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GOODBYE SALAZAR: THE IMPACT OF THE CARNATION REVOLUTION ON LIVING CONDITIONS

ANDREW EMANUEL MEDEIROS

Work project carried out under the supervision of:

Luciano Amaral
Nova School of Business and Economics

João Pereira dos Santos
Nova School of Business and Economics

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Abstract

The Carnation Revolution saw Portugal's *Estado Novo* end via a military coup. This was followed by a critical period of instability that halted its past decades of economic growth. Was the decline in economic standards countered by the impact of social policies in living conditions? To weigh this impact we use the synthetic control method, mapping out data from similar OECD nations. We find that life expectancy and human capital increased more than its synthetic counterfactual, while fertility and marriage rates increased in the short-run (but declined after/in the 1980s) and age at childbirth declined in the late 1970s.

Keywords: Economic History, Synthetic Control Method, Portugal, *Estado Novo*, Societal Development, Comparative Economics.

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1. Introduction

When a longstanding conservative dictatorship ends, what happens to the populace? Are they blessed with freedoms they had demanded for sometime; is their nation racked with instability; are they better off than they were? As examined by Zak and Feng (2003) the rate that a regime may fall is determined by their policies on the political-economic environment. Portugal's *Estado Novo* was founded upon an authoritarian corporatist regime that spanned nearly forty years, seeing its end via a military coup on April 25th, 1974. This regime was characterized by censorship, repression, and political corruption. The coup, dubbed the Carnation Revolution, was followed by a critical period of instability. One of the key goals of the revolution was to improve the living conditions, such as life expectancy or social mobility, of Portuguese citizens. In the decades leading up to the revolution, Portugal was a largely agricultural country with a low standard of living as shown in Lains et al. (2007). The *Estado Novo* regime, as described in Corkill (2003), had implemented policies that favoured economic growth during a period when welfare was the focus of European nations. As a result, many Portuguese citizens were living in poverty and lacked access to basic services such as education and healthcare. Upon the fall of the regime, Portugal was rocked by instability based on political as well as economic turbulence from the sudden shock of the past regime's collapse and the cessation of their previous mechanisms and stances: From the end of the colonial wars that brought hundreds of thousands of *retornados* as well as the end to the trade with the colonies; to the spurts of political violence that caused many in Portugal to fear a potential communist take-over and thus causing vast capital flight as examined by Bohnet and Santos (2022). These many shocks to the nation halted its past decades of growth higher than that of its European peers. This period of economic loss was however met with a period of vast democratization of society as well as a period where the Third Portuguese Republic attempted to catch up to other Western European nations' welfare states. Was the

decline in economic standards by the Carnation Revolution countered by the following social policies instituted in their impact on societal factors?

Mapping out this kind of comparative economics to analyze the treatment effect while maintaining stringent mathematical and analytical groundwork can be challenging because of the presence of pre-existing trends and other external factors that may have influenced the outcomes of interest. Therefore, it is important to use a method that can effectively control these factors and isolate the specific effects of the revolution on various social and economic outcomes. One such method is the synthetic control method, which has been widely used in comparative case studies to analyze the effects of interventions on various outcomes. The synthetic control method was created by Abadie and Gardeazabal (2003) as a means to evaluate the effects of an intervention in comparative case studies. These studies would see the method allow for one to compare a "synthetic" case (in which the intervention never occurred) versus the real case, seeing the difference between the two in the post-treatment period as the "treatment effect". This is done by contributing large time series datasets (ensuring there is enough time before the intervention as well as after it) with multiple nations similar to the treatment nation, however, they cannot have gone through a similar treatment: To construct a donor group to forecast the synthetic nation. By comparing the actual outcomes in the treated group (in this case, Portugal) with the synthetic control group, we can estimate the specific effects of the intervention on the outcomes of interest.

To apply the synthetic control method to the study of the effects of the Carnation Revolution, we first need to identify a group of control units that are similar to Portugal in the pre-revolution period. These control units can be other countries or regions that have similar economic and social characteristics to Portugal before the revolution: In this case, we shall be using OECD member nations. Next, we need to collect data on a set of relevant outcomes, such as GDP per capita, life expectancy, other economic data, and other social variables, for

both Portugal and the control units.

Once we have this data, we can use the synthetic control method to estimate the counterfactual outcome of the Carnation Revolution on these outcomes. This involves constructing a synthetic Portugal using a weighted combination of the control units, where the weights are chosen to minimize the difference between the pre-revolution outcomes in synthetic Portugal and the actual outcomes in Portugal. The estimated counterfactual outcomes can then be compared with the actual post-revolution outcomes in Portugal to evaluate the effects of the revolution on the living conditions of Portuguese citizens.

The main issues faced by this method relate to how the counterfactual compares against the actual evolution of society under the Third Portuguese Republic. To ensure a more accurate counterfactual we are mapping out data from similar OECD nations that were members prior to 1974; while also removing Spain and Greece due to both having faced similar treatments to the Portuguese revolution. These donor nations will be analyzed below using data from the OECD; the World Bank; the Penn World Table; and specific economic history papers, with data that spans between 1950 to 1992. The reason behind its ending in 1992 is to ensure the counterfactual is not impacted by the formation of the European Common Market on January 1, 1993.

The synthetic control method has been used to measure the effects of such shocks as: German Reunification by Abadie (2015), the Cuban Revolution by Geloso and Palvik (2020), the growing integration in Europe by Campos et al. (2019), and the impact of Brexit by Born et al. (2019). We will contribute to literature of this nature, one on democratic transitions, so that we can examine the socioeconomic effects using a rigorous casual method: Not solely on the economic impacts as seen in past research by Amaral et al. (2022). By using the synthetic control method, we can effectively control for pre-existing trends and isolate the specific effects of the revolution on various social and economic outcomes. This allows us to gain a

more accurate understanding of the impact of the Carnation Revolution on the lives of ordinary Portuguese citizens. Additionally, by comparing the synthetic control method with other methods, we can evaluate the strengths and limitations of each approach and determine which method is most appropriate for analyzing the effects of the Carnation Revolution.

2. Motivation

2.1. Portuguese Standards of Living Prior to the 1974 Revolution

Prior to the 1974 revolution in Portugal, the standard of living for many citizens was relatively low. Portugal up until the 1960s was a largely agricultural country with a low level of economic development, as seen in Lains et al. (2007) when looking at employment rates by sector and GDP growth by sector. The authoritarian regime in place implemented policies throughout its governance that favoured economic growth, adopting weak social programs in its later years due to internal pressures. As a result, many Portuguese citizens lived in poverty and lacked access to basic services such as education and healthcare.

As examined by Amaral (2019) the economy was in a golden age for growth, while for most of its existence inequality increased (only towards its end did it not). This rise was prescribed to how the regime took a hard pro-business and anti-labour stance, as stated by Amaral (2019) in page 216: “...labor regulation had the essential purpose of containing labor demands within a tight straightjacket.”. Later, there was a slight opening to some labour demands that relieved some pressures, however, Amaral (2019) still argues the regime was still far behind that of other Western European nations.

Even in this golden age of economic growth for Portugal according to World Bank data, in 1970, Portugal's GDP per capita was $934.1, which was much lower than the average for Western European countries at the time. This low level of economic development can be attributed to a number of factors, including the country's reliance on

agriculture and its lack of access to modern technologies and markets due to its pariah status on the world stage for possessing colonies. Additionally, the distribution of income was highly unequal, with a significant portion of the population living in poverty. Lains et al. (2007) examine how in 1970, the poverty rate in Portugal was estimated higher than in other Western European nations due to the urbanization and industrialization seen in the 1950s to 1974.

Amaral et al. (2021) examine using the synthetic control method on the GDP per capita of Portugal in relation to the Carnation Revolution and conclude that the revolution and the many shocks that followed it made GDP per capita lower than it would have been without the revolution. This treatment effect poses insights regarding the economic side, one the regime heavily favoured over social factors. However, regarding the social factors other literature shows what was sacrificed to achieve this; primarily how while the economy appeared to flourish, inequality followed suit.

Lains et al. (2007) delve into this period of inequality during a time of economic growth; seeing it in line with an inverted-U Kuznets' curve with the peak located in 1959. Their analysis argues that this growing social pressure around wage inequality became one of the factors behind the coup d'etat.

Furthermore, access to education and healthcare was limited for many Portuguese citizens. Amarao (2018) argues how the *Estado Novo* regime implemented policies that prioritized economic growth over the welfare of the population, leading to inadequate funding for education and healthcare. However, there still was a major push by the regime to address the large illiteracy rate the country faced. As examined by Palma and Reis (2021) who argue it did not mainly rise due to government policies, but because of a shift of values in the family.

Overall, prior to the 1974 revolution, the standard of living for many Portuguese

citizens was relatively low compared to other Western European countries. The authoritarian regime in place implemented policies for some time that focused heavily on an authoritarian corporatist economic policy while also pushing for conservative Catholic social principles and self-reliance in the populace. These kinds of mechanisms of governance greatly differed from democratic states in Western Europe. However, the revolution that took place in 1974 marked the end of the *Estado Novo* regime and led to the worsening of GDP per capita as shown in Amaral et al. (2022).

2.2. The *Estado Novo* Regime Stance on the "Welfare State"

The *Estado Novo* regime for some time had a negative stance toward the concept of the welfare state. The welfare state is a system in which the government provides social services and support to citizens, such as healthcare, education, and unemployment benefits. The *Estado Novo* regime, on the other hand, focused more on policies regarding economic growth than that of welfare of the general population. Ferrinho et al. (2006) argue that this stance lasted until the regime admitted it needed to address these responsibilities post-World War Two.

One of the key reasons that the *Estado Novo* regime was opposed to the welfare state was its emphasis on traditional values and social hierarchy. The regime was authoritarian, and conservative, and believed that individuals should be responsible for their own well-being. This meant that the government did not see it as its responsibility to provide support for citizens who were unable to provide for themselves. For example, the regime implemented policies that limited access to education and healthcare for a period of time, relying on the private sector to provide these services. Only women who received higher education were able to vote, compared to men who only needed to be literate.

Additionally, the Estado Novo regime was concerned with maintaining control over the economy and preventing the development of a powerful labour movement. For

example, the government allocated little funding for education and healthcare and relied on the private sector to provide these services. This allowed the regime to maintain control over the economy and prevent the development of a strong labour movement that could challenge its authority.

