# The Cuban Experiment: Institutions and the Wealth of Nations

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## Resumo

Este trabalho tem como objetivo investigar o impacto das instituições socialistas implementadas em Cuba depois da Revolução de 1959 no nível de renda per capita do país. Para isso, adota-se o método de controle sintético desenvolvido por Abadie e Gardeazeabal (2003). Cuba é um candidato natural para tal experimento, uma vez que foi o único país latino-americano a adotar um regime socialista no século XX. No caso cubano, a evidência mostra que as instituições socialistas adotadas pelo governo revolucionário em 1959 tiveram um impacto negativo sobre o nível do PIB per capita durante o período compreendido entre 1959 a 1974. Nossas estimativas sugerem que se Cuba não tivesse adotado tal mudança institucional, o nível do seu PIB per capita teria sido anualmente em média 28,5% maior do que de fato ocorreu no período estudado. Os resultados são robustos de acordo com os testes realizados.

Palavras-chave: Cuba, instituições, capital humano, PIB per capita, controle sintético
Código JEL: O43, P27, P36, N16

## Abstract

This paper studies the role played by socialist institutions implemented in Cuba after the 1959 Revolution in its level of income per capita. We adopt the method of synthetic control developed by Abadie and Gardeazeabal (2003). Cuba is a natural candidate for such experiment, since it was the only country in Latin America that adopted a socialist regime in the 20th century. In the Cuban case, evidence shows that the particular institutions adopted by the Revolutionary Cuban Government in 1959 had a negative impact on the level of GDP per capita for the period between 1959 and 1974. Our estimates suggest that had Cuba not changed its institutions, its GDP per capita level would have been on yearly average 28.5% higher than the performance actually achieved during the aforementioned period. The results are robust to the tests performed.

Key words: Cuba, institutions, human capital, GDP per capita, synthetic control
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## 1 Introduction

Do institutions matter to economic growth? That is the question many scholars have been trying to answer. Our effort distinguishes itself from other studies that tried to address the same question because we will use a novel econometric method called "Synthetic Control". Explaining in a nutshell, we will interpret the 1959's Cuban Revolution as a "treatment" on Cuban institutions and then compare the Cuban economic performance with the performance of a properly constructed counterfactual called, not surprisingly, "Synthetic Cuba".

For over the last twenty years economists devoted much effort in trying to measure and identify the role played by institutions on the economic growth of countries. In spite of the many pages written and regressions run on the subject, there is no conclusive evidence on the actual importance of institutions to economic growth. Our work intends to present additional evidence on this matter.

Cuba constitutes an interesting case study about the relationship between institutions and economic growth, since it was the only country in Latin America that has adopted and maintained socialist institutions throughout the 20$^{th}$ century. Such fact creates a unique opportunity to investigate the impact that traditional political, social and economic institutions of socialism had on the Cuban income per capita. This becomes even more interesting when using a method that is able to avoid the problems of standard econometric methods based upon selection on observables.

Our work is divided in seven sections. The second section is a summary of the literature on institutions and growth. The third section presents the Cuban historical background before the 1959's revolution and also how the country organized its institutions in the following years. The following section discusses the adopted empirical strategy, known as synthetic control, and also the performed inference tests. The last three sections describe the data, discuss the results and give our final conclusions, respectively.

Results show that institutions implemented in Cuba after the 1959's revolution had a negative impact on the country's per capita income. We also show that the human capital level of the country, one of the highest among Latin American countries, kept following its earlier tendency of growth after the institutional change. That is a crucial hypothesis, since if the level of human capital had lowered, we would not be comfortable to assign the lower GDP per capita to institutional change in the country. Our finding corroborates the hypothesis of Acemoglu *et al.* (2005) that institutions have a significant impact on the wealth of nations. The average yearly gap between the Cuban and the Synthetic Cuban GDP per capita is -28%. This is an indicative that socialist's institutions were extremely harmful to the Cuban economy.

## 2 Institutions and Growth

Institutions have recently been on the research agenda mainly due to influence of the works of Douglass North (1981, 1990). Nowadays one understands institutions as being a set of rules and restrictions (formal or informal) that limit the strategic behavior of economic agents. From this definition we can think of institutions as being the social or legal rules regarding financial markets, international trade, labor market, market for goods and services and property rights. Those rules and restrictions might shape the behavior of economic agents which in its turn affect economic outcomes.

Once economists can agree on a definition of institutions, the task to identify and measure their impact on economic growth begins. A lot of empirical work has been carried out by scholars trying to identify the influence of institutions on growth (e.g., Hall and Jones, 1999; Easterly and Levine, 2003; Dollar and Kraay, 2003; Rodrik, Subramanian and Trebbi, 2004). Although some scholars assert that institutions are not

crucial to economic growth (e.g., Barro, 1999; Alvarez *et al.*, 2000; Bloom and Sachs, 1998; Sachs, 2001), the literature on institutions and growth is well-established.

There are two main difficulties one faces when tries to finds causality between institutions and growth. First of all, there is the problem of finding an adequate measure of institutional quality given the rather broad definition of institutions themselves.

For example, the risk of expropriation by government and government effectiveness capture only few aspects of institutions and also do not distinguish political restrictions from the mere choices of the dictator. In its turn, the constraints on the executive is a "volatile" variable and therefore may reflect simply the current distribution of political forces resulted from the last election results. Therefore, that variable might also fail to capture more enduring rules that impose restrictions on the economic environment.

Moreover, the second main difficulty scholars face when studying the impact of institutions on growth is the reverse causality problem. Institutions probably are affected by economic growth. Such fact invalidates the results obtained from methods that require the selection on observables assumption. The adoption of empirical strategies using instrumental variables, for instance, could overcome this problem, but they face many critiques regarding the validity of instruments and the adequacy of the available data.

Despite the difficulties stated above, empirical research has been quite intense in this field. Some authors try to relate the current institutions with the country's legal origins. La Porta *et al.* (1998, 1999) find evidences that countries which adopted legal codes similar to the common law have a better economic performance than countries that adopted legal codes more similar to civil law. But scarcity of information, time controls and countries fixed effects limit the validity of such results.

Also, there are authors that tried to relate institutions with colonial origins, for instance, Engerman and Sokoloff (1997, 2005), Acemoglu *et al.* (2001; 2003) and Acemoglu *et al.* (2005). Engerman and Sokoloff (1997, 2005) call attention to the importance of factor endowments in determining the type of institutions Europeans brought to the New World. Despite this approach recognizes the importance of geographical conditions, their argument differs from others. Bloom and Sachs (1998) and Sachs (2001) state that geography is the main explanation to long run economic growth rather than institutions. To Engerman and Sokoloff, geographical conditions matter to the extent that it influences institutions. In the case of the New World, initial conditions were crucial because factor endowments differences shaped the *types of colonization and institutions* adopted in different parts of the Americas.

