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Revolution and Economic Growth: Evidence from the Sandinista Revolution*

Filippo Silano†

Abstract

This study examines the repercussions of the 1979 Sandinista revolution on Nicaragua's economic growth trajectory. Drawing on the synthetic control method, it constructs an artificial counterpart to Nicaragua with the primary objective of estimating the counterfactual gross domestic product (GDP) per capita growth rate, assuming that the revolution did not take place. By doing so, the study quantifies the extent to which the Sandinista revolution influenced the country's economic development. The results show that the Somoza removal and the immediate implementation of the Sandinistas policies led to a slight improvement of GDP per capita's growth rate (+2%). On the other hand, the civil war's intensification that ensued (1984-87) negatively affected the initial positive effect of the revolutionary government policy making. This study contributes to a better understanding of the economic dynamics associated with revolutions and civil wars. The findings underscore the significance of considering the broader context in assessing historical events' economic implications and call for further research into the long-term effects of such institutional and political transformations.

Key Words: Sandinista, Nicaragua, Revolution, Civil war, Synthetic control method, Economic growth, Economic development, Political economy

JEL Codes: O54, N46, P16, P26, C21, H56

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1. Introduction

Revolution, defined as a significant and often violent change in government and related structures (The Editors of the Encyclopaedia Britannica 2023a), is often driven by the pursuit of redistribution, wherein revolutionary forces aim to implement alternative wealth distribution policies (Roemer 1985). In the realm of political economy, two distinct game theoretical approaches have been developed to analyse revolution. Roemer (1985) interprets it as a two-person game involving the revolutionary and incumbent leaders, while Grossmann (1999) views the success of revolution hinging on the leader's entrepreneurial skill.

Revolutionary upheavals tend to be more prevalent in agrarian societies with pronounced wealth disparities (as seen in the 1917 Russian revolution), facilitated by an elite of kleptocratic rulers (Acemoglu and Robinson 2012). Kleptocracy, evident in certain African and Caribbean countries, involves the rulers expropriating income and capital from citizens to enrich themselves, leading to highly inefficient economic policies (Acemoglu, Robinson, and Verdier 2004). Such nations are often characterised by low income, with the ruler monopolizing the majority of wealth, creating a breeding ground for conflicts (Collier and Hoeffler 1998).

Nicaragua, governed by kleptocracy for 46 years and a largely agricultural-driven economy (Nietschmann 2023), provides an apt case study for analysing the economic effects of revolution. The elite's prioritisation of power over economic development hindered progress, as it disrupted efficiency improvements driven by technological advancements (Nietschmann 2023).

In contrast to the prevailing game theory approach, this research takes an empirical stance to assess the impact of revolutionary rule on economic growth, measured through GDP per capita growth rate. Departing from the limited literature on this subject, the study employs the synthetic control method – an innovative technique commonly used in comparative politics and public policy developed by Abadie, Diamond, and Hainmueller (2015) – to estimate the effect of the 1979 Sandinista revolution. This method allows for the creation of a counterfactual scenario in which the revolution did not occur, with Nicaragua serving as the treated unit. The

hypothesis is that the economic and social policies introduced by the Sandinistas' government supported Nicaragua in the recovery from the kleptocratic regime it endured.

This paper takes the following form. Section 2 outlines Nicaragua's historical background highlighting the socio-economic and political context leading to the revolution. It follows Section 3 outlining the data and empirical strategy. Hence, Section 4 illustrates the results and the Conclusion sketches avenues for future research.

2. Historical and institutional context

Nicaragua, situated in Central America, has exhibited a history characterised by highly inefficient political systems. As a Spanish colony from the 16th century, it suffered grave consequences for the indigenous population (Fukuyama 2014). Achieving independence in 1821, Nicaragua's liberation was the result of the efforts of revolutionary forces inspired by events in Mexico and El Salvador (Nietschmann 2023).

