreme outliers and are dropped from the analysis. The protectorate of Bahrain had a government above tribal level that signed a protectorate treaty with Great Britain; it is included in the sample. We also have two cases from the Caribbean, namely, Jamaica and Trinidad and Tobago. These are dropped because prior to colonial rule these islands were sparsely settled by indigenous groups.

In order to estimate the causal effect of colonialism, I use different matching methods. Ideally, in order to assess the causal impact of colonization, we would compare

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<sup>10</sup>These are Sierra Leone, Gabon, Somalia, Cote D'Ivoire, Mali, Djibouti, Central African Republic, Kenya, Equatorial Guinea, and Guinea-Bissau.

<sup>11</sup>The Algerian War of Independence began in 1954 and ended in 1962. The inclusion of Algeria does not change the results.

the performance of the group of always independent and colonized countries after matching on the conditions under which they are found. These conditions may be political, economic, and/or geographic. Note, however, that including any economic variables that are typically considered in growth regressions or in analysis of income levels is problematic. The difficulty arises due to the bias introduced by the post-treatment effect. It may be impossible to conceive of a world where the only variable that changes is whether the country is colonized or not without changing any other variable that could potentially have an effect on economic performance. For example, level of education is typically included in equations of the determinants of growth. However, if educational attainment rose faster under colonial rule, then controlling for schooling would introduce bias. The same problem exists for political variables as well.

A solution to the difficulty introduced by the post-treatment effect is to use political and economic variables prior to colonial contact. Unfortunately, data on economic variables prior to colonial contact are sparse. Further, they are non-existent - as discussed later - for the countries that eventually enter the sample in the empirical analysis. On the political side, however, there is information on pre-colonial state organization that one may use. In addition to the political aspect, we can also use a host of geographic variables.

The particular empirical proxies used in the analysis are:

- State History 1750: Bockstette *et al* (2002) create an index of state antiquity based on answers to three questions<sup>12</sup>. These answers are recorded for all coun-

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<sup>12</sup>The questions are: i) whether there was a government above the tribal level, ii) whether it

tries for every fifty year period between 1 to 1950 CE. I use their score for the period 1750-1800 for two reasons. First, for all the countries in the sample that I use, we know that European contact prior to 1800 was non-existent or minimal. Hence, we can consider these values for state centralization as precolonial. Second, the effects of the industrial revolution had yet to be felt outside England prior to 1800. More organized political units were perhaps better prepared to partake of the industrial revolution once they felt its effects in the ensuing periods. An often cited example being Japan.

- Bio Conditions: From Olsson and Hibbs (2005, 930)<sup>13</sup>. Indicates biogeographic conditions and is the first principal component of two variables: Plants and Animals. Plants is “number of annual or perennial wild grasses with a mean kernel weight exceeding 10 mg known to exist in prehistory in various parts of the world.” Animals is “the number of domesticable mammals weighing more than 45 kg known to exist in prehistory in various parts of the world.”
- Geo Conditions: From Olsson and Hibbs (2005, 930). Indicates geographic endowments and is the first principal component of four variables: Climate, Latitude, Axis, and Size. Climate is based on the Koppen system of climate classification and takes four values. 0 denotes the worst climate for agriculture while 3 denotes the best. Distance from the equator in absolute latitude degrees

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was home-based, and iii) the fraction of territory covered. They find that state history is a robust predictor of growth rates in the period 1960-1995, across different specifications.

<sup>13</sup>Olsson and Hibbs contend that particular biogeographic initial conditions - that is, plants and animals suited to domestication - favored an early transition to sedentary agriculture which facilitated the emergence of more organized political and social units. Eventually, large empires and states emerged in more favorably endowed regions which set them on the path of technological advancement which, they claim, is reflected in the divergence in income per capita among countries in the present-day.

is indicated by latitude. Axis is a measure of the East-West orientation of major landmasses. It captures the “barriers to the transmission of goods, people and ideas.” Size is simply the size of the “landmass in square kilometers to which each country belongs.”

- Landlocked: A variable indicating whether a country is landlocked. It takes on a value of 0 if a country has coastal territory and a value of 1 otherwise.

As discussed previously, the indicators for economic performance are:

- Mean Income per Capita (log): The mean income per capita (log) for the period 1950-1959.
- Mean Growth Rate: The mean growth rate for the period 1950-1959.

A table of descriptive statistics for all the variables used in the subsequent analysis appears below:

*< Table 2 here >*

There are several matching methods. Among the most popular are those based on propensity scores. Others include nearest neighbor matching based on some distance metric. The basic idea of matching is to balance the dataset on the observable conditions such that assignment to treatment (that is, colonization) is random. The task is to find the most similar observations in terms of conditions in the colonized and non-colonized groups and record the counterfactual value on economic performance

in the relevant group. Since we are interested in the impact of colonialism on those countries which were in fact colonized, it is the average treatment effect for the treated (ATT) that is of interest.