The approach of Acemoglu, Johnson and Robinson (hereafter AJR or Acemoglu *et al.*) is not very different from the one espoused by Engerman and Sokoloff. Acemoglu *et al.* (2001, 2003) investigate the existence of a relationship between GDP per capita and institutions using the hypothesis that the type of colonization (settlement or exploitation) imposed by the European countries when colonizing the New World is the key element responsible by the current adopted institutions. Consequently, the type of colonization becomes a crucial explanatory factor to the economic performance of the colonized countries. They use the mortality rate of soldiers and bishops in the colonies as an instrument variable to past institutions. Their findings suggest that low economic development and macroeconomic instability is indeed a consequence of having poor institutions.

In the third study of AJR, they used information of GDP per capita level of both Koreas (North and South) before and after their secession in 1953 to investigate the economic impact of the radically different institutions adopted by both. It is well known that right after the secession, North Korea adopted a dictatorial socialist regime in line with

Soviet Union, while the South followed a different track adopting also dictatorial political regime, but with market institutions in line with the United States. According to the authors, given that both countries were once the same and shared not only a common culture but also very similar economic and geographical conditions, the eventual differences that one finds on their economic performance after the secession can only be attributed to the different institutions adopted after their separation. Acemoglu *et al*. (2005) have found that South Korea outperformed economically the North during the entire post-secession period.

As one might suspect, because of the difficulties exposed above, a consensus has not been entirely achieved on the literature regarding this matter. There is an opposite view whose supporters claim that institutions play no major role on the economic performance. One of the main critiques to the work of AJR is Albouy (2008). This author pointed out many problems regarding the quality of mortality rate data and also the interpretation that AJR gave to it (e.g. periods of campaigns may have a positive effect in such rate). A response to this critique was given in Acemoglu *et al*. (2011). They adopt some of Albouy's suggestions and show that the main results found in previous work are still valid.

Another critique of AJR's position is Glaeser *et al*. (2004). This author and his colleagues argue that it is wrong to attribute the different trajectories of North and South Korea's GDP per capita levels to the different institutions adopted. Glaeser *et al*. (2004) critiques are mainly two: the first one is regarding the inadequacy of using proxy variables as a measure of institutional quality; secondly, the authors affirm that sound institutions are merely a consequence of human capital and, therefore, it is its accumulation that matters to a country's economic performance. According to the authors, in the Korean case, for instance, it would be the increasing education of South Korean citizens relative to that of their northern neighbors that would explain their different GDP per capita levels.

The second critique claims that the works affirming the role of institutions have largely ignored the role of human capital as the promoter of not only good economic performance, but also sound institutions. For instance, the article of Acemoglu *et al*. (2001) uses invalid instruments because, according to Glaeser *et al*., the settlers have not only brought their institutions from Europe to the New World, but also part of their stock of human capital. To show his point, Glaeser *et al*. use the same data used by AJR, but this time they run a regression of GDP per capita of countries in 1995 on the exogenous component of human capital. This component is obtained running a first stage regression of human capital against the same instrument that AJR used in his paper - the settlers' mortality rate in colonies. They found a statically significant impact of the results in the first stage, and either in the second even controlling for institutions (expropriation risk). Institutions, in its turn, shows no significance in the determination of GDP per capita in 1995.

The controversy stated above motivates our work. Our contribution to this debate uses a singular case in Latin America, namely the 1959 Cuban Socialist Revolution. To motivate our exercise, we use the basic premises of Acemoglu *et al*. (2001, 2003) which establish a relationship between past and current institutions to partially justify our empirical strategy.

In Latin America, almost all countries were in the past colonies of extractive nature, and consequently had, according to AJR, poor institutions. Cuba is by no means an exception to that fact. Therefore, if our main premise is valid, until 1959 the Latin American countries should have presented reasonably similar institutions. That fact allows us to see the Cuban revolution as a "treatment" which has radically changed the

country's institutions in relation to other Latin American countries. Consequently, those other countries become candidates to be used as controls in the assessment of the impact that socialist institutions had in Cuba's economic performance.

Perhaps the greatest challenge faced by researchers of economic history and development is to obtain a valid counterfactual to establish the causal relationship between institutional change and economic performance of a given country.[4] The use of standard econometric methods is not adequate to this purpose because such methodology is subject to several restrictions which, taken together, cast doubts on the obtained results. To illustrate this point, the scarcity of cross-country historical data extending for large periods of time limits the efficacy of methods based on selection on observable characteristics. Moreover, reverse causality between per capita income and institutions requires the adoption of alternative empirical strategies such as the instrumental variables method, which are always susceptible to criticism regarding its validity, like Glaeser *et al.* (2004) and Albouy (2008).

Ideally, random experiments are the best way to assess the effect of a given treatment on the treated variables. However, such procedures have proven to be an almost impossible task when studying economic phenomena. After all, how could one obtain a random sample of different sets of institutions applied randomly to countries in order to test the impact of such institutions on their economic performance?

It is obvious that each country in Latin America might have unobservable characteristics that become each one a singular case. However, the fact that they were all colonies of extractive nature approximate them in many observables characteristics such as the economic dependence on some commodities, similar factor endowments and Hispanic colonial origins. These and other common characteristics allow some kind of comparability, which is the main goal of this study. In addition, the method we implement, under certain conditions, ensures if we are able to fit the treated unit with the untreated synthetic control unit in observables characteristics, we are able to do the same regarding unobservable characteristics (see Abadie *et al.,* 2010). This point assures we may replicate a natural experiment and we are able to say that any differences in GDP per capita's trajectory is due to the socialist revolution and its intrinsic institutions implemented in Cuba after 1959.

**3 A Brief History of Cuba**

From the 16th century onwards, Cuba was a Spanish colony and its economy was directed towards the production of sugar and tobacco. With direct support of the United States, the country conquered its independence in 1898. However, Cuba still maintained the features of a colony with its social and economic structures remaining the same as before. During the entire period prior to the 1959's revolution, Cuba suffered from a highly unstable political environment, constantly changing between democracies and dictatorships. Besides the sugar production, the country received many foreigners which fostered tourism related activities such as night-clubs, hotels, restaurants, and so on.

The source of revolutionary sentiment in Cuba was largely attributed to the popular dissatisfaction with the country's political instability and the alignment of Fulgêncio Batista's government with the interests of US foreign policy. The United States had a long-lasting influence throughout Cuban history since the 19th century, which was considered intrusive according to Cuban nationalists. From 1953 onwards, a guerrilla was created by Fidel Castro and Ernesto "Che" Guevara to overthrow the incumbent government and change political and economic organization of the island.

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[4] The importance of counterfactuals in economic history was highlighted by Fogel (1964, 1967).

After six year of a guerrilla type war, the rebel forces managed to depose Batista's government. Among the initial measures adopted by the revolutionary government were the investments on healthcare, urban and rural reform. Such reforms meant the redistribution of property from private citizens to the State. Also, there was an attempt to diversify the economy for two major purposes: (i) to achieve self sufficiency in food production; and (ii) to foster the creation and development of industries with the objective of reducing the country's economic reliance on sugar.