As examined by Ferrinho et al. (2006), the regime went through two waves of reforms: in 1945-1968 when they acknowledged their responsibilities for healthcare, and in 1968-1974 when primary healthcare began to emerge. Ferrinho et al. (2006) state that in the post-war period the regime realized the sanitary position was poor and that the private health sector was not enough to address it, saying in page 299: "...improving maternal and child health, tuberculosis control, leprosy control, malaria eradication and treatment of psychiatric diseases." This, Ferrinho et al. (2006) explains, was undertaken by building more hospital facilities across the nation and the formation of a ministry of health and welfare in 1958. However, Ferrinho et al. (2006) argues this was not to the level demanded by the public and was seen as merely a means to calm down the growing criticism of the lack of state assistance. The period spanning from 1968-1974 mainly saw the reforms as a political softening of the regime under Marcelo Caetano. In an attempt to address how there were no concrete goals or structure for health policy in the nation, primarily being dependent on different non-connected ministries. The reforms included the organization of hospitals in 1968, the office for health planning being created in 1970, and the reorganization of the health ministry in 1971 to see that, with Ferrinho et al. (2006) saying in page 300: "Health was, for the first time, formally recognized as a right guaranteed by the state." In the end, however, Ferrinho et al. (2006) argue these institutions were still underfunded and lacked many important resources, only really being able to take a preventive stance on issues and promote better maternal/child healthcare: vaccinations and medical examinations.

Another paper by Amaro (2018) showed how post-World War Two democratic nations saw the adoption of welfare practices as a means of modernizing, while authoritarian states saw it far differently. The *Estado Novo* regime cared not for the socialist or liberal models of welfare and decided upon their own way of welfare. This way compared to the other models saw massive failures by the Portuguese Corporatist Social Security model in all forms. Amaro (2018) argues this in page 437 is due to Portugal being: "...unable to disconnect itself from a conservative, authoritarian and retrograde ideology…"

Overall, the *Estado Novo* regime did not see welfare as their top priority for some time. The regime's lack of prioritization slowed the potential rate of improvement for Portuguese standard of living. This contributed to the low standard of living for many Portuguese citizens prior to the 1974 revolution and was one of the factors that led to the overthrow of the *Estado Novo* regime.

2.3. The Shock of the Carnation Revolution

The shocks presented by the Carnation Revolution had a profound impact on Portuguese society and the economy. As examined by Matta et al. (2003) crises accompanied by large protests (in Portugal's case bouts of political terrorism) are usually followed by an immediate fall in the economy. This economic downfall was, however, met by the new democratic government implementing a series of political and economic reforms that aimed to improve the living conditions of Portuguese citizens. These reforms included the legalization of political parties, the introduction of free and fair elections, and the implementation of policies that promoted social justice and economic development for the general public as an attempt to catch up with other democratic nations.

Additionally, as argued in Lains et al. (2007) the economy shifted from being primarily agricultural to being more diversified, with a focus on industries such as tourism

and technology that can still be seen in contemporary Portugal. This push for economic modernization was now also preceded by the modernization of social policies. For healthcare Ferrinho et al. (2006) see the period from 1974 to 1990 as one that saw the foundation of the national health service, which is still in place in contemporary Portugal: This saw the enforcement of healthcare standards as well as the accessibility of health services to the general public. Seen by Ferrinho et al. (2006) in page 302 as "...a period of extraordinary progress in the field of health care, leading to increased access and equity." Though, towards the end Ferrinho et al. (2006) argue it faced issues regarding rapidly increasing health budgets.

The major issue of literacy in the Portuguese public, which was previously one of the main social concerns that the *Estado Novo* held, also saw reforms. These reforms examined by Gomes et al. (2015) spanned between 1974 to 1977 (called *Revolutionary Period in Progress*), seeing it help tackle gender inequality (with it greatly aiding older women) as well as poverty. The newly formed government saw to reaching into the countryside to address this via multiple campaigns/organizations as broken down in page 71 of Gomes et al. (2015): the National Pro-Union of Portuguese Students in the summer of 1974; the Armed Forces Movement (MFA) in the autumn of 1974 to the summer of 1975: the Ministry of Education and Culture in the spring of 1975 to 1977: and the Union of Communist Students (UEC) in the summer of 1976. These programs saw a drop of an illiteracy rate of 26 percent in 1974 to an illiteracy rate of 21 in 1981, and later an illiteracy rate of 12 percent in 1991 when looking at World Bank data.

One possible key effect of the Revolutionary Period in Progress brought after the Carnation Revolution was the increased involvement of citizens in the political process. Prior to the revolution, the *Estado Novo* regime had implemented policies that suppressed political opposition and suppressed free speech. However, following the revolution,

citizens were able to participate in the political process and express their opinions freely. Gomes et al. (2015) argue in page 78 that this worked alongside the literacy push to also benefit citizens by exposing "...the extremely high levels of poverty and lack of basic resources and infrastructures that characterized especially the rural world." This then, as argued by Gomes et al. (2015), led to the development of a more democratic and inclusive political system in Portugal. Possibly contributing to a more stable and prosperous country.

A sole major shock coming from the end of the Estado Novo, and with it the Portuguese colonial empire, was the *retornados* (Portuguese settlers returning from Africa following the decolonization process). The hundreds of thousands that returned to Portugal and their legacy has spurred many papers looking into many factors/impacts surrounding them; we shall be focusing on the papers by Lubkemann (2003); Carrington and Lima (1996); and David (2015). Lubkemann (2003) examines via forty in-depth interviews how the lives of the *retornados* were racked with difficulties right when they arrived due to the poor economic position Portugal found itself in right after the revolution. From housing to jobs there were more labourers than openings for them, seeing that Portugal's population increased by 5 percent within one year due to the mass influx. Carrington and Lima (1996) saw the 10 percent increase in the labour force due to the *retornados* as one that was relatively stamped out due to a European-wide labour market downturn. Carrington and Lima (1996) argue there was however an adverse effect on Portuguese salaries due to the increase in cheap labour, due to how the *retornados* were desperate for work. Lastly, David (2015) looks into how the approximate five hundred thousand *retornados* faced a unique sense of disregard by the society they returned to. Which, when considering the scale of the influx, David (2015) argues represents a noticeable portion of the population receiving potentially lower standards of living.

Overall, the shocks brought on by the Carnation Revolution had a significant impact on the lives of Portuguese citizens. The end of the authoritarian regime led to the adoption of new laws and policies that improved the standard of living for many people and increased the accessibility to many types of social programs that the public demanded for some time. It, however, also saw the short-term worsening of the overall economy alongside an increase of stress on the newly formed social programs. While also a section of the population, the retornados did not receive a boost in living standards compared to their fellow compatriots. These are just a few of the many shocks seen after the Carnation Revolution that are covered in research papers, however, few delve into the topic utilizing the synthetic control method. Only Amaral et al. (2021) use the method, but only in regard to economic outcomes.

3. Methodology

3.1. The Synthetic Control Method as a Comparative Tool for Historical Economics

The synthetic control method is a statistical technique used to evaluate the effectiveness of an intervention or policy on an outcome variable. It is commonly used in economics to assess the impact of a policy or treatment on a particular group or region. The basic idea behind the synthetic control method is to create a "synthetic" control group that closely matches the treated group in terms of its characteristics and trends in the outcome variable prior to the intervention. This synthetic control group is constructed using a weighted average of the untreated groups, with the weights chosen to minimize the difference between the treated group and the synthetic control group in terms of their pre-intervention characteristics and trends in the outcome variable.

To construct the synthetic control group, the weights for each untreated group are chosen to minimize the difference between the treated group and the synthetic control

group in terms of their pre-intervention characteristics and trends in the outcome variable. A simplification of the method explained in Abadie (2021) is as follows:

We have J observations (in this instance certain OECD members) over T time periods (from 1960 to 1992), let y_{it} be the outcome variable for group i at time t, where i is the group index and t is the time index. Let T be the time of the intervention (the Carnation Revolution of 1974) and w_i be the weight assigned to group i in the synthetic control group. The synthetic treatment period is then constructed using the following formula:

$$a_{it} = Y_{it} - Y_{it}^{N}$$

it is the treatment effect for unit i at time t. Y_{it}^{N} is the outcome when there is no treatment.

We then impose the following structure:

$$Y_{it}^{N} = \delta_t + \theta_t Z_t + \lambda_t \mu_t + \varepsilon_{it}$$

and we then assume there may be optimal weights to assign (w_2,..., w_J), so

$$Y_{1t}^{N} = \Sigma_{j=2}^{J} w_j Y_{jt}$$

for $\leqslant T_0$, the synthetic control method suggests using these weights as the means to estimate the counterfactual:

$$Y_{1t}^{N} = \Sigma_{j=2}^{J} w_j Y_{jt}$$

In summary, the synthetic control method involves constructing a synthetic control group using a weighted average of the untreated groups and then using a difference-in-differences approach to compare the treated group's post-intervention outcome to the synthetic control group's post-intervention outcome in order to evaluate the effectiveness of the intervention.

This method will be utilized by the synth2 code in Stata (Yam and Chen, 2021). Synth2 was created by Guanpeng Yan and Qiang Chen in 2021 and automates many of the stages required in the synthetic control model, while also aiding in the visualization of the data.

3.2. "Checks and Balances" in the Synthetic Control Method

To ensure a high level of robustness in a method that is open to researcher bias, due to how we decide on many of the data points utilized in the method there are multiple validity checks established: The two primary ones being the in-space placebo test and the in-time placebo test. With the in-space placebo test, we are able to test the true significance of the intervention if we see the magnitude of the placebo is extremely relative to the synthetic's magnitude and trajectory: Abadie (2021) explains this is done by attributing numerical significance by calculating the p-values, which tell us the probability of finding similar results for another unit. The in-time placebo test is used when there are doubts about the true significance if a similar or larger impact is seen for different time periods (not the treatment period): Abadie (2021) shows that this is done by imposing the intervention to occur at another date, if no impact is seen then the date decided for the intervention is appropriate.

The contextual requirements for using this method that has been established by Abadie (2021) are: the size of the effect and volatility of the outcome; availability of a comparison group; no anticipation of the treatment; no interference; convex hull condition; and time horizon. For the size of the effect and volatility of the outcome, Abadie (2021) argues it requires that we avoid utilizing outcomes that are susceptible to substantial random noise and volatility generated by common factors affecting other units. Availability of a comparison group Abadie (2021) explains is the concept that the analysis based on this method will be poor in the absence of a suitable comparison group, one of decent size that is similar to the treatment nation. No anticipation of the treatment simply means estimators may be biased if they are forward-looking, however, in the case of the Carnation Revolution it caught the general public off guard so there was no buildup of anticipation. No interference requires that the comparison nations have not undergone a

similar event (that is why we have dropped the OECD nations of Spain and Greece, as well as, have removed members that joined after 1974) to avoid spillover effects. The convex hull condition in Abadie (2021) argues that upon the construction of the synthetic model, it should be checked that the differences in characteristics of the affected units and the synthetic control are small: A potential way to address this is by transforming the outcomes to time differences, to growth rates, or measure the outcomes difference to pre-treatment means. Lastly, Abadie (2021) explains in page 412 that the time horizon states that: “The effect of some interventions may take time to emerge or to be of sufficient magnitude to be quantitatively detected in the data.”, so to address it we either wait until the effects of the intervention run their course or use surrogate outcomes or leading indicators of the outcomes.