Different matching methods use different algorithms to find counterfactual observations. In turn, causal estimates are extremely sensitive to the different techniques employed (Morgan and Harding 2006). I use several of these methods and check for robustness of estimates across different methods for a given specification.

Propensity score techniques include nearest-neighbor matching, radii matching, kernel matching, and stratification matching. Each matching algorithm uses the propensity score differently to generate the counterfactual observations (Becker and Ichino 2002). In *nearest neighbor* matching, each treated unit is matched to a control unit with the closest propensity score; in *radii* matching, each treated unit is matched to a control unit with a propensity score within a predefined range; in *kernel* matching, all treated units are matched with a weighted average of all control units, the weights being inversely proportional to the distance between the propensity scores of selected units in the two groups; and in *stratification* matching, the support of the propensity score is divided into intervals such that within each interval propensity scores of treated and control units are almost identical. In addition, I also use the nearest neighbor technique developed by Abadie *et al* (2001) that relies on a distance metric to find close observations in the counterfactual group.

Yet another technique used is a general multivariate matching method (GenMatch) that relies on a genetic algorithm to search for optimal balance (Sekhon 2007). The more general method examines the entire joint distribution of the matching variables

to achieve full balance as opposed to simply ensuring that the distribution of matching variables is the same in the treatment and control groups as in the algorithms mentioned previously. In the latter,  $t$ -tests are used to assess balance while in the former nonparametric Kolmogorov-Smirnov tests are required.

In Table 3, I report values for ATT for three different specifications. The base specification (Model 1) includes the State History 1750 and the Land locked variables. To these are added Geoconditions (Model 2); and Geoconditions and Bioconditions (Model 3). We can see that the coefficients are significant both across methods as well as models. Further, across methods for a given model, there is variance in the values obtained attesting to the sensitivity of the results to the technique employed. We can see, however, that the effect of colonial rule is negative (the coefficients have a negative sign.) The magnitudes of the coefficients, however, are extremely small.

< Table 3 here >

Table 4 presents balance statistics for Model 3 from the GenMatch procedure. Several different indicators of balance are reported: the difference in means;  $p$ -values from a  $t$ -test on the difference in means; the  $p$ -values from the Kolmogorov-Smirnov test; the ratio of the variances of the treated and control cases; and the mean standardized difference from the QQ plot. Comparing the relevant rows from ‘Before Matching’ and ‘After Matching’, we can see that balance has been greatly improved. The  $p$ -values from the  $t$ -test are no longer significant. Although the  $p$ -values from the Kolmogorov-Smirnov test remain significant, these are less so than in the pre-matching sample. The mean eQQ differences are smaller and the variance ratios tend closer to one

indicating greater balance in the post-matching sample.

*< Table 4 here >*

The results from repeating the analysis with mean growth rate instead of mean income per capita (log) are shown in Table 5. We can see that all coefficients have a negative sign and are all highly significant. The magnitudes, once again as with income per capita, are extremely small in economic terms.

*< Table 5 here >*

## **5 Sensitivity Analysis**

As discussed previously, matching estimators are used to correct for the bias resulting from ‘selection on observables.’ In order to do so we rely on the key assumption that conditional on the covariates assignment to treatment is random. In our case, we assume that the effects of colonial rule are not affected by any correlation between a country’s selection into the colonized group and unobserved factors. Although one cannot directly test the violation of this crucial assumption, one can use the ‘Rosenbaum bounds’ (Rosenbaum 2002) approach to get a sense of whether treatment effects are influenced by unobservables. The idea behind the ‘Rosenbaum bounds’ approach is to check how sensitive the results from the matching analysis are to varying levels of hidden bias (DiPrete and Gangl 2004).

In Tables 6 & 7, I present results from the Rosenbaum bounds analysis for mean income per capita (log) and mean growth rate, respectively. Before conducting the analysis, I ran a matching procedure employing the nearest-neighbor algorithm with a random draw on a specification with state history 1750, geo conditions, bio conditions, and land locked for both mean income per capita (log) and mean growth rate. The tables illustrate the sensitivity of the results to potential hidden bias. Our assumption about the potential endogeneity in assignment to treatment is given by  $\Gamma$  which reflects the odds of participation in treatment. Matched units have the same probability of participation only if  $\Gamma=1$ . If the odds of participation differ from 1 then it must be due to hidden bias.