In the diplomatic sphere, Cuba fostered a foreign policy that was relatively independent from the Soviet Union or China. The Soviet Union saw it as a problem and the situation only changed after 1968, when the Soviet Union invaded Czechoslovakia and received political support from Cuba. After that, Cuba deepened its political and economical ties with USRR socialist regime (Mesa-Lago, 1973, Staten, 2003).

In spite of what have been stated above, one could argue that, from the very beginning, the main institution imposed by the Cuban regime was a set of measures that could be defined by the expression "Push to Communism". Such measures can be summed as the desire to build a country with the voluntary participation of all citizens, collective work and the establishment of a "social salary". According to Ernesto Guevara, such measures would constitute the pillars upon which a country guided by a different logic than market economy would rest (Green, 1994). The clear socialist and anti-American path chosen by the Cuban government resulted in the imposition of an economic embargo by the US and its allies.

Following a sin-Guevarist tendency, the Cuban government policies in the first years of the revolution resulted in a disruption of the job market and in inefficiencies of many levels due to perverted economic incentives. However, that period also experienced the expansion of public services (Mesa-Lago, 1973). After 1973, it was clear that the initial policies were generating several economic problems and Castro decided then to change some of them. Following a more pragmatic way, the Cuban government forgot the idea of a "new socialist man" and started to give material incentives to the workers, diminishing some of the sources of inefficiencies. Moreover, there was a greater approximation between Cuban and Soviet regimes. At that time, Cuba increased its trade with the entire socialist block, replacing the American demand of sugar with the Soviet market (Mesa-Lago, 1974). At the end of the 20th century, with the fall of the Berlin Wall and the end of the Soviet Union, Cuba faced severe economic difficulties. Only in 1996, the Cuban economy started to recover under different policies created in order to face this new stage without foreign help.

Even in the beginning of the 20th century, Cuba already had good social indicators compared to other Latin American countries. This was fostered by the sugar economy and the economic ties with the United States. However, the sugar economy under the influence of a small Cuban elite and American companies was a source of a significant wealth inequality. Furthermore, corruption and political instability was a common feature of almost every presidential term. Despite having educational indicators above Latin American average, as we can see in Graph 1, there was a decrease in the literacy growth rates during the decades of 1940 and 1950. The Socialist Revolution in 1959 had a positive impact in literacy, since Castro invested heavily in social policies such as literacy campaigns.

**Graph 1 – Literacy Rates (%) in selected Latin American countries during the 20th century**
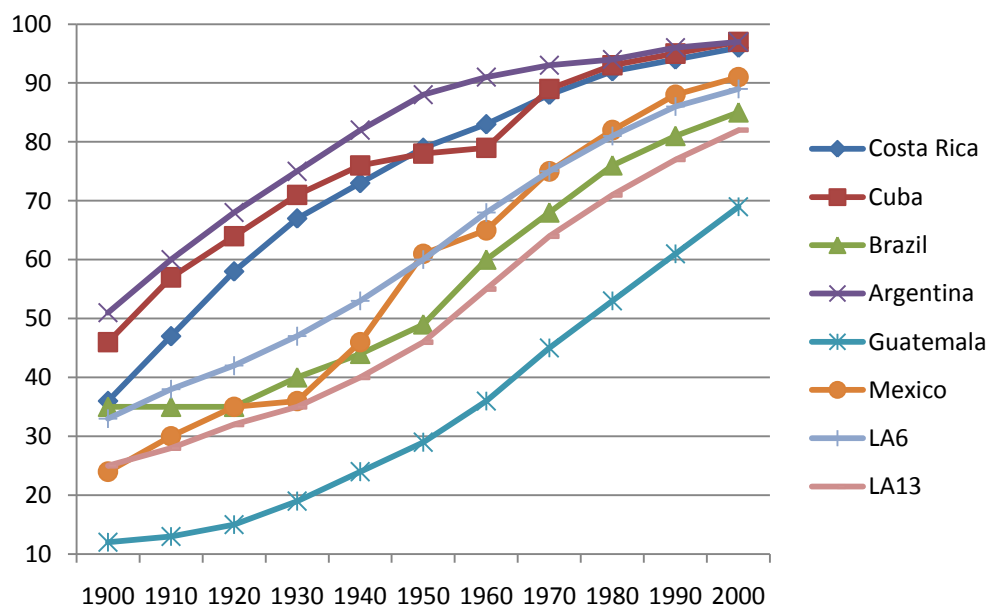


Source: Astorga, Bergés and FitzGerald (2005), p. 790
Notes: LA6 comprises the following countries: Argentina, Brazil, Chile, Colombia, Mexico and Venezuela. LA13 comprises the following countries: Bolivia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Guatemala, Haiti, Honduras, Nicaragua, Panama, Paraguay, Peru and Uruguay.

Further evidence that education was a priority in Cuba are the records of average years of schooling collected by Barro and Lee (2000). The Graph 2 shows that Cuba achieved good results on educational attainment compared to other Latin American countries – almost eight years with respect to the population over 25 years old in 2000. Educational attainment is a well-known proxy of human capital levels.

**Graph 2 – Average Years of Schooling of selected Latin American countries (with respect to the population aged 25 and over)**
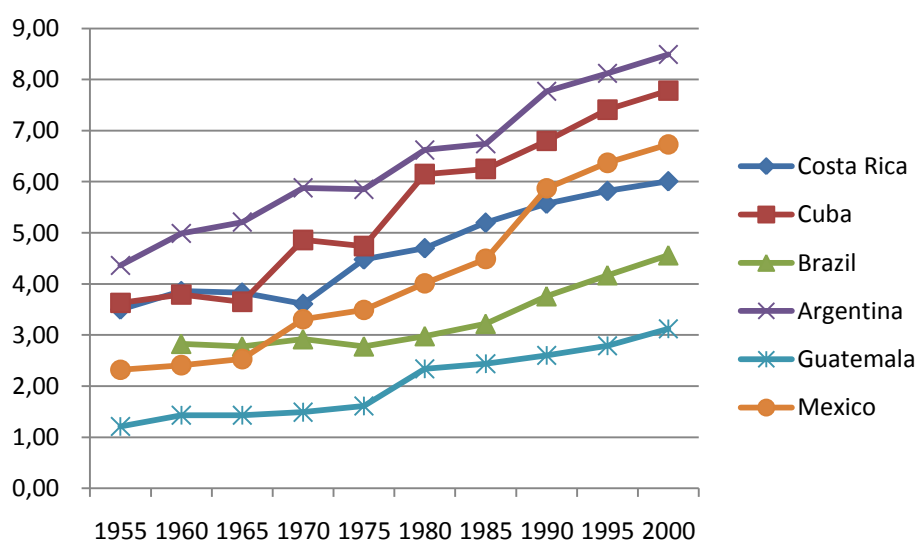


Source: Barro and Lee (2000)

Cuba continued to have higher literacy rates and average years of schooling with respect to other Latin American countries, lagging behind only few countries such as Argentina and Uruguay. Hence, the Cuban Revolution probably did not lead to a decrease of human capital stock of the country. If we assume that even if Cuba had not have a socialist revolution the human capital stock would be approximately the same of its actual levels along the last decades, then the differences between the actual levels of GDP per capita and our model's counterfactual findings cannot be attributed to differences in human capital levels. In this case, Acemoglu *et al*. (2005) are probably right to say that institutional change may be a better explanation.