4. Data

This paper utilizes for the synthetic control method a balanced panel sample of 22 OECD members for the period 1960 to 1992: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Iceland, Ireland, Italy, Japan, Luxembourg, Netherlands, New Zealand, Norway, Portugal (the treatment unit), Sweden, Switzerland, Türkiye, the United Kingdom, and the United States. The data for which has been collected from the OECD database; the World Bank database; the Penn World Table 10; and an economic history paper on health expenditures by Spooner (2022).

The outcome variables under examination are: life expectancy (general/male/female), human capital, , fertility rate, marriage rate, and age at childbirth. As stated previously the treatment period, the Carnation Revolution, is set in 1974. The variables used in the construction of the synthetic outcomes change due to the varying considerations of each outcome. Life expectancy (general/male/female) sees the use of the variables: alcohol consumption, health expenditure as a share of GDP, the share of

household savings at current PPPs, and welfare-relevant TFP at constant national prices (2017=1). Fertility rate sees the use of the variables: GDP per capita, the share of household savings at current PPPs, welfare-relevant TFP at constant national prices (2017=1), and the fertility rate of past years (set to 1970). It must be noted that for the in-space placebo test of the fertility rate and life expectancy the number of significant figures (sigf) had to be dropped from 7 to 5 for fertility rate, and 7 to 6 for life expectancy. This optimization allowed for the synthetic matrix to be able to be constructed, with all other outcomes having the default number of significant variables of 7. Human capital sees the use of the variables: the average annual hours worked by persons engaged, the share of household savings at current PPPs, GDP per capita, the inflation rate, and human capital of past years (set to 1970). In which the inflation rate (annual growth rate) is used as an economic determinant to address any time horizon problems. The fertility rate sees the use of the variables: GDP per capita, the share of household savings at current PPPs, welfare-relevant TFP at constant national prices (2017=1), and the past years of fertility rate (set to 1970). The marriage rate sees the use of the variables: GDP per capita, health expenditure, employment rate, the share of household savings at current PPPs, and the marriage rate of past years (set to 1970). Lastly, age at childbirth sees the use of the variables: GDP per capita, the share of household savings at current PPPs, welfare-relevant TFP at constant national prices (2017=1), premarital birth rate, and the age at childbirth of past years (set to 1970).

The contextual reasoning for the variables for each outcome is as follows: For life expectancy, the overall healthiness of the populace (alcohol consumption and health expenditure), as well as, the availability of services (household savings and welfare) are key in understanding it. For human capital one builds their value through education/experience (this being tracked using average hours worked) and the personal

wealth they have to invest in themselves (GDP per capita, inflation rate to track inflationary pressures, and their past human capital). For fertility rate, the level of wealth (GDP per capita) and the possibility of raising a child (household savings and welfare) are key factors, while also past years may influence the future (booms and busts in the past). For marriage rates, one's financial stability and well-being are key in the likelihood of starting a family (GDP per capita, health expenditure, employment rate, and household savings) and previous marriages may spur one to propose to their partner. Lastly, for age at childbirth stability again is key in the decision-making process of having a child (GDP per capita, household savings, and welfare) especially when women achieve more equality and gain the right to invest in smiles through education and careers (they delay having a child), and past experiences surrounding premarital births and others having children at certain ages may impact greatly the decision of the parents.

5. Results

5.1. Life Expectancy (Life expectancy at birth (General/Male/Female))

Figure 1A shows the general/male/female life expectancy present in both Portugal and its synthetic counterpart. We can see how in the early 1970s there was a decline and then a sudden spike in life expectancy before stabilizing again: This can be attributed to the escalation of the colonial war and the later ending of it due to the removal of the *Estado Novo* regime. Minus that brief period of volatility, the synthetic counterpart followed it closely across both genders. After the treatment period in all three groups, the synthetic counterpart fell below the actual in its integrity or almost: This is seen with the mean treatment effects of 0.8103 in general, 0.6608 for males, and 0.7327 for females. Shows a positive impact, while also showing how it aided women more, due to the previous regime's ultra-conservative values that weakened female social mobility as discussed in Gomes et al. (2015); with how the literacy campaigns across rural Portugal

greatly aided in not only educating women but also teaching standard health practices.

The donor structure of this synthetic outcome is seen in Table 1, column A. For life expectancy's synthetic outcome one nation could not be included in the synthetic control method, due to how they were missing large gaps of data for the variables used to construct the synthetic outcome: This nation was Luxembourg. The largest contributor for the general life expectancy being France, with a weight of 72.70%, followed by Türkiye with a weight of 25.3%, and Ireland with a weight of 1.9%. Both France and Türkiye share many cultural similarities with Portugal, while Luxembourg is not as similar. However, as mentioned by Ferrinho et al. (2006) from 1974 to 1990 Portuguese healthcare received multiple reforms to bring it in line with its neighbours' standards. All three donor nations had similar public healthcare institutions to that which the reforms framed themselves after.

We then utilize the in-space placebo test, seen in Figure 2A, to ensure that the results shown are actually meaningful. Looking at the figure we can see the significance the event had, when comparing the synthetic counterpart to Portugal (from 1974 and onwards, with its significance dissipating by the 1990s).

After the in-space placebo again we run the in-time placebo, setting the placebo intervention date to be 1971 to test if the treatment really does have any effect. Figure 3A shows that synthetic Portugal in all three groups still reproduces closely to the life expectancy of the new pretreatment period. Suggesting that the gap between Portugal and synthetic Portugal after 1974 is the treatment effect of the revolution: And that it is one of a positive nature.

5.2. Human Capital (An index based on schooling and returns to education)

Figure 1B shows the level of human capital present in both Portugal and its synthetic counterpart. We can see how up until around 1975 both followed the same path,

until Portugal saw a spike of progress in raising the human capital of the population, leading to synthetic Portugal to fall behind: with a positive difference of 0.0537 in 1980 and by 1992 a positive difference of 0.0665 (the mean treatment effect being 0.0263). This possibly shows the gradual progress of the reforms, discussed by (Gomes et al. (2015); and Ferrinho et al. (2006)), seen across education and healthcare finally bearing fruit. This follows the view held by Ferrinho et al. (2006) that the reforms in healthcare from 1974 to 1990 brought great access to the general public, while also improving the foundations of public healthcare for the future.

The donor structure of this synthetic outcome is seen in Table 1, column B. The largest contributor is Türkiye, with a weight of 88.6%, followed by Luxembourg with a weight of 9.4%, and Italy with a weight of 2%. These nations underwent periods of rapid social growth from the post-war period to the 1970s as their societies adopted a stronger welfare structure: Which in turn aided in raising the average human capital of their population. In Portugal, this period of rapid growth is seen between the 1970s to the 1980s. Another key aspect, especially when considering the lives of the populace, is the culture of the nation. Both Türkiye and Italy share a common Mediterranean climate and culture with Portugal.

As seen before we then utilize the in-space placebo test, seen in Figure 2B, to ensure that the results shown are actually meaningful. Again by looking at the figure we can see the significance the event had, when comparing the synthetic counterpart to Portugal (with this being more pronounced in 1975 to 1980 and 1985 to 1992).

After the in-space placebo, we run the in-time placebo, setting the placebo intervention date to be 1971 to test if the treatment really does have any effect. Figure 3B shows that synthetic Portugal still reproduces closely to the human capital of the new pretreatment period. Further suggesting that the gap between Portugal and synthetic

Portugal after 1974 is the treatment effect of the revolution: One of a positive nature as seen in the previous synthetic outcome.

5.3. Fertility Rate (Number of children born to each woman if she were to live)

Figure 1C shows the general/male/female life expectancy present in both Portugal and its synthetic counterpart. We can see how the synthetic counterpart closely follows Portugal until the treatment period of 1974: Afterwards, we see a spike in the actual fertility rate that rapidly declined to near contemporary levels, while the synthetic lowered as well but at a slower pace leading it to overtake the actual after 1974 (where the treatment effect is -0.0335): In total having a negative treatment effect, with a mean of -0.0403. These results may further support how the standard of living improved thanks to the revolution, due to the notion that has been proposed in many research papers that as factors around the standard of living improve the fertility rate declines (especially wealth and education).

The donor structure of the fertility rate is seen in Table 1, column C. The largest contributor to the fertility rate is Austria, with a weight of 59.5%, followed by Ireland with a weight of 27.7%, Japan with a weight of 8.4%, and Türkiye with a weight of 4.3%. All four nations either reached a high level of development or were nearly done with progressing to one. This development is the driver of the declining fertility rate, as seen in the famous Japanese case. The shift from the conservative authoritarian regime to an open democracy saw the liberation of women and their rights/access to education: This greatly aided their human capital as covered by Gomes et al. (2015).

Like the previous synthetic outcomes before, we then utilize the in-space placebo test, seen in Figure 2C, to ensure that the results shown are actually meaningful. We can see in the figure a noticeable significance around the late 1970s.

The in-time placebo is run again after the in-space placebo, setting the placebo

intervention date to be 1971 to test if the treatment really does have any effect. Figure 3C shows that the synthetic counterpart reproduces closely to the fertility rate of the new pretreatment period. Building off of what we saw both with human capital and life expectancy, it further suggests that the gap between Portugal and synthetic Portugal after 1974 is the treatment effect of the revolution: And that it is one of a positive nature in the standard of living, however, for fertility rate itself it is a negative one.

5.4. Marriage Rate (Crude marriage rate (per 1,000 inhabitants))

Figure 1D shows the general/male/female life expectancy present in both Portugal and its synthetic counterpart. We can see how the synthetic counterpart closely follows Portugal until the treatment period of 1974: Afterwards, we see a spike in the actual fertility rate that rapidly declined to near contemporary levels, while the synthetic lowered as well but at a slower pace leading it to overtake the actual after 1974 (where the treatment effect is -0.0335): In total having a negative treatment effect, with a mean of -0.0403. These results may further support how the standard of living improved thanks to the revolution, due to the notion that has been proposed in many research papers that as factors around the standard of living improve the fertility rate declines.