< Table 6 here >

< Table 7 here >

The Hodges-Lehmann point estimates reflect the uncertainty in the estimated Average Treatment Effect on the Treated at increasing levels of assumed hidden bias. At  $\Gamma = 1$ , there is no hidden bias and the estimates are equal ( $\hat{t}_{max} = \hat{t}_{min} = -0.761$  in Table 6). At higher levels of  $\Gamma$ , the gap between the upper and lower bounds widens: at  $\Gamma = 3.5$ , for example, the ATT could be as high as -1.217 and as low as -0.339.

From Table 6, we can see that the confidence interval includes zero once  $\Gamma$  crosses a value of 2.25. What this means is that the unobserved effect would have to increase the odds of being colonized by more than 2.25 before one can change one's conclusion about the the effect of colonization on the colonized. Similarly, for the mean growth



rate, the confidence interval equals zero once  $\Gamma$  crosses 2.50 (see Table 7). Thus, the odds of being colonized would have to increase by more than 2.50 to alter one's results.

Rosenbaum notes that a study can be considered to be sensitive to hidden bias when values close to one “could lead to inferences that are very different from those obtained assuming the study is free of hidden bias” (Rosenbaum 2002, 107). The results presented would indicate that the postulated effects due to unobservables would have to be quite large for us to cast doubt on the effects due to treatment.

## 6 Illustration

The preceding analysis was conducted for a small set of countries over a short time period. It is instructive to examine the paths of income per capita for colonized and independent countries over longer time periods<sup>14</sup>. The exercise further illustrates the importance of the counterfactual being considered to make any assessment.

An important case for which we have continuous series - beginning in 1884 and ending in 1946 - is British India<sup>15</sup>. Critics of colonial rule have typically used the Indian experience under British colonial rule to illustrate the negative impact of colonialism. And to reach such a conclusion, they have relied on the case of Japan. For critics, the comparison is simple: Japan remained independent and industrialized;

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<sup>14</sup>For certain dependencies, Maddison reports longer time series that include periods under colonial rule.

<sup>15</sup>British India includes present-day India, Pakistan, and Bangladesh.

British India was not independent and did not industrialize. The comparison relies on demonstrating that initial conditions were similar in the two countries. In an extensive discussion, Chandra (1989), shows that conditions in precolonial India and Japan were similar: both were strong centralized polities and exhibited signs of early capitalist relations. If such were the case, India would be expected to move along the same path as Japan. The fact that India did not do so was due to British colonial rule.

What do the data show us? Using the available data, I plot the evolution of per capita income over time for the two countries between 1600 and 1894 (see Figure 1). I treat British India as coming under colonial rule only after 1750; hence, per capita income prior to 1750 is precolonial. The plot ends in 1894 because Japan became a colonial power the next year.

< *Figure 1 here* >

In 1600, per capita incomes for Japan and British India were very similar, being \$520 and \$550 respectively. Around the time of colonization of British India, there was already a gap with Japan, with the latter slightly ahead. By 1894, the gap had grown and Japan enjoyed an income per capita almost twice that of British India. While the income difference of \$600 between British India and Japan does not seem large, it is evident from the figure that Japan had clearly taken off while India had stagnated.

India had stagnated despite facing the same initial conditions as Japan. But what would *have been* the path of income per capita of British India *had* it grown at the same rate as Japan. Three such paths are plotted based on initial conditions as of

1700, 1820 and 1870. Upon examining the plot, we can see that if Indian income per capita had grown at the same rate as Japan from initial conditions in 1700 - that is the precolonial period - the gap in 1894 would have been only \$39. In the period after colonial rule had begun, with 1820 as the starting date, if we examine the path of per capita income the gap in 1894 was larger at \$188. Further, the difference between the counterfactual Indian per capita income and the one actually observed was \$488. If we repeat the exercise for 1870, the corresponding figures were \$271 and \$217, respectively.

The above exercise suggests that some of the gap between the observed and the counterfactual Indian per capita income can be attributed to the slow growth of British India in the colonial period. Because the plot ends in 1894, however, we are unable to examine the path of Indian per capita over the rest of its colonial history.

We may consider alternative candidates for the counterfactual for British India. The always independent countries I consider are Switzerland, Thailand, and China. It is debatable whether Switzerland is a realistic counterfactual to British India. For example, if physical distance were the only constraint on the diffusion of the industrial revolution, then Switzerland would have been likely to industrialize and takeoff sooner than a distant British India. In a sense, the counterfactual world where British India would have been similar to Switzerland is farther than one where it would have been similar to China (or Thailand). Switzerland was the richest non-colonized territory in 1938 and I use it simply to study the gap - discussed previously - as it evolved in the colonial period.

