Organized Crime and Societal Dynamics *

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Abstract

Organized crime stands as a significant public policy concern within Brazil, given its potential to exert significant impacts on societal dynamics. In this study, we examine the impact of the ascension of an organized crime group in Manaus on the decision-making processes of the local population and firms. Leveraging an annual panel of municipalities spanning from 1991 to 2022, our research employs synthetic control methodology to scrutinize the multifaceted consequences of this crime group on labor market dynamics, educational attainment, and health outcomes. We find that the advent of the crime group has been linked to a substantial surge in school dropouts among young individuals. Moreover, subsequent years saw a consequential decline in the number of businesses operating within the city, along with a marked contraction in formal employment opportunities, althought not significant. Interestingly, our investigations uncover a nuanced dimension wherein lower-income individuals seem to exhibit a heightened propensity to engage in criminal activities during the initial phases of the crime group's establishment. Furthermore, we also find the criminal influence on the city's economic landscape a few years later.

Keywords: Organized crime, synthetic control, Família do Norte, labor market

JEL Codes:

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1 Introduction

Organized crime stands as a significant concern in public policy, given its potential to exert substantial impacts on societal dynamics and the economy. The U.N. estimates that the profits of transnational organized crime are U$1.6 trillion in 2009 (1.5% of global GDP) (UNODC, 2011). The emergence and growth of local crime groups hold the capacity to influence individuals' choices and behaviors (SOURCE). Despite its significance, the effects of organized crime on local economic activities remain underexplored due to the identification challenges, as well as the difficulty in observing reliable data on the extent of organized criminal activities (Mocetti et al., 2021).

In this study, we delve into the consequences of the rise of a local organized crime group in Manaus on the decision-making processes of both the local population and firms. Recent research has illuminated that organized crime enhances the perceived benefits of engaging in criminal activities (REFERENCE), potentially influencing individuals' decisions to partake in such actions. Additionally, these criminal organizations increase the riskiness and uncertainty of firms' environment, which, in turn, impacts formal job opportunities and firms' operations (Pinotti, 2015).

We analyze the emergence of the "Northern Family" (FDN) in Manaus. Drugowick and Pereda (2023) documented its ascent to become the third-largest Brazilian criminal faction, as evidenced by the Brazilian Federal Police's "La Muralla" operation (Polícia Federal, 2015). Before FDN, drug trafficking in Amazonas was primarily "family-based" and localized (Stahlberg, 2022)[1]. The emergence of FDN marked a transition toward a more organized and intensified illegal operation in 2006. As detailed by Drugowick and Pereda (2023), we also claim that FDN emergence in Manaus was exogenous. This perspective is rooted in the fact that local drug dealers, one of them involved in a prison massacre in 2002 in Manaus, were relocated from regional to federal prisions.[2] During their time in federal prison, they had interactions with leaders from prominent criminal organizations in Brazil: PCC and CV factions. These encounters served as inspiration for the creation of FDN upon their return to Manaus, especially to dominate the Solimões Route, a significant drug trafficking conduit.

The establishment of a structured faction, coupled with control over trafficking and the Solimões Route, facilitated FDN's swift growth. Their statute creation, registration system,

[1]Previously, family-based drug trafficking meant that individual criminals oversaw trafficking within specific neighborhoods.

[2]FDN's founding figures are Gelson Lima Carnaúba and José Roberto Fernandes Barbosa. Carnaúba was involved in a 2002 prison massacre at the Anísio Jobim Penitentiary Complex (COMPAJ). Barbosa's criminal engagement commenced at the age of 12 through drug sales in the Compensa neighborhood in Manaus.

and monthly "contribution to family's progress" played crucial roles[3]. The rapid expansion of FDN's dominion is further evident from reports that it controlled all streets, neighborhoods, and even the prison system of Amazonas by 2015.[4] In 2015, they had over 200,000 members, according to Polícia Federal (2015).

Focusing on Manaus as the epicenter of the group activities, we employ the synthetic control method with Brazilian city panel data, similar to Drugowick and Pereda (2023). We construct an annual panel of Brazilian municipalities spanning from 1990 to 2019. Our potential control municipalities, the donor pool, are municipalities that are not in the neighboring states of Amazonas (where Manaus is situated), and which share similar covariates with Manaus before FDN emergence. Drugowick and Pereda (2023) find that the criminal organization depreciated the GPD per capita by 2% per year. We examine the mechanisms behind this result or the social changes in decisions that have led to a decrease in economic activity. To do that, we apply the method to several outcomes, encompassing criminal activity (as measured by the homicide rate), educational choices (dropout rate across several age ranges), labor market indicators (total formal employment, number of firms, firms closures), and health variables (hospitalizations).

Our findings underscore the impact of the organized crime group's rise. Particularly noteworthy is the marked increase in the city's homicide rate since the group's establishment. Equally significant are the implications for education, as evidenced by elevated school dropout rates among young individuals. Furthermore, the subsequent years following the group's emergence witnessed a noteworthy decline in the city's business landscape, coupled with a significant reduction in formal employment opportunities (XXXXXX).

An important facet emerging from our research is the relationship between lower-income individuals and criminal engagement during the crime group's initial phases. Moreover, it is crucial to emphasize that the far-reaching economic implications of this criminal influence on the city's landscape only manifest several years after its inception.

Most of the existing literature focuses on the economic benefits reaped by criminal organizations for firms (Buchanan, 1973, and Backhaus, 1979), and their influence over the political sphere (Kugler et al. (2005), Dal Bo and Di Telia Dal Bo et al. (2006, 2007)). Few studies investigate its relationship with economic measures. Pinotti (2015) undertakes a cross-country comparison, while Drugowick and Pereda (2023) analyze the FDN criminal group's impact in Brazil. Both studies find a significant influence of criminal organizations on economic output

[3]this financial stream funded weapon procurement, legal representation, and assistance for prisoners and families

[4]Beyond criminal operations, FDN's influence extended to sports sponsorship and political engagement.

per capita. In line with this research landscape, we contribute to this literature by exploring the pathways through which criminal organizations mold societal decisions, ultimately contributing to economic output losses from firm closures and shifts in individual educational choices.

Regarding education outcomes, Monteiro and Rocha (2017) analyzes the impact of kids exposure to drug gang conflicts in Rio de Janeiro, Brazil and finds a negative effect on students math scores in standardized tests. In the same direction, Prem et al. (2023) shows reduction in dropout and grade failure rates and increase in math and reading scores in response to FARC's ceasefire.

In terms of formal work, Sviatschi (2022) shows that exposure to illegal markets during childhood raises the probability of staying at the cocaine industry in Peru.

Lastly, our paper also contributes to the effects of crime organizations on firms shutdown. In this literature, Mirenda et al. (2022) studies the Mafia and finds that mobsters' infiltration in firms results in a substantial increase in its earnings, without a proportional expansion in production resources, and it ultimately worsens the financial standing of the firm, often culminating in its withdrawal from the market. These observations align with evidence of money laundering.

2 Theoretical Framework on Impacts of Organized Crime

As Pinotti (2015) mentions, criminal organizations were not included in relevant surveys of economic literature, such as Freeman (1999), Dills et al. (2010) and Ehrlich (2010). Most of the literature focuses on the economic advantages of criminal organizations (Buchanan, 1973, and Backhaus, 1979), and on its impacts on the political class (Kugler et al. (2005), Dal Bo and Di Telia Dal Bo et al. (2006, 2007).)

The seminal[5] paper in modeling criminal decision-making is Becker (1968), which employs Rational Choice Theory (RCT) to delineate the individual's calculus in engaging in criminal activities. The model assumes that individuals are rational and decide whether to commit criminal acts based on a cost-benefit-analysis under uncertainty. Ehrlich (1973) expands on this theoretical model, postulating that an individual will choose to commit a crime if the following inequality holds:

$$U(W_c) > U(W_l) \tag{1}$$

[5]Draca and Machin (2015) provides a detailed review of the literature of crime and economic outcomes.

where W_c represents the expected net returns from the commission of a crime and W_l corresponds to the net returns of legal labor, which is devoid of risk. W_c is composed by the net return of apprehension and punishment (W_a), with probability of p, and of getting away with the crime (W_b), with probability of $(1-p)$.

$$W_c = pW_a + (1-p)W_b \tag{2}$$

$$W_a = W' + W_i - F \tag{3}$$

$$W_b = W' + W_i \tag{4}$$

where W' is the individual wealth, W_i is the net return of the crime and F is cost of the punishment (fines, incarceration, etc).

This simple model implies a positive correlation between the choice of commiting a crime and the crime net return (W_i) and negative correlation with the probability of being caught (p) and the cost of punishment (F).

Eventhough this model is simple, there is some evidence of its rational crime decision in the real world. Sviatschi (2022) demonstrates that when the returns of illicit activities rise, the prevalence of child in coca farming increases. Furthermore, these children exhibit an increased likelihood of prolonged engagement within the cocaine industry. Loughran et al. (2016) shows empirical evidence that a RCT model is a good approximation on how inividuals view cost and benefits before commiting a crime.

In the sphere of criminal organizations, the likelihood of being caught (p) is notably lower due to political affiliations and corruption within law enforcement. Furthermore, the crime net return (W_i) are significantly larger, with these organizations often gravitating towards more substantial endeavors, such as international drug trafficking. Both caractheristics create a scenario that increases the $U(W_c)$ and, ceteris paribus, the propensity of choosing to commit a crime.

3 Data

In this paper, we investigate the impacts of the establishment of FDN on various outcomes in Manaus. Employing a consistent synthetic control methodology across all outcomes re-

quires data at the municipality level. After thorough research, we compiled datasets from multiple sources, as outlined in the following subsections. The time frame for our analysis starts in 1991, due to the availability of population estimates for cities. The endpoint is set at the last year with available information, acknowledging the need for cautious interpretation in the Covid-19 pandemic year.

3.1 Crime

Homicide data is sourced from the 2023 Violence Atlas (Cerqueira et al., 2023), compiled by the Brazilian Forum on Public Security (FBSP) and the Institute of Applied Economic Research (IPEA). This atlas organizes data from various official sources[6]. We calculate the homicide rate per 100,000 people using estimated population data from the Brazilian Institute of Geography and Statistics (IBGE) spanning from 1991 to 2022.

3.2 Firms and Formal Employment

Data on the number of formal employments and firms per city is derived from the *Relação Anual de Informações Sociais* (RAIS) dataset from the Brazilian Ministry of Labor. RAIS is an employer-employee administrative dataset containing information on all labor contracts in Brazil. Similarly, we calculate the formal employment and number of firms per 100,000 people from 1991 to 2021.

3.3 Education

For Education data, we gather the performance rate from *Instituto Nacional de Estudos e Pesquisas Educacionais Anísio Teixeira* (Inep)[7]. Our focus is on dropout metrics due to the subjective nature of fail and approval rates, influenced by professor, school and government decisions. The data covers the periods 1996 to 2005 and 2007 to 2019. [8]

Unfortunately, we don't have a large timeseries of grades of a standardized test per municipality. The best possibility would be Prova Brasil, which is applied every two years since 1995.

[6]To our knowledge, there is no dataset of stealing, robbery or other related crimes by municipality.

[7]Data on performance rates from 1996 to 2005 was initially unavailable publicly. Subsequently, we submitted a request to the government under the Access to Information Law to obtain this data. The requested was accepted and the data is now accessible on GitHub at the following link: https://github.com/femdias/taxas-rendimento-escolar-inep .

[8]There was a change in the methodology from 2006 to 2007 which unable the calculation of the performance rates for the year 2006. For this reason, we estimate those rates as the mean between 2005 and 2007 and we don't use this year as control for the synthetic contol estimation.

But from 1995 to 2005 the sample is representative one in the State level, not municipality, making the pre-treatment periods too small for this method.

Unfortunately, standardized test grades per municipality lack a large time series. Although Prova Brasil could provide valuable insights, it is administered biennially and was representative at the State level, not municipality, from 1995 to 2005. Consequently, the pre-treatment period is insufficient in length for a synthetic control estimation.

3.4 Health

We use Ministry of Health data on hospital admissions collected from the Brazilian Hospital Data System (SIHSUS). Our dataset encompasses publicly funded or reimbursed hospitalizations, and we have specifically observed admissions based on individuals' municipality of residence from the period spanning 1995 to 2022. Within this dataset, we have detailed information concerning the admission dates, causes of hospitalization, and length of hospital stay, all classified according to the International Classification of Diseases - Tenth Revision (ICD-10) coding system (starting from 1998). Specifically, we examine data on mental and circulatory diseases, wuth the hypothesis that crime-induced stress may contribute to these health issues.

3.5 Socioeconomic variables

To calculate per capita variables, we utilize population data from the 1991, 2000, and 2010 Brazilian Census, with estimates for interim years by the Brazilian Institute of Geography and Statistics (IBGE). Population density is computed using municipality area. Covariates for the synthetic control include the share of people that had completed high school or above, the share of literate people, the share of economically active people, the unemployment rate, and average monthly income (R$ 1000), all from the 2000 Brazilian Census. Additionally, we incorporate GDP per capita (R$ 1000), manufacturing GDP share and agriculture GDP share from IBGE spanning 1999 to 2006. Finally, we use human capital (R$ 1000 per capita) and residential capital (R$ 1000 per capita), calculated by the Institute of Applied Economic Research (IPEA) using Census 2000 data.

4 Empirical Strategy

We investigate the impact of the emergence of the FDN criminal organization on various variables that measure individual and firm decisions. To this end, we predominantly employ

the synthetic control method, pioneered by Abadie and Gardeazabal (2003). Our identification strategy follows Drugowick and Pereda (2023).

The main identification hypothesis is that the treated unit — in this case, the city of Manaus where FDN was established — must be well-defined, ensuring that control group units remain unaffected by the treatment. To achieve this hypothesis, we exclusively consider cities outside the Amazonas state (which Manaus is the capital) and which are not affected by FDN (and preferebly by any other criminal groups). According to these criteria, our donor pool initially comprises all cities in the states of Goiás, Mato Grosso, and Tocantins[9].

The second hypothesis states that the donor pool should exhibit similarities to the treated region before the intervention (common support hypothesis)[10]. For assuring this, we selected 50% of municipalities with characteristics most akin to Manaus from the original donor pool[11].

Finally, we also exclude 10% of outliers in terms of the yearly variation in the outcome, following Abadie et al. (2015)'s advice that if an element of the donor pool experienced a significant idiosyncratic shock, it is excluded from the sample.

Regarding the specification, we follow Ferman et al. (2020)'s advice to use some pre-treatment outcome values and covariates as predictors when authors believe that some characteristics should be balanced. Given that Manaus is a large capital with a manufacturing center (Manaus Free Trade Zone) and the cities in the donor pool are predominantly small with a larger share in farming, we incorporate some covariates to enhance compatibility.

5 Results

In this section, we report the impacts of organized crime on various outcomes. For the synthetic control estimations and placebo test, we use the Synth[12] and Synth_runner[13] libraries in Stata, respectively. All estimations incorporate the following covariates for the year 2000: the share of people completing high school or above education, the share of literate people, the share of economically active people, unemployment rate (%), average monthly income (R$ 1000), human capital per capita (R$ 1000), and residential capital per capita (R$ 1000).

[9]For a more detailed rationale, refer to the 'Identification' section of Drugowick and Pereda (2023).

[10]Abadie (2021) emphasizes the importance of selecting a donor pool with characteristics similar to the treated unit.

[11]The selection process involved marking each observation (city and year pre-intervention) with 1 if the observation is within the 50% closest (in terms of covariate) to Manaus' value and 0 otherwise (using the ±2/3 standard deviation from the standardized normal distribution). We then selected those cities with the total number of 1's above the median.