The donor structure of fertility rate is seen in Table 1, column D. As seen with the synthetic for life expectancy, some nations had to be removed due to missing data. The nations that had to be removed are: Switzerland, France, Japan, Luxembourg, Netherlands, and Türkiye. The largest contributor to the marriage rate was New Zealand, with a weight of 87.3%, followed by the United States of America with a weight of 11.6%, and Ireland with a weight of 1.1%. All three nations had levels of women's rights that the revolution in Portugal brought out to the public; through such things as allowing women to vote freely, education campaigns, and discrimination laws. New Zealand being the largest contributor supports this, being the first self-governing nation to grant women's suffrage.

Like the previous synthetic outcomes before, we then utilize the in-space placebo test, seen in Figure 2D, to ensure that the results shown are actually meaningful. From 1974 to 1980 there was an extreme spike in significance between the synthetic counterpart and Portugal.

Once more we run the in-time placebo, setting the placebo intervention date to be 1971 to test if the treatment really does have any effect. Figure 3D shows that the synthetic counterpart reproduces closely to the marriage rate of the new pretreatment period. The large spike seen in Portugal around the mid-1970s can be attributed to the fall of Estado Novo's conservative policies on marriage (opening up divorce to more people, which in turn allowed for potential new marriages). Building off of what we saw with past outcomes, it further suggests that the gap between Portugal and its synthetic counterpart after 1974 is the treatment effect of the revolution: And that it is one of a positive nature in the standard of living.

5.5. Age at Childbirth (Mean age of women at childbirth)

Figure 1E shows the age of childbirth present in both Portugal and its synthetic counterpart. We can see how the synthetic counterpart closely follows Portugal until a sharp break in 1970 that raises some concerns about its significance. In total having a negative treatment effect, with a mean of -1.2030. As shown by the past synthetic outcome results, the results from age of childbirth again show how the standard of living improved thanks to the revolution. The reasoning behind this is the elevation of women in society and their increasing social development: Women were now able to focus on their own personal education and careers. So, the treatment effect for this outcome is negative, however, it was due to the progress seen in the standards of living improving for women and men.

The donor structure of age at childbirth is seen in Table 1, column E. As seen with

the previous synthetic outcomes, some nations had to be removed due to missing data. The nations that had to be removed are: Australia, Canada, France, the United Kingdom, Japan, Luxembourg, New Zealand, and Türkiye. The largest contributor for the age at childbirth is Italy, with a weight of 65.6%, followed by Ireland with a weight of 33.4%, Austria with a weight of 0.8%, and Denmark with a weight of 0.1%. All four nations are developed states that have seen the average age at childbirth increase over time due to the development of their respective societies and the development of women's rights: Especially the two largest donors, both previously conservative Catholic nations.

After seeing the large break in the synthetic prediction, we must make sure that the placebo tests show no means for concern about the validity of the results. The in-space placebo test, seen in Figure 2E, ensures that the results shown are actually meaningful. For age at childbirth the significance has a spike and then a steady growth around 1978.

Lastly to quell any doubt the in-time placebo test shown in Figure 3E shows that the synthetic counterpart still follows very closely, until the break, with Portugal. This large break may be prescribed to the colonial war forcing many women to wait for their husbands to return from the conflict. Delaying when they would have had their child. As seen with all past synthetic outcomes, this again suggests that the gap between Portugal and synthetic Portugal after 1974 is the treatment effect of the revolution: And that it is one of an overall positive nature in regards to the standard of living (while being negative for the age at childbirth).

6. Limitations/Directions for Future Research

Comparative economics requires a high level of robustness to ensure a lack of bias not only in the results, but also in the process that was undergone to construct the results. The synthetic control method does open many possibilities to researcher bias thanks to how the researcher determines what combination to use for the synthetic outcomes.

However, we have attempted to alleviate this limitation by explaining the reasoning behind each choice of a variable while also running multiple placebo tests to assess whether there is a significant impact being detected.

However, it is important to note that our study has some limitations. For instance, we were only able to analyze the short-term effects of the revolution on living standards to avoid interference from the European Common Market, and it is possible that the long-term effects may be different. Additionally, our analysis was based on aggregate data and did not account for potential differences within Portuguese society, such as regional disparities or income inequality based on race/ethnicity/gender/religion/etc. Two variables that would have potentially proven assets to this research were not available for use: literacy rates and education spending across (the majority of) the 22 donor nations from 1960 to 1992. If a historical database is made with these variables their impact on the synthetic outcomes should be examined. Lastly, societal statistics are not as plentiful as economic for economic history analysis. If the dataset was pushed further back, to 1950 or even 1940, these extra data nodes would prove valuable in further refining the results.

7. Conclusion

The synthetic control method proved to be a valuable tool in analyzing the impact of the Carnation Revolution on Portuguese living standards. By comparing the synthetic control group with the actual post-revolution data, we were able to accurately estimate the effect of the revolution on various indicators of living standards, such as life expectancy and human capital. Our analysis showed that the Carnation Revolution had a positive impact on Portuguese living standards, leading to improvements in social wealth and overall health.

To conduct our analysis, we first identified a set of 21 potential control countries that were similar to Portugal in terms of their pre-revolution economic and demographic

characteristics; while also ensuring they have not gone through the same kind of intervention. We then used the synthetic control method to construct a synthetic Portugal from the weighted average of these control countries. This synthetic Portugal served as our counterfactual scenario, representing what we would expect Portugal's living standards to be in the absence of the revolution.

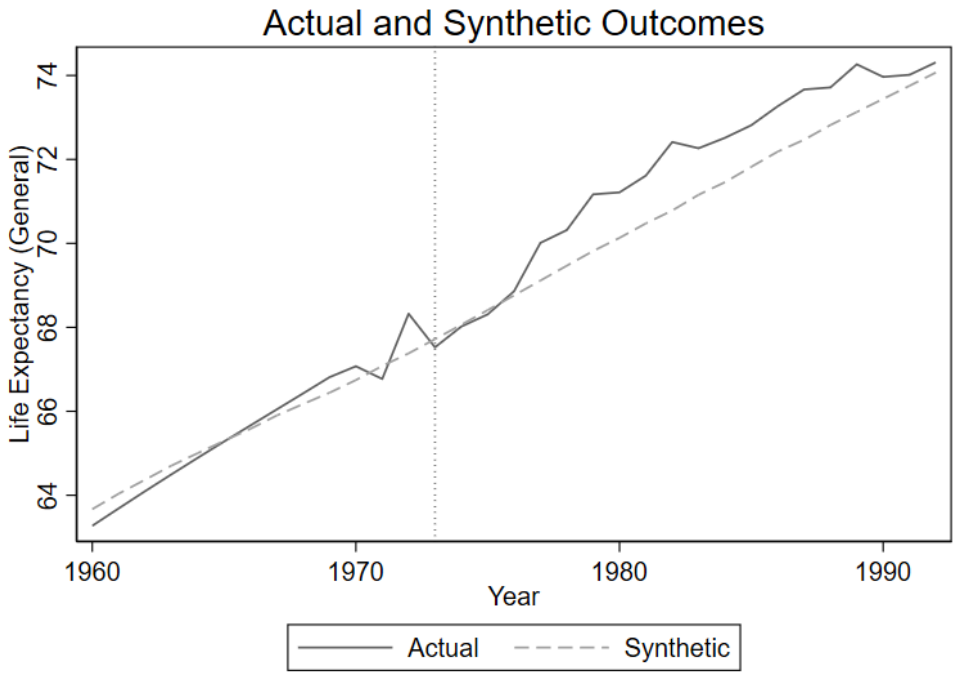
Next, we compared the actual post-revolution data for Portugal with the synthetic control group. This allowed us to isolate the specific effect of the revolution on various indicators of living standards, such as GDP per capita and life expectancy. Our analysis showed that the Carnation Revolution had a positive impact on these indicators, leading to improvements in economic equality and overall health.

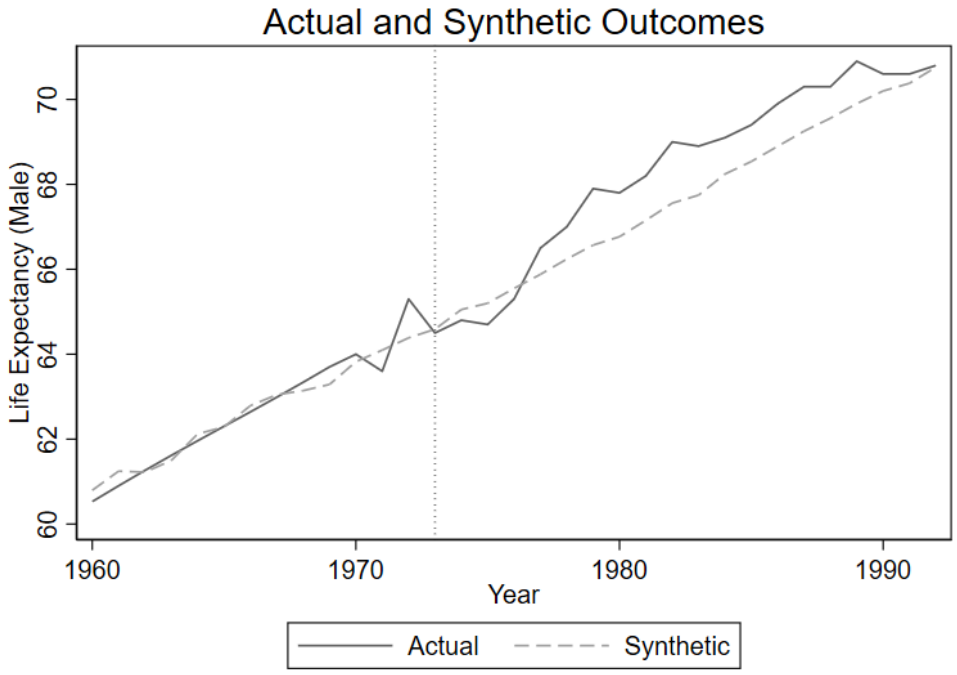
Overall, our study suggests that the Carnation Revolution had a positive impact on Portuguese overall living standards. This is seen with its positive effect on life expectancy, human capital, and marriage rate; while impacting negatively the fertility rate and age at childbirth. Without the intervention, the overall living standard seen in contemporary Portugal would be lower than it is. Further research is needed to fully understand the long-term effects of the revolution on Portuguese society and better construct synthetic control models to analyze it more precisely.

