LUND UNIVERSITY
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Organized Crime and Government Trust under the Covid-19 pandemic

The case study of Sicily

by

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Do municipalities in which organized crime is strongly established present lower Covid-19 vaccination rates, as a proxy for government trust? This paper aims to answer this question in the specific case of the Italian region of Sicily. Specifically, the analysis exploits a panel dataset of 390 Sicilian municipalities over 107 weeks (between the 27th of December 2020 and the 1st of January 2023) to study if areas with a higher presence of the Mafia, measured through historical sources and more recent data, negatively correlate with the cumulative weekly percentage of Covid-19 vaccinations per municipality. The main OLS results show that towns with a more established presence of the Mafia have lower levels of first-dose vaccinations during the first four months after the beginning of the vaccination campaign. This correlation is stronger and more persistent if more recent Mafia measurements are implemented. However, from March 2021, areas historically affected by the Mafia start to present higher vaccination rates, suggesting a potential involvement of organized crime in mobilizing the population to get vaccinated in order to gain more social consensus. However, due to the non-random distribution of the Mafia, these main findings may not be interpreted as a causal relationship. The study contributes to the literature on organized crime and government trust during socio-economic shocks, during which the timely and effective policy intervention of official institutions is crucial to avoid the rise of the Mafia consensus among the population.

Keywords: Sicilian Mafia, organized crime, government trust, Covid-19, vaccination campaign

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Glossary of Abbreviations

AIC – Akaike Information Criterion

ANBSC – *Agenzia Nazionale per l'amministrazione e la destinazione dei Beni Sequestrati e Confiscati alla criminalità organizzata* (National Agency for the administration and destination of assets seized and confiscated from organized crime)

BIC – Bayesian Information Criterion

CG Carabinieri – *Comando Generale dell'Arma dei Carabinieri* (General Command of the Carabinieri Force)

CSDCM - *Centro Studi e Documentazione sulla Criminalità Mafiosa* (Centre for Studies and Documentation on Mafia Crime)

DIA – *Direzione Investigativa Antimafia* (Antimafia Investigative Directorate)

DNA – *Direzione Nazionale Antimafia* (National Antimafia Directorate)

EU – European Union

GDP – Gross Domestic Product

GEDI – *Gruppo Editoriale S.p.A.* (Editorial Group S.p.A)

IV – Instrumental Variable

OECD – Organization for Economic Cooperation and Development

OLS – Ordinary Least Squares

RMSE – Root Mean Squared Error

UNODC – United Nations, Office on Drugs and Crime

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"Ci si dimentica che il successo delle mafie è dovuto al loro essere dei modelli vincenti per la gente. E che lo Stato non ce la farà fin quando non sarà diventato esso stesso un modello vincente".

"We tend to forget that the success of the mafias is due to their being perceived as winning models by people. And the State will not succeed until it becomes itself a winning model".

Giovanni Falcone[1]

1. INTRODUCTION

1.1 Research Problem

1656, the Naples Plague. The aristocracy had to make a deal with criminal groups, the so-called *Proto-Camorra*, in order to solve the disorders and handle the issue of corpses in the streets of the city (Bifulco et al., 2021). 1867, the cholera outbreak in Sicily. As workers started to abandon their agrarian jobs fearing for their health, the Mafia intervened providing the landowners with new workers through blackmail (Rosen, 2020). 2020, Covid-19 pandemic. The Sicilian Mafia distributed food to poor people in the neighborhood *Zona Espansione Nord* in Palermo (Bettiza, 2020). From the beginning of its establishment, it is evident that the Mafia in Italy has been used to exploit critical situations, in this case, plagues, and pandemics, in order to gain power and consensus to the disadvantage of the central government. During these contexts, the State and its bureaucracy might reveal inefficient and slow at intervening contrary to organized crime, able to act promptly, circumventing the law. Consequently, people may prefer to trust the Mafia more than the official institutions, even if they are not aware that these criminal organizations sooner or later will always ask for something in return.

A drastic event such as the Covid-19 pandemic, on one hand, might have weakened the confidence in the government, due to the difficult policies implemented and not always supported by the population, on the other hand, it might have reinforced the trust in the Mafia, as the only possible way of immediate help. Specifically, one moment in which trust in the institutions was strongly tested during this period is represented by the Covid-19 vaccination campaign. Looking at ***Figure 1*** and ***Figure 2***, it is evident that there is a strong correlation between government trust and vaccination rates' distribution in the Italian peninsula[2]. ***Figure 1*** shows the level of government trust in Italy

[1] From Falcone & Padovani (1991).

[2] In the Appendix, ***Figure A.1*** represents the positive correlation between government trust and vaccination rates in the Italian regions. Sicily has the lowest values both in terms of government trust and vaccination rates.

based on the survey "Aspects of Daily Life"[3] conducted in 2013 by the Italian National Statistical Institute (ISTAT). In this research, people were asked to answer the question: "How much do you trust the government from 1 (not at all) to 10 (Completely)?" The results, obtained by averaging the individuals' answers per province, show a significant decreasing pattern from the Northern to the Southern provinces. The lowest levels of government trust, with average individuals' answers going from 2.6 to 4.4 out of 10, are in the Centre region of Lazio, and the Southern regions of Apulia, Basilicata, Calabria, and Sicily (Camussi et al., 2018). On the other hand, ***Figure 2*** presents the level of vaccination rates per region updated on the 27th of April 2023, summing the percentages of the population that got from one to four doses[4] (GEDI Visual, 2023). Results follow a similar pattern to the government trust in ***Figure 1***. Indeed, vaccination rates decrease from the North to the South of Italy, being in line with the findings in the previous literature, positively correlating the level of trust and vaccinations (OECD, 2021; Sabahelzain et al., 2021; Trent et al., 2022). Overall, Sicily, Calabria, and Campania present the lowest levels of vaccinations, with individuals having received on average between 2.15 and 2.25 doses of the Covid-19 vaccine[5].

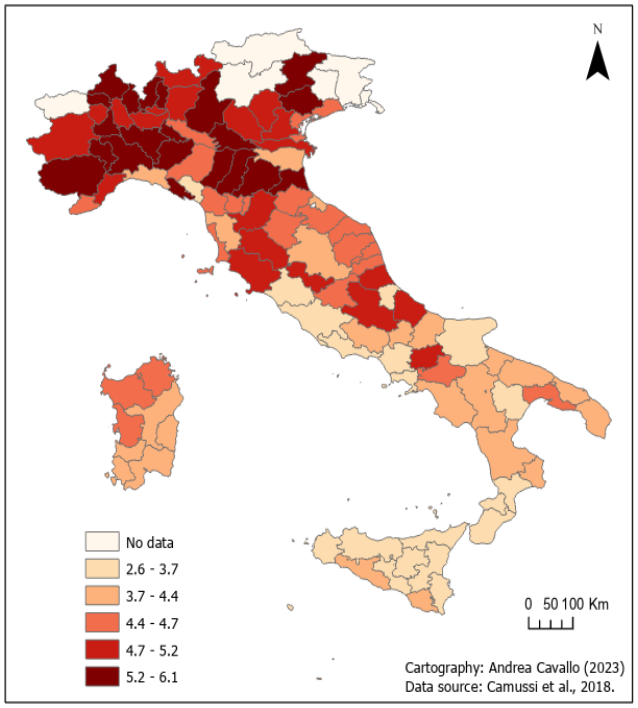


Figure 1
Government trust per Italian province.

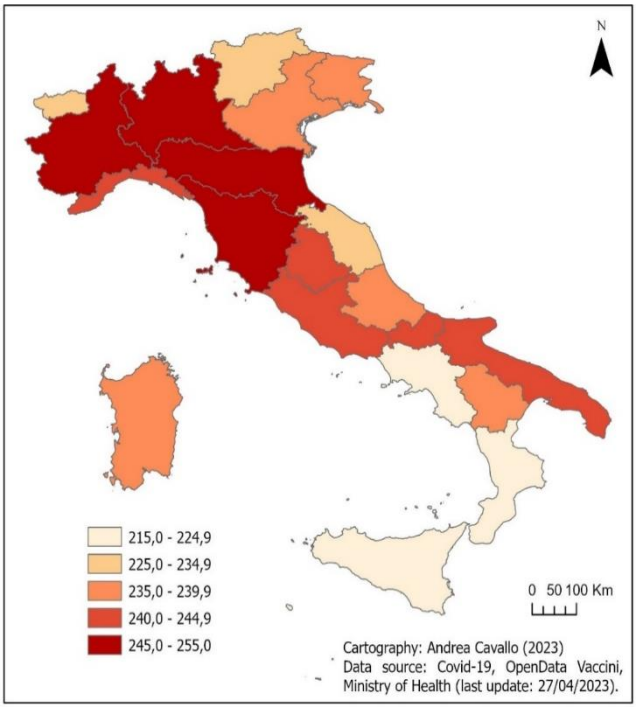


Figure 2
Vaccination rates per Italian region.

[3] *Aspetti della vita quotidiana* (ISTAT, 2013).
[4] Since data on vaccination rates are not available for all the provinces, ***Figure 2*** represents the information on a regional level, contrary to ***Figure 1*** which represent data on a provincial basis.
[5] Sicily, Calabria, and Campania respectively have administrated 215,67 percent, 218,785 percent, and 222,51 percent of Covid-19 doses over each regional population (GEDI Visual, 2023).

This paper aims to study if there is a relationship between the strength of the Mafia and the level of vaccination rates, as a proxy for government trust, in the region of Sicily[6] during the Covid-19 pandemic period. The main hypothesis is that municipalities more exposed to the presence of the Mafia may present a lower percentage of vaccinations, since in these areas people should exhibit a lower trust in the government and, consequently, a lower willingness to get vaccinated. Specifically, the study aims to answer two different questions:

Do Sicilian municipalities in which organized crime is strongly established present lower percentages of Covid-19 vaccination rates, as a proxy for government trust? Does this potential negative correlation vary if historical or more recent measures of the strength of the Mafia are adopted?

The econometric analysis relies on a municipality-weekly panel dataset, with information on the 390 municipalities in Sicily in 107 weeks between the 27th of December 2020, the day on which the vaccination campaign started, and the 1st of January 2023. The choice of Sicily as the study area is driven by three main reasons. First, Sicily is one of Italy's symbolic regions of organized crime. Having its roots in the first half of the XIX century, nowadays the so-called C*osa Nostra*[7] is considered one of the most powerful Italian Mafia organizations with the *'Ndrangheta* in Calabria and the *Camorra* in Campania (Calderoni, 2014b). Second, a very large number of studies have tried to quantify the strength and geographic distribution of the Mafia in Sicily on a granular level (Damiani, 1885; Cutrera, 1900; CG Carabinieri, 1987; CSDCM, 1994; Calderoni, 2014a). These data are fundamental for the following quantitative analysis. Last, as mentioned before, the Sicilian region has one of the lowest levels of vaccinations in Italy (GEDI Visual, 2023), however, presenting a high degree of variation across municipalities. This is an important element to study if the Sicilian Mafia could have partially influenced this distribution.

To measure the power of Sicilian organized crime per municipality, the two main implemented sources are (1) the historical dataset by Cutrera (1900) presenting a dummy equal to 1 if the Sicilian Mafia is considered established in a specific municipality, otherwise 0, and (2) the more recent information regarding the percentage of confiscated assets from the Mafia per municipality between 1981 and 2023 by the "National Agency for the administration and destination of assets seized and confiscated from organized crime"[8] (2023). Additional measures of the Mafia's strength, based on surveys, newspapers, and police reports, are then used as robustness checks. On the other hand,

[6] In the Appendix, ***Figure A.2*** presents the map of Sicily divided by provinces.

[7] *Cosa Nostra* ("Our Thing") is another way to define the association of Mafia organizations in Sicily, especially established in the Western area of the region.

[8] *Agenzia Nazionale per l'amministrazione e la destinazione dei beni sequestrati e confiscati alla criminalità organizzata* (ANBSC).

vaccination rates by dose (1st and 2nd dose) are expressed as cumulative percentages week by week and are available on request from the "Italian Ministry of Health - General Directory of Digitalization, Sanitary Information System and Statistics"[9].

Main OLS fixed-effects results show that during the first four months of the vaccination campaign, areas in which the historical dummy for the presence of the Mafia takes the value 1 have lower levels of vaccination rates, confirming the importance of government trust to accept to get vaccinated. This negative correlation is stronger and more persistent over time when using the more recent measure of the Mafia by the ANBSC (2023). However, after this initial period, results indicate a reverse pattern, since, from March 2021, the correlation becomes significantly positive when the historical information on the Mafia is implemented. This may be due to the evident necessity of vaccinations later in time and the Mafia's involvement in mobilizing efficiently people to get vaccinated. These results remain robust while implementing the different socio-economic robustness controls. However, it is important to highlight that this analysis only shows a negative correlation between the Mafia presence and the percentage of vaccinations, not addressing the issue of causality, due to the non-random distribution of organized crime on the Sicilian Island.

This paper aims to provide three main contributions. First, past literature mainly focuses on the historical development of institutions and socio-economic performance as the main factors affecting government trust in Italy. Little quantitative research is applied to the relationship between organized crime and government trust. Second, this study represents one of the first attempts to analyze the involvement of the Mafia in the recent Covid-19 pandemic. This example inserts in a vast literature on organized crime and socio-economic shocks, allowing for a comparison of the Mafia's influence and actions in different critical situations of history. Third, this study may be extended to other contexts and countries in which organized crime and corruption are significantly entrenched, showing the potential consequences of weak State intervention during socio-economic shocks.

1.2 Outline of the Thesis

The paper is divided as follows. Section one presents the general context of the study, focusing on the origins and development of the Sicilian Mafia, and presenting the Covid-19 pandemic, the related vaccination campaign, and its potential relation with the Mafia's activity. Then, section two analyzes past research on the relationship between government trust, organized crime, and socio-economic shocks. Section three introduces the main data implemented for the quantitative analysis, mainly the

[9] *Ministero della Salute – Direzione Generale della digitalizzazione, del sistema informativo sanitario e della statistica*. I sincerely thank this Institute for its availability in sharing data on vaccination rates for the realization of the thesis.

measures of the intensity of the Sicilian Mafia and the percentage of vaccinations per municipality, additionally presenting other socio-economic control variables that as well could affect vaccination rates. Successively, section four describes the econometric methodology applied for this analysis and section five discusses the main empirical results, including robustness checks. Section six analyses the potential weaknesses of the model, both in terms of data and methodological limitations, discussing potential improvements for future extensions. Lastly, a conclusion is provided.