[12]Abadie et al. (2011)

[13]Galiani and Quistorff (2017)

Additionally, we include the average of GDP per capita (R$ 1000), manufacturing share (% GDP), and agriculture share (% GDP) from 1999 to 2006, along with the average population density (1991 to 2006). We also use the biannual means of the pre-treatment outcome variable as predictors. We call this specification 'Baseline'.

For inference purposes, we conduct a placebo test[14] for each estimation, as proposed by Abadie et al. (2010). This is done to ensure that our results are not due to chance. We present a chart with its p-values for each post-treatment year. These p-values should be interpreted as the percentage of observations that had a larger effect than the treated unit (Manaus), rather than as standard p-values.

In the Appendix, we showcase the 'Benchmark' specification estimations, where only pre-treatment outcome variables are used as controls.

5.1 Crime

Figure 1 illustrates the effects of the emergence of FDN on the homicide rate per 100,000 population using the Baseline specification. Figure 2 indicates that, despite the separation between Manaus and its synthetic control, this difference may be attributed to randomness.

[14] Also known as a permutation test.

Figure 1: Homicide rate (per 100,000 population) of Manaus and the synthetic control: Baseline specification.

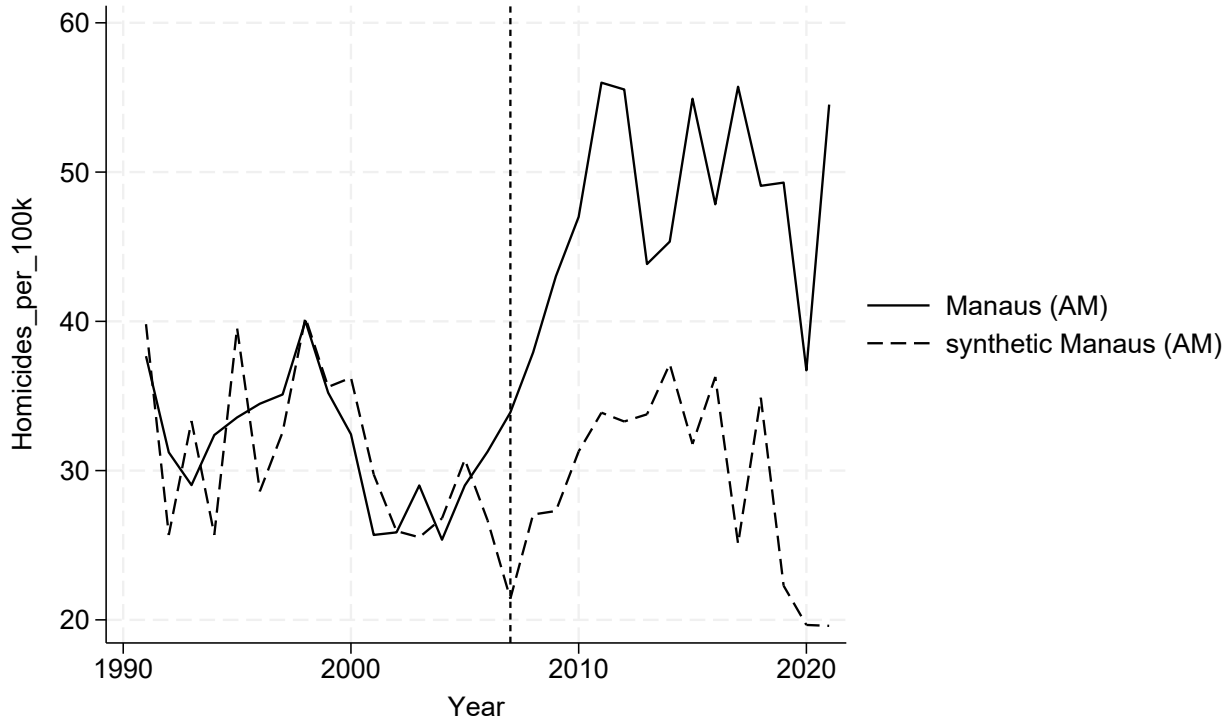
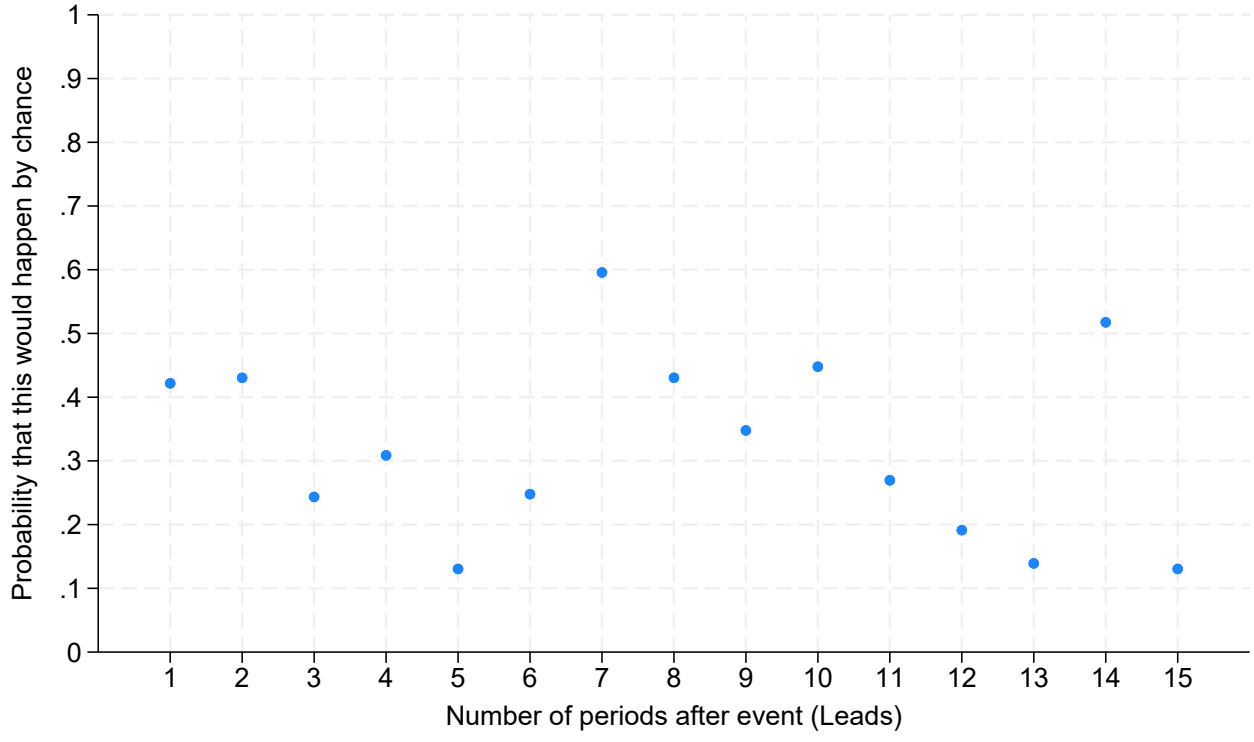


Figure 2: P-values of the synthetic control of homicide rate (per 100,000 population): Baseline specification.



5.2 Educational Decisions

In relation to the dropout rate, Figures 3, 5 and 7 depict Manaus and its synthetic control under the Baseline specification for school years 1 to 4, 5 to 8, and high school, respectively.[15]

Figures 4, 6 and 8, reveal that the establishment of the FDN had a significant impact on the dropout rate for years 1 to 4 and 5 to 8 of school but not on the dropout rate for high school.

This finding is very curious. Dropout is a very large problem in Brazil, despite its downward trends in recent years. This problem has many causes, so its dificult to pin out the reason for the Manaus trend. We can hypothesize that it maybe indicates that families on Manaus are more propense to take their kids out of school, either for using them as infant labor or for moving to other city. At the same time, it maybe points to an early exit of teens to the informal market, either because of the observtion that people without formal education have sucess in criminal endevours.

This discovery is intriguing. Dropout rates pose a substantial challenge in Brazil, despite its downward trend in recent years. Given the multifaceted nature of this issue, pinpointing the specific reasons for the observed trend in Manaus is challenging. One hypothesis could be that families in Manaus are more inclined to withdraw their children from school, either for utilizing them in informal labor or relocating to other cities. Simultaneously, it might indicate an early departure of teenagers to the crime market, potentially influenced by the perception that individuals without formal education can find success in criminal endeavors.

[15] In Brazil, years 1 to 8 encompass students aged 7 to 14 years old, while high school represents students aged 15 to 17 years old.

Figure 3: Dropout rate from school year 1 to 4 of Manaus and the synthetic control: Baseline specification.

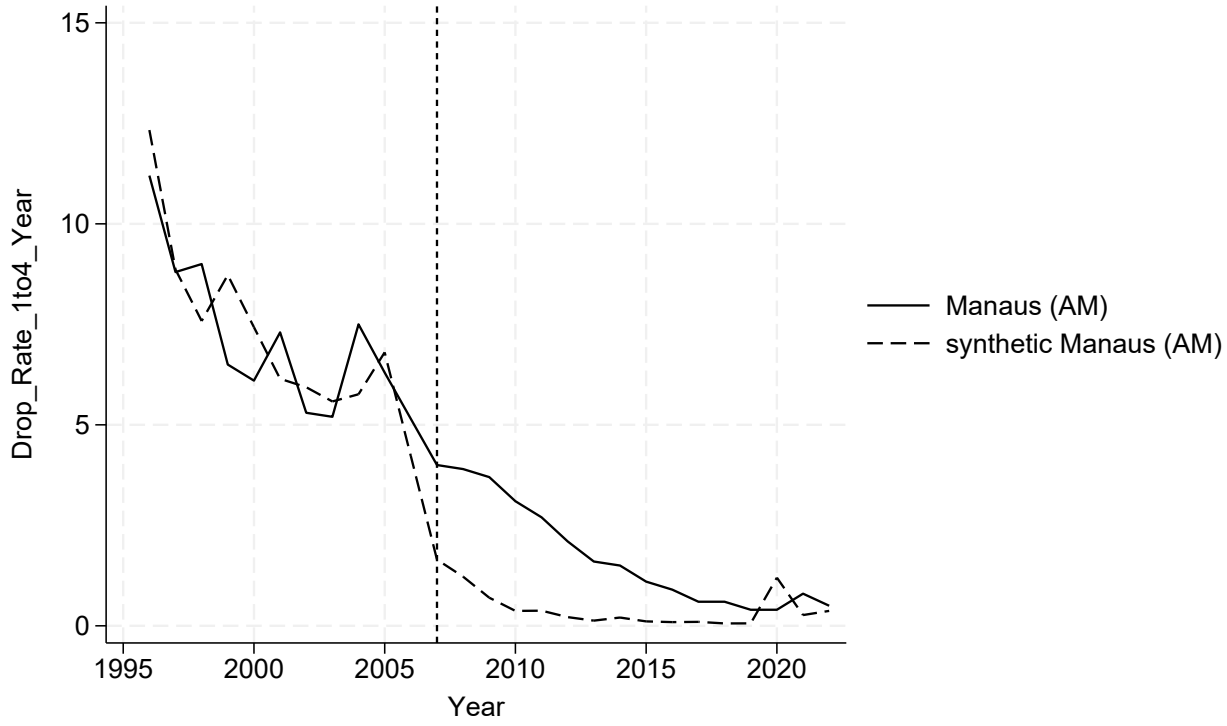


Figure 4: P-values of the synthetic control of dropout rate from school year 1 to 4: Baseline specification.

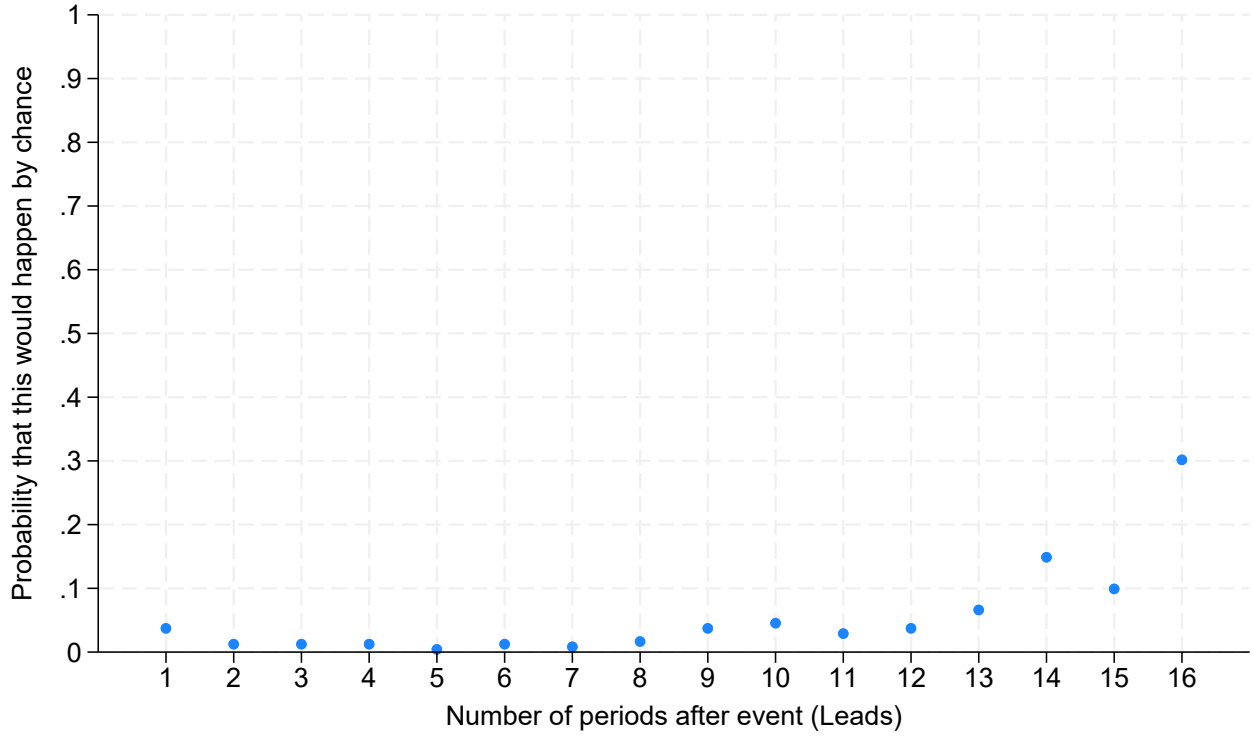


Figure 5: Dropout rate from school year 5 to 8 of Manaus and the synthetic control: Baseline specification.