The comparison of British India with Switzerland is illuminating (see Figure 2). Be-

ginning in 1884, even if British India *had* grown at the pace of Switzerland, its per capita income would have at most doubled in 1938. A doubling of per capita income would have been no small achievement. But note that if we repeat the exercise with initial per capita incomes as of 1700 and 1820, respectively, the corresponding figures in 1938 would be \$3987 and \$3125. Hence, most of the gap between the actual per capita income and the counterfactual seems attributable to British India falling behind prior to 1884.

< *Figure 2 here* >

How did other comparable independent Asian countries perform? If the critics of colonialism are correct then one expects them to perform better than British India. In Figure 3, I plot the path of demeaned income per capita for Thailand, China, and British India<sup>16</sup>. All three fall farther away from the world mean income per capita and follow one another fairly closely. Moreover, while British India began to recover slightly after 1913, the other two continued to fall.

< *Figure 3 here* >

We may also look at other dependencies in the region for which we have longer time series. Figures 4 and 5, show graphs for Indonesia and South Korea, respectively. Also included in both plots are Thailand and China. Once again, in Figure 4, we see the same pattern that we saw in the case of British India with Indonesia beginning to

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<sup>16</sup>Data for Thailand and China are available only for certain time points. Continuous series for China begins in 1929.

recover after 1900. The graph for South Korea is more interesting. Although South Korea had been a protectorate of Japan since 1895, it became a colony only in 1910. From Figure 5, one can see that South Korean per capita income begins to recover immediately after 1910. Can we attribute the recovery to colonial rule? Considering that China and Thailand kept moving farther away from the mean world per capita income suggests that the recovery was due to growth after the imposition of Japanese rule.

< *Figure 4 here* >

< *Figure 5 here* >

Asian dependencies fell behind after the industrial revolution. But their experience was not unique. Countries that were comparable such as China and Thailand failed to take-off as well. Independence did not guarantee industrialization. Remarkably, after 1900, while some dependencies showed signs of recovery, territories that were independent continued to stagnate or fall farther away from the mean world income per capita. The comparison indicates that at worst colonial rule did not have any effect and at best the effect may have been slightly positive.

So far I have relied on comparisons of particular cases. One may also compare the mean income per capita of groups of countries categorized by their political status; that is those that were always independent and those that were dependencies. In addition to political status, I divide the group of always independent countries by

geographical region. Figure 6 shows one such plot<sup>17</sup>. We can see from the figure that the group of independent Western European countries was clearly ahead of all other groups by 1938. On the other hand, the group of independent Asian countries was stagnant; their per capita incomes barely improved from 1820 levels.

< Figure 6 here >

In between the two extremes were the group of Asian dependencies; the group of independent Eastern European countries; and Turkey. Although the group of independent Eastern European countries did not do so well as their Western European neighbors, their mean per capita was more than twice that of the group of independent countries and the group of dependencies in Asia, respectively. The group of Asian dependencies performed slightly better than the group of Asian countries that remained independent. If we were to add<sup>18</sup> more countries (graph not shown) to the group of Asian dependencies, the mean per capita would improve by an additional \$200 in 1938. Meanwhile, Turkish per capita income, after recovering from the war, stayed below that of the group of Eastern European countries in 1938.

The comparisons suggest that the answer to the question of whether colonial rule had an impact on the economic development of the colonized is inconclusive. Any

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<sup>17</sup>The countries in each group and the time periods used are as follows: 1. Dependencies are British India, Indonesia and Sri Lanka (years=1820, 1870, 1884-1938); Independent Countries in Western Europe are Austria, Finland, Sweden, Norway, and Switzerland (years=1820, 1870-1938); Independent Countries in Eastern Europe are Czechoslovakia, Greece, Hungary, Poland, Romania (years=1870, 1900, 1913, 1928-1938); Independent Countries in Asia are China and Thailand (years=1820, 1870, 1890, 1913, 1929, 1938); Independent Turkey (years=1820, 1870, 1913, 1923-1938).

<sup>18</sup>The group of Asian dependencies was enlarged by adding Malaysia, The Philippines, South Korea, and Taiwan. The years used were 1820, 1870, 1912-1938.

assessment depends on the counterfactual employed.

## 7 Remarks

Statistical analysis with observable political and geographic variables as background conditions supports the conclusion that the causal effect of colonization was negligible. Such was the case for the causal effect of colonization on both income per capita and growth rate. Although the coefficients obtained through the various matching procedures were robust, statistically significant, and negative indicating that colonization was detrimental for the colonized, the magnitudes of the coefficients were too small to be important in economic terms.

It is important to note that the analysis was conducted on a small sample of countries for the period 1950-59 and as such any conclusions are tentative. In any case, the result is particularly striking because except for the Asian dependency of Bahrain all the dependencies in the sample were African. Those critical of colonization have often cited African cases as illustrative of the detrimental effects of colonial rule. The analysis however indicates that the difference in performance between the typical dependent territory and the typical independent territory was negligible. Further it is unlikely that the results are affected by unobserved factors that determine selection into the colonized and independent groups. Sensitivity analysis indicated that the estimates were robust to hidden bias.