2. CONTEXT

2.1 The origins of the Sicilian Mafia

Despite some examples of Mafia-like activities in Sicily dating back to the end of the XVI century (Cancila, 1984), most studies argue that the Mafia's first appearance has to be collocated in the XIX century, a period characterized by the end of feudalism, the tumultuous fall of the Bourbon Kingdom and the Unification of Italy (Gambetta, 1993; Dickie, 2004; Lupo, 1996; Lupo 2010).

As expressed by Lupo (1996, p. 33), "the abolition of the feudal system which was ordered by [Bourbon monarchy's] decree in Sicily in 1812 […], destroyed a number of fundamental cadres of the ancient régime". Until 1812, barons of the feudal lordship possessed over three-quarters of the Sicilian villages (Bandiera, 2003). They recruited private guards to protect their lands from potential revolts, and, at the same time, they had specific civic, social, and judicial duties toward the peasants (Dimico et al., 2017). The 1812 land reform aimed to modernize this archaic system, trying to eliminate barons' feudal privileges, but eventually it had a negative impact on society. On one hand, conflicts between the Spanish Crown and the barons increased, lowering the levels of law enforcement (Buonanno et al., 2015), on the other hand, peasants, and shepherds, living in poor conditions and not able to buy land plots, revolted and joined the brigands' groups (Gambetta, 1993). The decree significantly weakened landowners and reinforced the *gabelloti*, tenants that used to administrate the fields for their landowners, but that, after 1812, managed to become the new owners, however, keeping the same production organization as under the feudal system (Marciante, 2023). *Gabelloti* hired their own private guards, called *campieri*, that usually had been under the orders of barons before 1812. As shown by Colajanni (1900), the most advantageous way to recruit a *campiere* was by hiring him from the brigands' groups to avoid attacks from the brigand's companions. This system of coalitions between *gabelloti*, *campieri*, and brigands resulted in situations of corruption and intimidation: landowners that could not afford a *campiere* were potentially exposed to the attacks of the brigands and were required to pay in order to obtain back their stolen properties. This system, described by Lupo (1996) as Proto-Mafia, was first documented on the 3rd of August 1838 by the attorney general of Trapani P. Calà Ulloa:

"This general corruption has led people to rely on exceedingly strange and dangerous remedies. In many towns of the province of Trapani, there are brotherhoods, species of sects that call themselves parties, with no color or political purpose, [...], only under the dependence of a leader, who here is a landowner, there a parish priest. A common fund is used according to need, to exonerate an official,

to buy him, to protect an accused person, or to blame an innocent. These are like small governments in the government. The population has come to a tacit agreement with criminals. When thefts occur, mediators intervene offering transactions to recover stolen items"[10,11].

According to Franchetti (1877), the abolition of the feudal system gave the start to a process of "democratization of the violence", theoretically transferring the right to use force from the aristocracy to the State, but practically being in the hands of new social groups. This situation of corruption and crime was consolidated after the Italian Unification in 1861. Indeed, the newly constituted State was unable to enforce the rule of law (Acemoglu et al., 2020) and the promoted policies to "make the Italians" were seen as obligations by the ruling elite, creating discontent among the Sicilian population (Dimico et al., 2017) and leading to the uprising of Palermo in 1863. Lupo (1996) argues that this was the period in which the Proto-Mafia turned definitely into the Sicilian Mafia that has been characterizing the history of Sicily until nowadays, since in a general context of conflict and insecurity, the demand for private protection increased (Nardin et al., 2016; Acemoglu et al., 2020). Numerous studies have tried to empirically address the strengthening of the Mafia during the second half of the XIX century and understand its geographic distribution on the Sicilian Island. Areas with higher levels of land productivity (Del Monte and Pennacchio, 2012), greater land fragmentation (Bandiera, 2003), or the presence of remunerative sulfur mines (Buonanno et al., 2015) needed more private protection and resulted to present stronger settlement of the Mafia. Additionally, a role seemed to be played by specific socio-economic shocks: a significant increase in the demand for oranges and lemons[12] (Dimico et al., 2017), a severe drought in 1893, and the consequent revolts of peasants (Acemoglu et al., 2020), the institution of mandatory conscription, followed by draft evasion and government led-repression (Marciante, 2023), are all events that favored the spread of the Sicilian Mafia.

[10] Translation from: "*Questo genere di corruzione ha fatto ricorrere il popolo a rimedi oltremodo strani e pericolosi. Vi ha in molti paesi [del Trapanese] delle fratellanze, specie di sette che si dicono partiti, senza colore e scopo politico, senza riunione, senza altro legame che quello della dipendenza da un capo, che qui è un possidente, là un arciprete. Una cassa comune sovviene ai bisogni, ora di far esonerare un funzionario, ora di conquistarlo, ora di proteggere un imputato, ora d'incolpare un innocente. Sono tante specie di piccoli governi nel governo. La popolazione è giunta ad un tacito accordo con i criminali. Quando si verificano furti, appaiono i mediatori che offrono transazioni per il recupero degli oggetti rubati*" (P. Calà Ulloa, 8th August 1838).

[11] Notice that the common fund is financed by rustling or kidnapping for extortion purposes.

[12] This demand shock for oranges and lemons (the so-called Market of Lemons) followed Lind's discovery in the late-XVIII century on the effective use of citrus to cure scurvy (Dimico et al., 2017).

2.2 The development of the Sicilian Mafia

At the end of the XIX century, the action of the Sicilian Mafia expanded from a purely agricultural context to a larger and larger portfolio of services, getting involved in "dispute resolution, cartel enforcement, and electoral canvassing" (Marciante, 2023, p. 17) and consolidating the previously started process of "democratization of violence" (Franchetti, 1877). The presence of the Mafia in Sicily became widely acknowledged, defined as groups or individuals who engaged in organized violence or threat of violence to have control of the economic and political life of their towns and whose power was usually considered by local people as more legitimate than the distant and oppressive State government (Paoli, 2014, p. 122). Indeed, the State repressions generated a higher level of distrust towards the central government, and a larger support for the Mafia and its protection services (Marciante, 2023). The increasing strength of the Mafia started to worry the Italian government, which eventually decided to intervene. One of the first episodes occurred in 1925. Mussolini considered the Mafia as a potential menace for the establishment of Fascism in Sicily (Duggan, 1989) and undertook an anti-Mafia campaign between 1925 and 1929 that culminated with the capture of over 11.000 people and the escape of numerous Mafia families to the United States (Reece, 1973). This repression substantially weakened the Sicilian Mafia's activities until 1943, the year in which the Allies Forces invaded the Italian peninsula. Indeed, in this period, the State and its ability to maintain order dissolved, leaving the Italians in a situation of uncertainty and prompting them to consider again the Mafia as a possible defense from conflict (Lupo, 2010). Additionally, some interpretations argue that a secondary role in the new strengthening of the Sicilian Mafia was played by its relationship with the growing American Mafia (Lupo, 2010) and by the support against the Fascism government during the Allies' invasion (Finkelstein, 1998). In this context, the Mafia adapted to the economic changes, starting to operate "in the exploitation of the rapid building expansion of many Sicilian towns and in the involvement in tobacco and drug trafficking" (Fulvetti, 2004, p. 67). This situation was also facilitated by the alliance between the Mafia and the Christian Democrats, exchanging political support for judicial impunity and economic favors, until the beginning of the 1960s (Seindal, 1998; Fulvetti, 2004; De Feo & De Luca, 2017). The expansion of illicit activities and the increased economic profitability led the Sicilian Mafia to modernize its organization system, opting for a centralized hierarchical structure. However, some clans were against this initiative, starting a violent competition between each other to take control of specific markets and generating a "First Mafia War" between 1961 and 1963, and a "Second Mafia War" between 1981 and 1984 (Neumann et al., 2017). This context of tension led to the intervention of the Antimafia Commission, culminating with the Maxi Trial of 1986-1987, in which 475 Mafiosi were put on trial,

338 were convicted, and 19 with life terms (Suro, 1987). The Mafia reacted violently against the State, murdering, among others, the two symbols of the Maxi Trial, the magistrates Giovanni Falcone and Paolo Borsellino. However, after the capture of the Mafia "Boss of Bosses" Salvatore Rina, violent conflicts alleviated, with *Cosa Nostra* resulting significantly weakened by all these events (Paoli, 2008).

Nowadays, the Sicilian Mafia counts around 150 groups, between 2000 and 3000 members, mainly in the provinces of Palermo, Trapani, and Agrigento (Paoli, 2014, p. 124). Its main criminal interests remain drug trafficking, extortion and usury, and online gambling (Ministero dell'Interno, 2022). Based on the recent estimations by Calderoni (2014b), *Cosa Nostra* on average earned between €1.4 and €2.3 billion from 2007 to 2011. However, the Sicilian Mafia does not represent anymore the strongest organized crime in Italy, being behind 'Ndrangheta and Camorra which approximately possess 68% of total Italian Mafia revenues (Calderoni, 2014b).

2.3 The Covid-19 pandemic in Italy

On the 31st of January 2020, the Italian newspaper *Il Corriere della Sera* announced: "Coronavirus, first two cases in Italy. They are two Chinese people on holiday in Rome. They arrived in Milan on the 23rd of January" (Servegnini, 2020)[13]. Initially, Covid-19 outbreaks mainly involved the regions of Lombardia and Veneto, with the first confirmed Covid-19 death on the 21st of February in the province of Padua (Ferro, 2020). Soon, the virus spread across all the regions, and in March 2020 Italy registered the highest number of confirmed cases after China (Saglietto et al., 2020). On the 9th of March 2020, Italy was the first country in the world to declare a national lockdown, prohibiting people from leaving their homes, unless for work, necessity, or health reasons (Presidente del Consiglio dei Ministri, 2020). The effects of this implementation started to be evident in April 2020: Covid-19 cases and deaths slowly decreased and from the 4th of May, the lockdown was declared over, going back gradually to pre-Covid-19 everyday life. However, during the autumn of 2020, Covid-19 cases increased again (De Natale et al., 2020). A series of new lockdowns and regional containment measures characterized the period between September 2020 and May 2021, during which also Central and Southern regions were strongly hit by the pandemic (Natilli et al., 2022). From this period on, a fundamental role was played by the vaccination campaign, starting on the 27th of December 2020. To incentivize people to get vaccinated and contain the diffusion of new variants, in

[13] Translation from: "*Coronavirus, primi due casi in Italia. Sono due cinesi in vacanza a Roma. Sono arrivati a Milano il 23 gennaio*" (Servegnini, 2020).

August 2021, the Green Pass certificate[14] was introduced, allowing only vaccinated people or people presenting a negative Covid-19 test to enter indoor public places such as restaurants, cinemas, and gyms. These initiatives led to a progressively better situation in the country, and, on the 1st of April 2022, the Italian government declared the end of the Covid-19 state of emergency.

Overall, according to the last updated data by the Italian Ministry of Health, 25.809.208 Covid-19 cases have been confirmed in Italy between February 2020 and May 2023 (Ministero della Salute, 2023a), and 50.016.750 people, representing 84.73% of the Italian population, have completed their vaccination cycle between December 2020 and May 2023 (Ministero della Salute, 2023b)[15].

2.4 The Covid-19 pandemic in Sicily and the Mafia involvement

Focusing on the region of Sicily, in the first semester of 2020, the impact of Covid-19 was lower compared to the Northern regions. Indeed, due to its geographical position, in mid-March 2020 the pandemic in Sicily was still in an early stage and the adopted lockdown policies prevented its spread in this area (Sebastiani et al., 2020; Tramuto et al., 2021). However, the trend changed during the autumn: from the 6th of November 2020, the central government, due to pressure on hospital beds, implemented new lockdowns and travel restrictions for six specific regions, including Sicily (OECD, 2020). This situation aggravated at the beginning of 2021, with Sicily categorized as "Red" in January 2021, and then being predominantly "Orange" between February and May, maintaining more than 100 municipalities strictly under lockdown (Quotidiano di Sicilia, 2021)[16]. As in the rest of the peninsula, the Covid-19 pandemic in Sicily weakened during the summer of 2021 and then reappeared in two main waves between the end of 2021 and the beginning of 2022, then alleviating its spread. Overall, the Sicilian Island is the fifth region in Italy per number of Covid-19 cases in absolute values, but it ranks 16th among the 20 Italian regions when considering the ratio between the infected population and the total Sicilian population (Ministero della Salute, 2023b).

Table 1 presents the total numbers and percentages of Covid-19 cases in Sicily and its provinces until the 8th of May 2023. Provinces with the highest percentages of Covid-19 infected people are Messina, Syracuse, Catania, and Ragusa.

[14] The Green Pass certificate was already existing before (since 1st July 2021); however, it was mainly essential for traveling abroad.

[15] A completed vaccination cycle referred to people that got either two doses, a mono-dose vaccine, or that recovered from a previous Covid-19 infection. Referring to the third dose, a total of 40.488.860 people, representing 68.59% of the Italian population, were vaccinated between October 2021 and May 2023 (Ministero della Salute, 2023b).

[16] Regions in Italy were categorized by color (white, yellow, orange, and red), depending on the severity of the Covid-19 pandemic.

Table 1: Total confirmed Covid-19 cases per province in Sicily.

	Total Covid-19 cases	% of infected population
Sicilia	**1.825.465**	**37,443**
Palermo	427.793	34,979
Catania	424.926	39,615
Messina	257.792	41,993
Syracuse	161.147	41,389
Agrigento	141.566	33,429
Trapani	139.686	33,159
Ragusa	124.988	39,603
Caltanissetta	96.525	37,715
Enna	51.042	31,869

Source: own elaboration from data by Ministero della Salute (2023b).

As in the rest of Italy, the vaccination campaign in Sicily started on the 27th of December 2020, however proceeding more slowly than the national average. At the beginning of August, calculations by *Il Sole 24 Ore* were predicting that on average 80% of the Italian vaccinable population would have been vaccinated by the 9th of September, but these results were hiding substantial differences across regions, especially in the case of Sicily (Ferrazza, 2021). Indeed, Sicily, with a total of 106.000 administrated doses per 100.000 inhabitants, was the second-last region in terms of vaccination rates after the autonomous province of Bolzano[17]. This divergence is still evident today: respectively 77.55% and 73.48% of the total Sicilian population have got the first and the second dose, representing the lowest values in Italy together with the region of Valle d'Aosta and the autonomous province of Bolzano (GEDI Visual, 2023).

How can the Mafia, specifically *Cosa Nostra*, take advantage of this situation? The Covid-19 pandemic has been defined by The World Bank (2020) as the deepest recession since World War II. In Italy, the pandemic led to a significant drop in employment and income: the number of employees decreased by 945.000 units between February 2020 and February 2021, and the GDP per capita at the end of 2020 was 8.9% lower than the previous year (ISTAT, 2023). Specifically in Sicily, GDP per capita at market prices fell from 18.242,8 to 17.212,1 between December 2019 and December 2020, with 17.7% of households in relative poverty compared to the Italian average of 11.1% (ISTAT, 2023). These dramatic conditions were the perfect context for the action of the Mafia. Indeed, organized crime is not new to this kind of event, exploiting drastic moments such as natural shocks

[17] Compared to Sicily, Lombardia, the most efficient region in terms of vaccinations, presented a total of 128.000 administrated doses per 100.000 inhabitants (Ferrazza, 2021).