In the early 20th century (1912), the country came under increasing influence from the United States (US), resulting in a de facto occupation. This was primarily driven by the US's vested interests in Nicaragua's exports, including commodities like coffee and bananas (Zaremba 1992). However, the US-oriented government faced disapproval from peasants and workers, leading to social tensions and ultimately triggering the first Nicaraguan revolution, led by nationalist rebel Augusto César Sandino, who vehemently opposed the US occupation forces. Although the revolution ended in failure, with the death of Sandino at the hands of the National Guard in 1934 (Nietschmann 2023; Zaremba 1992), the guerrilla experience sowed the seeds for the later Sandinista movement.

Following Sandino's death, the US-trained National Guard leader, Anastasio Somoza García, assumed control of the government, initiating a reign characterised by bribery and patronage that cemented the Somoza family's power. As rent extraction steadily increased under the dictator's rule, his assassination in 1956, orchestrated by an unknown young assailant, marked a significant turning point. Anastasio Somoza

was succeeded by his two sons, both of whom became presidents: Luis Somoza Debayle (1956-63) and Anastasio Somoza Debayle (1967-72, 1974-79). Over their 44-year rule, the kleptocratic elite accumulated considerable wealth, primarily through the appropriation of vast land areas (The Editors of the Encyclopaedia Britannica 2023a).

2.1 The revolution and the civil war

The revolutionary party, known as FSLN (Frente Sandinista de Liberación Nacional or Sandinista National Liberation Front in English), was inspired by the iconic Nicaraguan figure, Sandino. The FSLN, a paramilitary organization, emerged in 1962 with a commitment to solidarity-oriented socialism. By the time of the 1979 revolution, the rebel army comprised approximately 5,000 volunteers (The Editors of the Encyclopaedia Britannica 2023b).

At the outset of the revolution, the staggering inequality in Nicaragua was epitomised by the fact that the annual income of the incumbent leader Somoza Debayle amounted to between 40 and 50 percent of the country's GDP. Such extreme inequality also hindered access to adequate healthcare (Zaremba 1992). The Sandinistas' revolutionary fervour was significantly fuelled by their determination to address these deeply-rooted issues of inequality.

Following the ousting of the ruling elite, the Sandinistas faced a nation in turmoil. The revolution resulted in approximately 10,000 fatalities, while the two-year war (1978-79) left the country's infrastructure in ruins (Lacina and Gleditsch 2005). Despite this challenging situation, the newly-formed government, led by Daniel Ortega, swiftly initiated a series of crucial reforms aimed at transforming Nicaragua into a more equitable and civilised society. These social policies encompassed vital areas such as education, health, and gender equality.

In terms of education, the Sandinistas implemented a robust reform to combat illiteracy and improve educational opportunities for all citizens. Health conditions, especially for the impoverished majority, were also prioritised, aiming to provide better healthcare services and access to medical facilities. The government's activism in social rights sought to challenge traditional gender roles, empowering women to

participate in the civil life and even revolutionary actions (Zaremba 1992).

In terms of economic policy, the Sandinistas designed and implemented an ambitious agrarian reform to address the substantial land inequality prevalent in the country. Land was the primary means of production for the majority of the population, and the government took significant steps by confiscating landholdings owned by the Somoza family. This reform marked a pivotal moment in Nicaragua's economic history and represented the initial strides towards developing a more equitable economic system. Notably, the government opted for nationalizing major industries without adhering to the Soviet-style central planning (The Editors of the Encyclopaedia Britannica 2023b).

The revolutionary success, however, was met with resistance from the US, who perceived it as a drift towards Soviet influence. Consequently, the Carter administration halted food aid to Nicaragua, and the Reagan administration, starting from 1981, deployed military forces to redefine their sphere of geopolitical influence. This marked the onset of the civil war, also known as the contra war, which exacerbated the challenges faced by the FSLN-led government (The Editors of the Encyclopaedia Britannica 2023b; Zaremba 1992). The period from 1984 to 1987 witnessed heightened intensity in the conflict, causing severe damage to the country's infrastructure. The war persisted until 1990, culminating in the defeat of the Sandinista government led by Daniel Ortega, primarily driven by the economic depression (The Editors of the Encyclopaedia Britannica 2023b). The death toll from the conflict reached the dramatic figure of 30,000 casualties (Lacina and Gleditsch 2005).