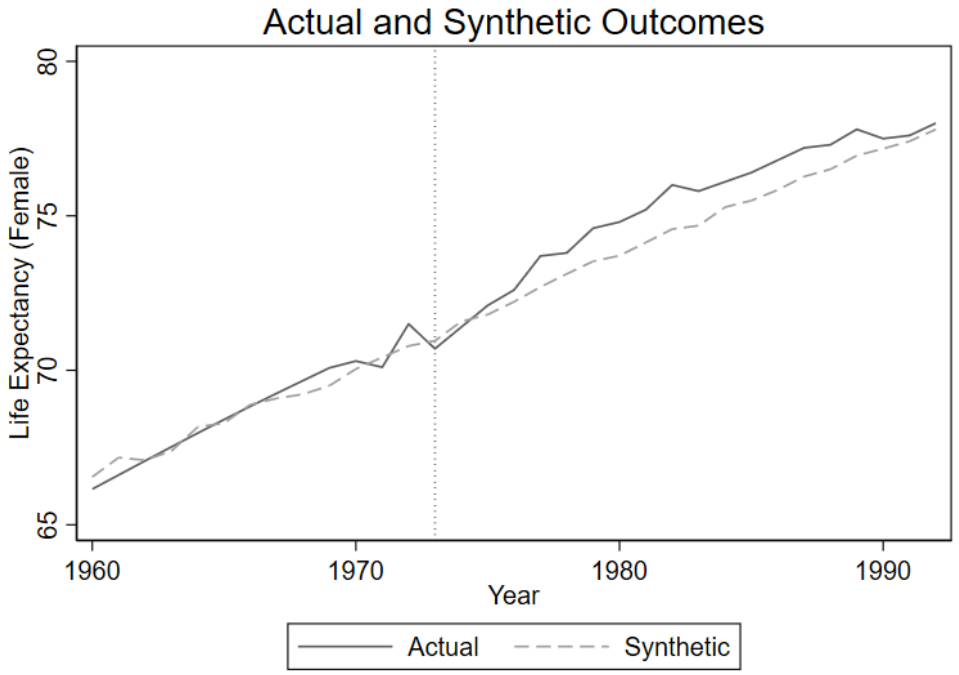
Figures

Figure 1: Predictions

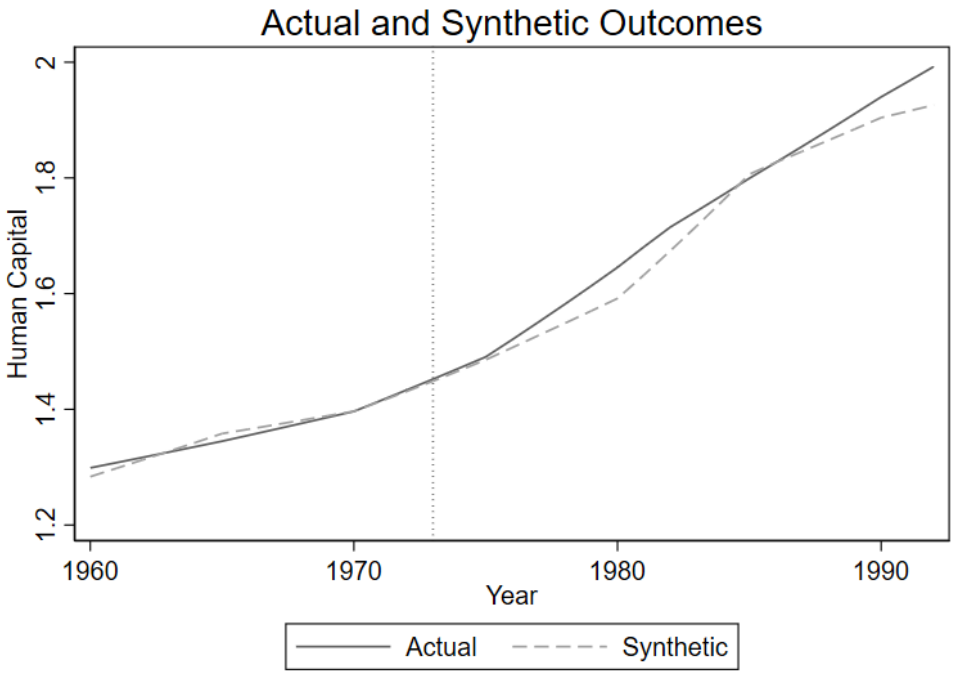
A) Life Expectancy (General/Male/Female)