Summing up, the revolution in Cuba resulted in a drastic change in the country's institutions. Arguably it can be stated that the abolition of private property and the institution of central planning were among the most drastic of those changes. The measures and policies stated above can be defined as the institutions implemented by the socialist regime in Cuba. Cuban socialist institutions, which did not relied extensively on markets, and the trade embargo had an enduring influence on Cuban economic performance. Institutional change and trade are probably the main reasons why Cuba did not grow, instead of lack of human capital as one could argue. The effects of the institutions implemented by the Cuban government from 1959 onwards will be tested in the next sections.

## 4 Empirical Strategy

Although most Latin American countries had relatively similar colonial pasts, one could, rather naively, attempts to investigate the impact of socialist institutions in Cuba's economic performance simply by using the trajectory of the average income per capita of Latin American countries as a counterfactual to the trajectory of per capita income of Cuba after the revolution. However, using this average and comparing it with Cuba is not sufficient to establish a casual relationship between institutions and economic performance, once there could be observable and non-observable factors which might have affected the trajectories of income per capita of both groups after the revolution as we already have discussed. For this particular reason, even though Graph 3 shows significant difference between both groups, it is not possible to infer casual relationships of any sort.

**Graph 3- GDP per capita - trajectory (1990 International Geary-Khamis dollars)**



– – – Average of LA countries without Cuba  ——— Cuba
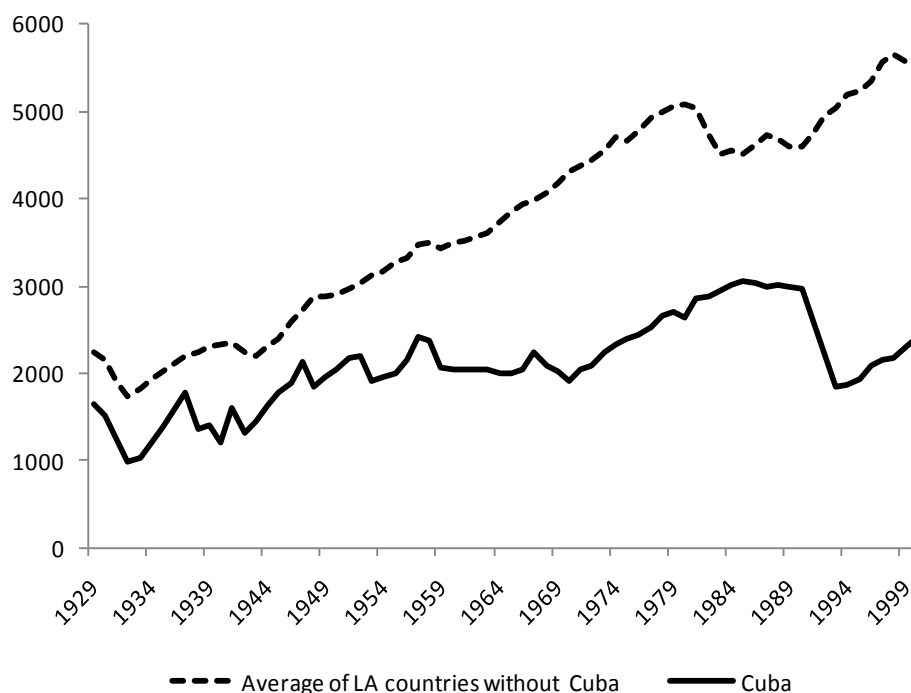
To solve the methodological difficulty of finding a valid counterfactual, we use the Synthetic Control method developed by Abadie and Gardeazabal (2003). Such method was used for the first time to measure the economic costs of terrorism in the Basque country of Spain. Like all the other methodologies used to infer causal relationships of a given treatment, the Synthetic Control tries to create an adequate counterfactual and compare it with the actual treated group or individual.

In our case, we would like to find out what was the effect of socialist institutions in the country's income per capita after the 1959's revolution. To do this we must know how Cuba would have performed had not opted to follow the socialist track in 1959. Afterwards we compared it with Cuba treated with socialism. The problem is that we do not observe the untreated Cuba, we only observe Cuba treated with socialism. Therefore the GDP income per capita trajectory of Cuba without socialism is a latent variable.

Synthetic control method consists in trying to build this latent variable using information of untreated units prior to the treatment. The information is a set of variables that are, by hypothesis or previous knowledge, correlated with the variable we would like to examine. We assign a weight to each control unit based on a constrained optimization process that minimizes the distance between a vector of characteristics of the treated variable and of control units. That set of information is processed in order to generate the trajectory of the key variable absent the treatment of the treated individual. Formally, let C be the number of control units which are candidates to compose the synthetic unit; $P = (p_1, p_2, \ldots, p_c)'$ is a (Cx1) vector representing the weight that each candidate control unit has in building the synthetic control; $X_1$ is a (Kx1) matrix where K is the number of pre-treatment variables associated with the treated unit (Cuba), $X_0$ is a (KxC) matrix containing the pre-treatment variables associated with all the candidates to control units. The inputs of $X_1$ and $X_0$ are the average of each covariate variable through the pre-treatement period. Also, let W be a diagonal matrix on which every diagonal component is associated with a given pre-treatment variable and represents the weight that variable has in explaining the key or interest variable. The weights $P = (p_1, p_2, \ldots, p_c)'$ are obtained solving the following constraint optimization problem:

$$\min_{p \,\epsilon\, P}(X_1 - X_0 P)^{'} W (X_1 - X_0 P)$$

$$where: P = \left\{ (p_1, \ldots, p_C)^{'} \, subject \, to: \sum_{i=1}^{C} p_i = 1, p_i \geq 0 \; (i = 1, \ldots, C) \right\}$$

The problem's solution gives a vector P* consisting of the optimal weights that each control unit will have when building the synthetic Cuba. Once we obtain the weight vector, we create the latent variable for the synthetic control unit which, in our case, is the GDP per capita of Cuba without socialism. Such variable is simply a weighted average of every control unit's GDP per capita where the weight is the one that has been obtained through the constrained optimization process. This new variable is compared with the treated unit's variable.

Formally, let $Y_0$ be a (Tx1) vector where each component stands for observation of the treated unit's GDP per capita for in each one of T periods of analysis, and $Y_1$ is a (TxC) matrix which contains the same variable, but this time for each control unit for all the same T periods. The key variable of the synthetic control unit, $Y_0^s$ and the treatment's impact, $\delta$, are defined by:

$$Y_0^s = P^* Y_1 \tag{1}$$

$$\delta = Y_0 - Y_0^s \tag{2}$$

In order to be successfully implemented, the synthetic control method requires that, in the period prior to the treatment, the treated unit and the synthetic unit share the same trajectory. As said early, when the synthetic control fit the treated unit with the untreated one in observables characteristics, under certain conditions, both units are fit in unobservable either, and we can infer causality in any differences in the interest variable's trajectory.