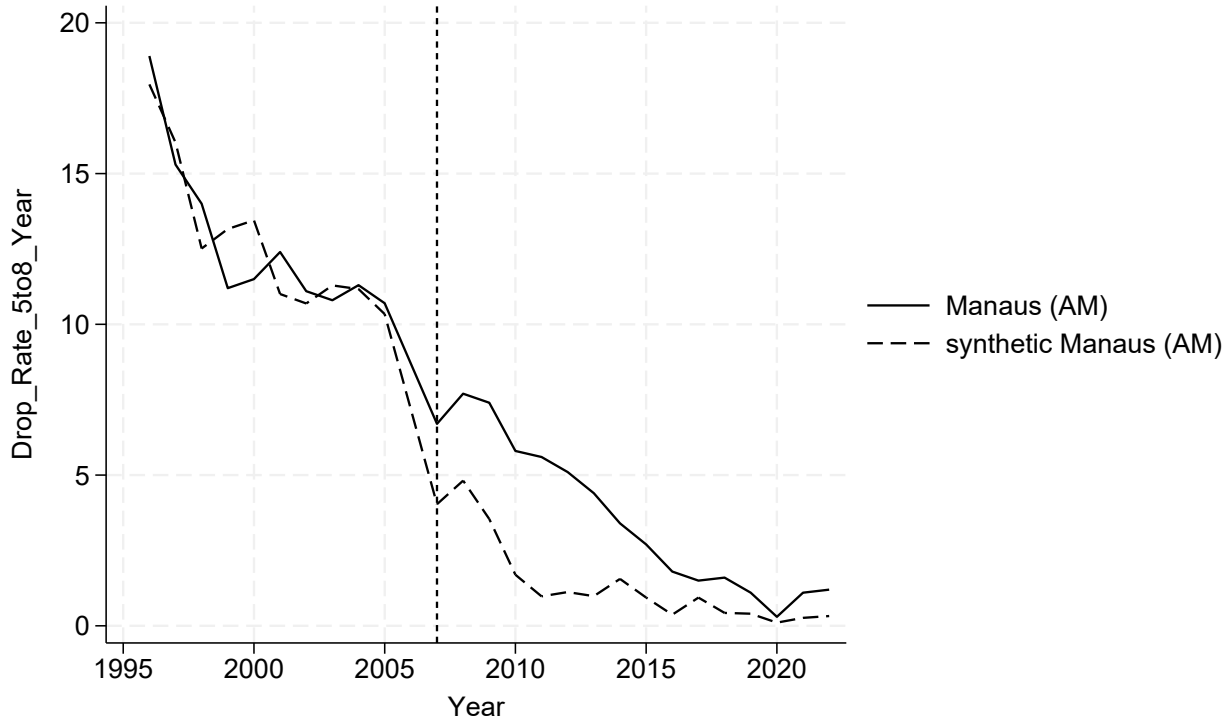


Figure 6: P-values of the synthetic control of dropout rate from school year 5 to 8: Baseline specification.

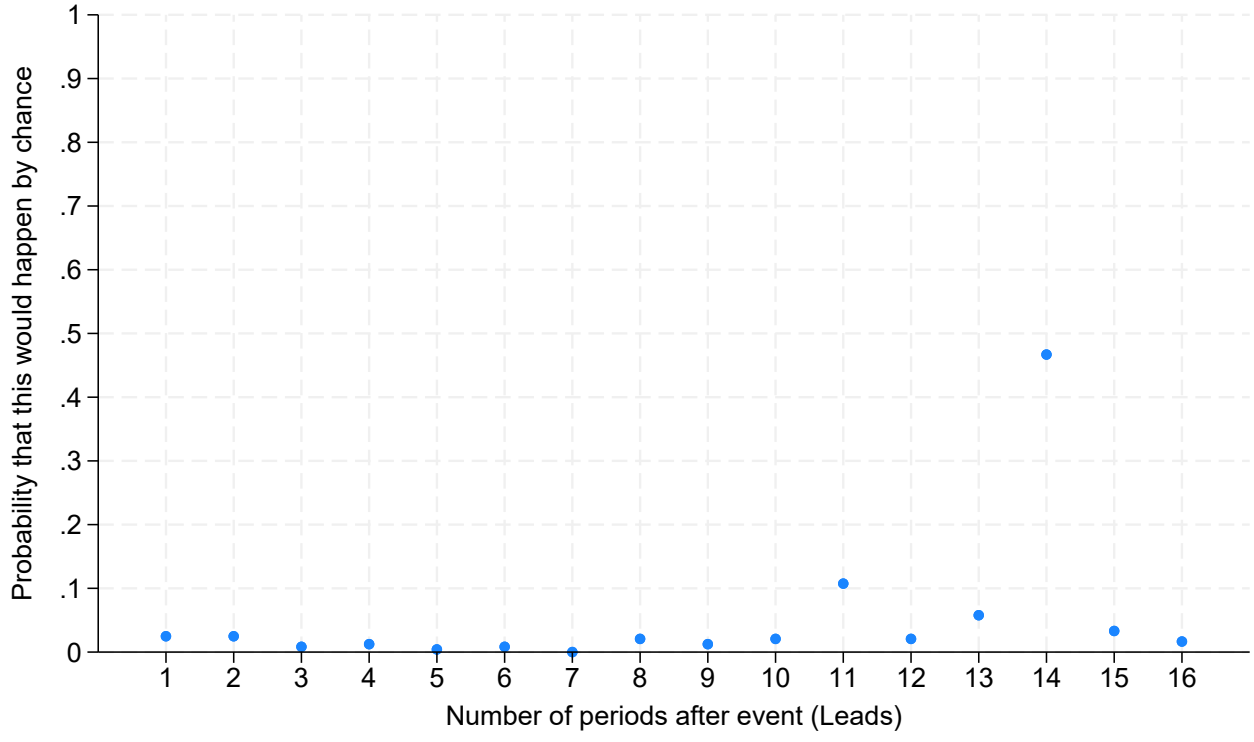


Figure 7: Dropout rate during High School of Manaus and the synthetic control: Baseline specification.

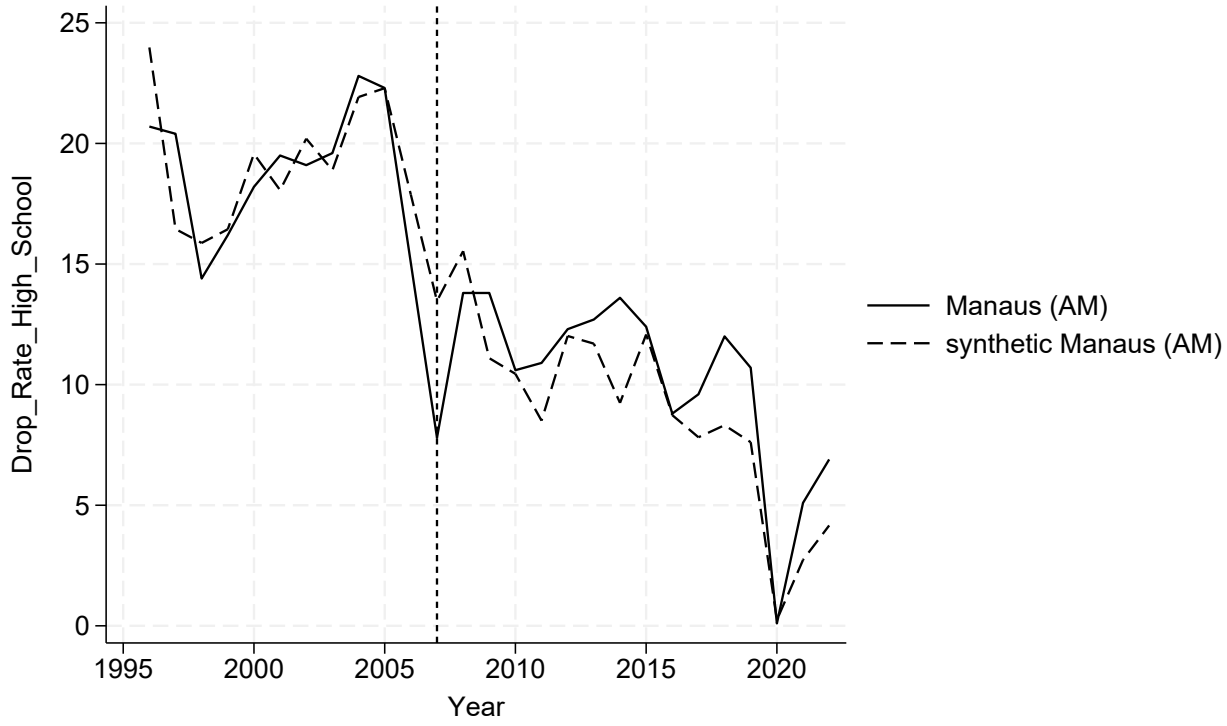
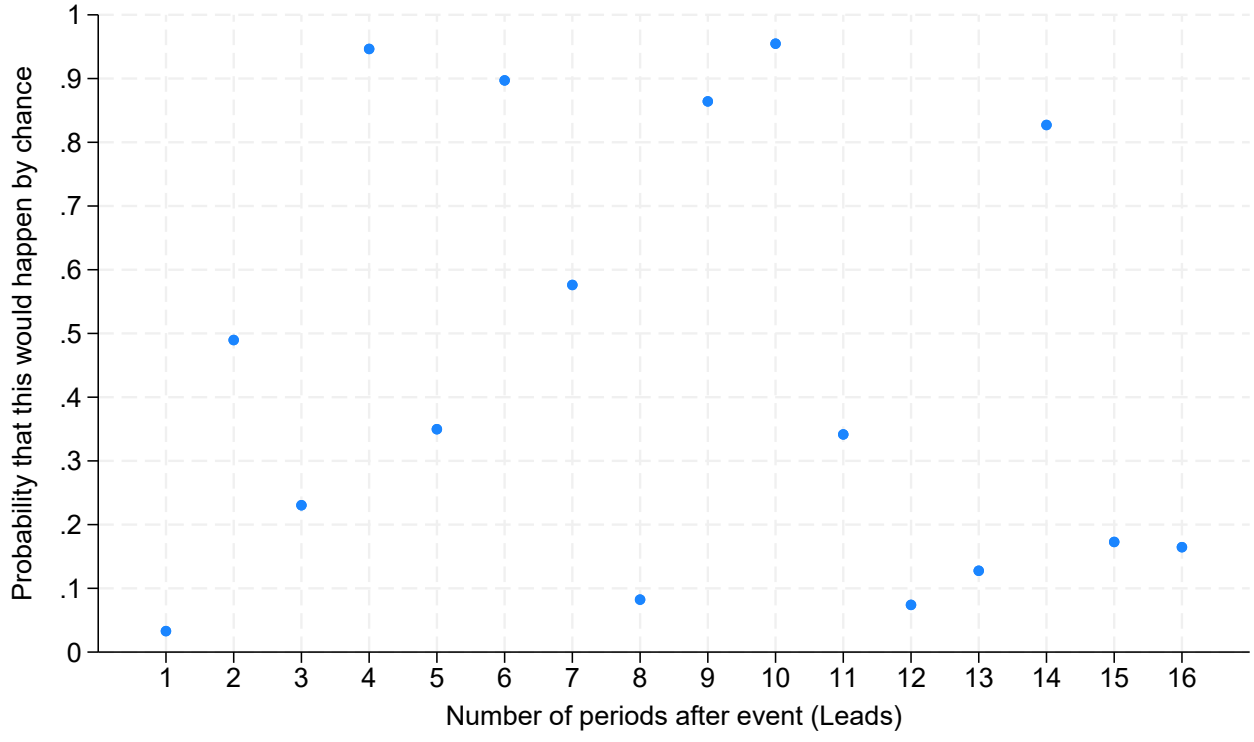


Figure 8: P-values of the synthetic control of dropout rate during High School: Baseline specification.



5.3 Firms and Formal Work

Figure 9 illustrates the effects of the emergence of FDN on the number of firms per 100,000 population using the Baseline specification. Figure 10 indicates that, despite the separation between Manaus and its synthetic control, this difference could be attributed to chance.

Figure 9: Number of firms per 100,000 population of Manaus and the synthetic control: Baseline specification.

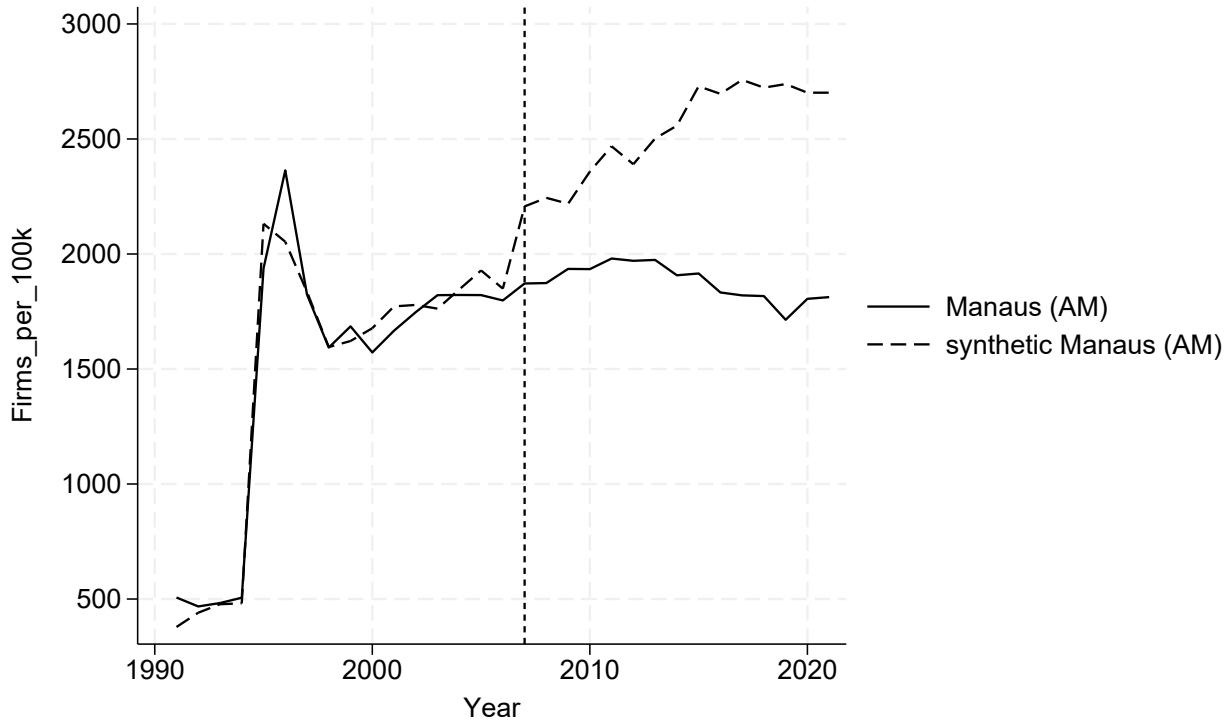
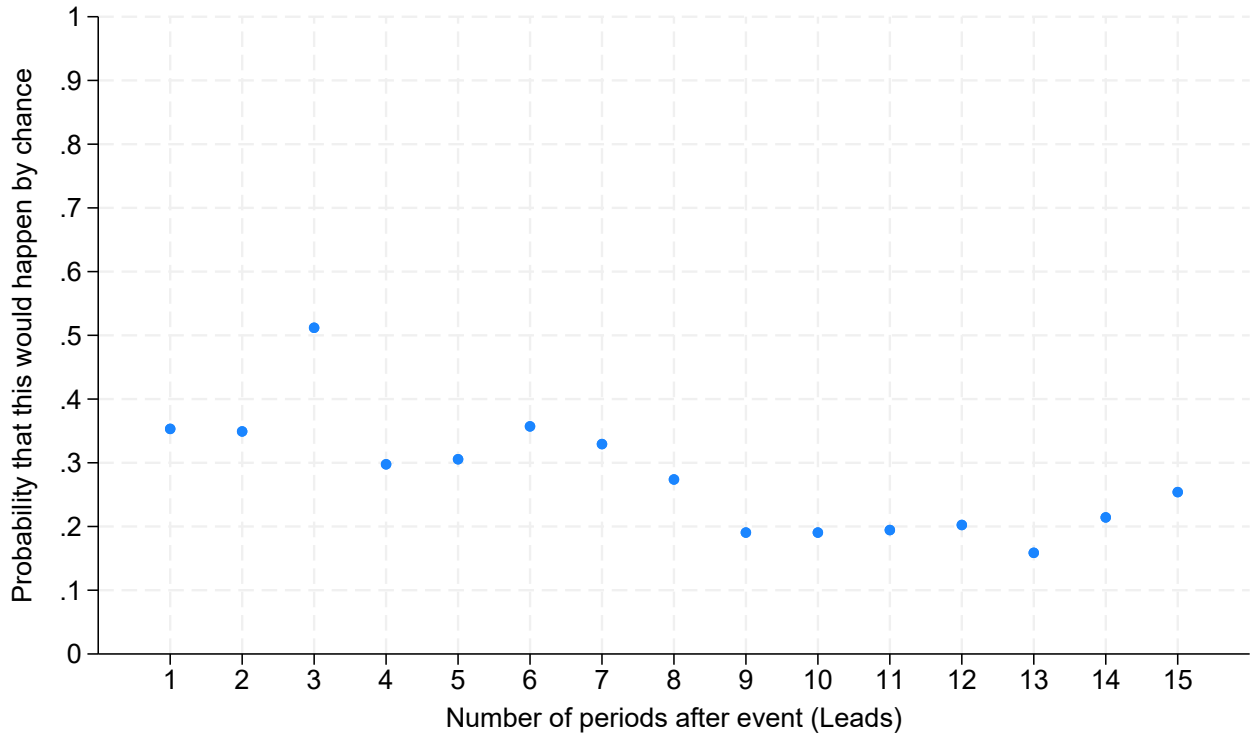


Figure 10: P-values of the synthetic control of number of firms per 100,000 population: Baseline specification.