The simple comparison of income per capita for the two sets of territories shows that

the answer to the question of the economic impact of colonial rule is inconclusive: we arrive at different conclusions depending on the counterfactual employed. However, the following general patterns are evident:

First, colonialism did not prevent an improvement in per capita incomes. In the decades following the industrial revolution Western European countries took off and stayed ahead of the rest of the world. Dependencies as a group fell behind but so did a number of territories that were independent. Among the dependencies were territories that performed just as well if not better than independent polities.

Second, independence did not guarantee an improvement in income per capita. Certain dependencies such as British India and Indonesia stagnated during the colonial period; but comparable countries in Asia such as China and Thailand stagnated as well. Both China and Thailand had been independent throughout their history and had strong centralized states. Meanwhile, South Korea, itself an old monarchy, outperformed all the other territories in the region during its time under Japanese colonial rule. In any case, at worst per capita incomes stagnated under colonial rule; they never deteriorated from precolonial levels.

On average, it appears that dependencies did not differ much in performance from territories that stayed independent. But as we have seen there was considerable variance in performance in both sets of territories. In the group of independent territories there were cases of successes such as Sweden along with failures such as Ethiopia. Similarly, among the dependencies, alongside the remarkable cases of success in the Caribbean were the spectacular failures in Africa. What determined success and failure among the dependent territories? Did the identity of the colonizer matter? If so, what were



the channels through which the identity of the colonizer played a role? How significant was it that different territories were inserted into the world economy at different points in time? These questions remain open for further research.

Table 1: List of Territories in the Sample

Dependencies	Always Independent
Algeria	Afghanistan
Angola	Albania*
Bahrain	Austria*
Benin	Bulgaria*
Burkina Faso	China
Burundi	Czechoslovakia*
Cameroon	Finland*
Chad	Greece*
Comoros	Hungary*
Congo, Dem. Rep.	Iran
Congo, Republic	Liberia
Gambia	Mongolia
Ghana	Nepal
Lesotho	Norway
Madagascar	Oman
Namibia	Poland*
Niger	Romania*
Nigeria	Saudi Arabia
Rwanda	Sweden
Senegal	Switzerland
Sudan	Thailand
Swaziland	Turkey
Tanzania	Yugoslavia
Togo	
Uganda	
Zambia	

\* Constituent parts of empires that are considered independent.

Table 2: Descriptive Statistics

Variable ( $n=36$ )	Mean	Std. Dev.	Min	Max
Political Status	0.583	0.5	0	1
Mean Income per Capita (Log)	7.029	0.912	5.882	9.262
Mean Growth Rate	0.032	0.018	0.012	0.093
State History 1750	31.154	15.712	0	50
Geoconditions	-0.043	1.02	-1.12	1.703
Bioconditions	-0.154	0.951	-0.968	1.389

Table 3: Mean Income per Capita (ATT)

		Model 1 <sup>a</sup>	Model 2 <sup>b</sup>	Model 3 <sup>c</sup>
Propensity Score	Nearest Neighbor	-0.846 (-1.521)	-0.88 (-1.878)	-0.796 (-1.65)
	Radii	-1.247 (-3.79)	-0.915 (-2.188)	-0.972 (-2.346)
	Kernel	-1.308 (-3.037)	-0.848 (-1.79)	-0.832 (-1.387)
	Stratification	-1.319 (-3.877)	-0.877 (-1.747)	-0.77 (-1.781)
Nearest Neighbor		-1.148 (-4.26)	-0.852 (-2.86)	-0.815 (-2.63)
GenMatch		-0.64 (-2.706)	-0.767 (-2.819)	-0.772 (-2.98)

<sup>a</sup> Covariates : State history 1750, Land locked

<sup>b</sup> Covariates : State history 1750, Land locked, Geoconditions

<sup>c</sup> Covariates : State history 1750, Land locked, Geoconditions, Bioconditions

Table 4: Balance Statistics\* (Mean Income per Capita)

Variable	Mean treated	Mean control	$t$ -test ( $p$ -value)	K-S test ( $p$ -value)	Var. ratio (Tr/Co)	Mean eQQ diff
Before Matching						
State history (1750)	25.357	39.271	0.004	0.028	2.023	14.813
Land locked	0.571	0.333	0.166	-	1.08	0.2
Geoconditions	-0.581	0.71	0	0	0.252	1.35
Bioconditions	-0.621	0.498	0.001	0	0.274	1.123
After Matching						
State history (1750)	33.625	32.392	0.475	0.03	0.85	4.233
Land locked	0.533	0.533	1	-	1	0
Geoconditions	-0.652	-0.674	0.845	0.05	0.443	0.244
Bioconditions	-0.605	-0.685	0.266	0.03	1.025	0.123