In this study, we use available information of Latin American countries to build the trajectory of Cuba's GDP per capita had it not been "treated" with the 1959's revolution and its consequent institutions. To ensure the robustness of our results, we implement some inferences tests. Our first strategy is to apply placebos tests in all Latin American countries to observe the effect of Cuban revolution in Cuba's GDP per capita in relation to other Latin American countries' GDP per capita. If the impact of the revolution is to have no meaningful effect in all countries except for Cuba, than Cuba must present different behavior from the placebos.

Our second inference strategy is to adopt a time placebo changing the year where the treatment took place for years prior to 1959. Some might argue that the civil war, which preceded the implementation of socialist institutions, affected the Cuban economy, therefore, the differences observes in trajectories of actual Cuban and synthetic Cuban's GDP per capita cannot be attributed exclusively to institutional change, but also to all the negative effects of the war (e.g. destruction of physical and human capital).

Finally, we apply the synthetic control using only countries of Central America due to their supposedly greater similarities to Cuba with respect to colonial origins and factor endowments. One can argue that using only countries of Central America as controls would make more sense than using the entire Latin America mainly due to so much unobservable differences that might be there between Cuba and South American countries. It is important to emphasize that such procedure involves a clear trade-off since the exclusion of controls might result in a worse adjustment of the RMSPE.

Some usual problems in empirical economic growth literature deserve additional comments. The reverse causality problem arises from the fact that institutions might be a function of economic growth, which is in its turn a function of the accumulated human

capital. Such fact would make the OLS estimator biased, which would invalidate any conclusion concerning the causal relationship between institutions and wealth of a given country. Our study avoids problems of this nature because the Synthetic Control unit has, by construction, only one difference from the treated unit: the institutional change that was set in motion by 1959's communist revolution. Consequently, our study is immune to the critiques raised by Glaeser *et al*. (2004). Additionally, we do not need to search any instrumental variable, avoiding critiques about instrument's exogeneity and data quality as Albouy (2008) pointed out in Acemoglu et *al.* (2001). Last, our work does not use any measure of institutions as treatment variable, and therefore is also safe from the criticism of using proxy variables for this purpose as we have already discussed above. However, we use the measure Polity Index to represent institutions as a pre-treatment variable.

## 5 Data

Data used in our work comes from different sources. The GDP per capita information was obtained from the Statistics on World Population GDP and GDP per capita, 1-2008 AD developed by Professor Angus Maddison (2003). The covariate variables were obtained, in their turn, from the Oxford Latin American Research Center, CIA – World Fact Book and Polity IV Project.

The pre-treatment period goes from 1929 to 1958. We go only as far as the data for Cuba was available and we end in the year prior to the Cuban revolution. The covariate variables used in the constrained optimization were: electricity measured in millions gigawatts hours; railways measured in kilometers built, terms of trade expressed in the ratio between export's unit value and import's unit value; Primary and Secondary School Enrolment expressed in thousands of people; Economic Active Population Employed in Agriculture and Manufacture also expressed in thousands of people; Land Size expressed in Km²; and Polity Index ranging from -10 to +10, which is a measure of how democratic a regime is, with -10 being a fully fledged dictatorship and +10 a perfect democracy.

The criteria used for selecting those variables were twofold: availability and predictive power. National account and financial data for developing countries are difficult to find for periods prior to 1950. For this particular reason we used variables that we believed were correlated with GDP income per capita. Railways and Electricity are supposed to be a proxy of physical capital stock. Terms of trade tries to capture the country's external condition. Economic Active Population (EAP) employed in Agriculture and Manufacture represents the job market's condition. Primary and Secondary School Enrolment aims to be measures of human capital. Polity Index tries to proxy the countries institutional quality. Other institutional measures are not included, because they are not available to most Latin American countries during the period of our investigation. Finally, Land Size enters in the process to increase the accuracy of finding which countries are more similar to Cuba. Physical and human capital, external economic condition, labor distribution, and institutions are, rather arguably, correlated with a country's GDP per capita.

Also, the countries used were those from Latin America whose data were available. They are the following: Argentina, Brazil, Chile, Colombia, Costa Rica, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Peru, Uruguay and Venezuela.

The whole period of our investigation goes from 1959 to 1974. It is important to highlight that the synthetic control estimates the total impact of some treatment on a given variable. We are unable to identify the effect on Cuba's GDP per capita when the institutional change occurs on the margin. Also, according to Abadie *et al.* (2010) in

order to ensure consistent estimations, it is not recommended that the post treatment period be large relative to the pre-treatment period. For this reason we decided to stop in 1974. In addition, the years that followed 1974 where marked by periods of economic and political turmoil (for example, the oil and debt crisis, the tightening of the USA trade embargo, and the crumbling of the Soviet Union) and some additional institutional changes in Cuba as we have already discussed in section 2.

## 6 Results

Table 1 shows the weight attributed to each control unit resulted from the optimization process. Only five of the 13 countries used as controls for the creation of Synthetic Cuba received a weight greater than zero. The country that received the greatest weight of the five was El Salvador (59.7%).

**Table 1**
**Control Unit's weights used in the construction of the Synthetic Control**

| Countries | Weights |
|-----------|---------|
| Argentina | 0.0% |
| Brazil | 0.0% |
| Chile | 12.2% |
| Colombia | 0.0% |
| Costa Rica | 0.0% |
| El Salvador | 59.7% |
| Guatemala | 0.0% |
| Honduras | 12.4% |
| Mexico | 12.8% |
| Nicaragua | 0.0% |
| Peru | 0.0% |
| Uruguay | 2.8% |
| Venezuela | 0.0% |

Table 2 below shows the pre-treatment average of each variable for Cuba, Synthetic Cuba and Latin American. One can notice that the values of the Synthetic and Treated Cuba are very similar for the majority of the pre-treatment variables. This gives us confidence that any perceived difference in the income's per capita trajectory of the synthetic and treated unit can be attributed to the implementation of the socialist regime in 1959. We test different combinations of pre-treatment variables and we found similar results in pre-treatment variables fit and RMSPE.

**Table 2**
**Description of Treated and Synthetic Cuba**

| Variables | Cuba | Synthetic Cuba | Latin American |
|---|---|---|---|
| GDP per capita Income | 1,714.6 | 1,719.2 | 3,292.4 |
| Electricity | 670.5 | 688.6 | 742.6 |
| Railways | 4,359.8 | 4,167.7 | 21,629.0 |
| Eco. Active Pop. Employed in Agric. | 728.5 | 869.8 | 2,189.4 |
| Eco Active Pop. Employed in Manuf. | 228.5 | 162.7 | 745.3 |
| Primary School Enrolment | 397.9 | 351.5 | 1,314.9 |
| Secundary School Enrolment | 19.5 | 19.4 | 57.7 |
| Terms of Trade | 1.2 | 0.9 | 1.1 |
| Land Size | 109,886.0 | 375,128.9 | 2,098,840.0 |
| Polity Index | 1.7 | -4.1 | -1.2 |

Graph 4 shows both the Treated and Synthetic trajectory of Cuba's GDP per capita. It can clearly be seen that both series follow a similar trend prior the year of 1959. After the institutional change one can notice a clear gap between both series. At that year, the trajectory of the Synthetic's GDP per capita begins to outgrow the series of treated Cuba which would mean, at a first glance, that the socialist institutions had a negative impact on the country's GDP per capita.