Similarly, Figure 11 depicts the impact of the emergence of FDN on formal work per 100,000 population using the Baseline specification. Figure 12 indicates that the difference between the trajectories could be attributed to chance.

Figure 11: Number of formal jobs per 100,000 population of Manaus and the synthetic control: Baseline specification.

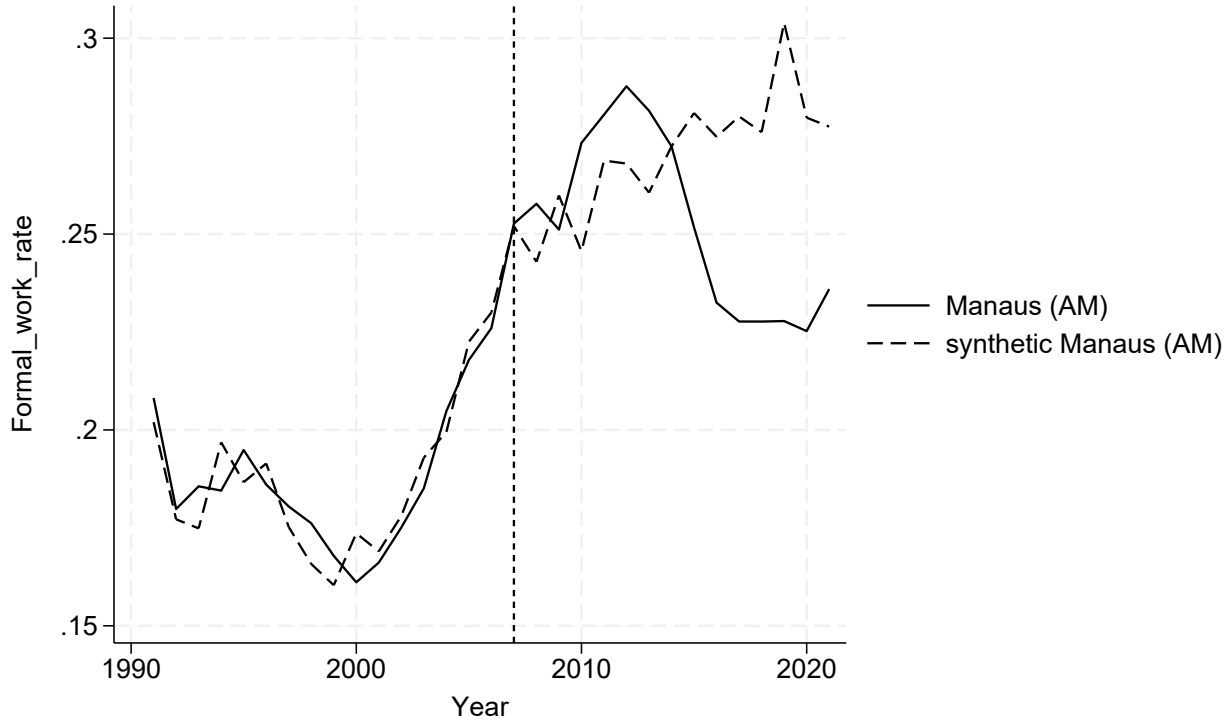
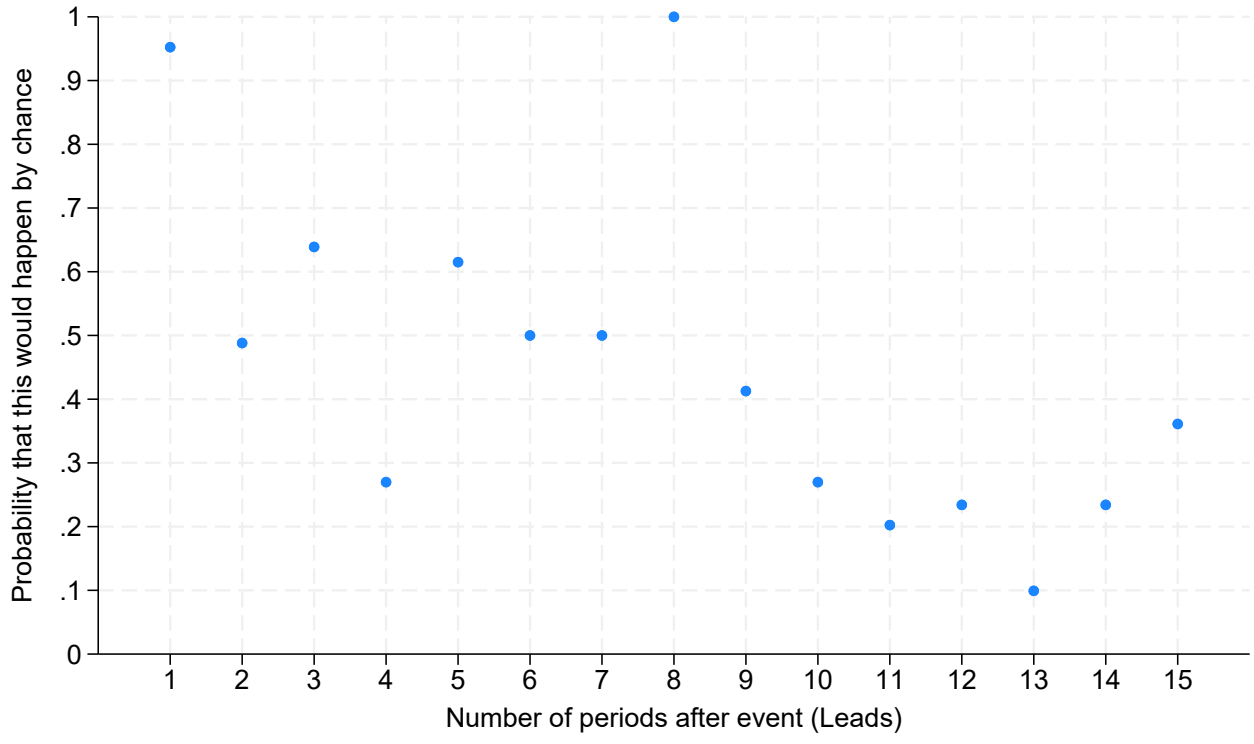


Figure 12: P-values of the synthetic control of number of formal jobs per 100,000 population: Baseline specification.



5.4 Health Outcomes

In Figures 13, 15 and 17, we present the effects of the creation of FDN on total, mental health-related, and circulatory-related hospitalizations per 100,000 population using the Baseline specification. Figures 14, 16, and 18 show that the observed differences are not statistically significant and can be attributed to chance.

Figure 13: Hospitalizations per 100,000 population of Manaus and the synthetic control: Baseline specification.

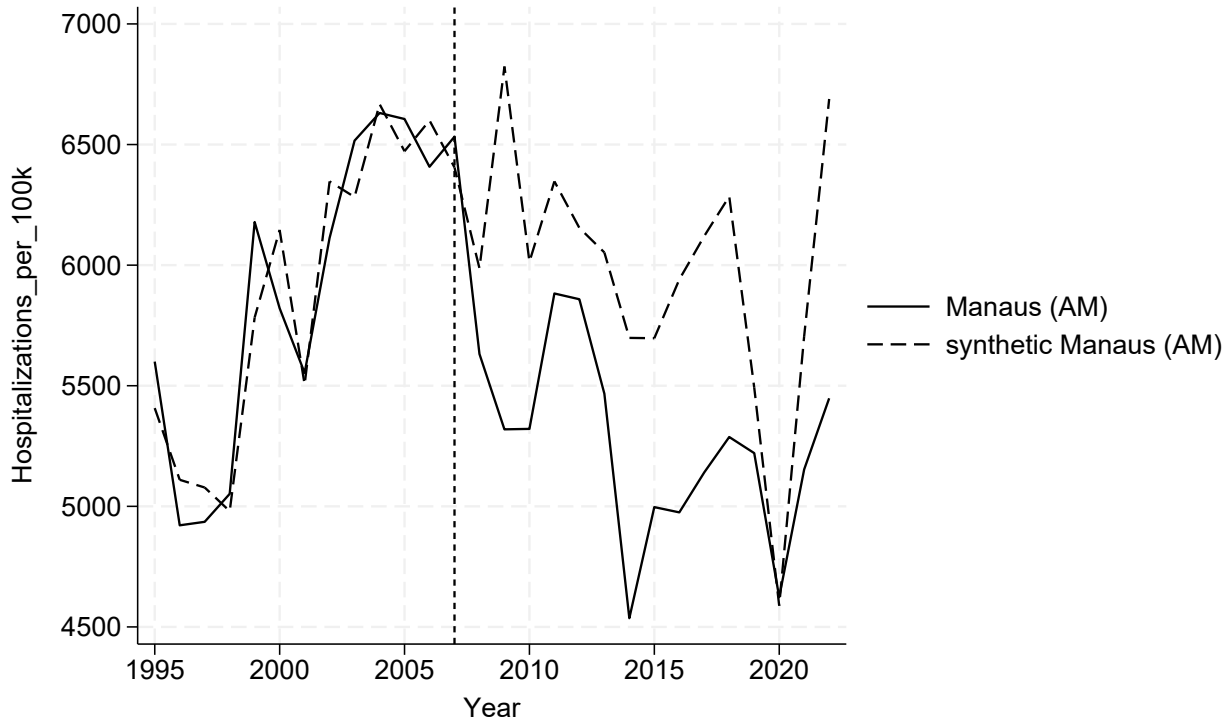


Figure 14: P-values of the synthetic control of hospitalizations per 100,000 population: Baseline specification.

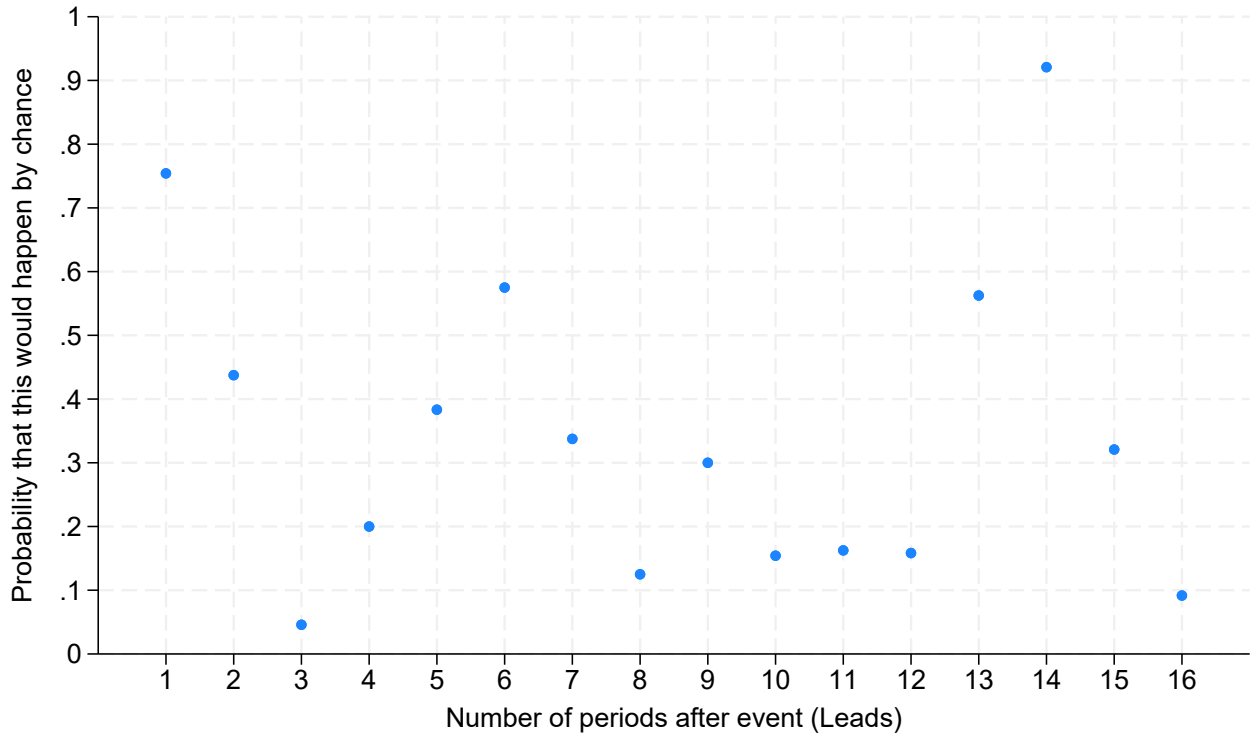


Figure 15: Mental diseases hospitalizations per 100,000 population of Manaus and the synthetic control: Baseline specification.

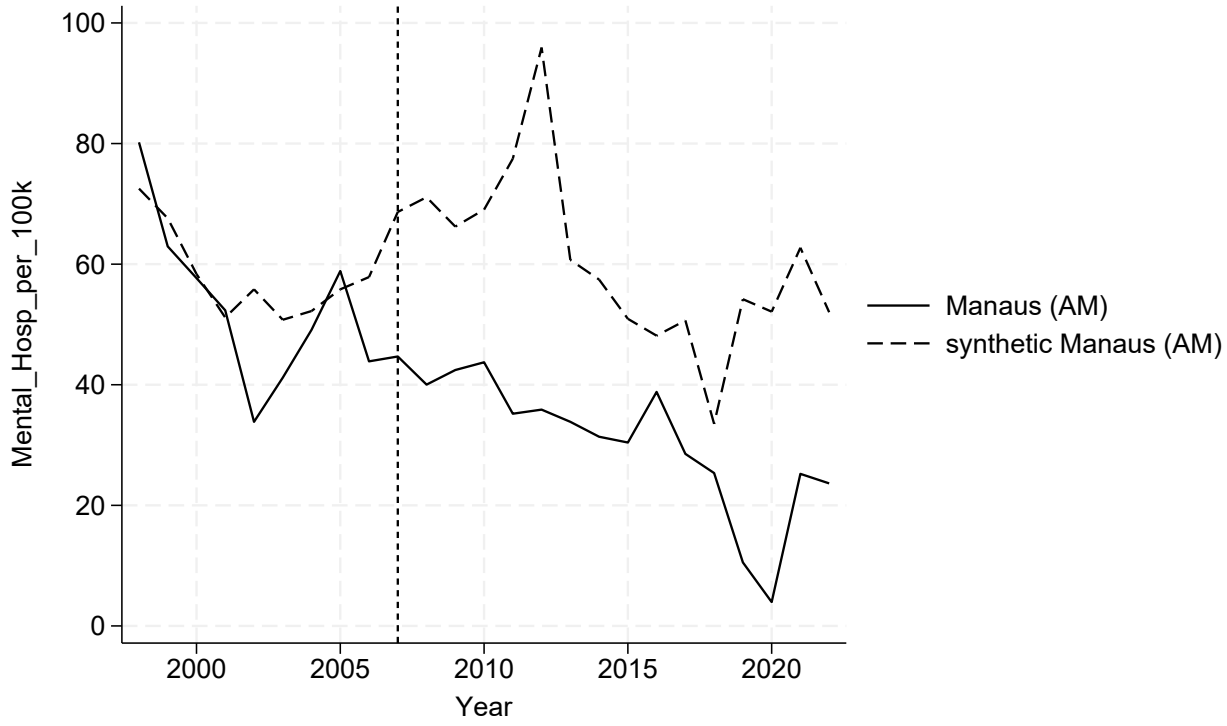


Figure 16: P-values of the synthetic control of mental diseases hospitalizations per 100,000 population: Baseline specification.