\* Results from GenMatch procedure using Model 3

Table 5: Mean Growth Rate (ATT)

		Model 1 <sup>a</sup>	Model 2 <sup>b</sup>	Model 3 <sup>c</sup>
Propensity Score	Nearest Neighbor	-0.018 (-2.856)	-0.018 (-3.331)	-0.022 (-1.902)
	Radii	-0.017 (-2.218)	-0.017 (-3.129)	-0.028 (-3.863)
	Kernel	-0.017 (-2.371)	-0.017 (-2.657)	-0.024 (-3.079)
	Stratification	-0.014 (-2.442)	-0.015 (-2.555)	-0.024 (-3.765)
Nearest Neighbor		-0.022 (-3.51)	-0.015 (-2.94)	-0.0157 (-3.01)
GenMatch		-0.024 (-3.163)	-0.0198 (-5.233)	-0.017 (-4.118)

<sup>a</sup> Covariates : State history 1750, Land locked

<sup>b</sup> Covariates : State history 1750, Land locked, Geoconditions

<sup>c</sup> Covariates : State history 1750, Land locked, Geoconditions, Bioconditions

Table 6: Rosenbaum bounds - Mean Income per Capita [log]

$\Gamma$	$p$ -critical	Dependency status treatment effects			
		$t_{max}$	$t_{min}$	$CI_{max}$	$CI_{min}$
1.00	0.000398	-0.760476	-0.760476	-1.13355	-0.418244
1.25	0.001716	-0.847008	-0.694404	-1.3536	-0.283486
1.50	0.00461	-0.886607	-0.644211	-1.41787	-0.211834
1.75	0.009431	-0.966165	-0.578318	-1.56009	-0.108268
2.00	0.016249	-1.00391	-0.539587	-1.58513	-0.05658
2.25	0.024945	-1.04699	-0.50341	-1.67139	-0.017963
2.50	0.035297	-1.08054	-0.453796	-1.75229	0.129774
2.75	0.04705	-1.12354	-0.425633	-1.76834	0.199084
3.00	0.059947	-1.14274	-0.393413	-1.89833	0.242096
3.25	0.07375	-1.2013	-0.368327	-1.92983	0.275096
3.50	0.088251	-1.21675	-0.338756	-2.28886	0.312105
3.75	0.103269	-1.27359	-0.305756	-2.45618	0.572163
4.00	0.11865	-1.3536	-0.283486	-2.46537	0.605163

$\Gamma$  : log odds of differential assignment due to unobserved factors

$p$ -critical : lower bound of significance level

$t_{max}$  : upper bound Hodges-Lehmann point estimate

$t_{min}$  : lower bound Hodges-Lehmann point estimate

$CI_{max}$  : upper bound confidence interval ( $\alpha = 0.95$ )

$CI_{min}$  : lower bound confidence interval ( $\alpha = 0.95$ )

Table 7: Rosenbaum bounds - Mean Growth Rate

$\Gamma$	$p$ -critical	Dependency status treatment effects			
		$\hat{t}_{max}$	$\hat{t}_{min}$	$CI_{max}$	$CI_{min}$
1.00	0.000209	-0.019155	-0.019155	-0.024652	-0.011323
1.25	0.000964	-0.020295	-0.017631	-0.02615	-0.009664
1.50	0.002708	-0.021341	-0.015698	-0.02704	-0.00859
1.75	0.005721	-0.022484	-0.014753	-0.028572	-0.006951
2.00	0.010101	-0.022812	-0.013692	-0.029042	-0.006514
2.25	0.01581	-0.023469	-0.012812	-0.029777	-0.005521
2.50	0.022727	-0.023954	-0.011783	-0.030879	-0.004522
2.75	0.030697	-0.024572	-0.011588	-0.031276	.000981
3.00	0.039553	-0.024958	-0.01129	-0.032657	0.002044
3.25	0.049138	-0.025419	-0.010771	-0.033676	0.002334
3.50	0.059307	-0.025598	-0.010266	-0.034881	0.003078
3.75	0.069933	-0.025981	-0.009881	-0.035538	0.004141
4.00	0.080907	-0.02615	-0.009664	-0.037761	0.004431

$\Gamma$  : log odds of differential assignment due to unobserved factors

$p$ -critical : lower bound of significance level

$\hat{t}_{max}$  : upper bound Hodges-Lehmann point estimate

$\hat{t}_{min}$  : lower bound Hodges-Lehmann point estimate

$CI_{max}$  : upper bound confidence interval ( $\alpha = 0.95$ )