**Graph 4 - GDP's per capita Trajectory**
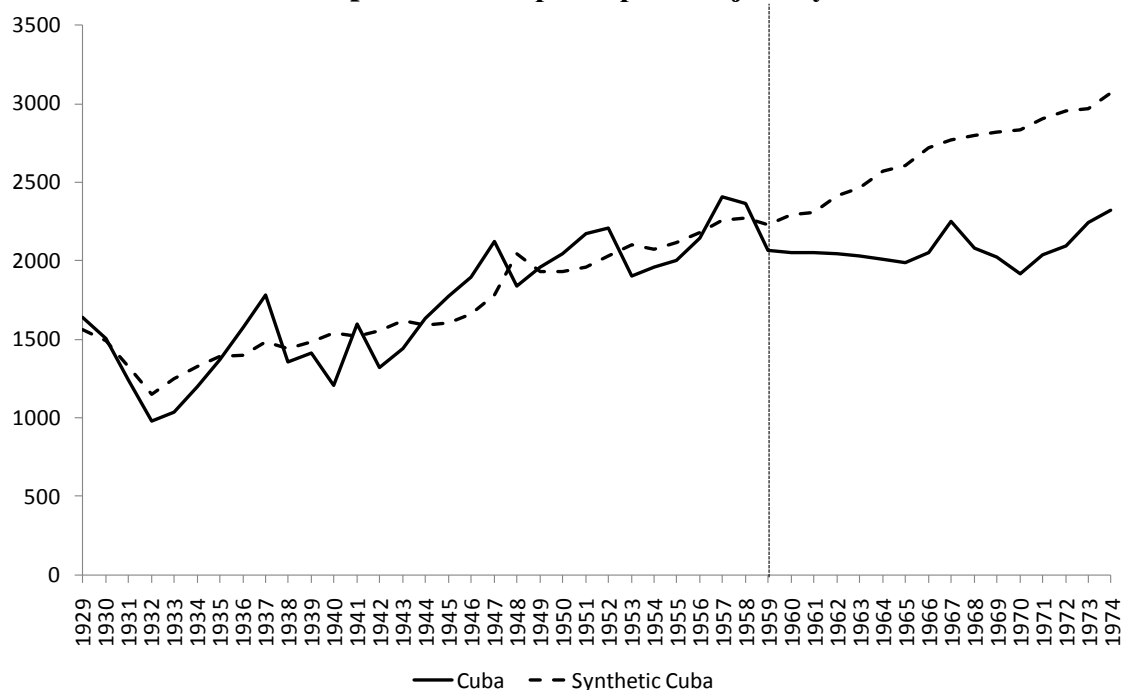


Our results can be summed up by presenting the average yearly Gap of Treated and Synthetic Cuba in relative terms. The average yearly gap is 28.5%, which means that, on average, in a given year, Cuba would have been 28.5% richer if it had not changed its institutions from market based to socialist based institutions.

The results obtained in the placebos permutation's test are presented in Graph 5. We excluded from the distribution the observations of Uruguay and Venezuela due to their high RMSPE relative to Cuban.[5] The thicker line represents the gap between treated and synthetic Cuban GDP per capita. It is possible to notice that during the post-treatment period, Cuba's GDP per capita stays below all other lines but one, which was already below the thicker line prior to 1959. Since Graph 5 represents a distribution, one can claim that, since the behavior of Cuban "gap" is behaving quite differently and extremely from the other gaps, the treatment effect on Cuba is not merely a random and meaningless phenomena.

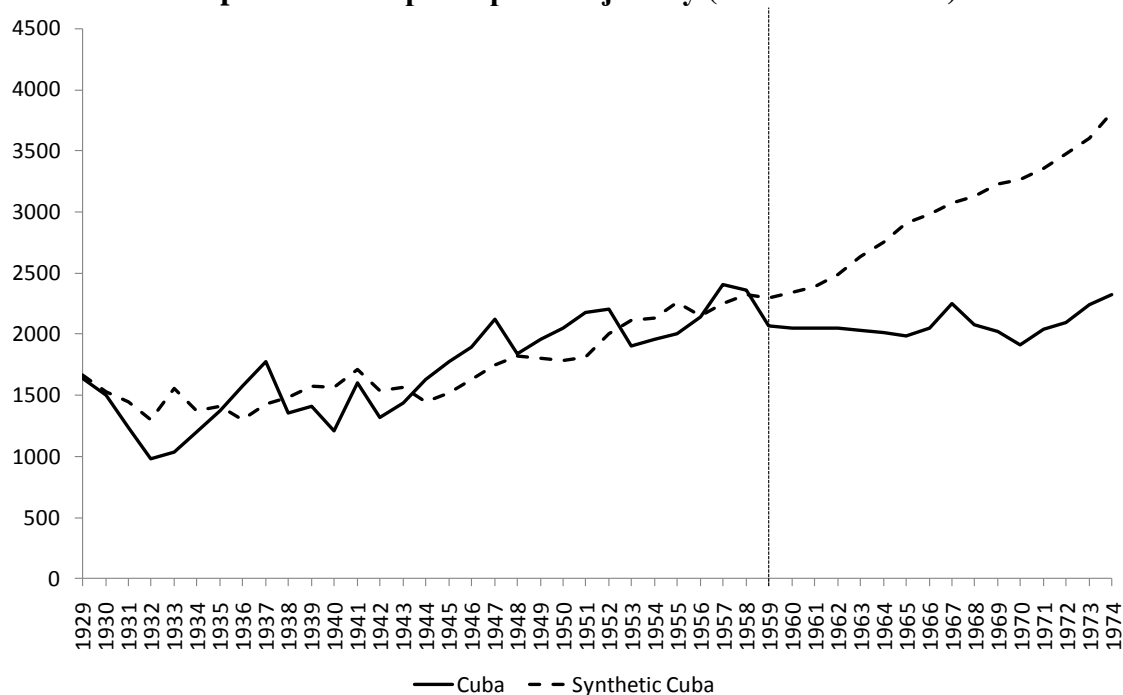**Graph 5 – Placebo Permutation Test**
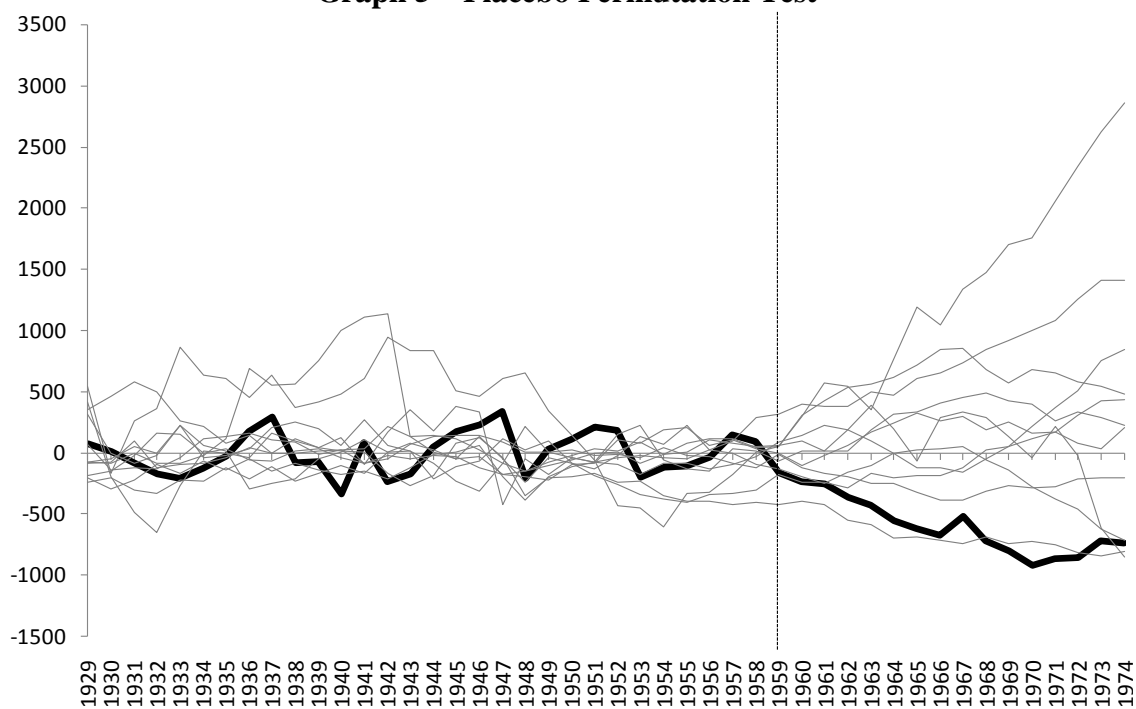