(e.g., earthquakes[18]), or economic crises (e.g., the 2008 financial crisis; Le Moglie & Sorrenti, 2022) to help people in difficulty, gain support, and then, ask for something in exchange when the crisis is over. Under the Covid-19 pandemic, Roberto Saviano (2020), an Italian writer and journalist constantly tackling the topic of organized crime, announced that Mafias were going toward the "Great Speculation". During a crisis period, organized crime can act with more freedom, due to lower levels of control, and in the case of Covid-19, a new element, isolation, facilitated its action even more. In these contexts, people who are hungry or sick do not care about who produces and distributes food and medicine, consequently opting for the Mafias' options since more efficient and faster than the unorganized intervention of the State. The Covid-19 pandemic could provide two main areas of action for the Mafia, according to the Antimafia Investigation Directorate[19] (Ministero dell'Interno, 2020). First, in the short-term, crime organizations could aim to consolidate their social consensus, through "forms of welfare", such as lending money, and distributing food and medicines, to then capitalize it in electoral votes or other favors. For instance, in the neighborhood of *Zona Espansione Nord* in Palermo, during the lockdown of March 2020, the brother of a well-known Mafia boss provided food to families in difficulty, anticipating the benefits promised by the State (Ministero dell'Interno, 2020, p. 81). Second, in the medium-long run, the Mafias could take advantage of the desperate demand for liquidity by many companies and the need for financial injections in a market that needs to recover from the pandemic stop. Indeed, owners of businesses that are financially in difficulty, "can either choose to drown with [their] ideals or swim, when someone [the Mafia] throws a life vest [at them]" (Bettiza, 2020). Hence, the Covid-19 pandemic represented a suitable moment for the Mafias to construct their electoral campaign, investing in social consensus. The already low levels of trust in the institutions in the Southern regions (Camussi et al., 2018) could have been worsened during the Covid-19 pandemic, increasing the support for the Mafias, perceived as more prone to help the population in difficulty than the State.

[18] The infiltration of Mafia organizations in the management of tenders and help funds has been witnessed during the earthquakes of Irpinia in 1987 (Barbato, 2020) and L'Aquila in 2009 (Galullo, 2009; Postiglione, 2010; Imperiale & Vanclay, 2020).

[19] *Direzione Investigativa Antimafia* (DIA).

3. PREVIOUS RESEARCH

What can influence trust in the national government? Numerous studies have tried to answer this question from different angles, due to the innumerable number of variables that can affect this phenomenon. Firstly, the current level of trust may be influenced by the history of each specific country (Putnamn, 1993), specific past events (Damico et al., 2000), and inherited culture and thoughts generation by generation (Algan & Cahuc, 2010). Second, key roles are played by the type of government (Ljunge, 2014; Uslaner, 2018) and its micro and macro performance (Bouckaert & Van de Walle, 2001). Government micro-performance is mainly related to bureaucratic and administrative tasks (Peeters et al., 2018; Hitlin & Shutava, 2022), while government macro-performance is linked to concepts such as economic growth, unemployment, and inflation (Campbell, 2004; Wang, 2005; Kroknes et al, 2015). Lastly, a relevant aspect negatively correlated with trust is represented by the degree of corruption and crime in the country (Morris & Klesner, 2010; Richey, 2010).

Studies regarding Italy conclude that the level of government trust increases with the proximity of the institutions to the citizens[20], however being low compared to the European average (Arrighi et al., 2022), while, its distribution significantly varies province by province, presenting a negative trend going from the Northern to the Southern regions (Camussi et al., 2018). Several scholars have tried to investigate the reasons behind this overall low level of government trust and this consistent variation across the country. Three main explanations are provided.

Part of the literature attributes the current situation already to the Italian Pre-Unification history, depending on the quality of past institutions and the number of conflicts as a factor of cohesion and cooperation against a common enemy (Putnam, 1993; Bauer et al., 2016). Indeed, since the Middle Ages, the North and Centre areas of Italy started to have more active civic societies, involving many citizens in the socio-political life, and presenting more horizontally organized governments (Putnam, 1993). On the other hand, the South was hierarchically administrated, modeled on a feudal-autocratic system of government, and characterized by a high level of "parasitism" in politics (Alesina & La Ferrara, 2002; Accetturo & Mocetti, 2019). Putnam (1993) argues that these different levels of democracy and cooperation shaped the different degrees of trust across the Italian peninsula.

Another explanation comes from the heterogeneous socio-economic development of the Italian peninsula after the Unification in 1861, causing different feelings towards public institutions. Indeed,

[20] The study by Arrighi et al. (2022) finds that respectively 43%, 36%, and 33% of the survey respondents answered positively in terms of trust in the local, regional, and national government.

nowadays the South of Italy is significantly less developed than Northern areas, presenting lower income levels, high unemployment rates, and a more backward system of public infrastructures, a divergence that consistently increased from the second half of the XIX century (Daniele & Malanima, 2011; Daniele & Malanima, 2012)[21]. This socio-economic gap might have been influential in creating a feeling of resentment in the Southern population that could consider itself as left behind by the government, at the same time perceived as favoring Northern regions. This is in line with the interpretation of "government serving some communities better than others" as a source of distrust in the institutions (Hitlin & Shutava, 2022, p. 13).

Lastly, a significant role in eroding government trust is covered by organized crime and corruption, highly rooted in the Southern regions of Italy. The population experiencing the Mafia in their municipalities might have lower confidence in the government for different reasons. First, numerous studies document the Mafia's infiltration into government institutions and the several episodes of corruption of public officials (Seindal, 1998; Buonanno et al., 2016; De Feo & De Luca, 2017; Alesina et al., 2018). De Feo and De Luca (2017) find that, after the Second World War, areas with a larger presence of the Mafia supported the Christian Democratic Party in exchange for economic advantages in the construction sector, while Buonanno et al. (2016) show that, with the collapse of the Italian party system and the arrival of new parties in the Nineties, a significant number of votes in favor of Berlusconi's Forza Italia was coming from areas plagued by the Mafia. This situation may lead people living in municipalities with a strong presence of organized crime to consider the government as complicit with the Mafia's organizations, resulting in a decline in its trust. Second, Mafia's illegal economic profits from extorsion, drug trafficking, and online gambling are invested in the legal economy "to accomplish tasks such as money laundering, generating [more] profits and raising forms of social consensus in the local population" (Le Moglie & Sorrenti, 2022, p. 143; UNODC, 2020). In this case, on one hand, citizens may raise suspicions about the government's ability to control and regulate economic activities, allowing the Mafia to freely operate in the legal economy, on the other hand, they might increase their trust toward organize crime, seen as an alternative in the provision of jobs and capital (Gambetta & Reuter, 1995). Third, the presence of organized crime and corruption also hampers the effectiveness of the justice system and law enforcement authorities, then negatively affecting the trust in the government (Chanley et al., 2000; Wike & Holzwart, 2008; Blanco & Ruiz, 2013). Indeed, the Mafia presence might create a feeling of powerlessness and fear among the

[21] In 1861, the gap in GDP per capita between Northern and Southern regions was between 7 and 20 percent (Daniele & Malanima, 2012), while, at the beginning of the XXI century, the average GDP per capita in the South was around half of the GDP per capita in the North (Daniele & Malanima, 2011).

citizens, distrusting more and more the government, inefficient at providing protection. This attitude might reveal itself difficult to change in the long run, even if improvements in the justice system are applied (Sherman, 2002). Additionally, this level of insecurity, especially increasing during socio-economic crises, could be considered by criminal organizations as an opportunity to increase their social consensus through the offer of help and protection for citizens in need, ulteriorly damaging the trust in the State (Acemoglu et al., 2020). Overall, the presence of the Mafia and government trust go in opposite directions, highly dependent on the efficiency and strength of the State intervention.

On the other hand, it is important to understand the impact of critical historical moments (e.g., socio-economic shocks, natural disasters, pandemics) on government trust. In this case, the population may either increase or decrease its trust in the government depending on different factors, mainly the nature and severity of the shock, the general context in which it occurs, and the State's response.
The political will and the ability to implement specific reforms are prerequisites for establishing public trust (Buscaglia & van Dijk, 2003) since citizens are willing to support their government "if they believe that the crisis is severe and the government can handle it effectively" (Acharya et al., 2021, p. 2). During periods of crises, citizens ask governments for leadership and guidance, but if their interventions are slow and uncoordinated, not improving the general situation, trust in the institutions may be rapidly eroded. For instance, numerous studies show that, overall, trust in national governments during the Financial Crisis of 2008 significantly decreased, since institutions were not able to regulate the financial sector adequately (Roth, 2009; Roth, 2011; Pew Research Center, 2022; Roth et al., 2022). However, these effects consistently vary over time, since part of the countries more involved in the Financial Crisis of 2008 implemented effective measures, recovering previous levels of trust in the long run, while, other countries, already in the short run, did not present significant negative drops in government trust since they were considering themselves less hit by the crisis compared to other countries (Venetoklis, 2021).
In addition, socio-economic and natural shocks highlight inequalities within society, potentially impacting government trust. Indeed, the government's response, which should aim to minimize the impact of the shock (e.g., through expansive social policies or redistribution reforms) could favor certain groups and fail to intervene in solving inequalities, consequently diminishing the general level of trust, or moving preferences in the support of other parties (Margalit, 2019). For instance, in this regard past literature has found that, under natural disasters such as earthquakes, a poor administration of financial aid influenced by episodes of corruption, may negatively affect the confidence in the government (Weng et al., 2015).

All these concepts can be applied to the recent Covid-19 pandemic, during which the success of policies aiming to solve the critical moment was highly dependent on trust in the authorities and respect for their decisions. Different public-health policies might result in different levels of public trust (Nielsen & Lindvall, 2021). This variation might be influenced by the strictness of the government interventions to face the Covid-19 pandemic, the country's performance in response to the applied policies compared to other countries (Van der Meer, 2017), or the level of political trust before the crisis, that, if already weak, could bring conflict and less government support during the socio-economic shock (Nielsen & Lindvall, 2021). For example, many Italians deemed the restrictions and lockdowns imposed by the government as excessive: indeed, citizens wanted to actively be involved in the decision-making process, not passively following the government dispositions. Consequently, these initiatives ulteriorly weakened the already fragile level of Italian government trust (Di Marco et al., 2021). From this perspective, a situation that highly tested the confidence in the official institutions was represented by the Covid-19 vaccination campaign. Numerous past studies conclude that a lack of government trust is associated with lower percentages of vaccines (Jamison et al., 2019; Miyachi et al, 2020; Marciante, 2023), and this is valid also during the Covid-19 pandemic (Đorđević et al., 2021; Trent et al., 2022). When the government is perceived as presenting a lack of competence (not able to offer safe and effective vaccines), lack of benevolence (indifferent to negative effects of the vaccine), or lack of integrity (delivering misleading information on the vaccine), citizens are less willing to trust the government, and get vaccinated (Van Oost et al., 2022).

In conclusion, past literature shows that government trust is, on one hand, negatively correlated with organized crime, and on the other hand, positively correlated with vaccination rates. The aim of the paper is to aggregate these two main findings, studying if a higher presence of the Sicilian Mafia could lead people to get less vaccinated, to show their distrust in the institutions. Hence, the main hypothesis is that the strength of the Mafia is negatively correlated with the level of vaccination rates.

4. DATA

In the following, data for the quantitative analysis are presented. The main independent variable is a measure of the strength of the Mafia per Sicilian municipality, the dependent variable is represented by the cumulative percentage of vaccination rates, as a proxy for government trust, per week and municipality, and lastly, a series of additional socio-economic controls are described. In the Appendix, ***Table A.1*** presents the descriptive statistics, summarizing the main variables implemented.

4.1 The Strength of the Mafia

Measuring the presence and strength of the Mafia is not easy since each organization is highly fragmented into several clans and is characterized by strict rules of secrecy and silence[22] (Dugato et al., 2020). In addition, the numerous dimensions of the Mafia, its "organization presence, violence, connection to politics and the legal economy", make the estimations of its presence highly complicated, leading scholars to focus on specific variables (Calderoni, 2014a, p. 4). To partially overcome this problem, the following econometric analysis implements seven measures of the Mafia, collected in different ways from 1885 until nowadays, to see if results follow a similar trend, consequently minimizing the biases. Specifically, three sources related to the historical presence of Sicilian organized crime (Damiani, 1885; Cutrera, 1900[23]) and four sources based on more recent investigations (CG Carabinieri, 1987; CSDCM, 1994; Avviso Pubblico, 2023; ANBSC, 2023) are implemented.

Data from Damiani (1885) comes from the Jacini Inquiry (1877-1885) that aimed to assess the agrarian sector and peasantry conditions in every Italian region. Abele Damiani was a member of Parliament, nominated responsible for the region of Sicily. The section of the Inquiry relevant to the following analysis is related to the information on the socio-economic conditions of peasants, in which the type and strength of crime in the region are discussed. Specifically, the question asked to 179 Pretori (lower court magistrates) in 158 Sicilian districts was: "What is the most common form of crime in the district? What are their causes?" (Dimico et al., 2017, p. 1099). Based on the answers of the Pretori, an ordinal variable measuring the intensity of the Mafia per district is constructed, assuming values 0 (no presence of the Mafia), 1 (low presence of the Mafia), 2 (intermediate presence of the Mafia) or 3 (high presence of the Mafia). Then, municipalities in each district are classified

[22] The Mafia's code of silence, or "*Omertà*", is defined as the solidarity aimed at concealing the identity of the perpetrator of a crime. This solidarity, dictated by consortia interests or imposed by fear of reprisal, consists in deliberately refraining from accusations or testimonies against certain individuals (Treccani, 2023).

[23] The analysis uses two different types of data by Cutrera (1900).

according to the answers of the Pretori (Acemoglu et al., 2020). However, this measure shows some concerns. First, as mentioned before, it is performed on a district level, and the direct conversion to a municipal level could potentially hide some geographic variations. Second, the estimations are based on the subjective evaluation of the Pretori, that could not have a correct understanding of the term Mafia, could underestimate its strength (e.g., if they were corrupted or members of the Mafia's clans), or could simply not see the phenomenon even if present (Dimico et al., 2017).