3. Data and empirical strategy

This research utilises country-level panel data, covering the time period from 1961 to 1996. The panel consists of countries forming the donor pool,¹ which serves as a basis for constructing the synthetic control (Abadie, Diamond, and Hainmueller 2015). The 45-year time span is divided into two distinct periods: 1961 to 1978, considered the pre-treatment period, and 1979 to 1996, the post-treatment period. This division is crucial for ensuring the validity of the synthetic control method, which will be

¹ Set of countries fulfilling particular requirements specified in the upcoming Section.

presented in the ensuing sections.

Data for the analysis was obtained from the World Bank, encompassing various indicators related to economic and social development – for more details, see the Data Appendix. The variables of interest are GDP per capita growth (annual %), school enrolment in secondary schools (% gross), inflation (annual %), life expectancy at birth, trade (% of GDP), and the fertility rate.

The decision to begin the time series from 1961 rather than an earlier date is primarily driven by data availability constraints for the dependent variable, GDP per capita growth (annual %). Indeed, the necessary data points for this variable are accessible only from 1961 onwards.²

In the upcoming section, the econometric specification and the synthetic control method will be introduced, highlighting their significance and how they address the research question concerning the economic impact of the 1979 Sandinista revolution on Nicaragua.

3.1 The model

From an econometric perspective, the selection of explanatory variables for GDP per capita growth rate draws inspiration from Cooper and Barro (1997)'s cross-country panel data analysis, examining the determinants of economic growth. Additionally, the choice of specific variables finds support in prior studies investigating terrorism and other forms of conflict, wherein the synthetic control method was applied (Bilgel and Karahasan 2019). The following control variables have been incorporated into the model:

- Life expectancy (*life_exp*)
- Education (% of enrolment in secondary school; *sch2%*)
- Inflation (%; *inf*)
- Trade openness (as percentage of GDP; *trade%GDP*)
- Fertility rate (%; *frt*)

² It should be noted that the selection of the time period for analysis and the data availability are crucial considerations to ensure the accuracy and reliability of the results obtained through the synthetic control method.

The decision to include the listed variables is driven by their relevance to the characteristics of Nicaragua, aligning well with the primary aim of the analysis: evaluating the impact of Sandinista policies on economic growth. Among these variables, the examination of life expectancy and the fertility rate holds particular significance, as these indicators were significantly affected during the kleptocracy era, under the rule of the elite. In contrast, the Sandinistas made substantial efforts to improve public health, resulting in positive changes in these indicators (Zaremba 1992). Similarly, the focus on education is essential, given the Sandinistas' commitment to combating illiteracy from the outset of their administration (Zaremba 1992).

The specification includes inflation, as warfare tends to cause extreme fluctuations in this macroeconomic variables' rates. Accounting for inflation is necessary to conduct a thorough analysis of GDP per capita growth in the context of a nation experiencing a war (Hamilton 1977). Similarly, the variable representing trade as a percentage of GDP holds particular importance for Nicaragua, where agricultural exports play a significant role in driving the country's economic model (Nietschmann 2023; Zaremba 1992).

Below, the econometric relationship between the dependent variable (GDP per capita growth rate) and its controls:

$$GDPpc(growth)_{ij} = \beta_0 + \beta_1 * life_exp_{ij} + \beta_2 * sch2\%_{ij} + \beta_4 * inf_{ij} + \beta_5 * trade\%GDP_{ij} + \beta_5 * frt_{ij}$$

where $i = 1, 2, \dots, 38$ and $j = 1, 2, \dots, 45$

In this study, two indices, represented by i and j respectively, denote the country of interest and the corresponding year for specific values taken by the variables. The rationale behind the choice of the number of countries and the time dimension will be elaborated in subsequent sections.

One crucial decision made in this analysis is to exclude a significant control variable, namely Foreign Direct Investment (FDI) as a percentage of GDP. The reason for the exclusion is the lack of comprehensive data for Nicaragua over a significant portion of the time series. As detailed in the forthcoming sections, the implementation of the

synthetic control method requires the treated unit (Nicaragua) to have complete coverage of its related variables (both dependent and independent) throughout the entire pre-intervention period (1961-78), without data gaps (Abadie, Diamond, and Hainmueller 2010).