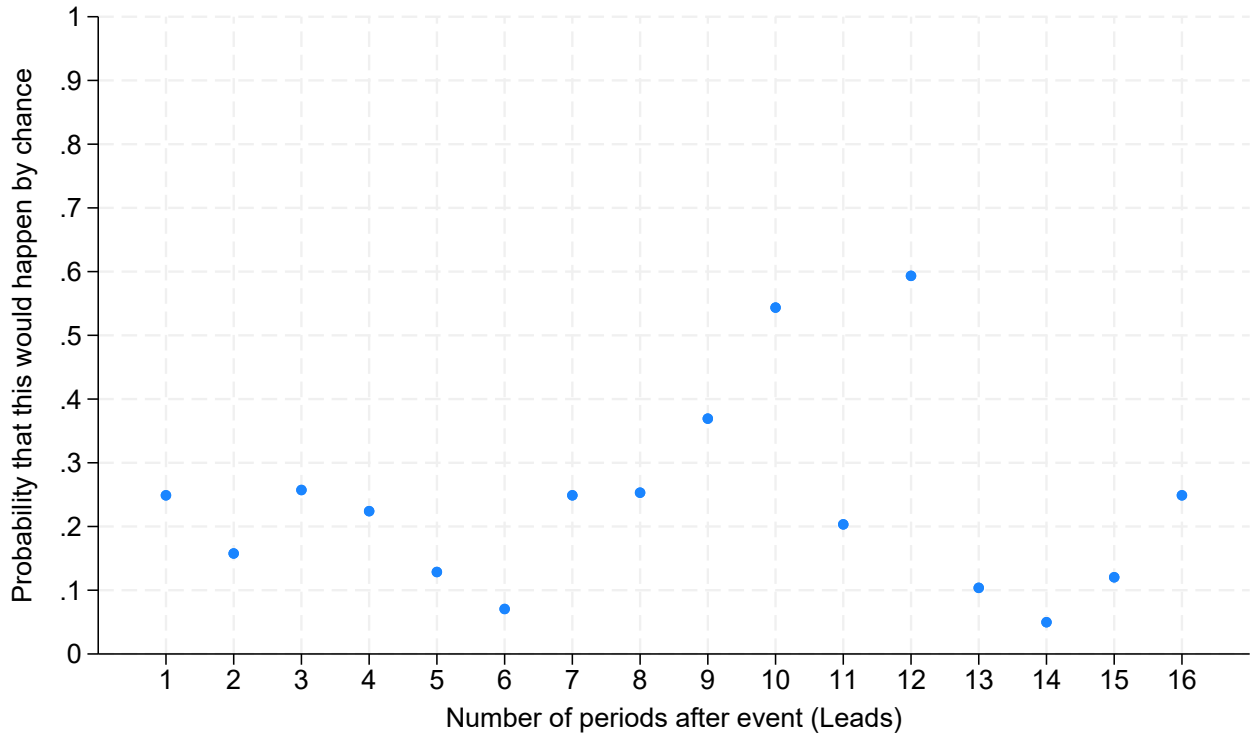


Figure 17: Circulatory diseases hospitalizations per 100,000 population of Manaus and the synthetic control: Baseline specification.

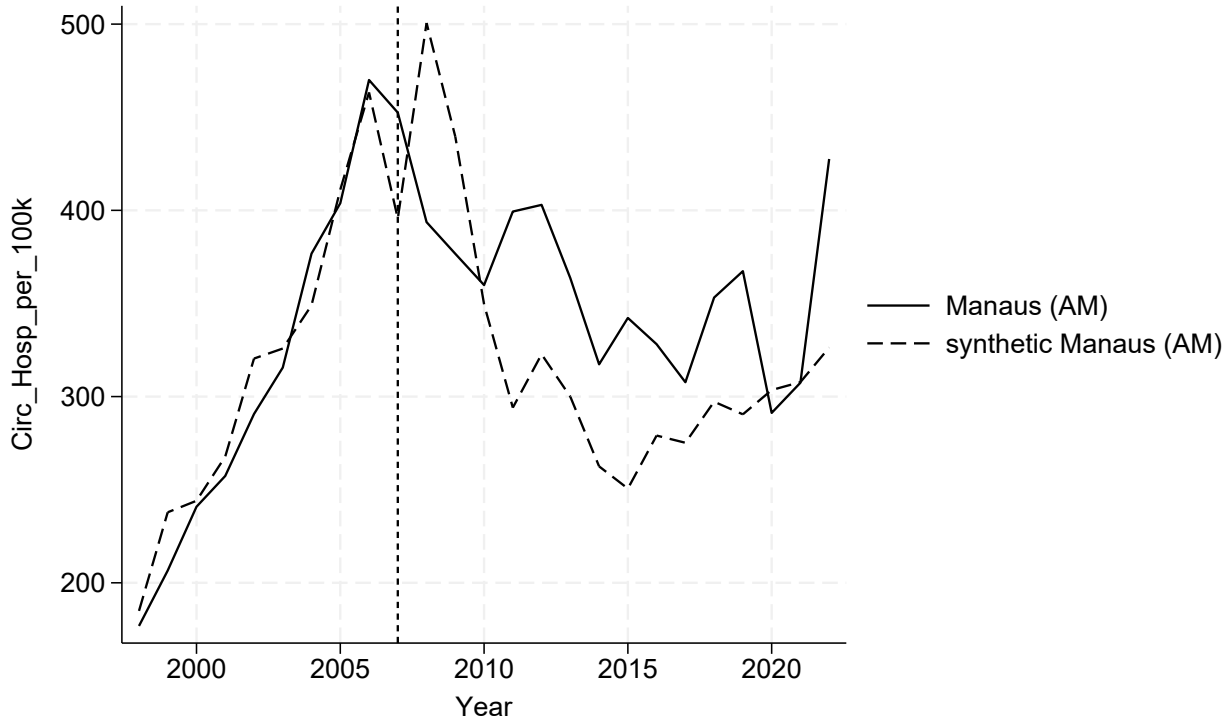
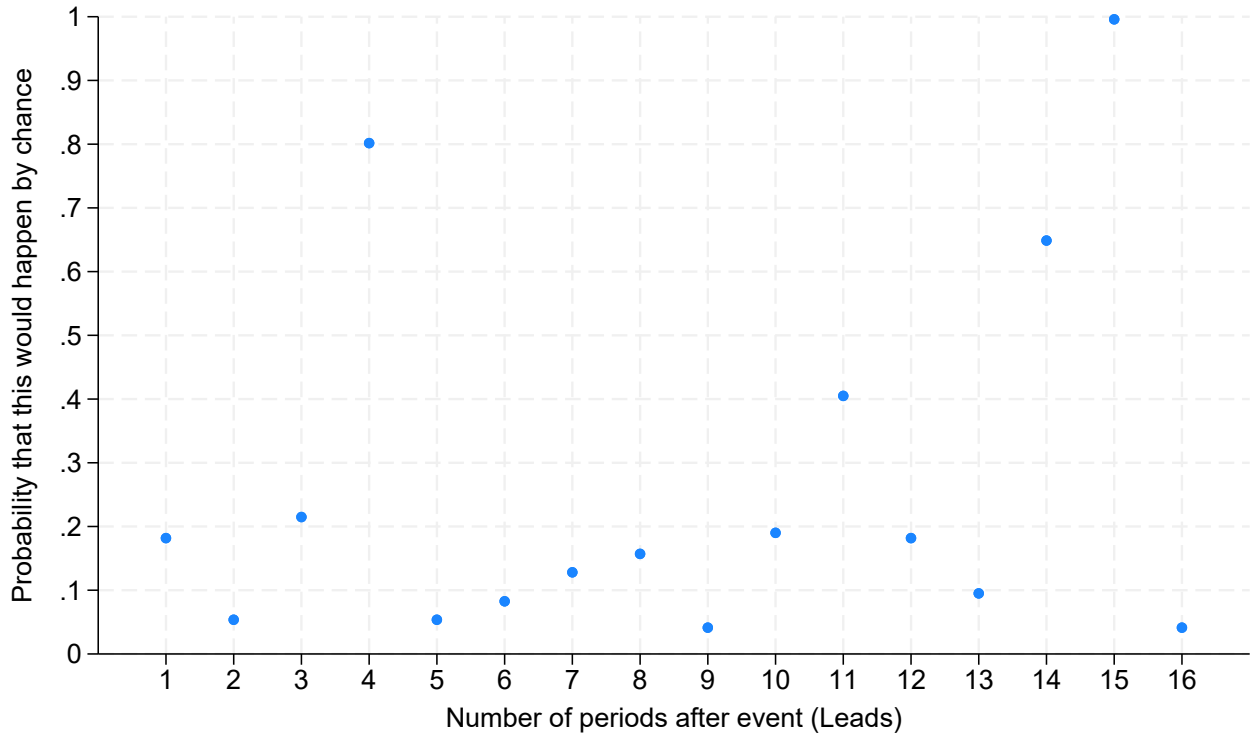


Figure 18: P-values of the synthetic control of circulatory diseases hospitalizations per 100,000 population: Baseline specification.



6 Final Remarks

In conclusion, this study underscores the far-reaching socio-economic implications of the rise of local organized crime groups in Brazil. Employing the synthetic control method, we sought to disentangle the causal effects of FDN on outcomes such as crime rates, educational decisions, firm establishment, formal employment, and health-related variables. Our study contributes to a more comprehensive understanding of the intricate interplay between crime, economic conditions, and societal choices.

Our findings shed light on several intriguing dynamics. Notably, the establishment of FDN appears to have had a significant impact on educational dropout rates for school years 1 to 4 and 5 to 8. One plausible hypothesis suggests that families in Manaus might be more inclined to withdraw their children from school because of the criminal violence, either for utilizing them in informal labor or relocating to other cities, reflecting broader socio-economic dynamics. Simultaneously, the observed impact might indicate an early departure of teenagers to the crime market, potentially influenced by the perception that individuals without formal education can find success in criminal endeavors. This nuanced intersection between educa-

tional decisions and criminal engagement warrants further investigation and nuanced policy considerations for addressing both challenges concurrently.

However, the implications on homicide rates, firm establishment, formal employment and hospitalization rates did not exhibit statistically significant differences between Manaus and its synthetic control. This finding suggests a need for further exploration into the complex interplay between organized crime and public health outcomes.

In conclusion, our study provides valuable insights into the heterogeneous impacts of organized crime, emphasizing the importance of considering diverse socio-economic dimensions. As policymakers and researchers grapple with the challenges posed by criminal organizations, our findings underscore the necessity of targeted interventions addressing the multifaceted nature of their consequences. Future research endeavors could delve deeper into understanding the mechanisms driving the observed effects, potentially informing more precise policy responses aimed at mitigating the negative outcomes associated with the presence of criminal organizations.

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Appendix Figures

Figure A1: Homicide rate (per 100,000 population) of Manaus and the synthetic control: Benchmark specification.

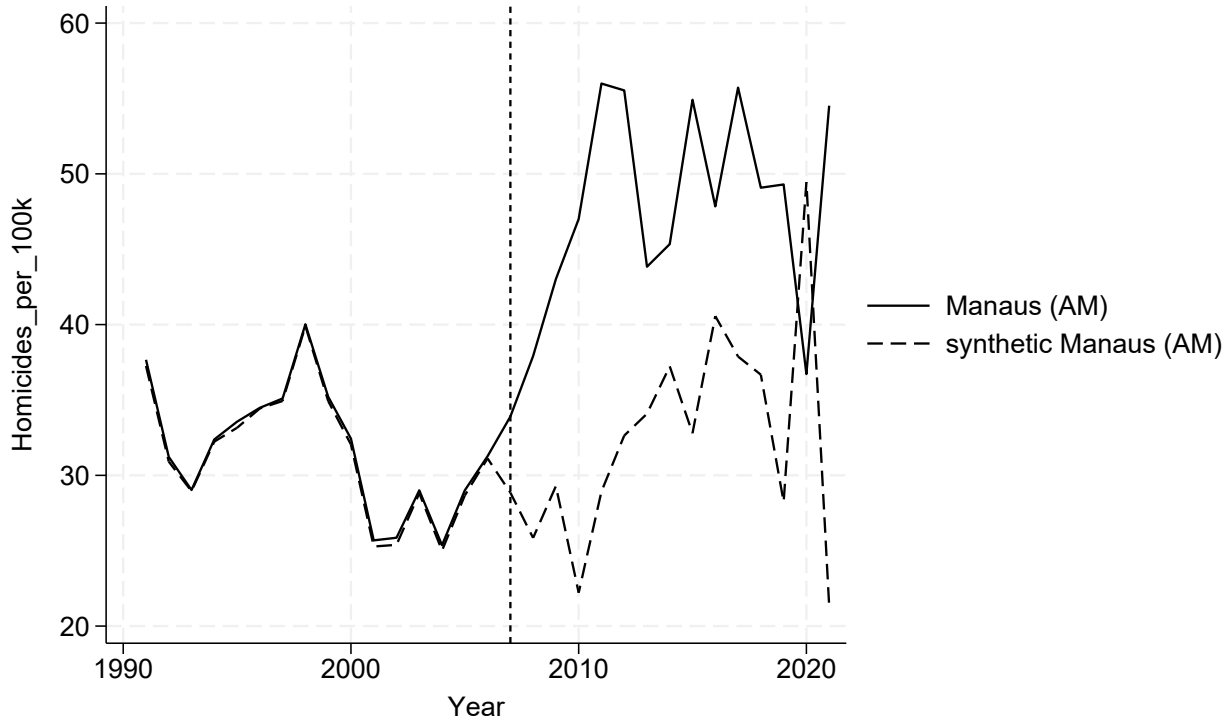

Figure A2: P-values of the synthetic control of homicide rate (per 100,000 population): Benchmark specification.