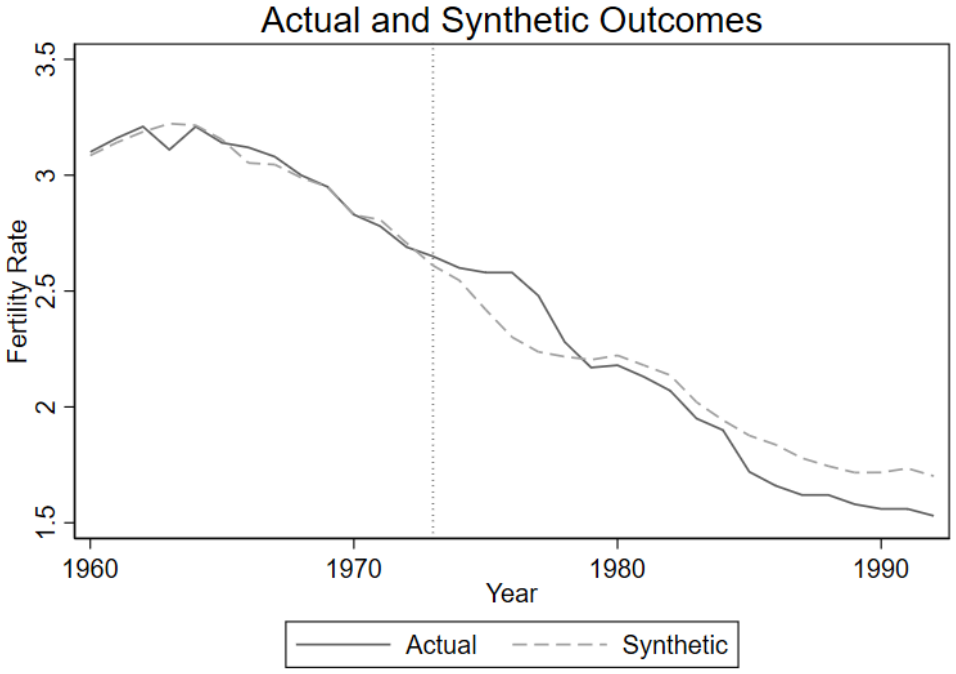




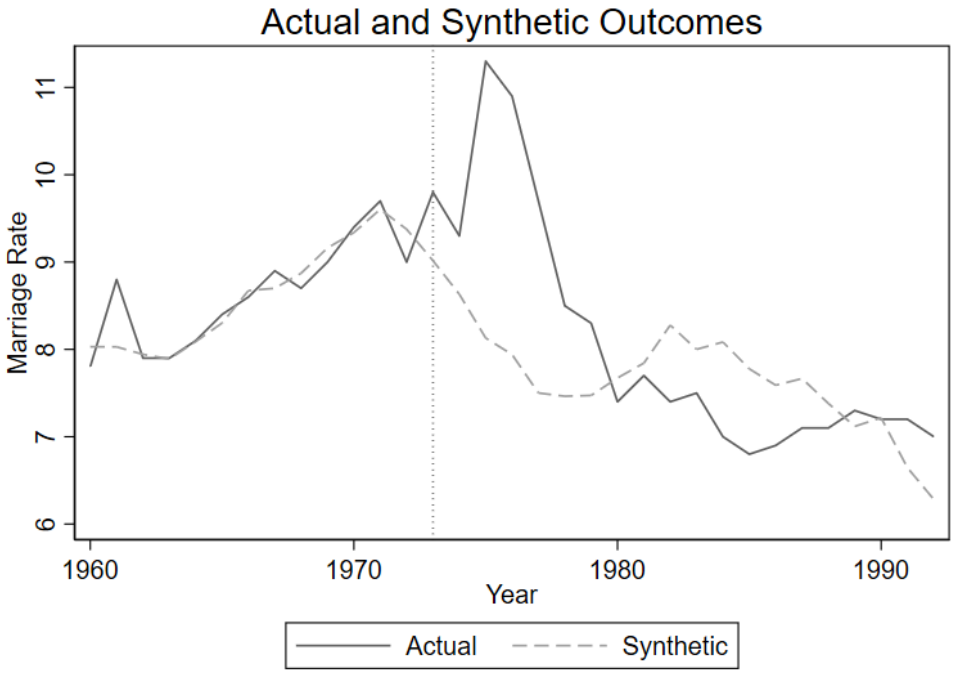
B) Human Capital



B) Fertility Rate



D) Marriage Rate



E) Age at Childbirth

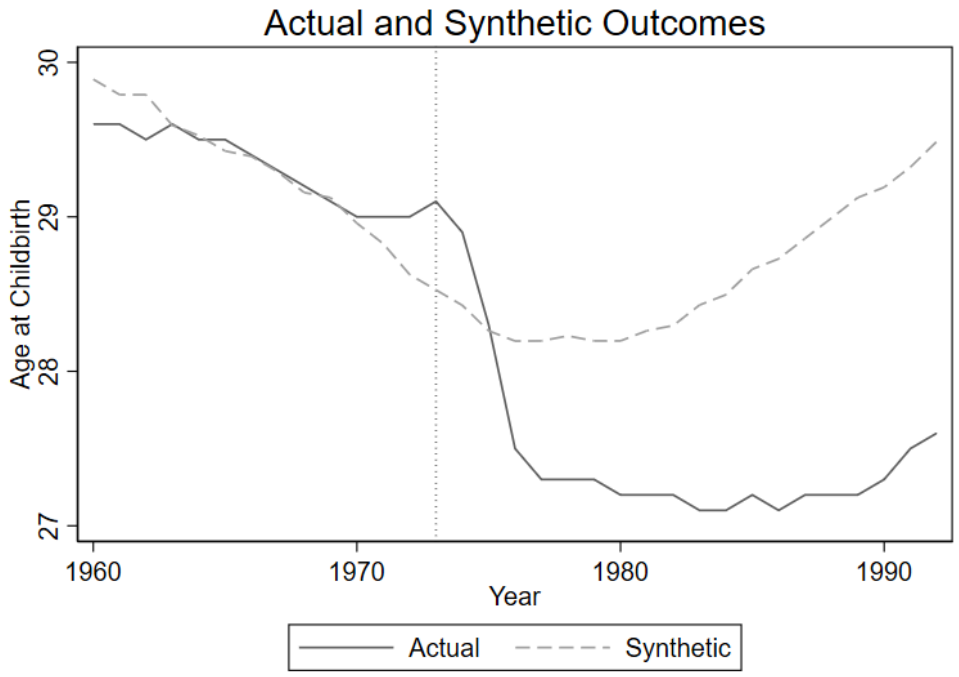
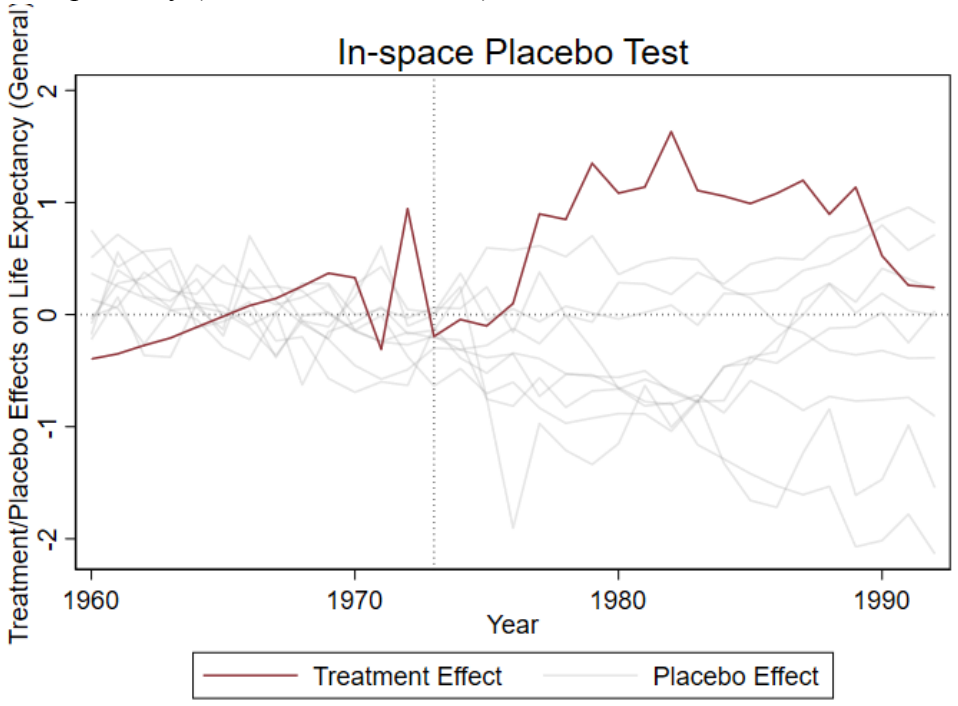
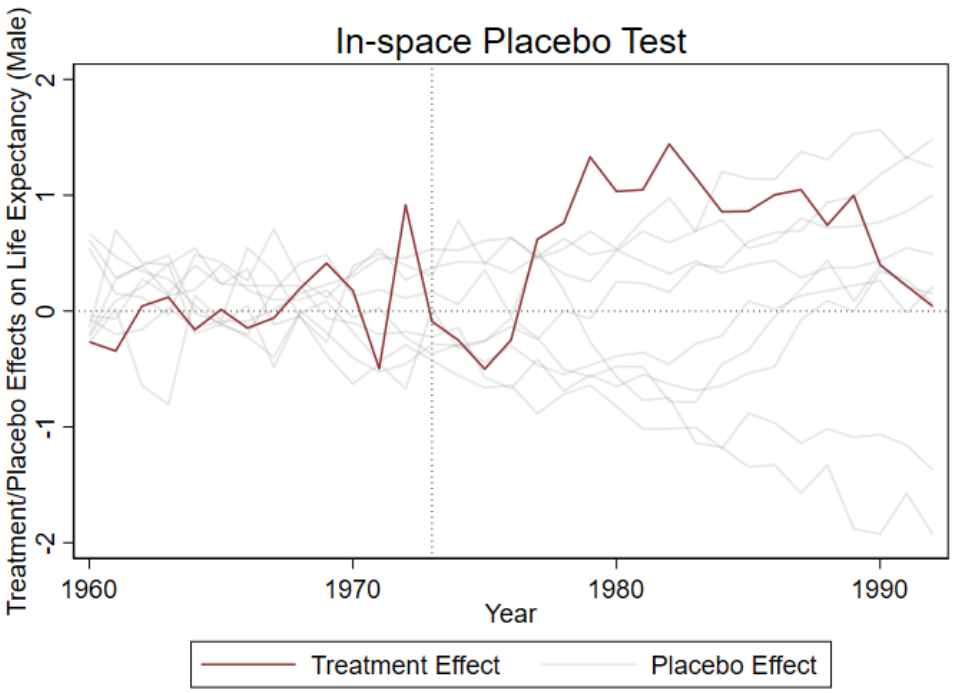
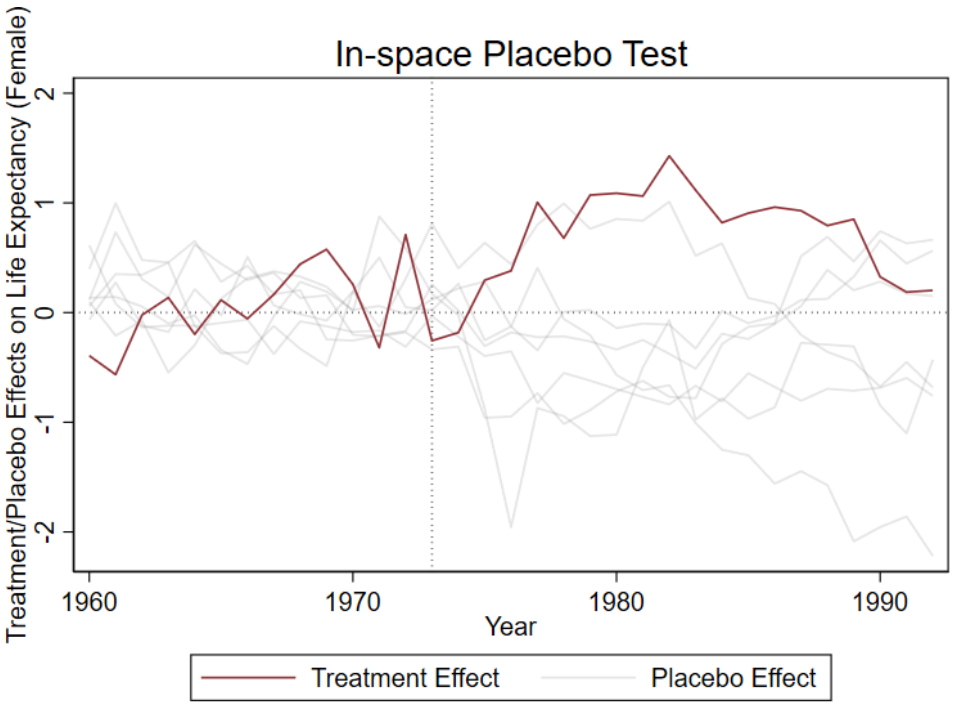


Figure 2: In-Space Placebo Tests

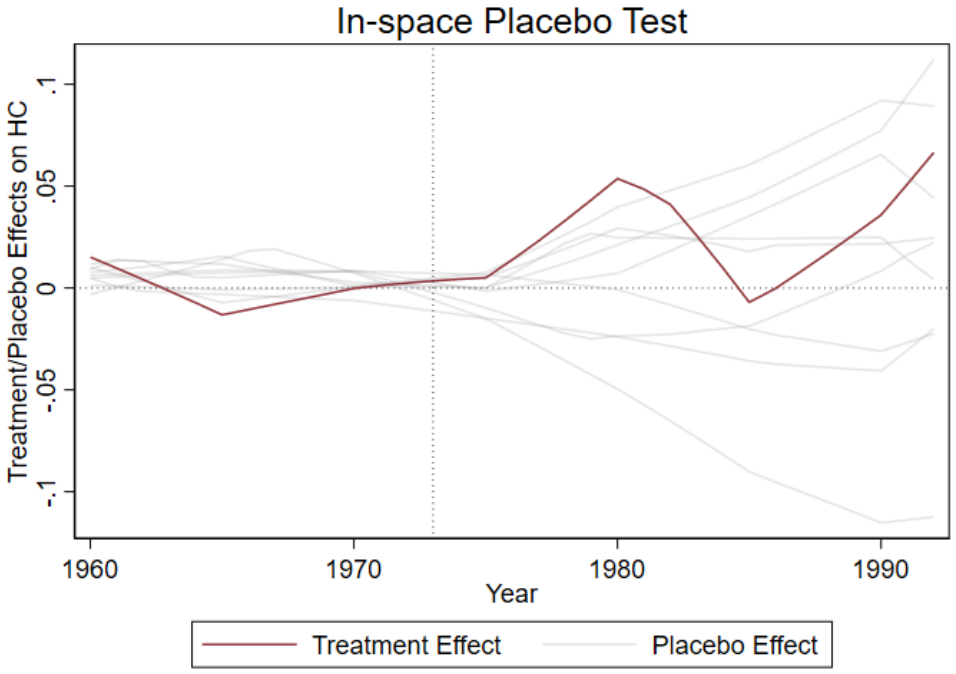
A) Life Expectancy (General/Male/Female)



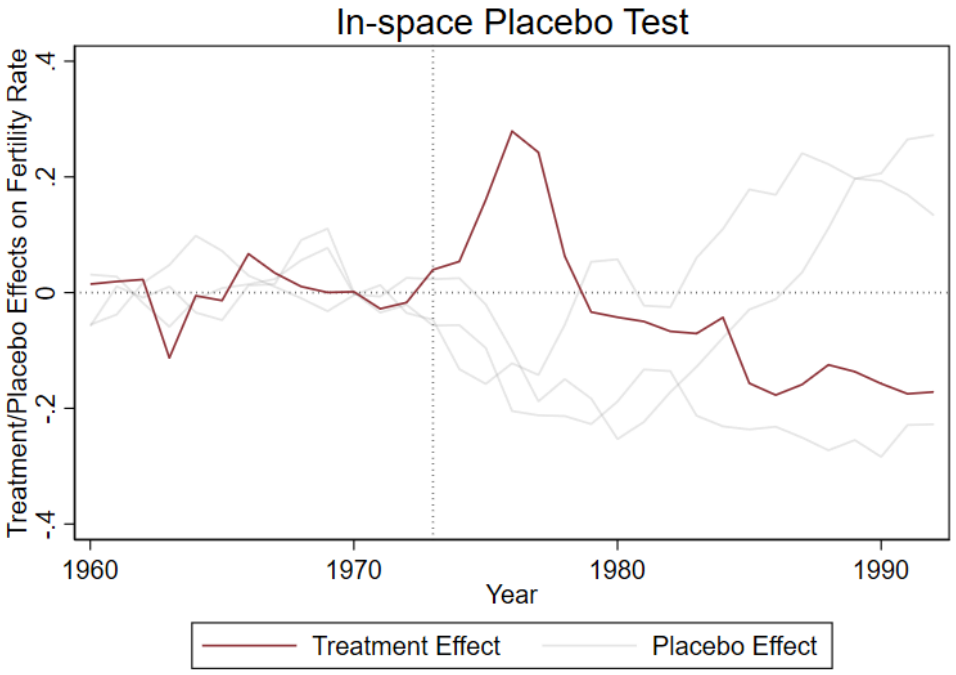

In-space Placebo Test
Treatment/Placebo Effects on Life Expectancy (Male)
2
1
0
-1
-2
1960
1970
1980
1990
Year
Treatment Effect
Placebo Effect