3.2 The synthetic control method

The synthetic control method was developed by Abadie, Diamond, and Hainmueller (2015) within the domain of comparative politics and public policy research. This method is employed to evaluate the impact of an event, policy or shock on a treated unit. The primary objective is to construct a synthetic comparison for the treated unit, allowing a precise measurement of the phenomenon's effect on the country, institution or entity object of analysis.

To achieve this goal, a weighted combination of comparison units, referred to as the *donor pool*, is created, ensuring that they closely resemble the treated unit. Notably, the comparison units have not been affected by the event of interest in the years preceding it. This time frame, known as the pre-intervention period, plays a critical role in the accuracy of the synthetic comparison, and needs to be sufficiently wide to ensure a robust estimation of the treated unit's counterfactual outcome (Abadie, Diamond, and Hainmueller 2015).

In line with this guidance, the study sets the pre-intervention period to a duration of 18 years, spanning from 1961 to 1979. The treated unit in this context is Nicaragua, and the event of interest is the occurrence of the Sandinista revolution in 1979. The synthetic counterpart is constructed using a reservoir of comparison units that did not experience a revolution or civil war during the pre-intervention period (1961-79).

The applicability of the synthetic control method to this specific case study is well-founded since a revolution can be regarded as an event occurring at an aggregate level and significantly impacting the administrative branch of an area of interest (Abadie, Diamond, and Hainmueller 2010).

The empirical analysis is carried out drawing on the R package *synth* allowing for a smooth application of the synthetic control method in a statistical software environment (Abadie, Diamond, and Hainmueller 2011).

3.3 The donor pool

The objective of the synthetic control method is to create a weighted combination of countries, fulfilling specific conditions, to closely resemble the characteristics of Nicaragua prior the outbreak of the civil war in 1979 (Abadie, Diamond, and Hainmueller 2010). As previously mentioned, the donor pool serves as a reservoir of potential comparison units, acting as a buffer to properly isolate the impact of an event on the treated unit's characteristics (Abadie, Diamond, and Hainmueller 2015).

To construct a feasible donor pool for this case study, it is essential to ensure that the countries included have not been affected by a revolution or civil war during the period from 1961 to 1979. Concerning the donor selection process, the study relies on the work of Collier and Hoeffler (1998), which provides a list of countries unaffected by civil wars between 1960 and 1992. This list is based on the operational definition of civil war by Singer and Small (1994), which outlines specific conditions that must be fulfilled by a conflict to align with such rationale. These include government participation, a minimum threshold of fatalities, and the occurrence within the country's political borders.

Upon applying this filter, the donor pool consists of 38 countries,³ which may appear extensive compared to the developers' recommendation of a more selective approach to avoid overfitting (Abadie, Diamond, and Hainmueller 2015). This is a concern when the characteristics of the treated unit are artificially matched with idiosyncratic variations in a large sample of unaffected units. Nevertheless, other studies in the literature, such as the analysis conducted by Bilgel and Karahasan (2019), have successfully used a wide donor pool comprising 73 control countries without generating bias. In summary, the construction of the donor pool involves careful consideration of countries unaffected by the event of interest. Despite the larger size of the pool in this case study, the literature suggests that a well-managed donor pool can yield reliable results without significant bias.

³ Argentina, Australia, Austria, Bolivia, Canada, Chile, Cameroon, Costa Rica, Denmark, Ecuador, Finland, France, Gabon, Ghana, Greece, Honduras, Israel, Italy, Japan, Kenya, Madagascar, Mexico, Malaysia, Niger, Nigeria, Norway, Nepal, Panama, Papua New Guinea, Senegal, Sierra Leone, Spain, Sweden, Syrian Arab Republic, Togo, Thailand, Uruguay, Venezuela.

4. Results

Presenting and discussing the results, firstly, the analysis lists the countries comprising the donor pool along with their respective weights describing the theoretical version of Nicaragua. Secondly, it displays a graph comparing the growth trajectories of Nicaragua with its synthetic counterpart.