The second historical data comes from Antonino Cutrera (1900), a Sicilian inspector that evaluated the presence of the Mafia in 1900 through his own experience, and the collection of information from police reports, and newspapers. For these estimations, Cutrera avoided data on criminal statistics, arguing that "the Mafia intensity cannot be represented with numbers [of crimes]" (Cutrera, 1900, p. 114), since it is not always related to delicts, and any detailed information on crimes exclusively attributable to the Mafia is not available. Cutrera examined the roots and the characteristics of the Sicilian Mafia gathering data on 285 out of 357 municipalities in the last decade of the XIX century. This data is presented in two ways: (1) a dummy variable that takes the value 1 if the Mafia is established in a municipality, regardless of its intensity, and (2) a four-point scale classification depending on the strength of the Mafia in each municipality. Past literature considers this evaluation more reliable than Damiani's (1885) since, on one hand, it is available on a municipal level and, on the other, Cutrera did not have any reason to employ different evaluation criteria, depending on the municipality (Buonanno et al., 2015; Dimico et al., 2017; Acemoglu et al., 2020). The main weakness is that the number of studied municipalities is limited. ***Figure 3*** summarizes the results by Cutrera (1900) showing a stronger presence of the Mafia in the Center-East areas of Sicily, mainly in the provinces of Agrigento, Caltanissetta, Palermo, and Trapani.

A first more recent measure of the Mafia is based on the parliamentary report by the Italian military police in 1987 (CG Carabinieri, 1987) that lists all the main Mafia families and the towns in which it is supposed they were based. A total of 80 municipalities are classified as Mafia strongholds (De Feo & De Luca, 2017)[24]. This information allows for the creation of a dummy variable taking value 1 if a Mafia family was present in a specific municipality during 1987, otherwise 0.

A similar procedure is applied to the study from the "Centre for Studies and Documentation on Mafia Crime"[25] at the University of Messina (1994). In this case, through the analysis of numerous news, details on Mafia families and their municipalities of influence are cataloged. This information has

[24] This period was characterized by the Maxi Trial (1986-1987) during which numerous important Mafiosi, called "*Pentiti*" (repentants) abandoned the Sicilian Mafia and started to collaborate with the State. Their contribution helped to obtain a large amount of information regarding *Cosa Nostra*.

[25] *Centro studi e documentazione sulla criminalità mafiosa* (CSDCM).

been transformed into a dummy taking the value 1 if the Mafia was operating in a specific municipality during 1994 (De Feo & De Luca, 2017).

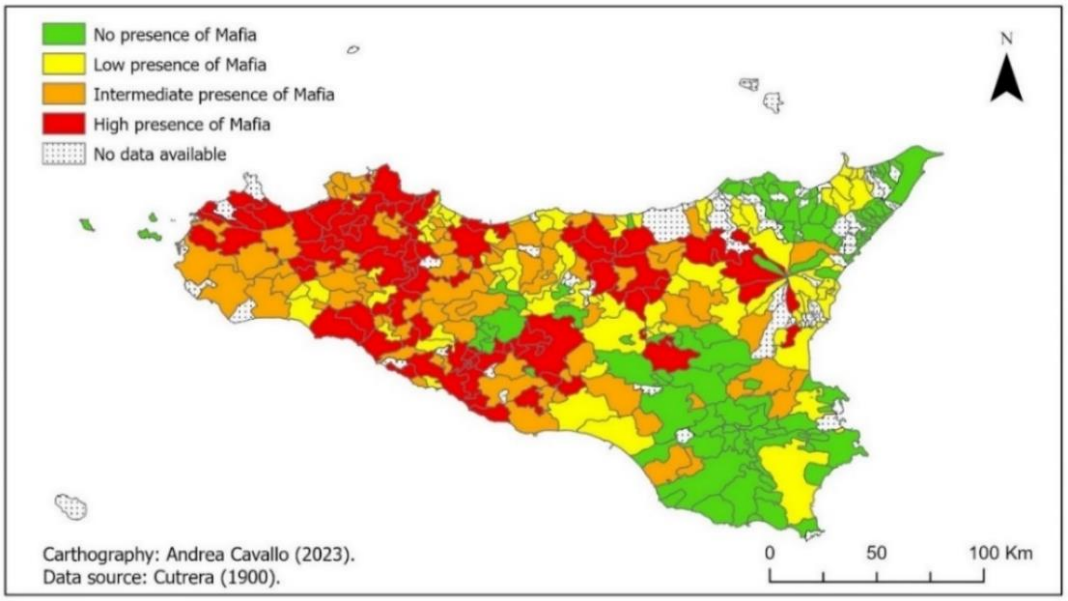


Figure 3: The historical presence of the Mafia on a municipality level in Sicily.

Note: Cutrera (1900) propose the results based on the Sicilian municipalities in 1900. However, over time, different municipalities have been aggregated into larger towns or split into smaller villages. The map depicts the current distribution of municipalities on the Sicilian Island, associating to each of them the specific historical observations by Cutrera (1900), when possible. Municipalities are divided into four different categories depending on the classification by Cutrera (1900).

The two most recent measures of the strength of the Mafia are the following: (1) the number of dissolved municipalities because of the Mafia infiltration in the local government between 1991 and 2023 and (2) the number of confiscated assets from the Mafia between 1981 and 2023.

The dissolution of municipal and provincial councils because of Mafia infiltration was instituted in response to the Black Friday Massacre in Taurianova[26] in 1991 by Decree-Law n. 164 (31st May 1991), and then converted into Law n. 222 (22nd July 1991). This legislation establishes that a municipality can be temporarily dissolved if councils' administrators are unequivocally found to collaborate directly or indirectly with the Mafia. In case of dissolution, the national government nominates an extraordinary commission of 3 people, covering the same role as the municipal council. In Sicily, from 1991 to 2023, 90 decrees of dissolution were issued (4 of which were canceled). In total, 71 Sicilian municipalities have been temporarily dissolved over time, 14 of which more than once (Avviso Pubblico, 2023). From this information, a dummy variable taking the value 1 if the town was dissolved at least once is created as an additional measure of the Mafia's intensity.

[26] On the 3rd of May 1991, fights between local Mafia families in Reggio Calabria reached their peak: four people were killed, making the whole country aware of the inhuman character of the 'Ndrangheta, the strongest Mafia-type organization in the region of Calabria.

Last, the main organization that studies the number of Sicilian confiscated assets from the Mafia is the "National Agency for the administration and destination of assets seized and confiscated from organized crime" (ANBSC). Data per municipality is available from 1981 until 2023, divided by type of confiscated asset (firm or real estate) and institutions in charge of their management. This second categorization divides the assets as directly managed by the State or transferred from the State to the municipalities and managed by the latter. Sicily is the Italian region that presents the largest amount of confiscated assets over time (ANBSC, 2023). ***Table 2*** summarizes the main results.

Table 2: Total number of firms and real estate confiscated from the Mafia between 1981 and 2023.

	Confiscated real estate from Mafia	Confiscated firms from Mafia
Managed by the State	9109	929
Managed by the municipality	7919	559

Source: own elaboration from data by ANBSC (2023).

The available information on confiscated assets (number of firms and real estate) has been summed up and divided by the population of each municipality, in order to obtain the percentage of total confiscated assets per municipality, a more consistent measure of comparison between areas. The geographic distribution of this variable is shown in ***Figure 4***, overall confirming the variation presented in ***Figure 3***. A larger presence of confiscated assets, and supposedly a higher strength of the Mafia, is evident, especially in the provinces of Palermo and Trapani, and in specific areas of Agrigento, Caltanissetta, Catania, and Messina.

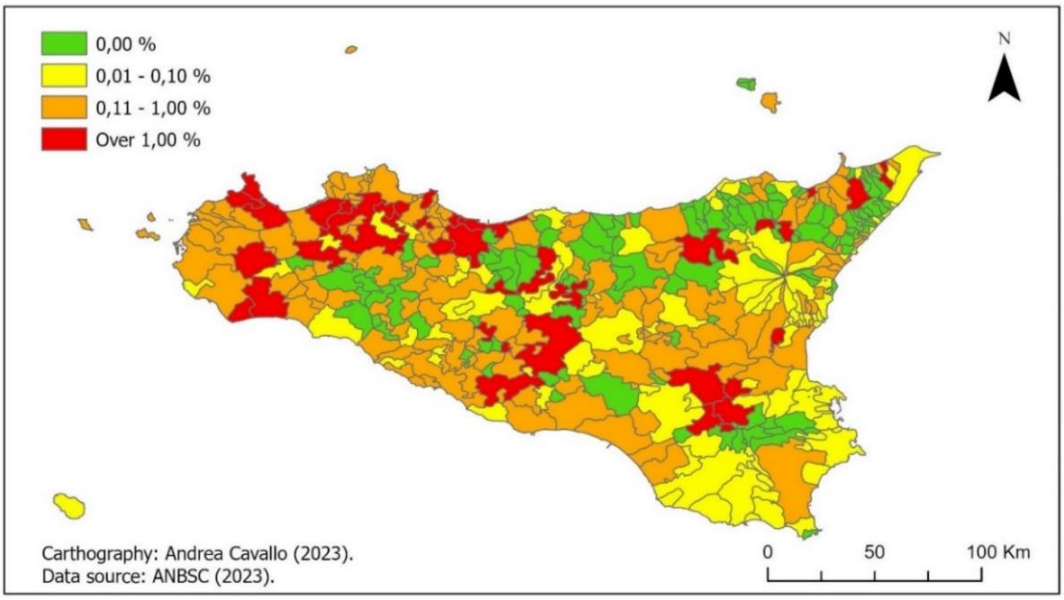


Figure 4: The percentage of confiscated assets over the population per Sicilian municipality.

Note: municipalities are divided into four classes depending on the percentage of confiscated assets over the total population (0% no Mafia, 0.01-0.10% low Mafia, 0.11-1.00% intermediate Mafia, and over 1.00% high Mafia).

It is important to underline that all the observations, especially the information regarding historical data, have been transformed in relation to the name of current municipalities in order to perform the following analysis. Municipalities that over time were created from splitting past towns are attributed the same Mafia's strength of the previous larger municipality, while municipalities that were created from the aggregation of more towns are attributed a Mafia's strength equal to the average of the past intensities of the Mafia in relation to their population and rounded to the closest integer number.
As mentioned before, all these proposed measures are an attempt to measure the presence of the Mafia per municipality, however, each one focuses on specific variables, potentially neglecting other dimensions of organized crime. ***Table 3*** reports the pairwise correlation between all the different measures of the Mafia described, showing an overall positive correlation that, as expected, decreases over time due to the different events that involved the Mafia and changed its geographical distribution. The only negative correlation regards the variable of confiscated assets between 1981 and 2023 with the variables Mafia 1885, Mafia 1900, and Mafia 1994. This may be partially due to the significant distance in time of the performed measurements and the fact that these most recent values focus only on confiscated assets, not having an overall picture of the Mafia's actions. However, if the three outlier observations presenting the highest percentages of confiscated assets[27] are temporarily canceled[28], all the variables are positively correlated with each other by at least 10 percent (***Table 4***).

In the following empirical analysis, the two main sets of variables implemented are (1) the Mafia's dummy variable by Cutrera (1900), as a historical source to study the long-term correlation between the presence of the Mafia and the level of government trust, proxied by vaccination rates, and (2) the percentage of confiscated assets from the Mafia as a more recent measure and the only continuous data available. The other variables referred to as the strength of the Mafia are then implemented as robustness checks.

[27] The three temporarily dropped municipalities are Roccella Valdemone and Furnari in the province of Messina and Resuttano in the province of Caltanissetta. They present large percentages of confiscated assets, especially because their populations are significantly small (below 2000 inhabitants). It is also important to highlight that Furnari was temporarily dissolved for Mafia infiltration in the local government in 2009.
[28] In the study by Cutrera (1900), the province of Messina presents the largest number of municipalities with missing data regarding the presence of the Mafia (respectively 41), supporting the idea that these areas could have been less accurately studied (Roccella Valdemone and Furnari are in the province of Messina).

Table 3: Pairwise correlation between measures of Mafia presence.

	Strength Mafia 1885	Strength Mafia 1900	Dummy Mafia 1900	Dummy Mafia 1987	Dummy Mafia 1994	Dissolved towns 1991-2023	Confisc. assets 1980-2023
Strength Mafia 1885	1.0000						
Strength Mafia 1900	0.3289	1.0000					
Dummy Mafia 1900	0.2339	0.8031	1.0000				
Dummy Mafia 1987	0.2216	0.4279	0.3286	1.0000			
Dummy Mafia 1994	0.1569	0.3646	0.2731	0.5221	1.0000		
Dissolved towns 1991-2023	0.2254	0.2770	0.1917	0.2514	0.2041	1.0000	
Confisc. assets 1981-2023	-0.0016	-0.0536	-0.0851	0.0215	-0.0051	0.0212	1.0000

Table 4: Pairwise correlation between measures of Mafia presence (not including outliers).

	Strength Mafia 1885	Strength Mafia 1900	Dummy Mafia 1900	Dummy Mafia 1987	Dummy Mafia 1994	Dissolved towns 1991-2023	Confisc. assets 1980-2023
Strength Mafia 1885	1.0000						
Strength Mafia 1900	0.3244	1.0000					
Dummy Mafia 1900	0.2276	0.7999	1.0000				
Dummy Mafia 1987	0.2196	0.4249	0.3243	1.0000			
Dummy Mafia 1994	0.1545	0.3599	0.2665	0.5209	1.0000		
Dissolved towns 1991-2023	0.2293	0.2857	0.2011	0.2550	0.2078	1.0000	
Confisc. assets 1981-2023	0.1613	0.1556	0.1063	0.2488	0.1586	0.1354	1.0000

Note: the outlier municipalities temporarily canceled are Roccella Valdemone, Furnari, and Resuttano.

4.2 Vaccination Rates

The Covid-19 vaccination rates in Sicily are obtained on request from the "Italian Ministry of Health - General Directory of Digitalization, Sanitary Information System and Statistics". The available data represents the number of weekly vaccinations per type of dose (1st and 2nd dose) and Sicilian municipality between week 52 of 2020, during which the vaccination campaign started, and week 52 of 2022 (ending the 1st of January 2023). In total, the database contains observations on 390 Sicilian municipalities over a period of 107 weeks. These raw values have been summed up cumulatively and divided by the population over 12 years old of each municipality (ISTAT, 2020)[29] in order to obtain the evolution of vaccination rates per municipality and week. Despite some partial results regarding the different types of vaccine doses, the main analysis focuses on the first dose of the Covid-19 vaccine for two main reasons. First, using the first dose allows for studying the initial reaction of the population to this new implementation, in which trusting the government was fundamental to getting or not vaccinated, and the presence of the Mafia could have played a significant role in reducing the vaccinations' acceptance. Second, implementing the first Covid-19 dose allows for including the entire vaccination campaign period, therefore having a more complete time span for the analysis.