In-space Placebo Test
Treatment/Placebo Effects on Life Expectancy (Female)
2
1
0
-1
-2
1960
1970
1980
1990
Year
Treatment Effect
Placebo Effect

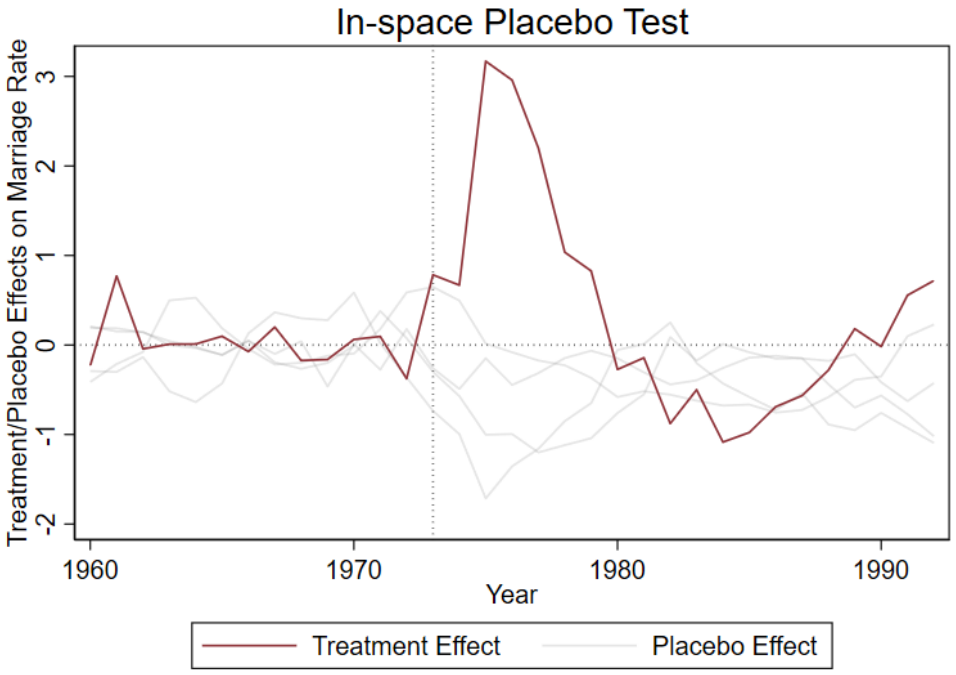
B) Human Capital



C) Fertility Rate



D) Marriage Rate



E) Age at Childbirth

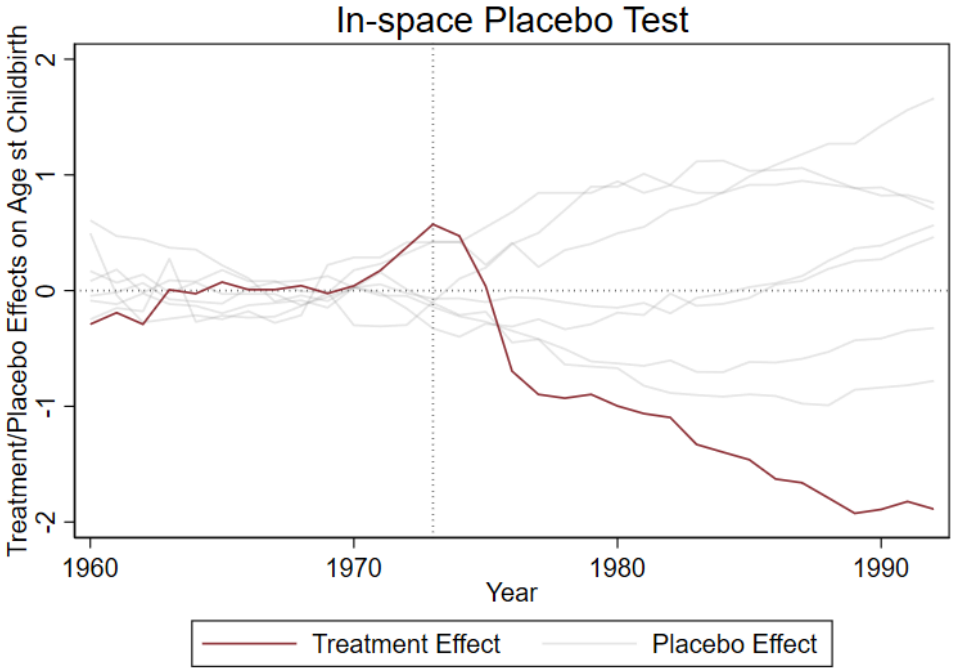
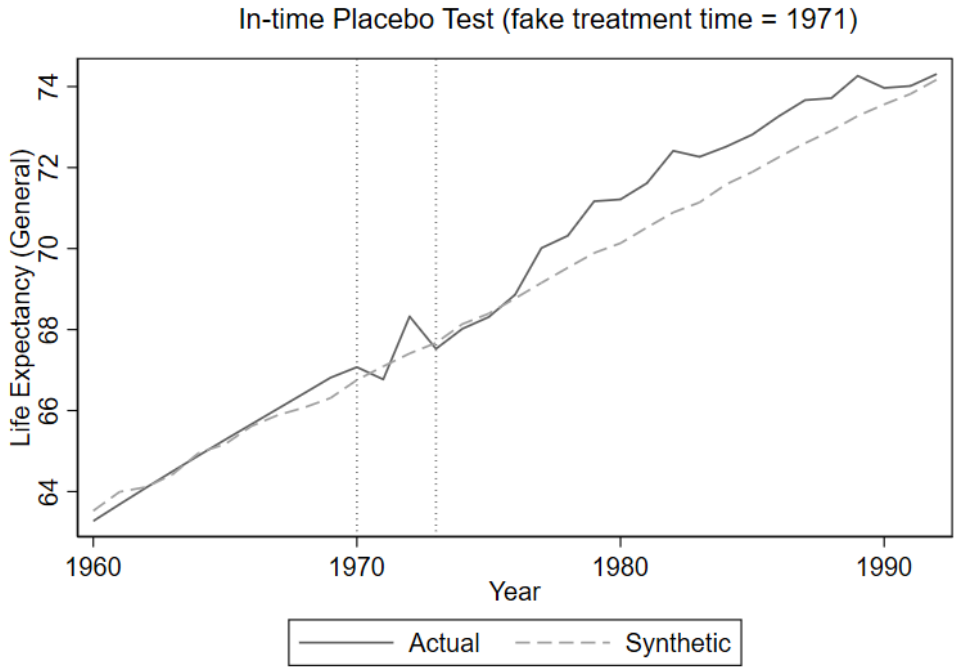
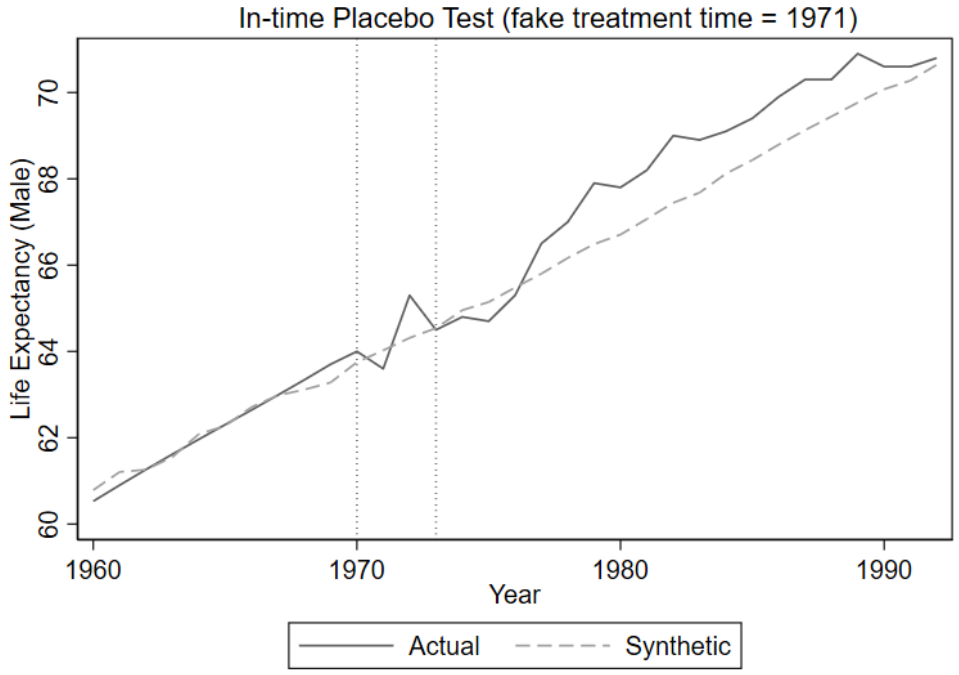
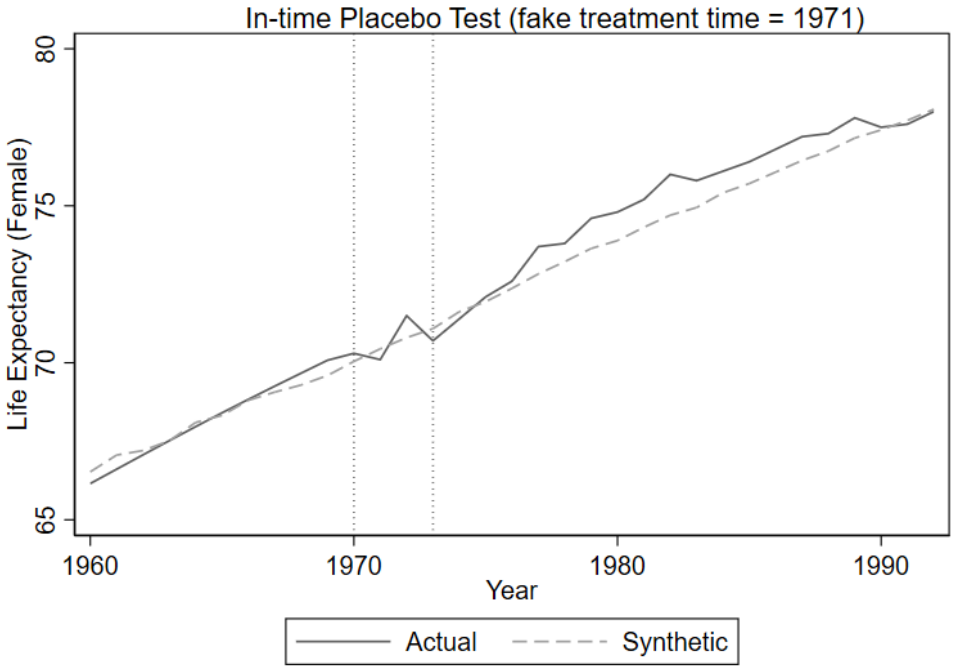