The second column of Table 1 displays the weights assigned to each country in the donor pool. These values indicate the contribution of each comparison unit to the construction of the synthetic counterpart for Nicaragua. It is essential to interpret these values as composition ratios, where the sum of all weights equals 1.

As shown in Table 1, the countries with the highest weights (in bold) in the donor pool are Gabon (0.031), Honduras (0.437), Kenya (0.230), Panama (0.011), Papua New Guinea (0.090), Togo (0.024), and Venezuela (0.094). Notably, Honduras emerges as the major contributor, accounting for 43.7% of the construction of synthetic Nicaragua. This is attributed to the similarity between the histories of Honduras and Nicaragua, who both experienced Spanish colonisation and similar rent-seeking institutions negatively affecting their economic development (Clegern 2023). This institutional affinity is further emphasised in Table 2, which demonstrates a high degree of accuracy in matching the macroeconomic and development fundamentals of the two countries. The geographical composition of the other countries in the donor pool, primarily from Sub-Saharan Africa and Central-South America, is also expected. This alignment is closely linked to political economy, as Nicaragua, during the pre-treatment period (1961-79) and even before, was governed by a kleptocratic regime—a common characteristic among many developing countries in the Caribbean, Central-South America, and Africa (Acemoglu, Verdier, and Robinson 2004). This condition is a consequence of the lack of institutional development, which stems from the legacy of colonialism (Acemoglu and Robinson 2012). Consequently, the synthetic control weights follow a converging path with respect to Nicaragua's pre-revolutionary institutional architecture as well as socio-economic features.

Table 1. Synthetic control weights for synthetic Nicaragua

Country	Synthetic Control	Unit
Argentina	0.002	1
Australia	0.002	2
Austria	0.002	3
Bolivia	0.003	4
Canada	0.002	5
Chile	0.003	6
Cameroon	0.006	7
Costa Rica	0.000	8
Denmark	0.002	9
Ecuador	0.004	10
Finland	0.001	12
France	0.002	13
Gabon	0.031	14
Ghana	0.003	15
Greece	0.002	16
Honduras	0.437	17
Israel	0.002	18
Italy	0.002	19
Japan	0.002	20
Kenya	0.230	21
Madagascar	0.005	22
Mexico	0.003	23
Malaysia	0.005	24
Niger	0.004	25
Nigeria	0.004	26
Norway	0.002	27
Nepal	0.003	28
Panama	0.011	29
Papua New Guinea	0.090	30
Senegal	0.004	31
Sierra Leone	0.004	32
Spain	0.002	11
Sweden	0.002	33
Syrian Arab Republic	0.004	34
Togo	0.024	35
Thailand	0.000	36
Uruguay	0.002	37
Venezuela	0.094	38

Source: Author's own calculation

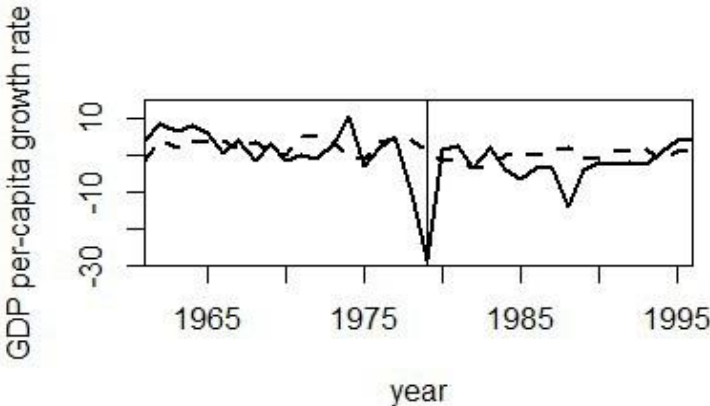
In Table 2, the value ranges taken by the countries in the donor pool for each variable of the model are presented to facilitate a comparison with Nicaragua. The information provided demonstrates a reliable resemblance between the path taken by each country and Nicaragua during the pre-intervention period. An outlier is Venezuela’s inflation rate, which exhibits an extremely larger upper value compared to Nicaragua’s. However, removing Venezuela from the comparison units set does not significantly impact the results, thereby rejecting concerns of idiosyncratic bias (Abadie, Diamond, and Hainmueller 2015).