Figure** 5* shows the vaccination trends from the 27th of December 2020 and the 2nd of January 2022, dividing the municipalities into four groups depending on the percentage of confiscated assets from *Cosa Nostra*, as a measure of the strength of the Mafia. It is evident that, after an initial phase of low vaccinations all over the Island, from the second half of March 2021, areas presenting no confiscated assets from the Mafia show an evident higher growth in the number of administrated first doses, while the values for municipalities with low, intermediate, and high levels of Mafia are lower, only recovering from July 2021. It is important to underline that the trend is significantly similar in areas with intermediate and high strength of the Mafia, while towns with low levels of Mafia need more weeks to get closer to the other municipalities' levels of vaccination rates, even if, their numbers remain overall slightly lower. On the other hand, ***Figure 6 presents the distribution of vaccination rates of people over 12 years old in Sicily by first (left) and second (right) doses, at the end of 2021 (week 53 - 2021) and at the end of 2022 (week 52 - 2022). Areas presenting the lowest numbers of vaccinations are the North-East coast (province of Catania and part of the province of Messina), the Southern province of Enna, and the North-West area around Palermo.

[29] The percentage of vaccination rates has been calculated over the population older than 12 years old, since the administration of Covid-19 vaccine to children between 0 and 12 years old started later, with lower vaccination numbers.

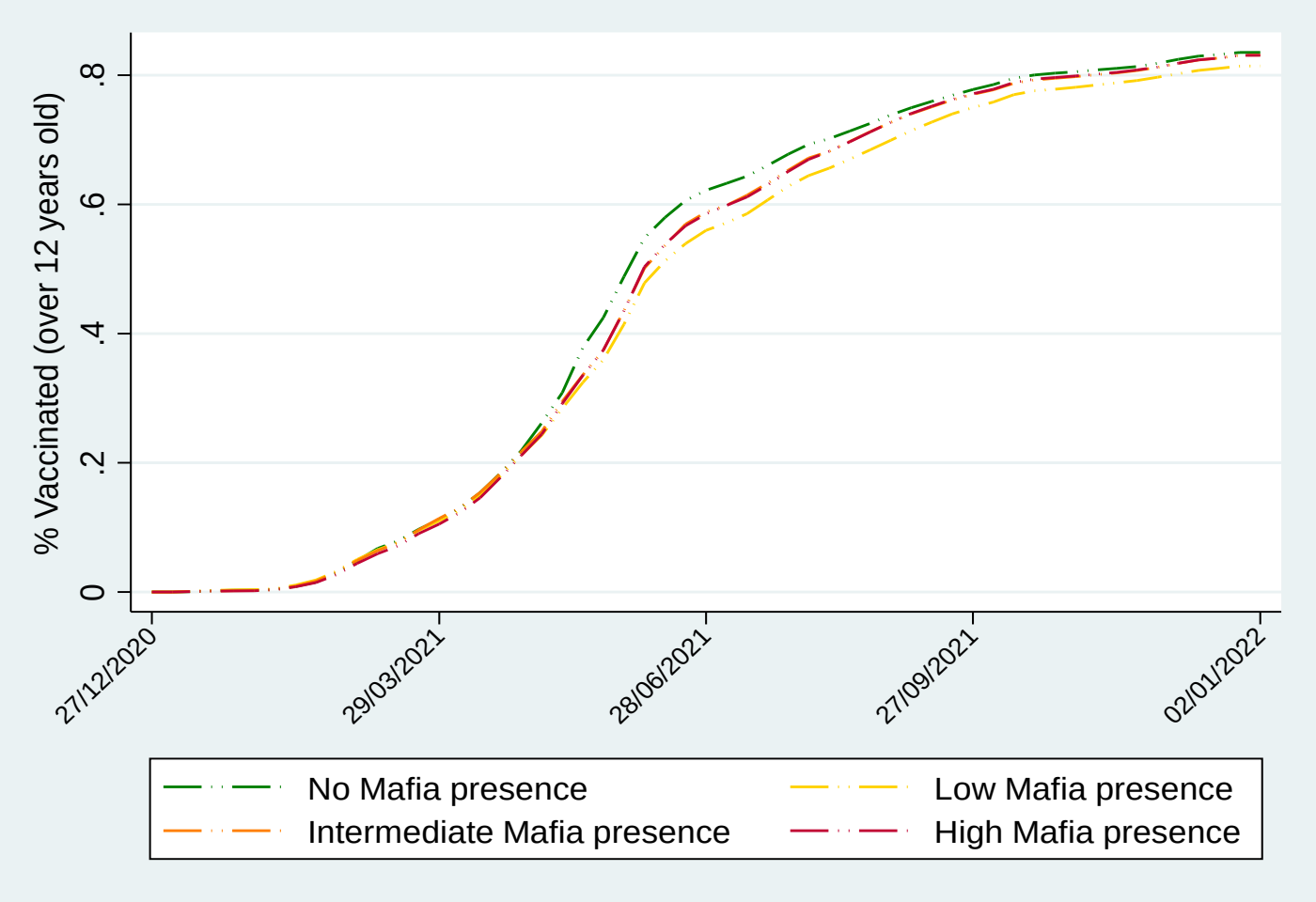


Figure 5: Average vaccination rates per group of municipalities depending on the percentage of confiscated assets from the Sicilian Mafia, 27th December 2020 – 2nd January 2022 (population over 12 years old).

Source: data on vaccination rates are from the Italian Ministry of Health; data on confiscated assets from the Sicilian Mafia are from the ANBSC (2023).
Note: municipalities with no Mafia presence have no confiscated assets from the Mafia; municipalities with low Mafia presence have a ratio between confiscated assets and municipality population between 0.01 and 0.1%; municipalities with intermediate Mafia presence have a ratio between confiscated assets and municipality population between 0.11 and 1%; municipalities with high Mafia presence have a ratio between confiscated assets and municipality population over 1%.

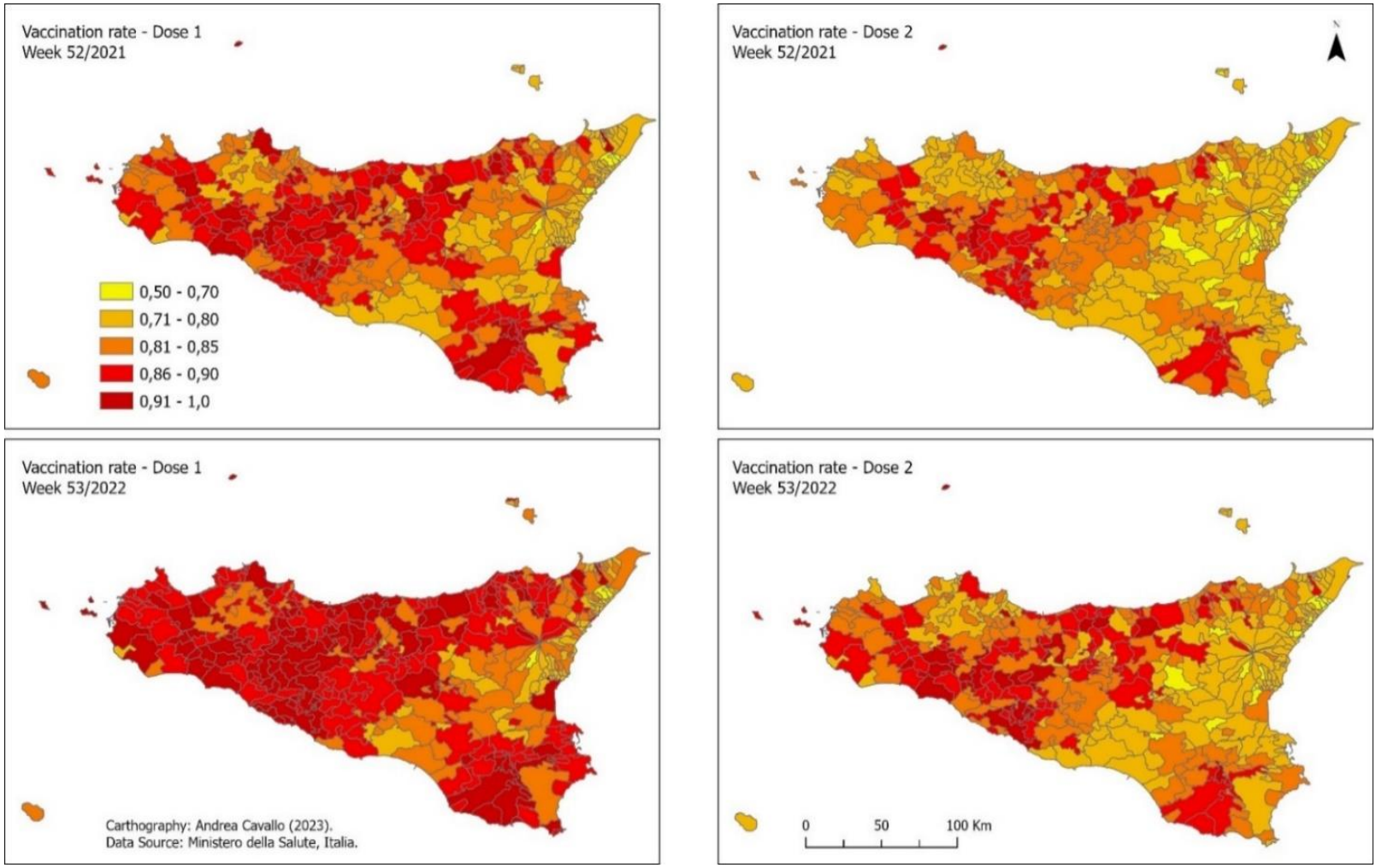


Figure 6: Percentage of Covid-19 vaccinated people (1st and 2nd dose) over 12 years old per Sicilian municipality, December 2021 - December 2022.

Note: municipalities are divided into five classes depending on the percentage of vaccinated people. The ranges are 50-70 %; 71-80 %; 81-85 %, 86-90 %, and 91-100 %.

4.3 Control Variables

A series of control variables are implemented in the model in order to account for potential omitted variables that could influence vaccination rates, instead of the strength of the Mafia. Two main groups of control variables can be identified, mainly related to population and economic characteristics.

Main population controls are the share of people over 60 years old (2020), the structural index of the working population[30] (2020), the change in mortality rate between 2019 and 2020, and the presence of foreign residents (2020). These values, available on a municipality level, are from the "Permanent Census of Population and Housing"[31] of 2020 (ISTAT, 2020). A municipality with an older population (share of people over 60 years old) is expected to be positively correlated with the levels of Covid-19 vaccination rates since elderly people represented the most exposed group to the pandemic and were the first category on which vaccinations started to be administrated. In addition, areas that present an older working population (structural index of the working population) are also expected to have larger vaccination rates, due to the later age and the different Covid-19 restrictions applied toward not vaccinated working people. Change in mortality rates due to the Covid-19 pandemic should also have a positive impact on vaccination rates since a higher risk perception of the disease might incentivize citizens to get vaccinated sooner (Wang et al., 2020). A last control in terms of population is represented by the percentage of foreign residents: this correlation could be ambiguous since, on one hand, foreigners might trust more the State since they are missing the historical influence of the family and their new living conditions might be better than before (Bilodeau & Nevitte, 2003), on the other hand, they could have less confidence in the central government (Achangwa et al., 2021) since they do not feel protected by the government, for instance being victims of racist behaviors.

The second set of controls includes mainly economic variables, the logarithm of income per capita (2020), the employment rate (2019), the level of education in terms of the percentage of individuals with a university degree or a Ph.D. (2020), and the percentage of people commuting for work or study reasons. The income per capita is from the Italian Ministry of Economics and Finance (2023). Information on the total taxable income has been divided by the number of contributors per each Sicilian municipality to obtain values per capita. Then, these results have been transformed on a logarithmic base. Employment rates are extracted from *Il Sole 24 Ore* (Saporiti, 2019). The rest of the information is from the "Permanent Census of Population and Housing" of 2020 (ISTAT, 2020).

[30] The structural index of the working population is the percentage ratio between the working population aged 40-64 and the working population aged 15-39.

[31] *Censimento permanente della popolazione e delle abitazioni* (ISTAT, 2020).

Areas with higher income per capita and employment levels may positively affect vaccination rates since, on one hand, people may partly attribute their status to the good work of the State, and, on the other, wealthier municipalities may also be more organized in administrating the vaccine (Callaghan et al., 2021; Zhang et al., 2022). In addition, the implemented restrictive policies in some work contexts may have convinced undecided workers to get vaccinated to keep their jobs (Karaivanov et al., 2022; Mills & Rüttenauer, 2022). However, different studies show that numerous other socio-economic and political factors may influence this relationship negatively (Aw et al., 2021; Kanyanda et al., 2021). Similarly, the level of education may also have ambiguous effects on vaccination rates, as a proxy for government trust. Indeed, on one hand, different studies find that lower education rates are associated with greater hesitancy in the Covid-19 vaccine, especially due to the lack of knowledge of healthcare technologies (McElfish et al., 2021; Rzymski et al., 2021).); however, on the other hand, more educated people may present lower government trust due to their more critical attitude and lower satisfaction toward the State (Rieger & Wang, 2022), consequently potentially refusing to get vaccinated. For instance, Hakhverdian and Mayne (2012) find that the relationship between education and trust is negative in more-corrupted areas, but positive in clean societies: these conclusions, applied to a region plagued by the Mafia such as Sicily, could have a negative impact on the acceptance of the Covid-19 vaccine among more educated individuals. Last, the percentage of people commuting could positively impact Covid-19 vaccination rates since individuals that commute more might also have the possibility to reach more easily another town to get vaccinated if there are no Covid-19 vaccine centers in their own municipalities.

Besides these controls, final robustness checks are performed implementing the additional measures of the Mafia presence previously mentioned.

5. METHODS

The quantitative analysis is based on a panel dataset that includes a total of 41.730 observations regarding 390 municipalities in 107 weeks between the 27th of December 2019 and the 1st of January 2023. To analyze the relationship between the strength of the Sicilian Mafia and the degree of vaccination rates, a linear model using the OLS method is presented. Given the results of the Durbin-Wu-Hausman test, the best way to investigate how the Sicilian Mafia and Covid-19 vaccine correlate is represented by implementing a fixed-effects model, in order to account for the non-randomness distribution of the sample and control for unobserved time-invariant characteristics of municipalities. This analysis is performed through the main command areg on Stata 15.0. This function fits a linear regression absorbing one categorical factor, in this case, fixed effects by the number of the municipality. Additionally, clustering by municipality is implemented as an ulterior robustness check to account for concerns regarding heteroskedasticity and autocorrelation of residuals.