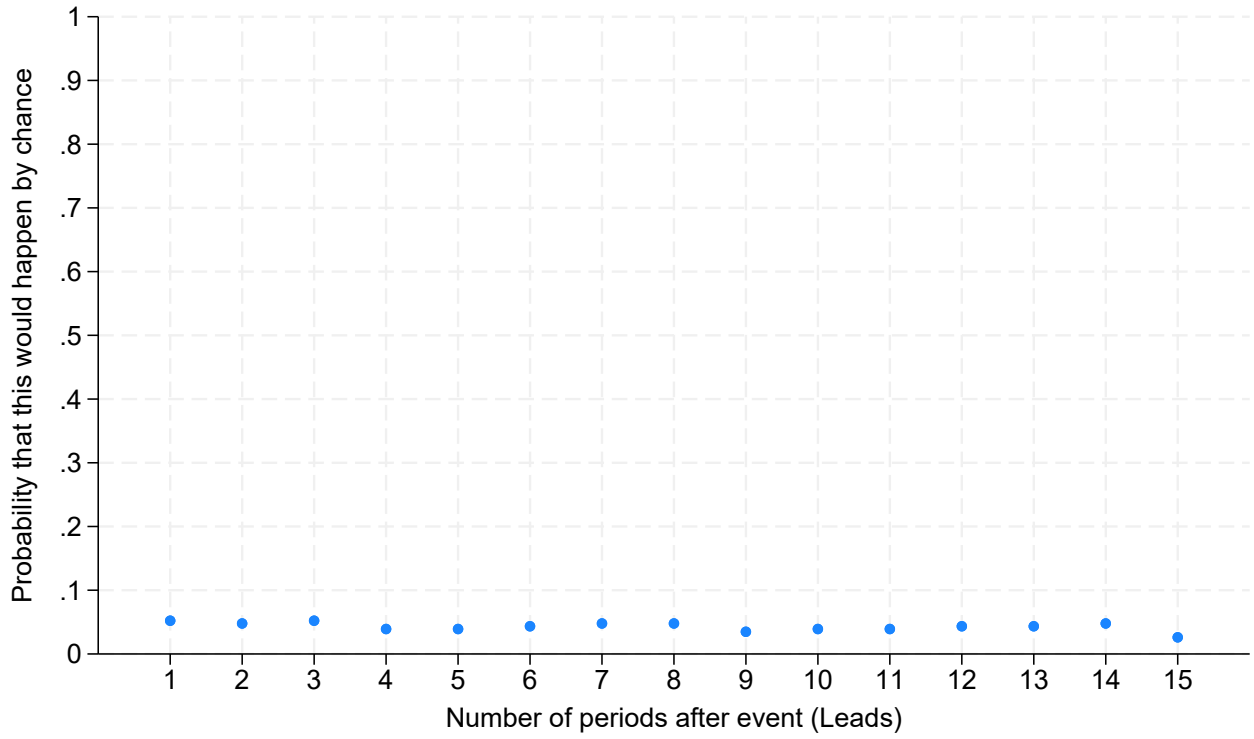

Figure A3: Dropout rate from school year 1 to 4 of Manaus and the synthetic control: Benchmark specification.

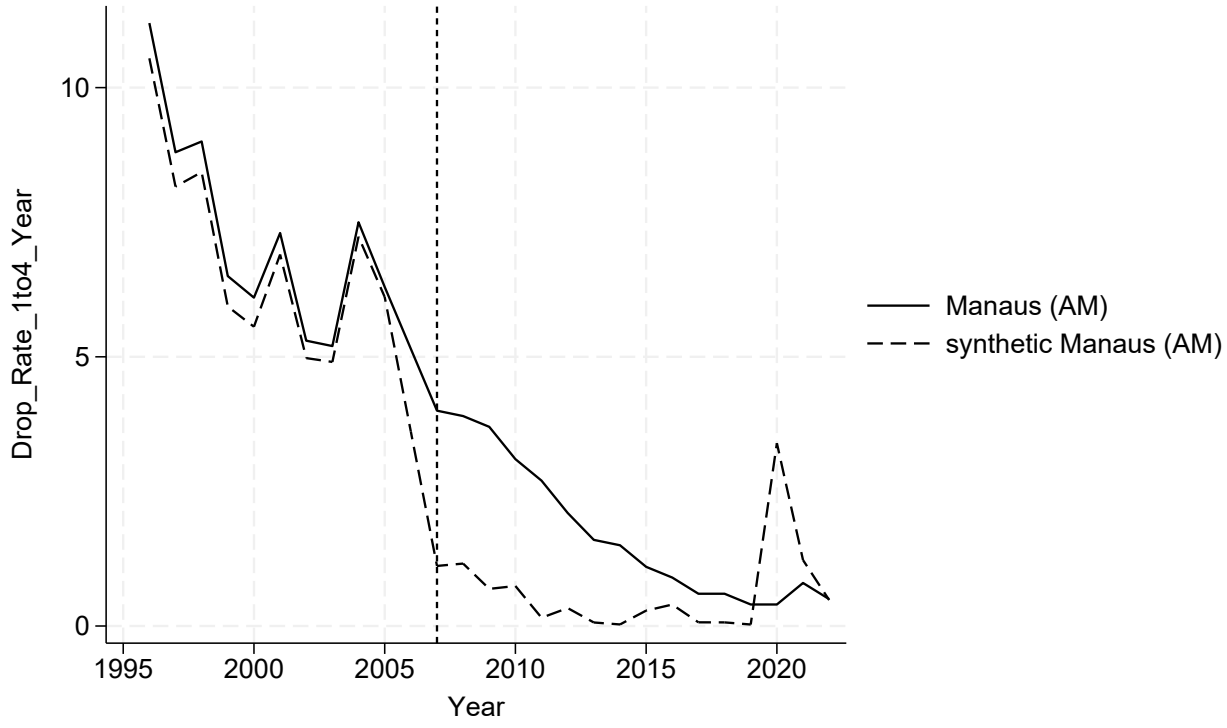

Figure A4: P-values of the synthetic control of dropout rate from school year 1 to 4: Benchmark specification.

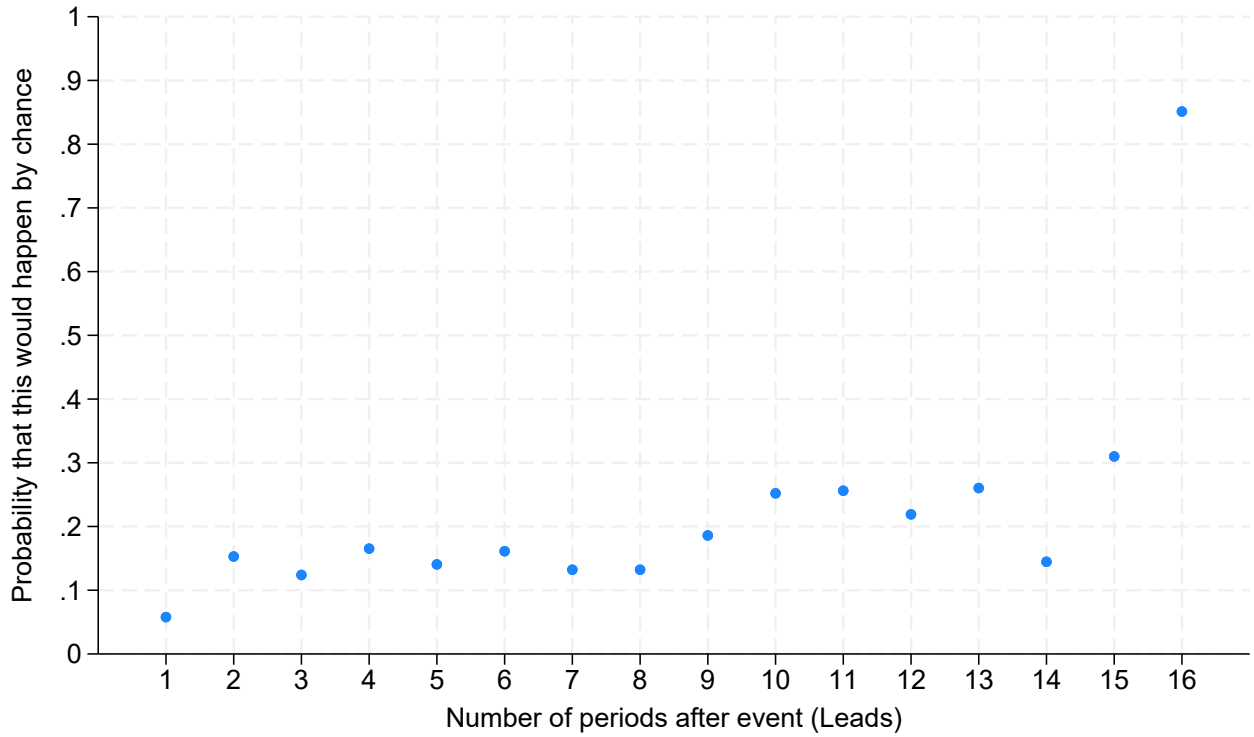

Figure A5: Dropout rate from school year 5 to 8 of Manaus and the synthetic control: Benchmark specification.

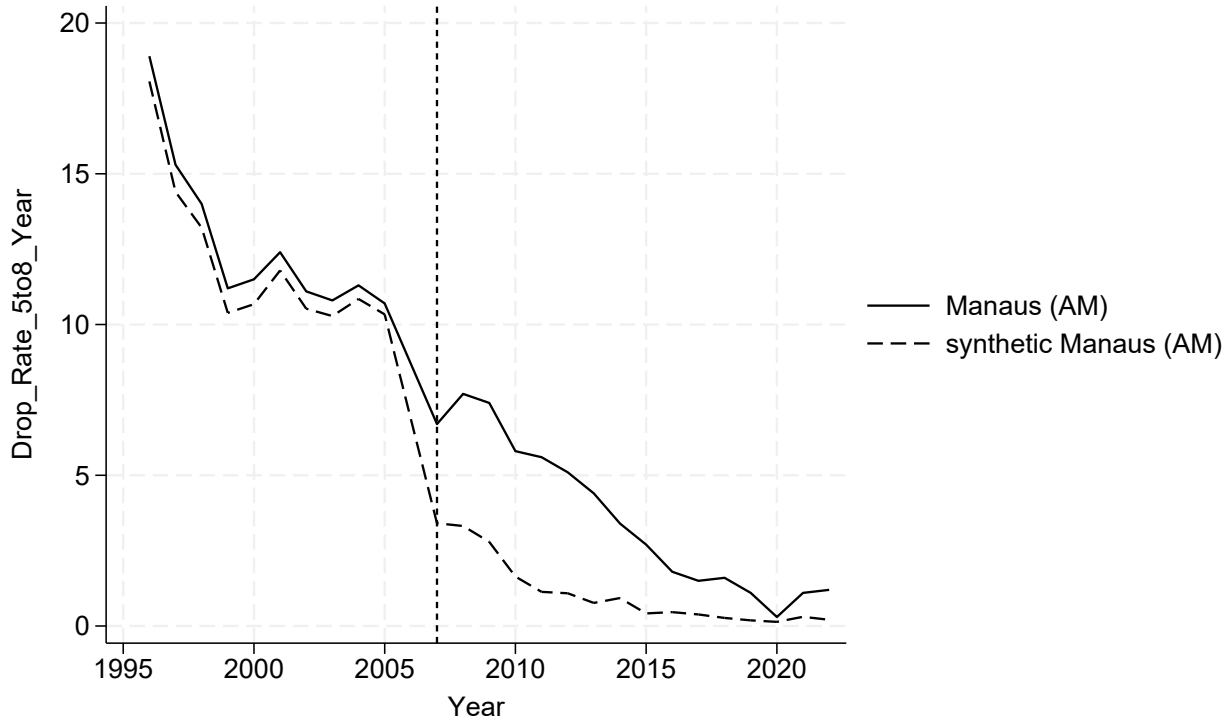

Figure A6: P-values of the synthetic control of dropout rate from school year 5 to 8: Benchmark specification.

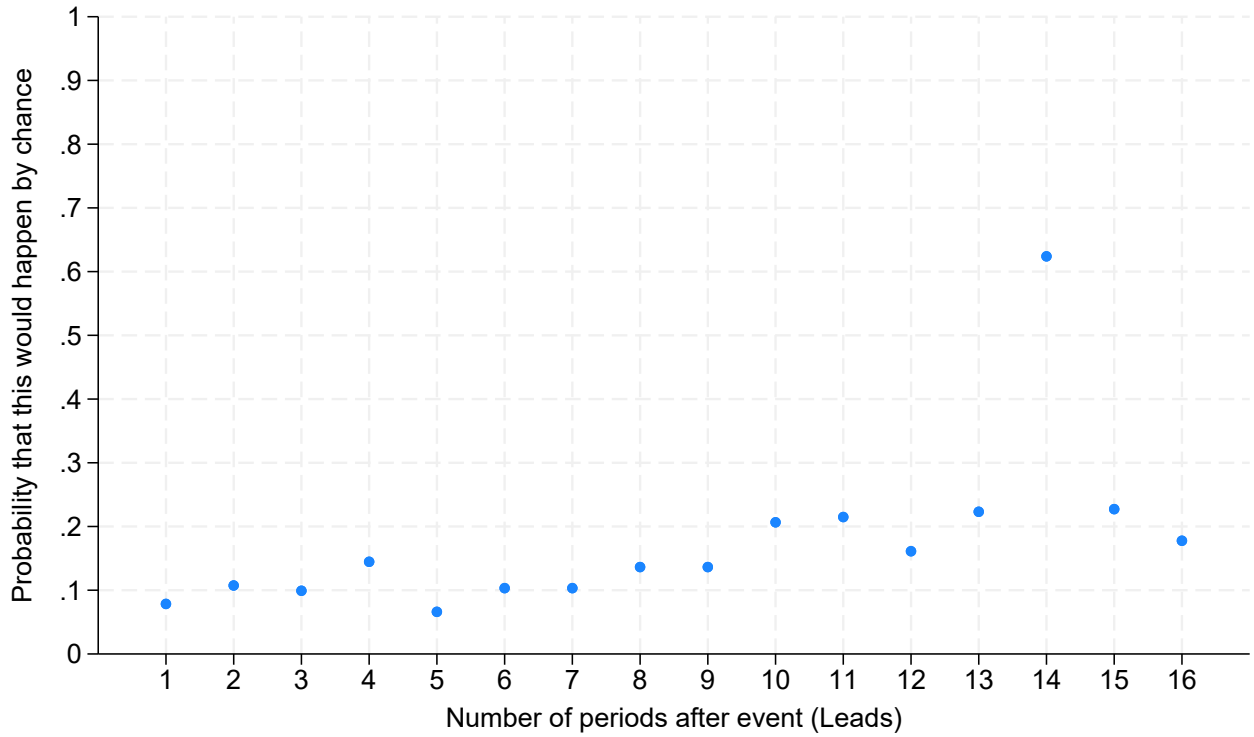

Figure A7: Dropout rate during High School of Manaus and the synthetic control: Benchmark specification.

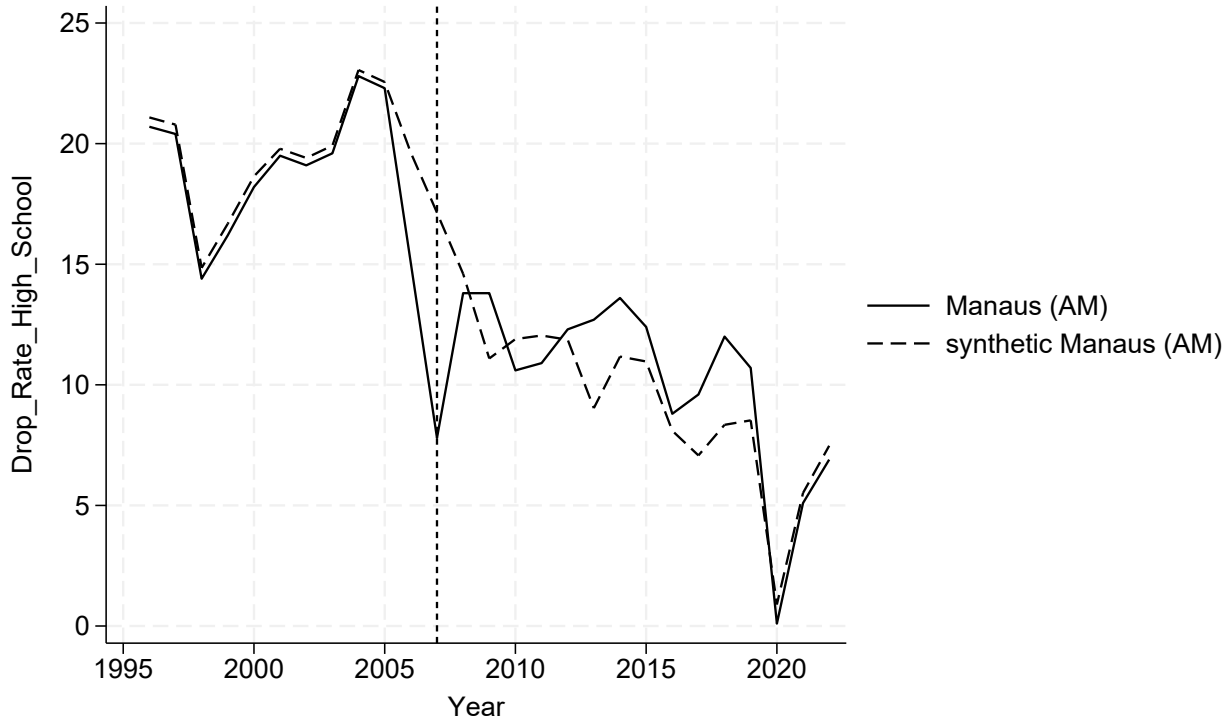

Figure A8: P-values of the synthetic control of dropout rate during High School: Benchmark specification.