Figure 3: In-Time Placebo Tests

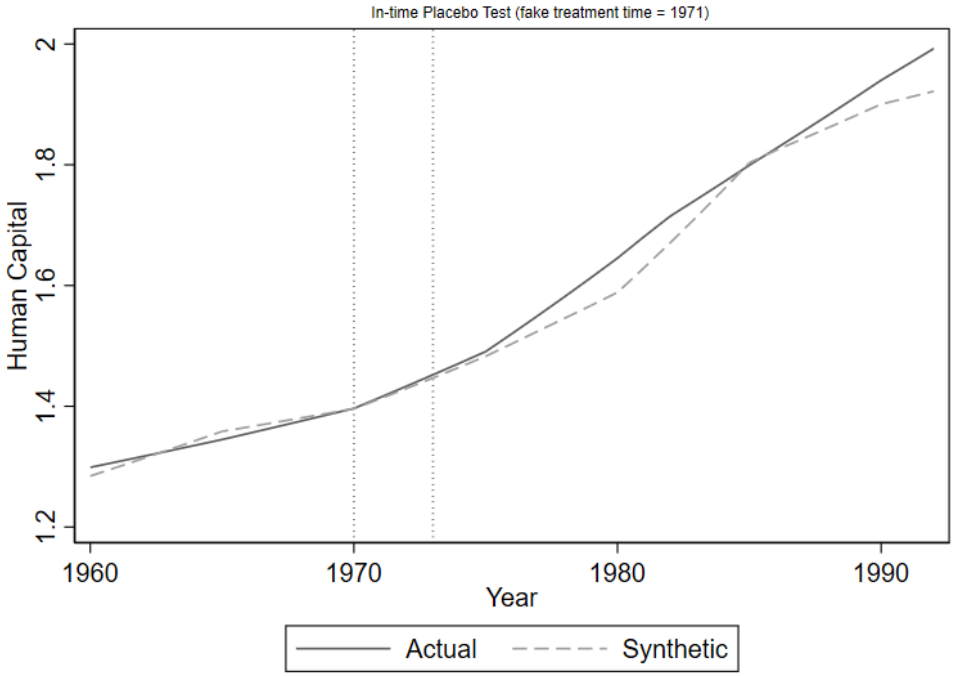
A) Life Expectancy (General/Male/Female)



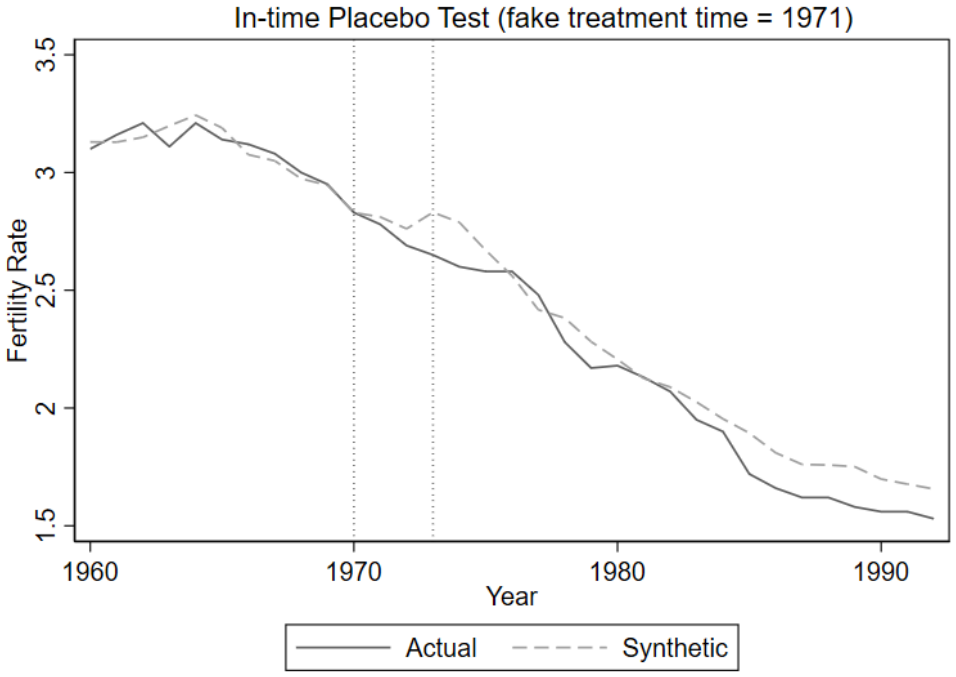




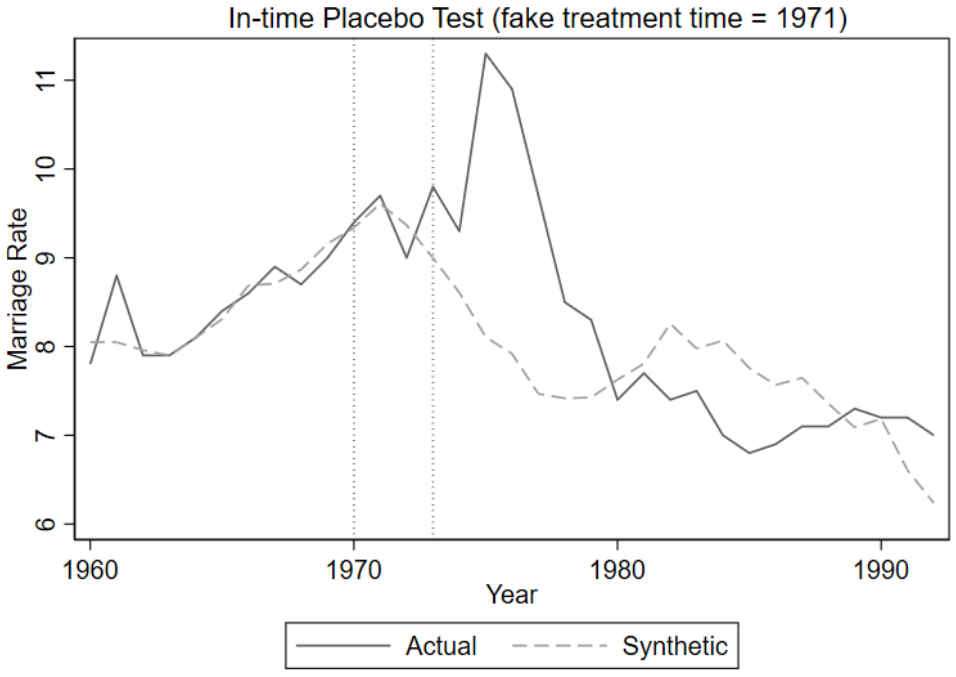
B) Human Capital



C) Fertility Rate



D) Marriage Rate



E) Age at Childbirth

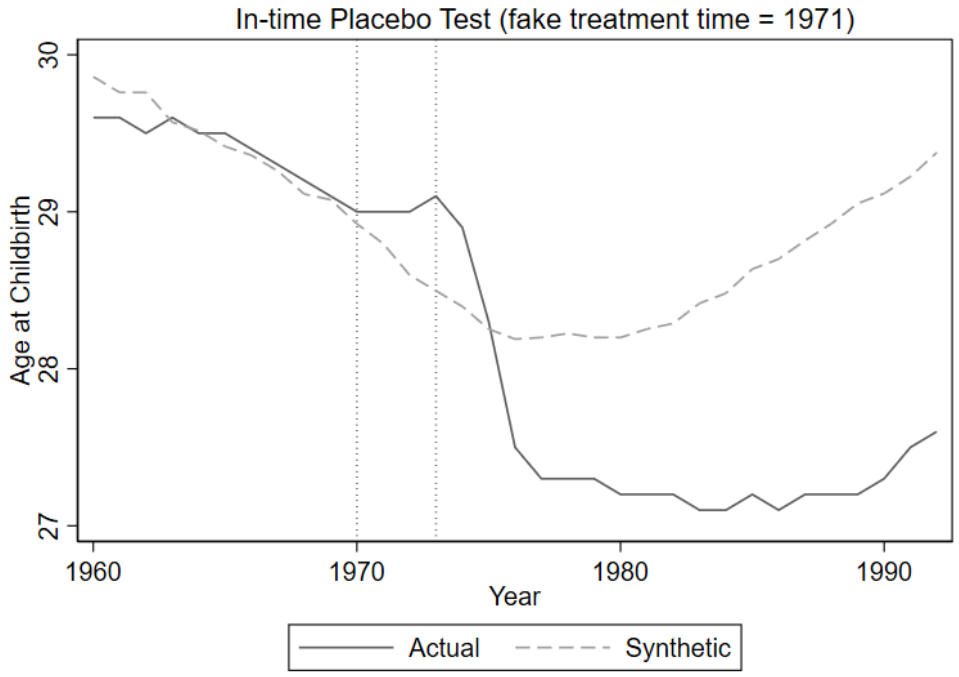


Table 1: Country Weights for Synthetic Portugal

Country	B: Synthetic Control Weight Life Expectancy (General / Male / Female)	A: Synthetic Control Weight Human Capital	C: Synthetic Control Weight Fertility Rate	D: Synthetic Control Weight Marriage Rate	E: Synthetic Control Weight Age at Childbirth
Australia	0	0	0	0	0
Austria	0	0	0.595	0	0.008
Belgium	0	0	0	0	0
Canada	0	0	0	0	0
Denmark	0	0	0	0	0.001
Finland	0	0	0	0	0
France	0.727/0.362/0.112	0	0	0	0
Germany	0	0	0	0	0
Iceland	0	0	0	0	0
Ireland	0.019/0/0.143	0	0.277	0.011	0.334
Italy	0/0.396/0.516	0.020	0	0	0.656
Japan	0	0	0.084	0	0
Luxembourg	0	0.094	0	0	0
Netherlands	0	0	0	0	0
New Zealand	0	0	0	0.873	0
Norway	0	0	0	0	0
Sweden	0	0	0	0	0
Switzerland	0	0	0	0	0
Türkiye	0.253/0.242/0.229	0.886	0.043	0	0
United Kingdom	0	0	0	0	0
United States	0.001/0/0	0	0	0.116	0

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