Finally, the last test we performed was one concerning the treatment's time period. One might attribute the Gap observed to the revolutionary war that preceded the instauration of the revolutionary regime in 1959. To test the validity of such claim we apply the synthetic control method changing the year where the treatment happened and compare their average to the treatment applied in 1959. Our window of estimation for the temporal placebo began in 1952 and ended in 1958. Results are presented in Graph 6 and show that, as expected, whatever caused the Gap observed indeed began in 1959.

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[5] Abadie *et al.* (2010) suggest that procedure when placebos reports RMSPE relatively higher then the treated unit. Uruguay and Venezuela had RMSPE at least three times higher than Cuba's one.

**Graph 6 – Temporal Placebo**



**Graph 7 - GDP's per capita Trajectory (Central America)**
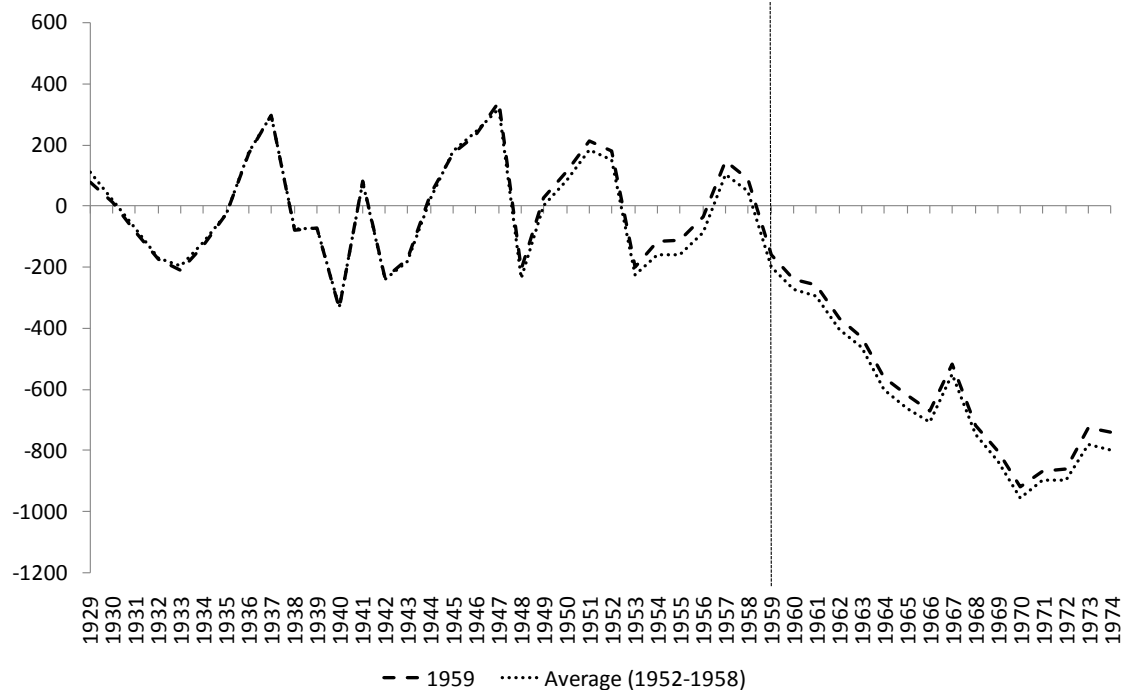


One could also claim that there are significant non-observable differences and other kinds of heterogeneities when one wished to compare countries in Latin America. For instance, Cuba, one might say, is hardly comparable to Paraguay or Brazil. For this reason it makes sense to repeat the same procedure done above, but this time using as controls only countries that belong to Central America. Graph 7, 8, and 9 below show the results.

Graph 7 shows the results of synthetic Cuba using only Central American countries. It shows that the divergence between the actual and the counterfactual path of Cuba's

GDP per capita began in 1959. The result is similar to the one previously obtained using the entire Latin America. Again, Cuba would perform better had it not pursued the socialist institutions option in 1959.

Graph 8 shows the results of the placebo permutation's test. Again, only Cuba's GDP per capita GAP seems to be affected negatively by the 1959' socialist revolution. The other two GAPs which are decreasing in time, present such negative tendency many years before 1959. Therefore, this procedure again reinforces our estimates results.