$CI_{min}$  : lower bound confidence interval ( $\alpha = 0.95$ )

Figure 1: Gap in Income per Capita: British India and Japan

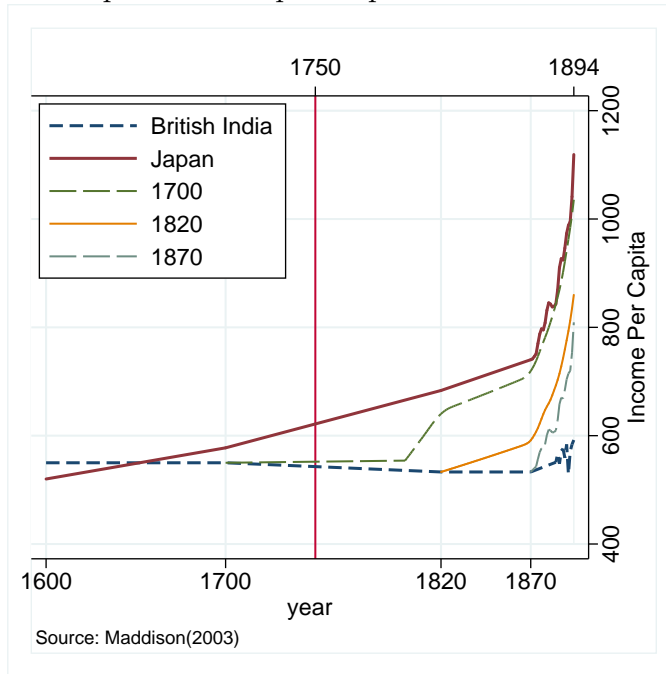




Figure 2: Gap in Income per Capita: British India and Switzerland

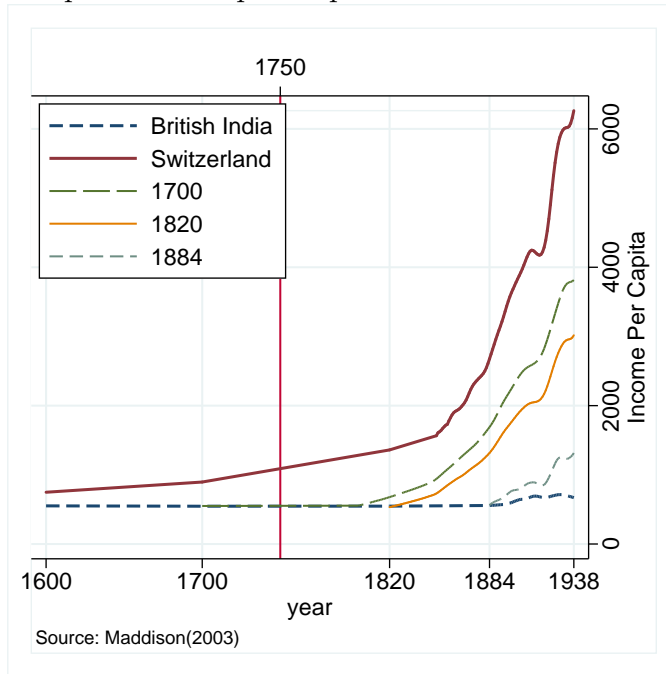


Figure 3: Regional Comparison: British India, China, and Thailand

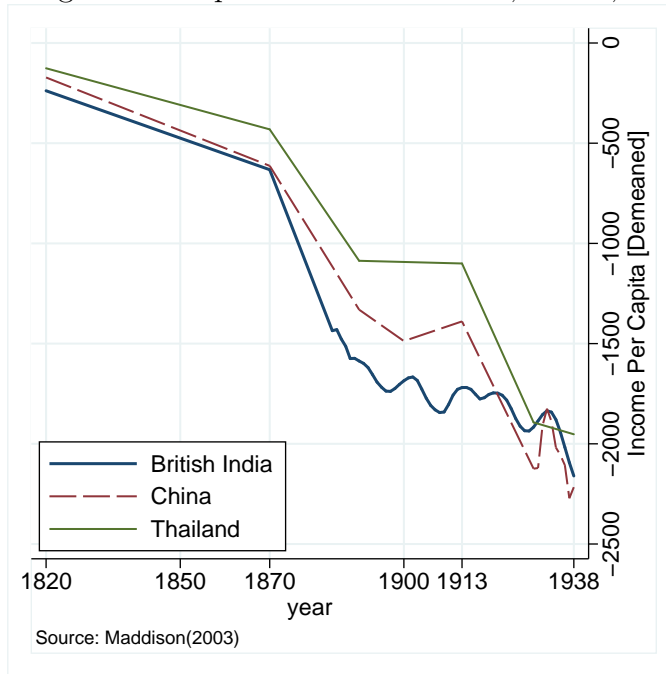