The main specification is the following:

$$Vaccine\_Rates_{jtv} = \alpha + \beta MeasureMafia_j * TimeID_t + \gamma TimeID_t + \varepsilon_{jtv} \quad (1)$$

where *j* identifies the municipality, *t* identifies the week and *v* identifies the vaccine dose (1st or 2nd dose). The dependent variable $Vaccine\_Rates_{jtv}$ represents the cumulative percentage of vaccinated people over the total population over 12 years old per type of dose, municipality, and week. The main independent variable $MeasureMafia_i$ measures the strength of the Mafia per municipality. This variable, since it is time-invariant, interacts with a trend variable $TimeID_t$ taking value from 1 to 107 (depending on the week) and consequently avoiding the fixed-effects model to cancel it out. Additionally, $TimeID_t$ is inserted with no interaction, to show the general trend of vaccination rates over time. Lastly, ε_{jtv} represents the error term.

Successively, a series of socio-economic controls are implemented to address the issue of omitted variable biases. Since these variables are time-invariant, they interact with the time trend $TimeID_t$. The new extended specification is:

$$Vaccine\_Rates_{jtv} = \alpha + \beta MeasureMafia_j * TimeID_t + \gamma TimeID_t + \delta \chi_j * TimeID_t + \varepsilon_{jtv} \quad (2)$$

where χ_j is a vector that includes all the different socio-economic control variables.

The main analysis can be divided into two sections depending on the implemented independent variable measuring the strength of the Mafia, mainly the dummy by Cutrera (1900) as a historical

measure of the presence of the Mafia and the percentage of confiscated assets from the Mafia between 1981 and 2023 by ANBSC (2023). The choice of conducting the principal research using these two specific variables of the Mafia is based on two reasons.

First, choosing a historical and a more recent measure of the Mafia's strength allows for studying their relationship with vaccination rates, both in the long and short run. Indeed, the historical Mafia by Cutrera (1900) investigates if organized crime could potentially have permanent effects on government trust proxied by the percentage of administrated vaccinations, while the most recent Mafia's variable by ANBSC (2023) analyzes if the current distribution of the Mafia, modified over time due to its involvement in numerous conflicts and wars, may have an ulterior impact on vaccination rates in the short run.

Second, these variables are considered the most compatible for the desired panel data OLS analysis, if the information criteria[32] and the completeness of the data are analyzed. In the Appendix, ***Table A.2*** shows the information criteria of the seven different Mafia measurements, canceling the municipalities in which there is no information regarding all the variables. It is evident that the two measures by Cutrera (1900) present the best fit for the described regression analysis, having greater values for adjusted R-Squared, and lower numbers for the root mean squared error, Akaike's Information Criterion, and Bayesian Information Criterion. However, the choice of focusing on the dummy instead of the categorical measure by Cutrera (1900) relies on the fact that in the latter, some potential circumstances and evaluations may have underestimated or overestimated the presence of the Mafia, while, simply assessing the presence or absence of the Mafia might reveal less biased results. On the other hand, the measure by ANBSC (2023) provides information for all the Sicilian municipalities, presenting a discrete level of variation, consequently being chosen as the second main variable for the analysis.

The expected results of this model are that organized crime is negatively correlated with vaccination rates, hypothesizing a stronger correlation with more recent measures, since, as seen in different previous studies, the effect of the historical Mafia on socio-economic variables tends to decrease over time (De Feo & De Luca, 2017; Acemoglu et al., 2020). However, this quantitative analysis allows to test only for correlation, not making it possible to conclude any potential causal relationship, due to the non-random distribution of the Mafia distribution. In the last part of the paper, a discussion on the causality issue, illustrating potential extensions in this research area, is provided.

[32] Adjusted R-squared, root mean squared error, Akaike's Information Criterion, and Bayesian Information Criterion.

6. EMPIRICAL ANALYSIS AND RESULTS

6.1 OLS results, the historical presence of the Mafia (Cutrera 1900)

In this case, the quantitative analysis implements as the main independent variable a dummy equal to 1 if the Mafia is considered established in the specific municipality by the information from Cutrera (1900), and 0 otherwise. Observations presenting a low, intermediate, or high degree of Mafia intensity are all classified as equal to 1. The specification is the following:

$$Vaccine\_Rates_{jtv} = \alpha + \beta DummyMafia_j * TimeID_t + \gamma TimeID_t + \varepsilon_{jtv} \quad (3)$$

The approach of this econometric analysis can be defined as a "difference-in-difference", comparing the difference in vaccination rates over time between the treated group exposed to the Mafia and the control group not exposed to the Mafia with respect to each specific reference period. This concept can be expressed as follows:

$$E(Vaccine_t - Vaccine_{base}|Mafia = 1) - E(Vaccine_t - Vaccine_{base}|Mafia = 0)^{33} \quad (4)$$

Figure 7 represents the obtained coefficients of the interaction between the $DummyMafia_j$ and the $TimeID_t$ in the first four months of the vaccination campaign regarding Covid-19 first dose, from the 27th of December 2020 until 11th of April 2021 (week 1-16). These values depict the difference on average between the percentage of vaccinations in areas with and without the Mafia over time. It is evident how the percentage of vaccinations is on average lower between week 2 and week 14 in municipalities in which the dummy for the Mafia presence is equal to 1. Overall, these coefficients are significantly negative in this first period of vaccinations, concluding that municipalities presenting historical Mafia might be correlated with lower degrees of administrated first doses. In the Appendix, ***Table A.3*** (Model 1) illustrates this interaction coefficient for the first 30 weeks, showing that vaccination rates until week 14 are, on average, between 0.17 and 0.36 percent lower if the dummy variable related to the presence of the Mafia in a specific municipality is equal to 1[34]. The coefficient becomes positive and partially significant between week 15 and week 25, indicating a recovery in vaccination rates of areas with historical Mafia presence. The convergence might be due to the worsening of the Covid-19 situation in Sicily between February and April 2021 that incentivized more people to get vaccinated, the spread of more accurate information regarding the vaccine over

[33] $Vaccine_{base}$ indicates the reference period.
[34] Results are negative and statistically significant at least at a 10% interval level in weeks 4, 5, 6, 7, 8, 9, and 11.

time increasing the level of trust, and the opening of more vaccine centers, that allowed people to get the vaccine more easily. However, from week 26 the coefficient becomes significantly positive, indicating higher vaccination rates in areas with the historical presence of the Mafia. These results are quite surprising and might suggest that, when the necessity of the vaccine became crucial, Mafia could mobilize the population more efficiently. Another hypothesis is that the Mafias could have infiltrated the distribution of the Covid-19 vaccines, as a new source of profit, affecting the change in vaccination rates per municipality (Hookway, 2020; Roberts, 2021). These results might indicate the potential complexity of the Mafia effect.

Additionally, in the Appendix, ***Table A.3*** (Model 2) depicts the estimations for the Covid-19 second vaccine dose. The coefficients' sign is similar to the results for the first dose; indeed, after an initial phase with significantly low positive values, some weeks present a negative coefficient, followed by positive values starting in week 21. However, these results are overall not statistically significant.

To summarize, the first results implementing the dummy variable for the historical Mafia presence show a significantly negative correlation between this variable and the first-dose vaccination rates in the first four months of the vaccination campaign, in line with the main hypothesis. However, from week 26, the coefficient becomes significantly positive suggesting higher levels of vaccination rates in areas in which the Mafia is historically strongly established.

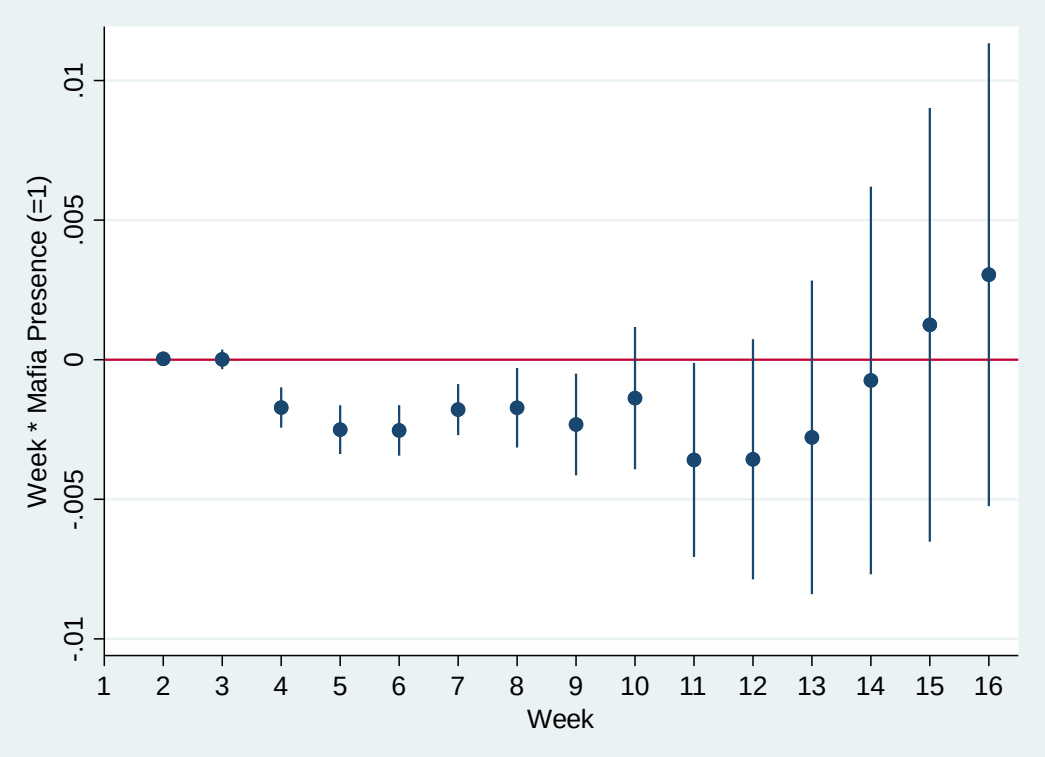


Figure 7: Trend of the coefficient for the interaction between the time trend (week) and the dummy for the historical Mafia presence (1900).

6.2 OLS results, a current measure of the Mafia (ANBSC, 2023)

The implementation of the percentage of confiscated assets from the Mafia by the ANBSC (2023) allows for a different analysis compared to the previous historical measure using a dummy variable. Indeed, on one hand, this data considers more recent values, potentially measuring the current distribution of the Mafia, on the other hand, since this information is continuous, it allows for exploiting the variation across municipalities to study its relationship with vaccination rates. In this case, the main specification is the following:

$$Vaccine\_Rates_{jtv} = \alpha + \beta Perc\_ConfiscatedAssets_j * TimeID_t + \gamma TimeID_t + \varepsilon_{jtv} \quad (5)$$

Main results are reported in ***Table A.4***, in the Appendix, subdivided by the type of doses and number of observations[35]. Regarding the first dose (Model 1 and Model 2), the negative relationship results to be more permanent than the findings by the previous interaction with the dummy variable since the coefficient is overall significant and negative until the beginning of June 2021 (week 23). After this period, the sign changes, becoming significantly positive until week 32. As expressed previously, this recovery might be due to the increase in the necessity of the Covid-19 vaccine over time due to the critical situation and the more precise information on the vaccination campaign. However, contrary to the previous findings, this correlation becomes no more significant after week 32, not supporting the idea of higher vaccination rates in areas with a greater level of confiscated assets from the Mafia. ***Table A.4*** (Model 3 and Model 4) also reports the results regarding the second dose showing a similar pattern to the first dose, and presenting significant values contrary to the findings using the dummy variable. Explanations for these estimations might be the completeness of data by ANBSC (2023), its measures' closeness in time to Covid-19, and its variation across municipalities.

Overall, the findings show that an increase in one standard deviation of the level of confiscated assets per municipality is on average correlated with a decrease in first-dose vaccination rates between 0.0047 and 0.43 percent[36] in the first 23 weeks of the vaccination campaign.

[35] Model 1 and Model 2 show estimations regarding the 1st vaccine dose, and Model 3 and Model 4 show estimations regarding the 2nd vaccine dose. In addition, Model 1 and Model 3 cancel the municipalities not available by Cutrera (1900) in order to compare the models that use confiscated assets with the previous models that implement the dummy variable.
[36] These values have been calculated by multiplying the standard deviation of confiscated assets (0.0301) by respectively the significant minimum (-0.00156) and maximum (-0.142) values of obtained coefficients between week 3 and week 23. Weeks 1 and 2 have not been considered due to their negligible magnitudes.

6.3 Robustness checks

Since numerous factors can affect the evolution of vaccination rates, different controls are implemented in the following to check for omitted variable biases.

The main controls regard the characteristics of the population, especially the age structure. Indeed, elderly people were the first group to have the possibility to get vaccinated since they were the individuals more at risk in terms of health; consequently, areas with a larger share of older people are expected to have higher percentages of vaccinations. The first implemented control represents the share of people over 60 years old over the total population per municipality. ***Table 5*** shows the results for Covid-19 first dose until week 30, using both the dummy variable (Model 1) and the percentage of confiscated assets (Model 2). Results are consistent with the previous analyses, highlighting a negative trend during the first weeks, being more persistent with the most recent measure of the Mafia's activity. However, it is interesting to notice that, during the first weeks, a higher presence of older individuals is negatively correlated with the percentage of first-dose vaccinations. Despite being against the initial hypothesis, these findings could be due to two main reasons: (1) at the beginning, besides elderly people, also the healthcare personnel and the individuals with disabilities had the possibility to get vaccinated, and (2) initially, the Covid-19 vaccine centers were limited, potentially creating difficulties for elderly people living in small towns to travel to get the vaccine. Around week 17, the coefficient for the interaction between the time trend and the dummy for the historical Mafia presence becomes positive and significant, confirming the previous results of larger levels of vaccination rates in areas with the historical establishment of the Mafia. On the other hand, as expected, from week 27, the percentage of confiscated assets from the Mafia no longer has a significant correlation with vaccination rates.

Subsequently, additional implemented controls in relation to population characteristics are the mortality rate change between 2019 and 2020, the structure of the working age population, and the number of foreign residents per 100 inhabitants[37]. In this way, on one hand, it is possible to check if an increase in mortality rate and a higher presence of older working individuals over younger ones are positively correlated with vaccination rates, and, on the other hand, how a larger presence of foreigners behaves in relation to the administration of the vaccine. In the Appendix, ***Table A.6*** shows the partial results after implementing these controls until week 30. The coefficients related to the

[37] In the Appendix, ***Table A.5*** shows the correlation matrix regarding the variables measuring Mafia and the control variables. Values are overall small (below 20%), excluding the variable measuring the number of foreigners per 100 inhabitants. However, checking for its distribution, the variable presents some outliers, that, once eliminated, allow for the reduction of correlation values below 25%.

interaction between the time trend and the two main measures of the Mafia remain robust. In addition, a higher structural index of the working population, meaning an older working class is correlated, as expected, with larger vaccination rates; on the other hand, changes in mortality rate between 2019 and 2020 show an overall positive correlation with vaccination rates from the beginning of March. Lastly, the composition of the population in terms of foreign residents does not present a unique pattern in the analysis, having coefficients' values that are not significant or significantly small in magnitude.