Table 2. Values range taken by the variables of the model: Synthetic Nicaragua’s contributors vs. Real Nicaragua

Country	GDPpc%	Education	Inflation	Life Exp	Trade%GDP	Frt%
Gabon	-25.79-36.84	14.57-49.22	-11.69-36.12	39.95-61.23	62.48-145.35	4.46-5.72
Honduras	-4.35-7.17	12.56-36.46	1.09-33.97	46.95-69.30	44.24-98.82	4.53-7.45
Kenya	-10.59-17.92	16.64-41.12	-0.17-45.98	47.00-59.08	47.70-74.57	5.40-8.13
Panama	-15.21-10.38	37.49-63.51	-0.06-16.26	61.37-74.29	91.87-156.00	2.83-5.84
Papua New Guinea	-5.97-15.26	7.14-12.76	2.85-23.16	42.35-60.69	44.12-107.80	4.65-6.27
Togo	-17.00-12.31	6.95-31.66	-3.52-39.16	40.94-55.88	55.23-140.86	5.66-7.28
Venezuela	-10.81-7.19	46.21-56.81	18.9-112.5	67.84-71.17	30.71-59.63	3.02-4.29
Nicaragua	-10.58-10.72	16.94-30.17	2.81-27.02	47.68-57.78	47.96-71.68	6.33-7.26

Source: Author’s own calculation

Figure 1. Trends in GDP per capita growth rate: Synthetic Nicaragua (dashed line) vs. Real Nicaragua (solid line)



Source: Author’s own calculation

Figure 1 depicts the comparison between the trends of GDP per capita growth in Nicaragua and its synthetic counterpart. To interpret the results, we will consider the dashed line (synthetic component) as if the Somoza dynasty were still in power, inefficiently administering the country (Acemoglu, Robinson, and Verdier 2004). First, it needs to be assessed if the path of Nicaragua is well resembled by its synthetic counterpart during the entire pre-intervention period, which ends in 1979 (indicated by the vertical line). The literature recommends a graphical evaluation, where the dashed and solid lines should closely match or follow the same trend throughout the pre-revolutionary period (Abadie, Diamond, and Hainmueller 2015). As shown in Figure 1, Nicaragua is well resembled by its synthetic counterpart. The dashed line accurately tracks the trend of GDP per capita growth across the time series (1961-78).

The second graphical requirement is that the two lines should significantly diverge in the aftermath of the critical event, which in this case is revolution (Abadie, Diamond, and Hainmueller 2010). As shown by Figure 1, such condition is met. Indeed, after the 1979 revolution, Nicaragua's GDP per capita growth sharply deviates from its synthetic counterpart. The largest divergence point occurs in 1979 when the value plummets to -30%. However, after the revolution, the trajectory of the two lines seem to converge between 1980 and 1983. From 1984 onwards, they start diverging again.

Upon taking over the Somoza dynasty, the Sandinistas promptly implemented agrarian and education reforms, which were crucial for the country's recovery after experiencing a kleptocratic regime and a revolution. Figure 1 illustrates that after the revolutionary guerrilla ended, the GDP per capita growth dropped to -30%. The solid line representing synthetic Nicaragua shows that if the revolution had not occurred, the GDP per capita growth rate in 1979 would have been +2%. This indicates that revolutions entail unavoidable social and economic costs (Roemer 1985). However, in the period from 1980-83, an opposite trend emerges, with the solid line above the dashed line throughout this period. This implies that Nicaragua's economic performance under the Sandinistas outperformed the hypothetical scenario where the Somozas remained in power. This result supports the study's hypothesis according to which the revolutionary policies had a positive impact on growth. The main driver of

this positive performance is likely to be the agrarian reform, which redistributed wealth by liberalising land areas previously owned by the incumbent elite (Nietschmann 2023). Health system and education reforms may also contribute to growth in the long run, potentially attracting foreign direct investment through a spillover effect (Blomström and Kokko 2003).