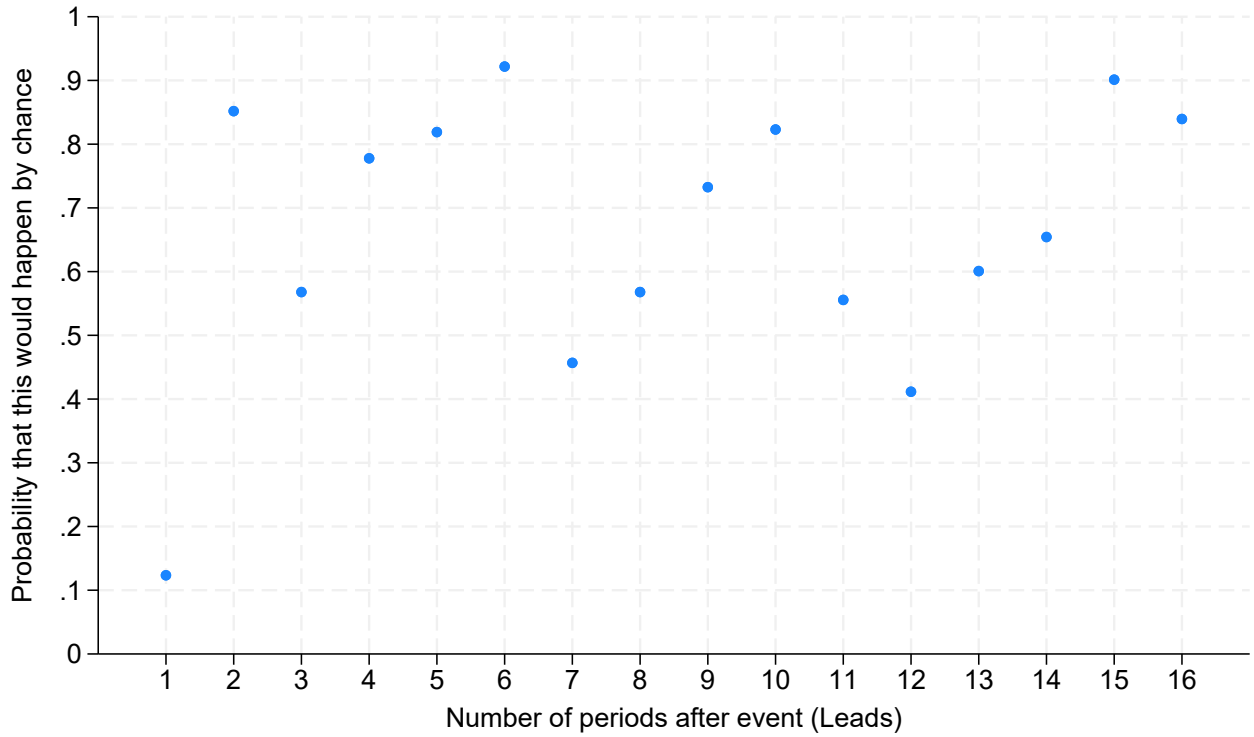

Figure A9: Number of firms per 100,000 population of Manaus and the synthetic control: Benchmark specification.

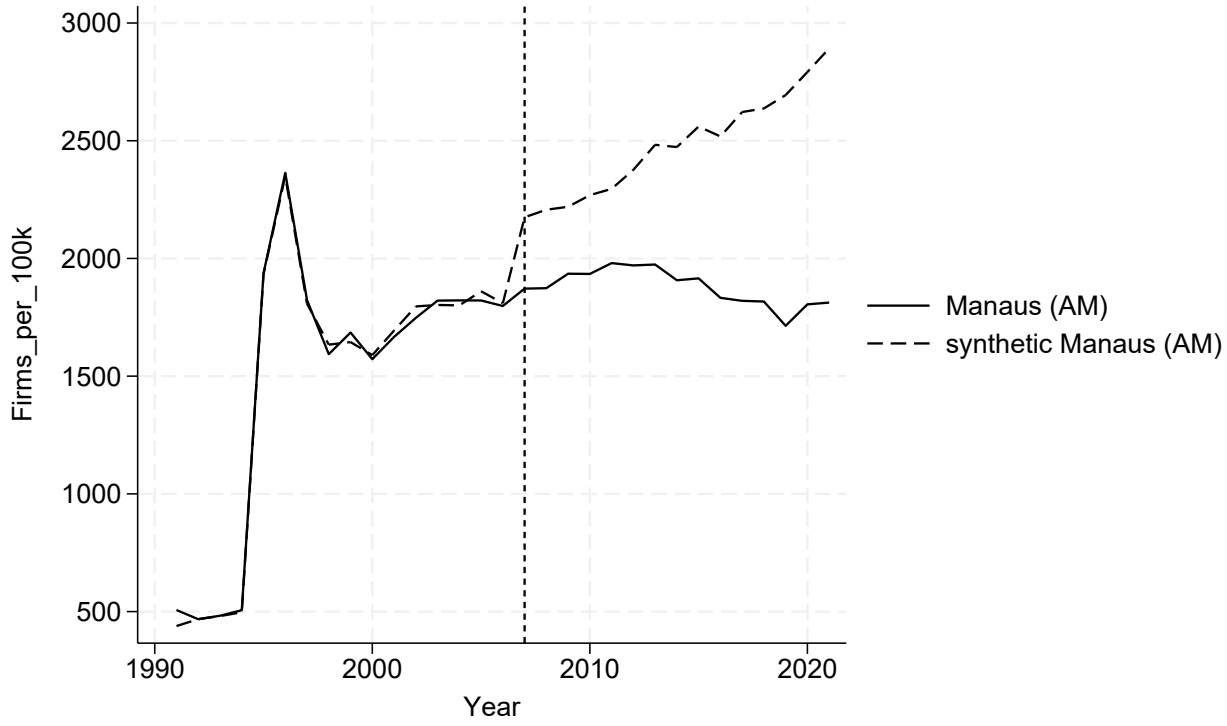

Figure A10: P-values of the synthetic control of number of firms per 100,000 population: Benchmark specification.

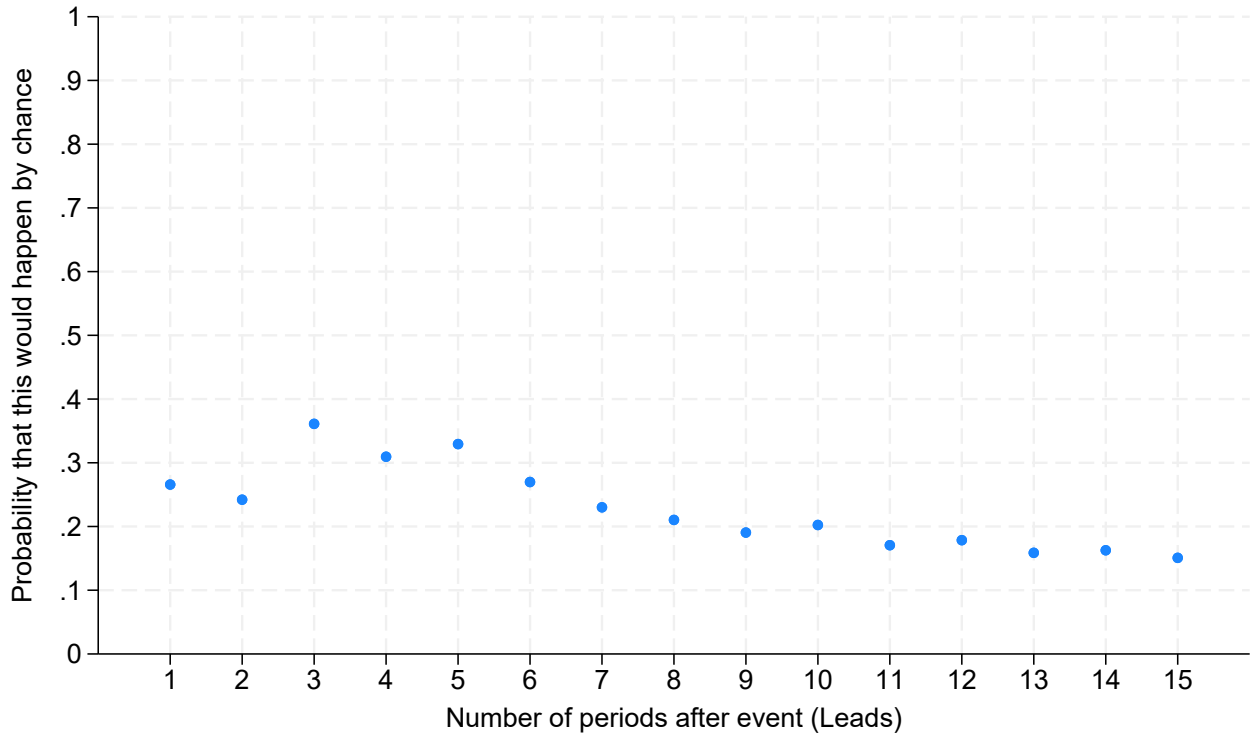

Figure A11: Number of formal jobs per 100,000 population of Manaus and the synthetic control: Benchmark specification.

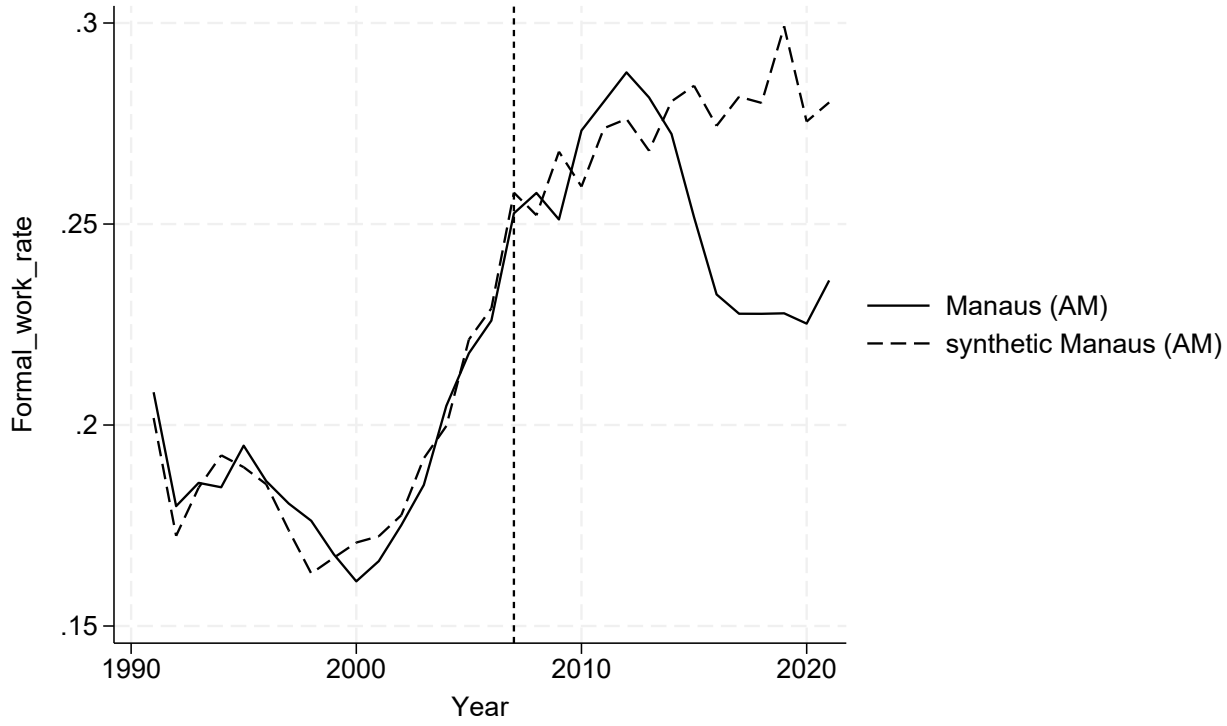

Figure A12: P-values of the synthetic control of number of formal jobs per 100,000 population: Benchmark specification.

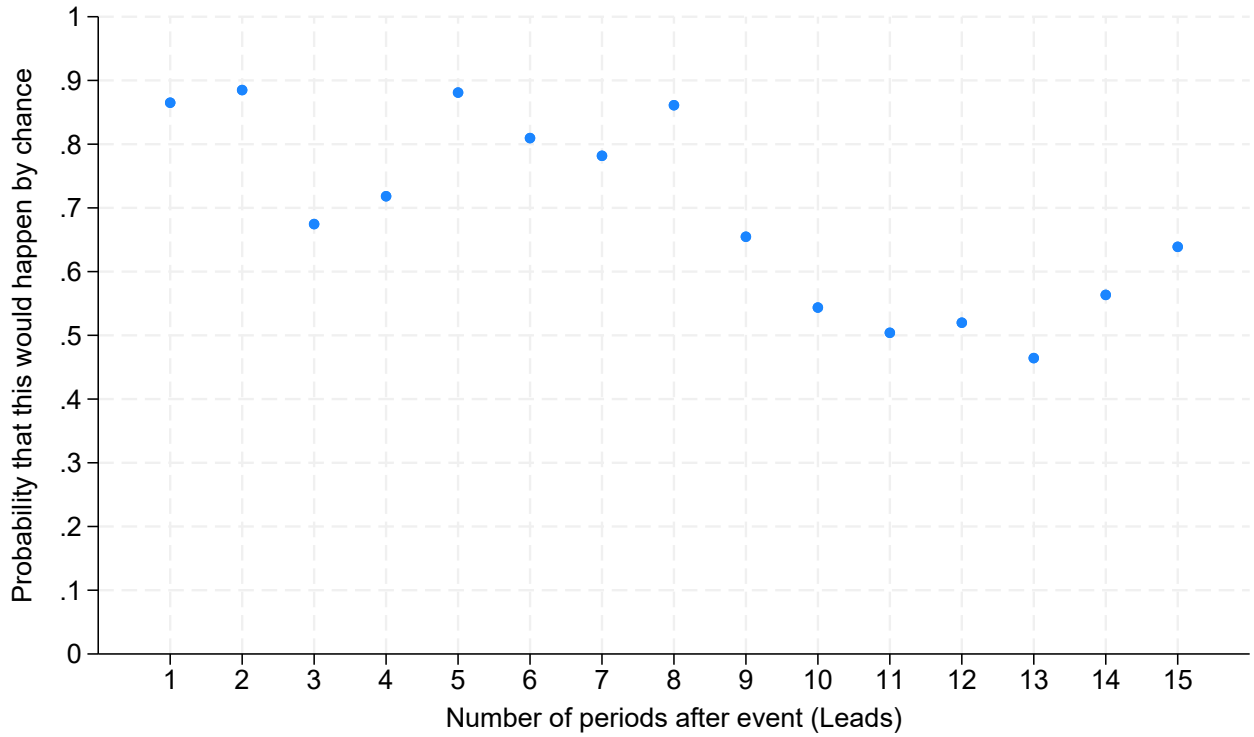

Figure A13: Hospitalizations per 100,000 population of Manaus and the synthetic control: Benchmark specification.