Additional socio-economic variables that could impact the level of vaccination rates, instead of the Mafia presence, are the logarithm of income per capita in 2020, the employment rate in 2019, the degree of commuting for work or study every 100 inhabitants in 2020, and the level of education expressed as the percentage of individuals having a university degree or a Ph.D. in 2020. Due to the high correlation between some of these variables[38], two groups of regressions are run, the first one including only the logarithm of the income per capita, and the second one implementing the other three measures. As shown in the Appendix (***Table A.7***), coefficients regarding the interaction between the time trend and the Mafia's strength remain robust both in terms of significance and magnitude[39].

Table 5: OLS results, with control for the share of the population being 60 or more years old.

	Model 1 – Covid-19 vaccine dose 1		Model 2 – Covid-19 vaccine dose 1	
Week	Time Trend * Dummy Mafia	Share pop. over 60	Time Trend * Confiscated assets	Share pop. over 60
2	0.0000313**	-0.427***	-0.0000725	-0.398***
	(0.0000132)	(0.0662)	(0.0000444)	(0.0620)
3	-0.0000294	-0.431***	-0.00130***	-0.401***
	(0.000179)	(0.0658)	(0.000459)	(0.0616)
4	-0.00179***	-0.435***	-0.00500**	-0.400***
	(0.000365)	(0.0655)	(0.00196)	(0.0615)
5	-0.00259***	-0.436***	-0.00657**	-0.399***
	(0.000440)	(0.0655)	(0.00259)	(0.0614)
6	-0.00261***	-0.436***	-0.00746**	-0.399***
	(0.000456)	(0.0654)	(0.00299)	(0.0614)
7	-0.00186***	-0.435***	-0.00918***	-0.400***
	(0.000467)	(0.0655)	(0.00247)	(0.0613)
8	-0.00173**	-0.428***	-0.00906	-0.401***
	(0.000739)	(0.0660)	(0.00652)	(0.0616)
9	-0.00229**	-0.423***	-0.00469	-0.398***
	(0.000940)	(0.0667)	(0.00850)	(0.0618)

[38] See the Appendix, ***Table A.5***.

[39] Income, employment, and education variables present a positive correlation with vaccination rates in the first months of 2021. On the other hand, commuting rates' coefficients are significantly negative from week 11, however presenting a low magnitude.

10	-0.000972	-0.381***	-0.0212**	-0.353***
	(0.00131)	(0.0659)	(0.00978)	(0.0620)
11	-0.00257	-0.310***	-0.0263***	-0.290***
	(0.00169)	(0.0660)	(0.00769)	(0.0626)
12	-0.00200	-0.249***	-0.0437***	-0.220***
	(0.00206)	(0.0665)	(0.00908)	(0.0638)
13	-0.000863	-0.208***	-0.0607***	-0.192***
	(0.00263)	(0.0677)	(0.00980)	(0.0640)
14	0.00165	-0.154**	-0.0841***	-0.147**
	(0.00326)	(0.0673)	(0.0109)	(0.0643)
15	0.00395	-0.118*	-0.108***	-0.106*
	(0.00368)	(0.0679)	(0.0119)	(0.0630)
16	0.00634*	-0.0511	-0.109***	-0.0494
	(0.00383)	(0.0662)	(0.0120)	(0.0615)
17	0.00996**	0.0159	-0.0810***	0.0115
	(0.00449)	(0.0663)	(0.0160)	(0.0622)
18	0.0128**	0.111*	-0.0743***	0.0877
	(0.00507)	(0.0654)	(0.0160)	(0.0624)
19	0.0205***	0.203***	-0.101***	0.162**
	(0.00569)	(0.0684)	(0.0189)	(0.0642)
20	0.0230***	0.260***	-0.138***	0.179***
	(0.00644)	(0.0693)	(0.0250)	(0.0674)
21	0.0277***	0.386***	-0.129***	0.254***
	(0.00848)	(0.0829)	(0.0314)	(0.0813)
22	0.0144	0.494***	-0.186***	0.417***
	(0.0106)	(0.107)	(0.0409)	(0.0966)
23	0.0102	0.656***	-0.224***	0.652***
	(0.0114)	(0.112)	(0.0436)	(0.109)
24	0.0126	0.764***	0.176***	0.722***
	(0.0108)	(0.106)	(0.0645)	(0.100)
25	0.0218**	0.728***	0.126**	0.715***
	(0.0102)	(0.0863)	(0.0498)	(0.0779)
26	0.0307***	0.688***	0.0902**	0.682***
	(0.00988)	(0.0774)	(0.0434)	(0.0689)
27	0.0402***	0.722***	0.0424	0.676***
	(0.00957)	(0.0692)	(0.0426)	(0.0612)
28	0.0446***	0.711***	0.0154	0.667***
	(0.00950)	(0.0648)	(0.0430)	(0.0577)
29	0.0450***	0.713***	0.0618	0.666***
	(0.00962)	(0.0639)	(0.0438)	(0.0567)
30	0.0489***	0.718***	0.0427	0.664***
	(0.00959)	(0.0605)	(0.0432)	(0.0546)
constant		0.135***		0.125***
		(0.0214)		(0.0195)
N		33063		41730
adj. R^2		0.992		0.989

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

6.4 Sensitivity analysis, alternative measures for the Mafia presence

The last part of the quantitative analysis substitutes the two main measures of the Mafia with the alternative variables, already presented in the section Data.

The first two controls regard the implementation of the two more historical measures of the Mafia by Damiani (1885) and Cutrera (1900), ordering the Mafia intensity from 0 to 3. ***Table A.8*** in the Appendix presents the results for the first 30 weeks. Interactions' coefficients of Damiani (1885) show that the higher the strength of the Mafia, the lower the level of vaccination rates until week 12, then having more mixed results; on the other hand, Cutrera's (1900) computations show that initially a negative coefficient is higher in absolute value when the strength of the Mafia is equal 3 until week 6. Overall, these results show a negative correlation between the presence of the Mafia and the vaccination rates at the beginning of the vaccination campaign, while increasing intensities of the Mafia strength do not seem to be perfectly correlated with decreasing vaccination rates. Furthermore, Cutrera's (1900) categorical variable confirms the previous results, with higher vaccination rates in areas with a greater intensity of the Mafia from March 2021.

The more recent dummies for the Mafia presence in 1987 and 1994, and the dummy referred to the dissolution of municipalities because of Mafia infiltration between 1991 and 2023 seem to be in line with these findings, presenting a negative trend of the interactions' coefficients in the first weeks, as depicted in ***Figure 8***[40]. Most significant negative estimations are found for the most recent measure of the Mafia, the dummy referred to the dissolution of municipalities, based on the period 1991 and 2023. On the other hand, the dummy of the Mafia presence in 1994 presents the shortest period with negative values. After this initial period, results show a positive correlation with respect to the dummies of Mafia 1987 and the dummy of Mafia 1994, while the dummy for dissolved municipalities does not show a clear pattern.

Hence, it is possible to conclude that implementing all the different controls does not change the initial OLS results. On one hand, the presence of the Mafia, despite its strength, continues to be negatively correlated with the vaccination rates in the first months, on the other hand, categorical variables for the Mafia intensity show a negative correlation with the number of administrated Covid-19 first doses during the first weeks of the vaccination campaign. However, this second finding is more consistent in relation to the data on confiscated assets, while it is less significant if the historical categorical variable by Damiani (1885) and Cutrera (1900) is used.

[40] In the Appendix, ***Table A.9*** reports the main results after implementing these variables during the first 30 weeks.

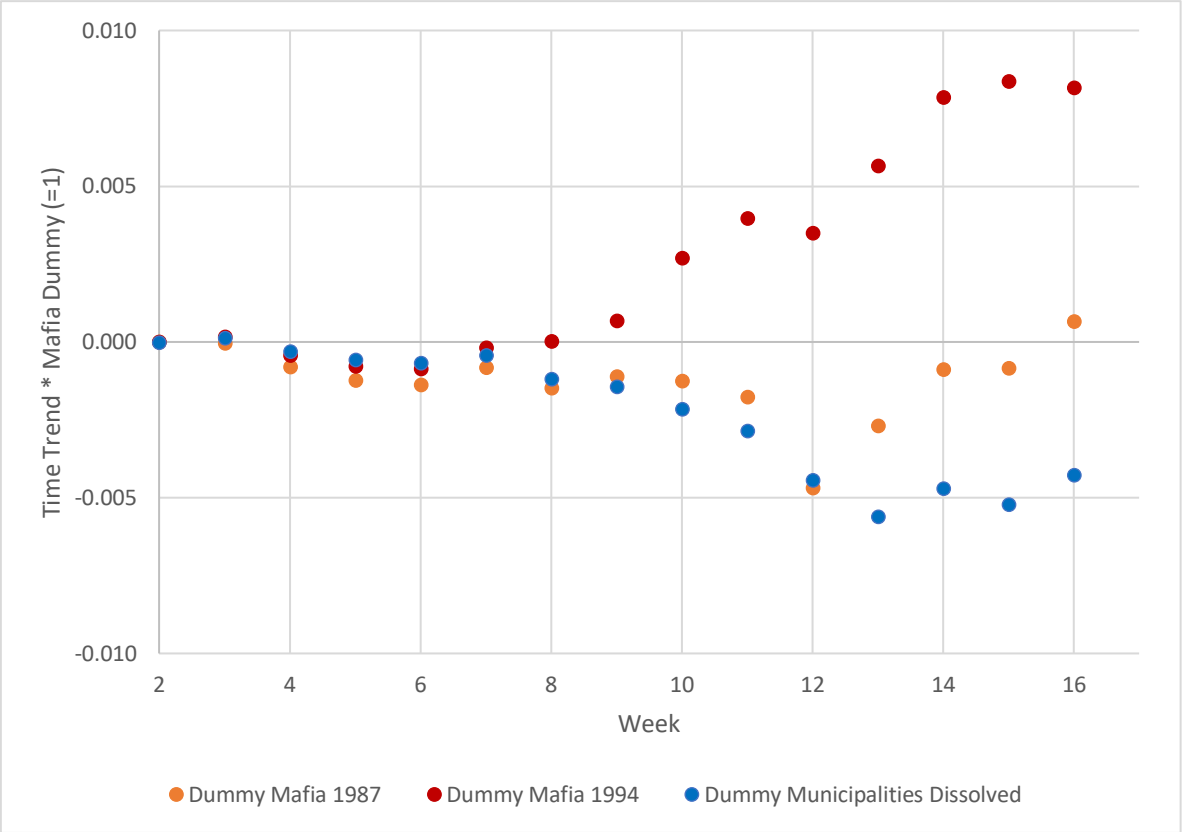


Figure 8: Trend of the coefficient for the interaction between the week and the dummy for the Mafia presence in 1987, 1994 and for the municipalities dissolved because of Mafia infiltration between 1991 and 2023.

7. LIMITATIONS OF THE ANALYSIS

7.1 Data limitations

In the following, main data limitations regarding the construction of the variables of vaccination rates and the strength of the Mafia, and the missing implementation of specific controls are presented.

Data on vaccination rates reflect the cumulative percentage of individuals with one or two doses of the Covid-19 vaccine over time per municipality. This information only includes the population with permanent residence in a Sicilian municipality. However, some individuals, despite having residence in a Sicilian municipality and being counted in the vaccination statistics, might temporarily not live in Sicily (e.g., for work or study reasons), consequently being vaccinated in another Italian region or abroad. This information could partially bias the results since other factors such as different policies in the new areas in which they live, a more organized healthcare system, and a potential lower proximity to the Italian government and organized crime, may lead to accepting the vaccine more or less positively. However, it is also important to underline that a certain level of government trust is inherited from the family, and the culture of the area in which an individual is born, consequently still having an impact on the decisions of the individuals (Algan & Cahuc, 2010).

The most critical variable is represented, as already discussed, by the strength of the Mafia, since it is highly complicated to estimate and compare the intensity of the Mafia across municipalities, due to the infinite areas in which organized crime is involved. In this case, different historical and more recent measures are considered in the quantitative analysis to account for the action of the Mafia from different perspectives and time periods. Numerous studies follow this approach (De Feo & De Luca, 2017; Acemoglu, 2020; Marciante, 2023) since the choice of a single variable can create misleading results. For instance, only focusing on data related to violence and offenses (e.g., bomb, fire attacks, money laundering, usury) has to be only partially addressed to the participation of the Mafia, since not all these illegal actions are attributed to Mafia organizations. On the other hand, specific crimes "suffer from a very high dark figure" (Calderoni, 2011, p. 4) because the statistics reflect the propensity of the population to report illegal actions and not their real distribution. The most typical example is represented by extortion. Indeed, people reporting this crime may be highly exposed to the threat of retaliation by the Mafia organizations; therefore, it might be possible that extortions reports are higher in areas in which Mafia has a lower strength, while they are underestimated in Mafia's stronghold municipalities (Daniele, 2009; Asmundo & Lisciandra, 2008). This aspect strictly relates to another problem of measuring the strength of the Mafia since organized crime could have

their headquarters in specific municipalities while acting, committing offenses, and making profits in other areas. This factor can also affect the population's perception of the Mafia in multiple ways, consequently leading individuals to show different levels of trust in the government. Some recent studies combine different information that can be attributed to the Mafias' activity in order to quantify the general level of organized crime in specific areas, mainly on a regional or provincial level (Mennella, 2009; Daniele & Marani, 2011; Caldeoni, 2011). On the other hand, two main studies have tried to address the degree of Mafia presence on a municipality level, mainly combining five different dimensions related to organized crime respectively between 2000 and 2011 (Transcrime, 2013) and between 2000 and 2015 (Dugato et al., 2020). Specifically, the main data that were aggregated are the number of Mafia groups mentioned by the "Antimafia Investigative Directorate"[41] and the "National Antimafia Directorate"[42] reports, the reported offenses for Mafia associations (presence and activities of the Mafia), the number of reported actual or attempted homicides (violence), the city councils dissolved because of Mafia infiltration (political infiltration) and the level of confiscated assets from the Mafia (economic infiltration). Unfortunately, these statistics and some of the specific aggregated measures, that could improve this quantitative analysis, are not publicly available, consequently leading only to the implementation of the last two variables as recent measures of the Mafia.