**Graph 8 – Placebo Permutation Test (Central America)**
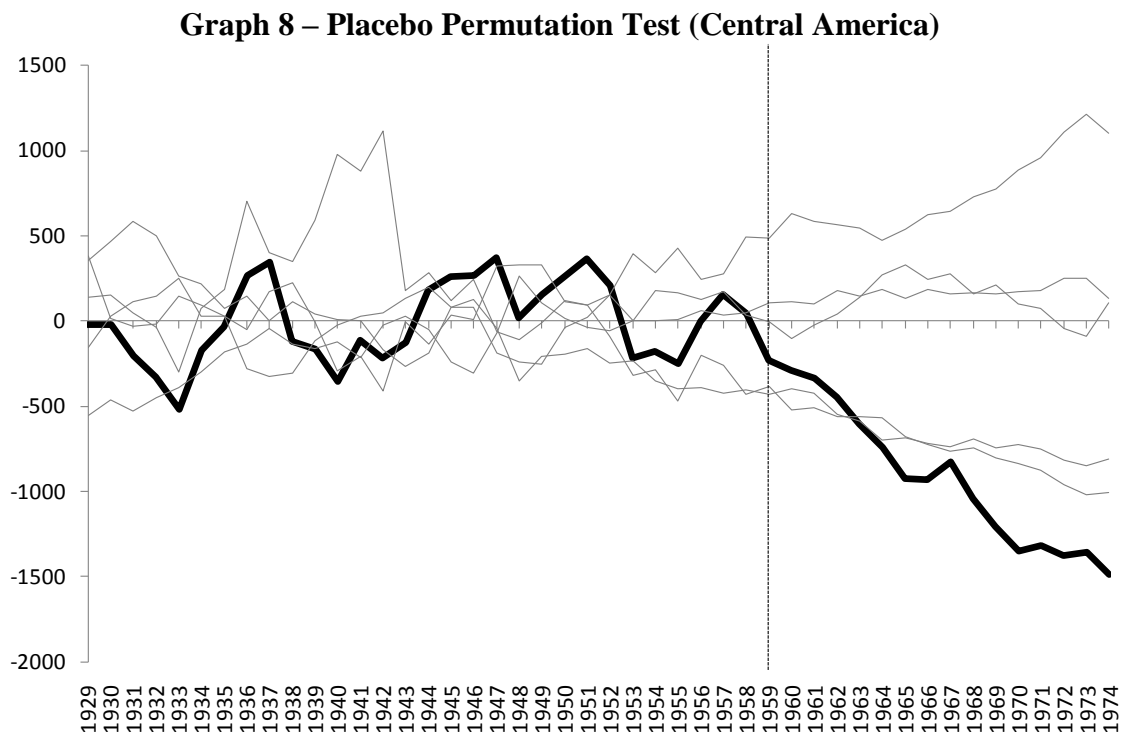


Finally, Graph 9 shows the temporal placebos using only Central American countries. They also turn out to corroborate the main findings of this work.

**Graph 9 - Temporal Placebos (Central America)**



── 1959    ······ Average (1952-1958)
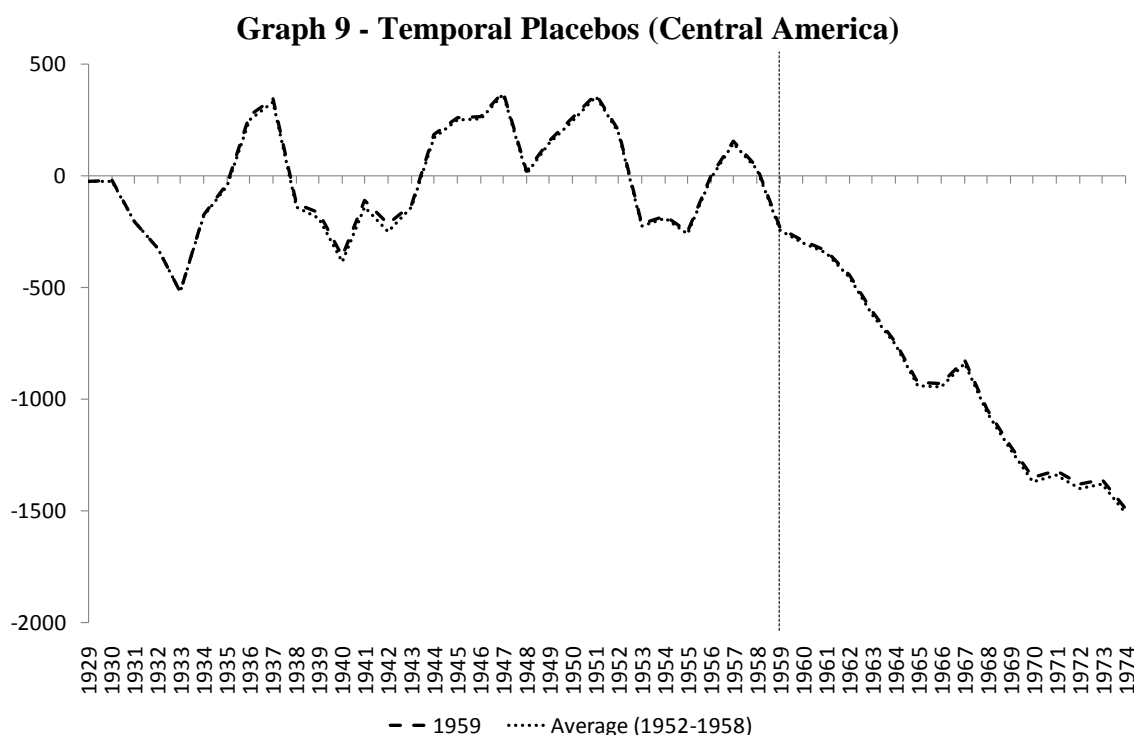
## 7 Concluding Remarks

Our study has shown additional evidence that institutions play an important role on a country's economic performance. Some conclusions must be highlighted. This finding corroborates Acemoglu *et al*. (2001; 2003) and Acemoglu *et al*. (2005) thesis claiming that institutions are indeed fundamentally important in order to explain the wealth of nations.

Secondly, our work overcome difficulties such as the reverse causalities and omitted variables problems that were pointed out by Glaeser and his associates. We also have not used proxy variables to capture institutional changes and therefore we also avoid criticism relating to those uses. Also, we do not need to use and "defend" the valid of instruments for institutions. Thus our findings stand immune to the common criticism that studies of this sort face.

Finally, the tests performed give robustness to our findings and show that the Gap between the Synthetic and Treated Cuban GDP per capita could easily be attributed to the institutional change that happened in 1959. Our tests rule out the possibility that the effect is merely random or that is a consequence of the destruction caused by the revolutionary war.

Further research must investigate the effects of the trade embargo imposed by the United States. Despite Cuba has replaced the embargo's losses by increasing trade with the Soviet bloc, it is possible that our results are underestimated if we consider that Cuba had gains of trade changing its trading partners. On the other hand, our results may be overestimated if commerce with the Soviet bloc did not overcome the losses imposed by the embargo. We still need better counterfactuals of how these political problems regarding trade affected Cuban's economic performance.

Although we suggest that institutions are fundamental to the prosperity of a country, we are not underestimating the relevance of human capital. Sound institutions are not only important to a country's higher productivity of physical capital, but also human capital. Cuba may had had "good" educational levels after 1959, but was under labor market institutions that did not ensure adequate conditions to labor appropriation of its

productivity. These institutions may have restricted the positive effects of human capital in wealth and income.

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