Figure 4: Regional Comparison: Indonesia, China, and Thailand

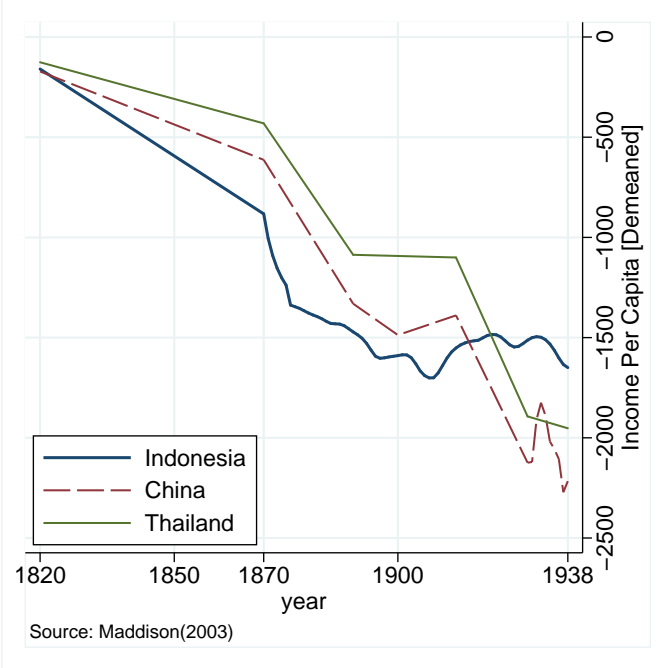


Figure 5: Regional Comparison: South Korea, China, and Thailand

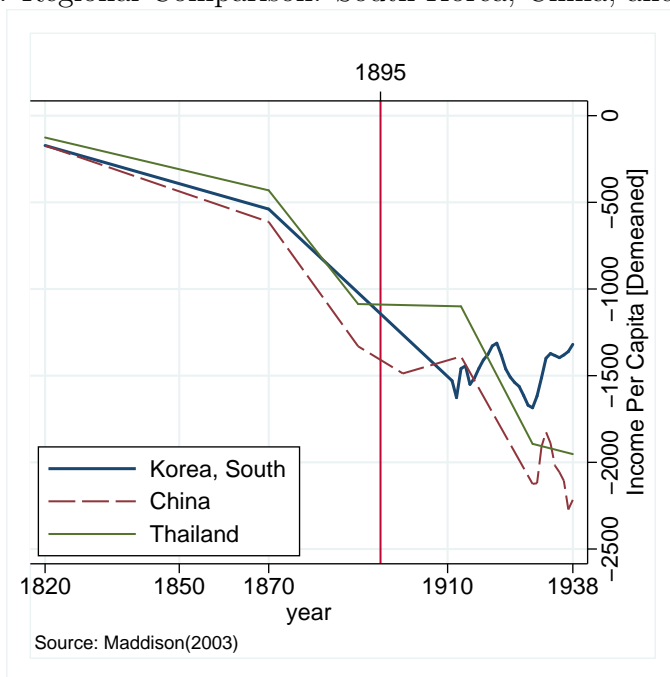
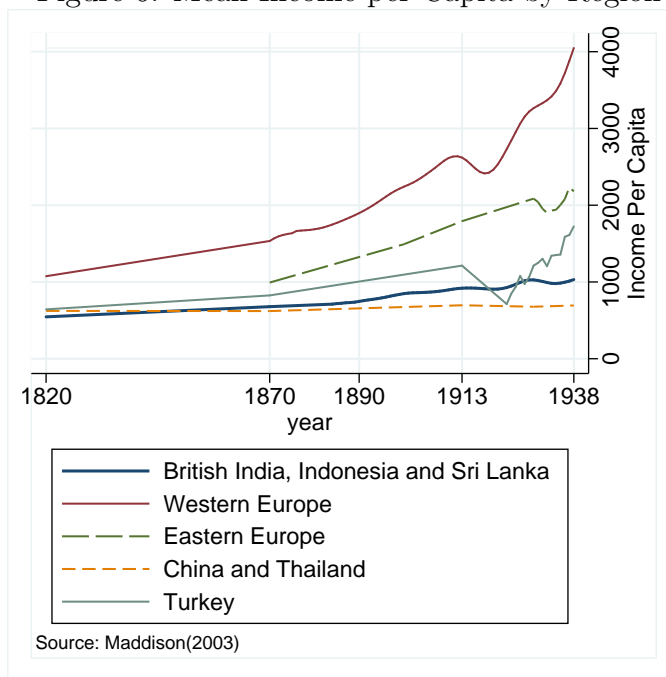


Figure 6: Mean Income per Capita by Region



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