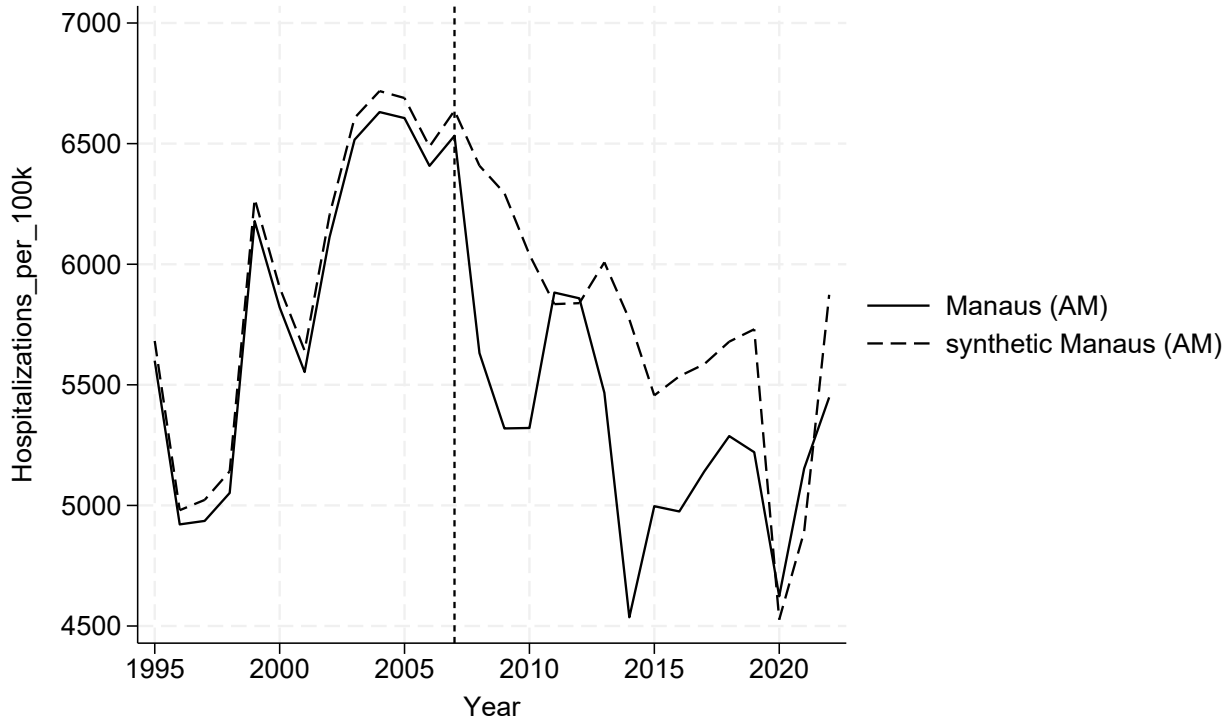

Figure A14: P-values of the synthetic control of hospitalizations per 100,000 population: Benchmark specification.

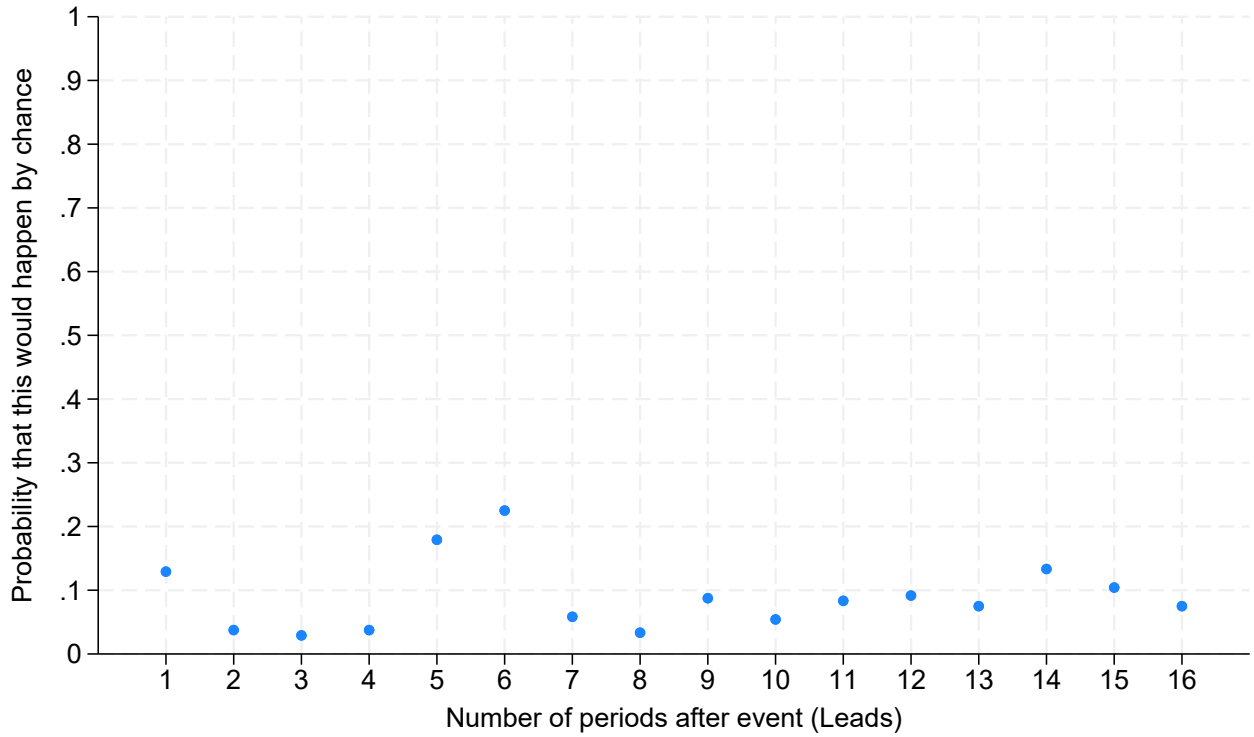

Figure A15: Mental diseases hospitalizations per 100,000 population of Manaus and the synthetic control: Benchmark specification.

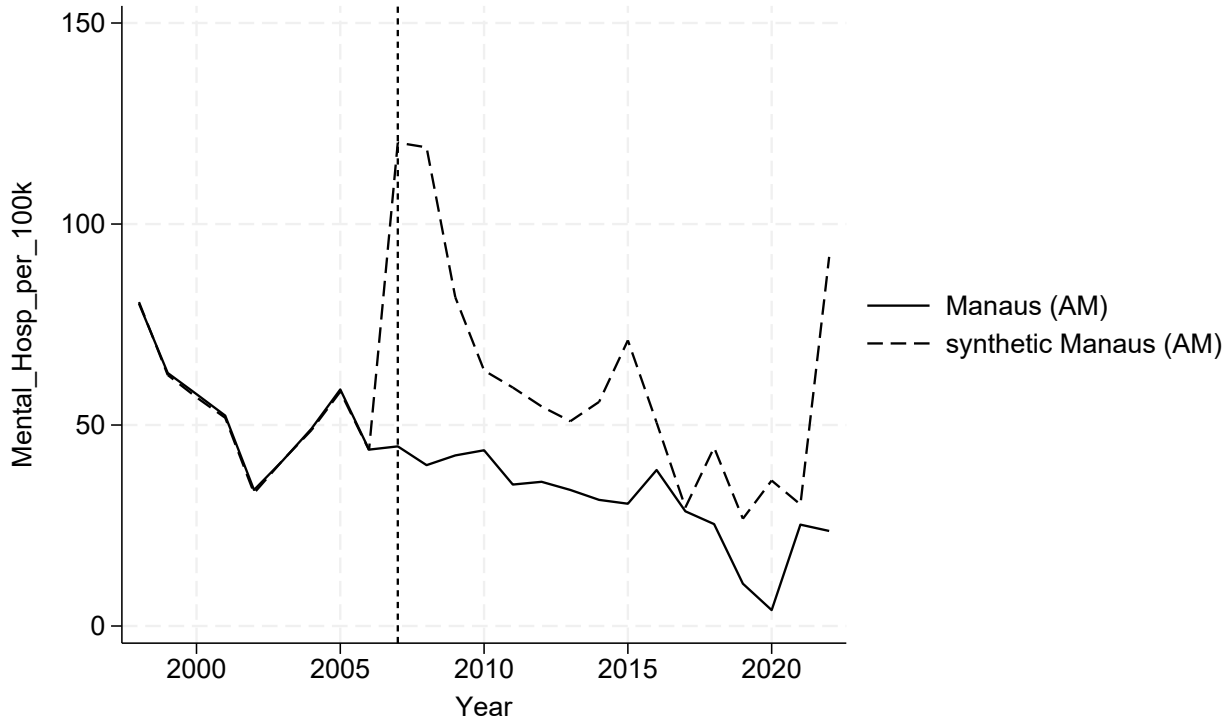

Figure A16: P-values of the synthetic control of mental diseases hospitalizations per 100,000 population: Benchmark specification.

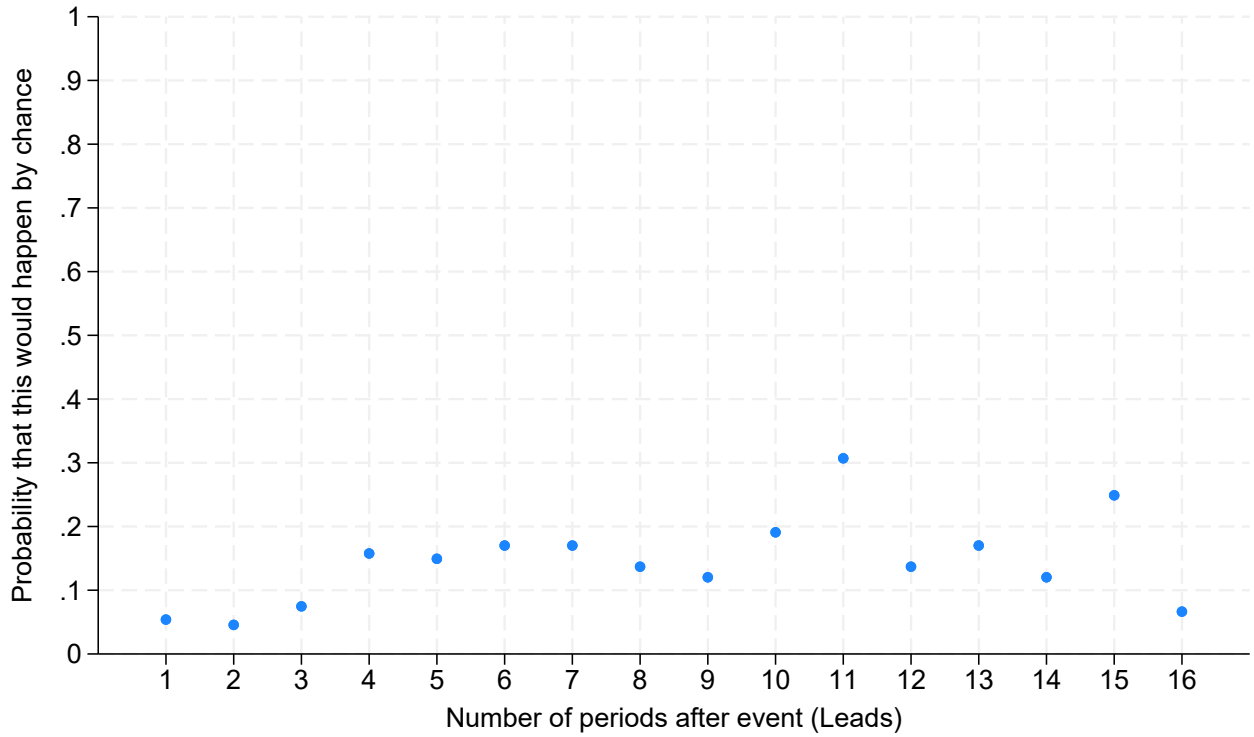

Figure A17: Circulatory diseases hospitalizations per 100,000 population of Manaus and the synthetic control: Benchmark specification.

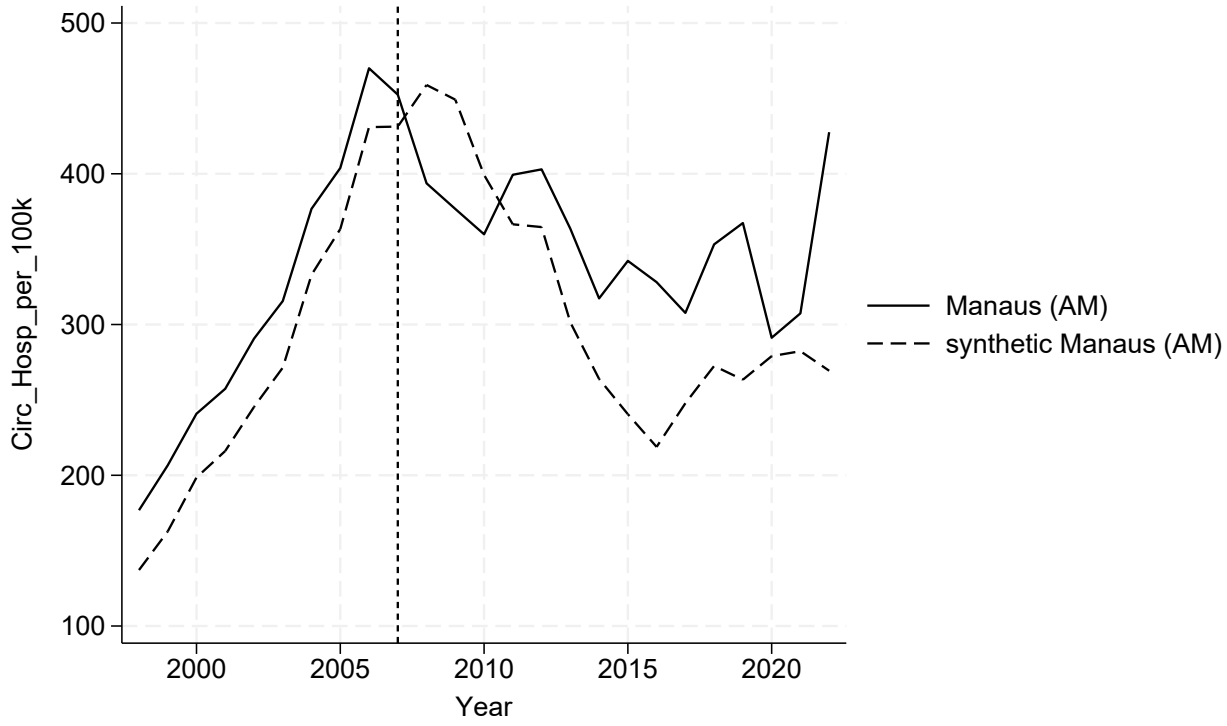

Figure A18: P-values of the synthetic control of circulatory diseases hospitalizations per 100,000 population: Benchmark specification.