However, during the period 1983-94, the graph indicates that synthetic Nicaragua outperformed its real counterpart. This suggests that the country, under the rule of the Sandinistas, exhibited worse performances compared to the hypothetical scenario of a continued Somoza rule. This negative trend peaks during the 1984-87 period, marked by the intensification of the contra war. The negative impact on GDP per capita growth is largely attributed to the US intervention, which led to the disruption of means of production and widespread humanitarian emergencies. The civil war had a detrimental effect on Nicaragua's already fragile economy and hindered the Sandinistas' development-oriented policies. Even after the end of the civil war in 1990, the contra war's negative effect continues to propagate, persisting until 1994.

4.1 Robustness checks

The statistical tool used to assess the robustness of the model is the MSPE (Mean Squared Prediction Error). This index of dispersion measures the accuracy of the predictions made by the synthetic control method. Specifically, it calculates the mean squared prediction error of the outcome variable, which in this case is the GDP per capita growth rate, over the pre-intervention period (1961-78). The synthetic control method aims to minimize this index through an optimisation process (Abadie, Diamond, and Hainmueller 2010).

The MSPE value obtained in this study is 30.064.⁴ While there is no specific threshold value provided in the literature to determine the reliability of the study, the magnitude of the MSPE in this case is considered not significant, especially considering the large panel data used for the analysis. This suggests that the synthetic control method provides a reliable estimation of the impact of the Sandinista

⁴Source: Author's own calculation.

revolution on Nicaragua's GDP per capita growth rate.

5. Conclusion

This study investigates the impact of the Sandinista revolution on Nicaragua's economic growth. The main findings indicate that the revolutionary guerrilla in 1978-79 had a significant negative effect on GDP per capita growth, which would not have occurred under the previous Somoza regime. However, the study shows that the initial period of the Sandinistas' government showed positive outcomes, both in terms of social and welfare improvements (such as fighting illiteracy and enhancing health assistance) as well from an economic perspective (through the agrarian reform and wealth redistribution). These policies contributed to a positive impact on economic growth, which persisted until the escalation of the contra war in 1984-87.

It is intriguing to ponder what might have happened if the contra war had not taken place. Perhaps Nicaragua could have had a chance for further socio-economic development. However, the Sandinista revolution eventually faced challenges and was considered a failure, as evidenced by the party's defeat in the first free election in 1990, largely due to the economic recession caused by the US-promoted civil war (Nietschmann 2023; Zaremba 1992).

To strengthen the validity of the results obtained through the synthetic control method, an additional approach such as a placebo study could be employed. This robustness check would aim to explore whether there were other determinants, aside from the revolution, contributing to the significant disparity observed between synthetic Nicaragua and its real counterpart during the period of 1978-79 (Abadie and Gardeazabal 2003). Incorporating such an extension could provide valuable insights for future research in this area.

Overall, this study sheds light on the complex dynamics of revolution and its effects on economic growth, and offers a basis for further investigations to deepen the understanding of the historical and economic factors at play in Nicaragua's development.

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Appendix of data sources

- **GDP per capita growth** (annual %): “Annual percentage growth rate of GDP per capita based on constant local currency [...]”.
<https://data.worldbank.org/indicator/NY.GDP.PCAP.KD.ZG>
- **School enrolment in the secondary school** (% gross): “Gross enrollment ratio is the ratio of total enrollment, regardless of age, to the population of the age group that officially corresponds to the level of education shown”.
<https://data.worldbank.org/indicator/SE.SEC.ENRR>
- **Inflation** (annual %): “Inflation [...] reflects the annual percentage change in the cost to the average consumer of acquiring a basket of goods and services that may be fixed or changed at specified intervals”.
<https://data.worldbank.org/indicator/FP.CPI.TOTL.ZG>
- **Life expectancy at birth:** <https://data.worldbank.org/indicator/SP.DYN.LE00.IN>
- **Trade** (% of GDP): “Trade is the sum of exports and imports of goods and services measured as a share of GDP”.
<https://data.worldbank.org/indicator/NE.TRD.GNFS.ZS>
- **Fertility rate:** “[...] represents the number of children that would be born to a woman if she were to live to the end of her childbearing years and bear children [...]”. <https://data.worldbank.org/indicator/SP.DYN.TFRT.IN>