A last potential issue regarding the data involves the controls. Specifically, a variable that was not included in the model, but that could have had a discrete impact on the level of administrated vaccines is represented by a measure of the efficiency of the healthcare system under the Covid-19 pandemic. Indeed, areas more organized for the vaccination campaign could have managed to administer a larger number of vaccine doses to the surrounding population in a shorter amount of time. A potential measure to quantify this factor could be represented by the distribution of Covid-19 vaccination centers in Sicily and their distances to the different municipalities. However, this spatial regression analysis is complicated since information is not accurate and only available for the main Covid-19 centers at the beginning of the vaccination campaign in January 2021[43], while, in the following weeks, many more facilities were equipped to administer Covid-19 vaccines.

[41] Direzione Investigativa Antimafia (DIA).
[42] Direzione Nazionale Antimafia (DNA).
[43] "Costruire Salute – Vaccinazioni Covid-19 Sicilia" ("Build Health – Covid-19 Vaccinations in Sicily", 2021) shows that only 62 municipalities were presenting a Covid-19 vaccination center in Sicily in January 2021.

7.2 Methodology limitations

The main results find a negative correlation between the presence of the Mafia and the percentage of vaccination rates during the first months of the vaccination campaign. However, even after including different control variables, it is not possible to talk about a causal relationship since these findings might be distorted due to endogeneity problems. Indeed, the main explanatory variable, the strength of the Mafia, is not randomly distributed over the Island since many socio-economic and political factors have affected its establishment in specific areas over time. In addition, there could be a problem of reverse causality between the more recent measures of the strength of the Mafia and the government trust since, even if, on one hand, a more powerful Mafia could decrease the confidence in the institutions, on the other, weak governments could favor the expansion of organized crime. Consequently, the main methodological limitation, that could potentially be addressed in future studies, regards the problem of causality. In this field, one of the main econometric strategies applied by past literature is the implementation of an instrumental variable, valid if significantly correlated with the endogenous independent variable, and if exogenous with respect to the error term. Two common sources have been used by authors as potential instruments for the presence of the Mafia.

First, some scholars have exploited weather shocks, specifically the fluctuations in rainfall as an exogenous source of variation, instrumenting the strength of the Mafia in order to study its effects on socio-economic outcomes. For instance, Barone and Narciso (2015) exploit the level of rain in the first half of the XIX century, as a proxy for land value, to instrument the expansion of the Mafia, while Acemoglu et al. (2020) use the drought of 1893 as a reason for rural conflict, higher need for protection and empowerment of *Cosa Nostra*. In this way, they solve endogeneity problems regarding the non-random distribution of the Mafia in Sicily, finding a positive causal relationship between organized crime and the allocation of public funds (Barone & Narciso, 2015) and significant negative effects of the Mafia on the economic development of Sicilian municipalities in the medium run (Acemoglu et al., 2020). A second possible IV technique, implemented by De Feo & De Luca (2017), exploits the historical measures of the Mafia (Cutrera, 1900) as an instrument for more recent Mafia distribution (CG Carabinieri, 1987) in order to study the support of Sicilian organized crime to the Christian Democratic Party between 1946 and 1992. However, Buonanno et al. (2016, p. 71) argue that, even if this IV strategy might solve the reverse causality problem, the historical and current presence of the Mafia might be both "related to omitted variables that are correlated with electoral outcomes". This factor might be taken into account if the discussed paper will be extended, trying to study the causal relationship between organized crime, government trust, and vaccination rates, through the implementation of the historical Mafia as IV.

8. DISCUSSION AND CONCLUSIONS

Past research has shown that one of the main reasons for low government trust in Southern regions of Italy is due to the strong presence of organized crime. On one hand, the numerous episodes of corruption regarding the Mafia's involvement in politics and the diffuse perception of not feeling protected by the State against Mafia organizations, make the population more reluctant to trust official institutions. On the other hand, socio-economic shocks that can have dramatic consequences on people's life conditions are seen as means for the Mafia to increase its consensus, thanks to its fast intervention in support of people in need, contrary to the potentially inefficient and slow organization of the government. These situations may even increase distrust in the official institutions in favor of Mafia organizations, even if it is important to underline that organized crime sooner or later always asks for something in return.

This study aims to analyze this second mechanism during the specific socio-economic shock represented by the Covid-19 pandemic and its related vaccination campaign in the region of Sicily. Indeed, during this dramatic period, numerous news reported that Sicilian Mafia members' relatives were distributing food and medicines among the Italian citizens in need, whereas the State, due to its slow and inefficient bureaucracy, was presenting difficulties in implementing policies to help the population. This situation may have ulteriorly harmed the confidence in the institutions, a factor that could also have negative repercussions on the level of acceptance of the Covid-19 vaccine.

Hence, the main objective of the paper is to study if a higher presence of the Mafia on a municipal level in Sicily may be negatively correlated with the level of Covid-19 vaccination rates, as a proxy for government trust. The choice of Sicily as area of analysis is due to the strong establishment and influence of the Mafia on the Sicilian Island since the XIX century, the numerous available studies that try to quantify its presence on a granular level, and its low levels of vaccinations compared to the other Italian regions. Specifically, the study exploits a panel dataset of 390 municipalities in Sicily over a period of 107 weeks, between the beginning of the Covid-19 vaccination campaign and the 1st of January 2023. The two main implemented variables measuring the strength of the Mafia are the historical source by Cutrera (1900), expressed through a dummy variable that takes the value 1 if the Sicilian Mafia was established in a specific municipality in 1900, otherwise 0, and the more contemporary information on the percentage of confiscated assets over each municipality's population between 1981 and 2023 (ANBSC, 2023).

Main OLS fixed-effect results are in line with the expectations. Specifically, areas historically exposed to the Mafia (Cutrera 1900) have on average between 0.17 and 0.36 percent fewer Covid-19 first-dose vaccination rates than areas with no Mafia presence until week 14. On the other hand, a one-standard deviation increase in the percentage of confiscated assets per municipality is on average correlated with 0.0047-0.43 percent fewer vaccinations until week 23, hence, being more persistent over time compared to the historical Mafia. These findings potentially confirm past literature results associating higher levels of organized crime with lower levels of government trust, in this case, proxied by vaccination rates. However, it is interesting to notice that, in the case of the historical information of the Mafia, its relationship with vaccination rates changes over time, becoming significantly positive, especially from week 26, partially diverging from past research. This may express the complexity of the Mafia's impact that, when the necessity of vaccination became evident, could have mobilized the population more efficiently to gain more consensus, resulting then in higher levels of vaccinations in the areas affected by the Mafia.

This study contributes to showing how, on one hand, the Mafia can take advantage of these difficult socio-economic contexts to obtain more power, on the other hand, how a strong State and prompt intervention are essential for avoiding the empowerment of organized crime. However, no causal interpretation can be attributed to the main results due to the non-random distribution of the Mafia in Sicily. This could represent a potential topic for future studies, potentially implementing an IV strategy to solve endogeneity problems. In addition, the relationship between the Covid-19 pandemic and organized crime, a still little studied field, opens the discussion to numerous areas of study. Interesting research might be to investigate how the electoral behavior changed during the Covid-19 pandemic, due to an increase in the Mafia's popularity or which economic trends sectors more connected to the Mafia (e.g., agrarian, construction, and health sectors) presented under this socio-economic shock.

In conclusion, this study was intended to provide a contribution to the literature on organized crime and government trust during socio-economic shocks. Furthermore, despite the specific context and factors of analysis, this paper can give a better understanding of the history and development of organized crime from different perspectives.

REFERENCES

Accetturo, A., & Mocetti, S. (2019). Historical origins and developments of Italian cities. *Italian Economic Journal*, *5*, 205-222.

Acemoglu, D., De Feo, G., & De Luca, G. D. (2020). Weak States: Causes and consequences of the Sicilian Mafia. The Review of Economic Studies, 87(2), 537-581.

Achangwa, C., Lee, T. J., & Lee, M. S. (2021). Acceptance of the COVID-19 vaccine by foreigners in South Korea. *International Journal of Environmental Research and Public Health*, *18*(22), 12035.

Acharya, A., Grillo, E., & Pei, H. (2021). Building Trust in Government The Opportunities and Challenges of Adverse Shocks.

Alesina, A., & La Ferrara, E. (2002). Who trusts others? *Journal of public economics*, *85*(2), 207-234.

Alesina, A., Piccolo, S., & Pinotti, P. (2019). Organized crime, violence, and politics. *The Review of Economic Studies*, *86*(2), 457-499.

Agenzia Nazionale per l'amministrazione e la destinazione dei beni sequestrati e confiscati alla criminalità organizzata (ANBSC). (2023). Infoweb beni confiscati. Available online at: https://openregio.anbsc.it/statistiche [Accessed 15 May 2023].

Algan, Y., & Cahuc, P. (2010). Inherited trust and growth. *American Economic Review*, *100*(5), 2060-2092.

Arrighi, J. S., Battestini, J. T., Coatleven, L., Hublet, F., Marini, S., & Quedet, V. (2022). The Scale of Trust: Local, Regional, National and European Politics in Perspective. Group d'études géopolitiques, working paper.

Asmundo, A., & Lisciandra, M. (2008). Un tentativo di stima del costo delle estorsioni sulle imprese a livello regionale: il caso Sicilia. In *I costi dell'illegalità: mafia ed estorsioni in Sicilia* (pp. 113-136). Società editrice Il Mulino.

Avviso Pubblico - Enti locali e Regioni contro mafie e corruzione. (7 April 2023). Amministrazioni Sciolte per mafia: mappe interattive. Available online at: https://www.avvisopubblico.it/home/home/cosa-facciamo/informare/documenti-tematici/comuni-sciolti-per-mafia/amministrazioni-sciolte-mafia-mappe-interattive/ [Accessed 15 May 2023].

Aw, J., Seng, J. J. B., Seah, S. S. Y., & Low, L. L. (2021). COVID-19 vaccine hesitancy—A scoping review of literature in high-income countries. *Vaccines*, *9*(8), 900.

Bandiera, O. (2003). Land reform, the market for protection, and the origins of the Sicilian mafia: theory and evidence. *Journal of Law, Economics, and Organization*, *19*(1), 218-244.

Barbato, E. (23 December 2019) Qualcuno Fece Presto. E fu la Camorra. *Terre di Frontiera*. Available online at: https://www.terredifrontiera.info/camorra-e-terremoto-1980/ [Accessed on 9 May 2020].

Barone, G., & Narciso, G. (2015). Organized crime and business subsidies: Where does the money go?. *Journal of Urban Economics*, *86*, 98-110.

Bauer, M., Blattman, C., Chytilová, J., Henrich, J., Miguel, E., & Mitts, T. (2016). Can war foster cooperation? *Journal of Economic Perspectives*, *30*(3), 249-274.

Bettiza, S. (5 May 2020). Coronavirus: The lure of mafia money during the crisis. BBC World Service. Available online at: https://www.bbc.com/news/world-europe-52537573 [Accessed 9 May 2023].

Bifulco, M., Pisanti, S., & Fusco, I. (2021). Lessons from the 1656 Neapolitan Plague: Something to learn for the current coronavirus Pandemic? *Vaccine*, *39*(27), 3641-3643.

Bilodeau, A., & Nevitte, N. (2003, August). Political trust for a new regime: the case of immigrants from non-democratic countries in Canada. In *Annual Meeting of the Canadian Political Science Association, Halifax, NS*.

Blanco, L., & Ruiz, I. (2013). The impact of crime and insecurity on trust in democracy and institutions. *American Economic Review*, *103*(3), 284-288.

Bouckaert, G., & Van de Walle, S. (2001, September). Government performance and trust in government. In *Ponencia presentada en la annual conference of the European group on public administration, vaasa (Finlandia)* (Vol. 2, pp. 19-42).

Buonanno, P., Durante, R., Prarolo, G., & Vanin, P. (2015). Poor institutions, rich mines: Resource curse in the origins of the Sicilian mafia. *The Economic Journal*, *125*(586), F175-F202.

Buonanno, P., Prarolo, G., & Vanin, P. (2016). Organized crime and electoral outcomes. Evidence from Sicily at the turn of the XXI century. *European Journal of Political Economy*, *41*, 61-74.

Buscaglia, E. & van Dijk, J. (2003). Controlling organized crime and corruption in the public sector. In *Forum on crime and society* (Vol. 3, No. 1/2).

Calderoni, F. (2011). The Mafia Index. A measure of the presence of the mafia across Italian provinces. In *Research Conferences on Organised Crime at the Bundeskriminalamt in Germany 2008-2010* (pp. 141-162). Luchterhand.

Calderoni, F. (2014a). Measuring the presence of the mafias in Italy. *Organized Crime, Corruption and Crime Prevention: Essays in Honor of Ernesto U. Savona*, 239-249.

Calderoni, F. (2014b). Mythical numbers and the proceeds of organized crime: estimating mafia proceeds in Italy. *Global Crime*, *15*(1-2), 138-163.

Callaghan, T., Moghtaderi, A., Lueck, J. A., Hotez, P., Strych, U., Dor, A., Fowler, E. F. & Motta, M. (2021). Correlates and disparities of intention to vaccinate against COVID-19. *Social science & medicine (1982)*, *272*, 113638.

Campbell, W. R. (2004). The sources of institutional trust in East and West Germany: Civic culture or economic performance? *German politics*, *13*(3), 401-418.

Camussi, S., Mancini, A. L., & Tommasino, P. (2018). Does trust influence social expenditures? Evidence from local governments. *Kyklos*, *71*(1), 59-85.

Cancila, O. (1984), Come Andavano le Cose nel Sedicesimo Secolo, Palermo, IT: Sellerio.

Centro studi e documentazione sulla criminalità mafiosa (CSDCM). (1994). Mappa approssimativa delle famiglie e degli associati di stampo mafioso in Sicilia. Messina: Università degli Studi di Messina.

CG Carabinieri - Comando Generale dell'Arma dei Carabinieri. (1987). Relazione Del Comandante Generale dell'Arma dei Carabinieri alla Commissione Parlamentare sul Fenomeno della Mafia.

Chanley, V. A., Rudolph, T. J., & Rahn, W. M. (2000). The origins and consequences of public trust in government: A time series analysis. *Public opinion quarterly*, *64*(3), 239-256.

Colajanni, N. (1900), Nel Regno della Mafia. Dai Borboni ai Sabaudi, Rome, IT: Rivista Popolare.

Costruire Salute – Le persone prima di tutto. (2021). Io mi vaccino. Available online at: https://www.costruiresalute.it/?q=io%20mi%20vaccino [Accessed 17 May 2023].

Cutrera, A. (1900). *La mafia e i mafiosi*. Palermo: Alberto Reber.

Damiani, A. (1885), Atti della Giunta per la Inchiesta Agraria e sulle Condizione della Classe Agricola. Volume XIII, Tomo II, Fascicolo IV. (Tipografi del Senato, Roma: Forzani e C.).

Damico, A. J., Conway, M. M., & Damico, S. B. (2000). Patterns of political trust and mistrust: Three moments in the lives of democratic citizens. *Polity*, *32*(3), 377-400.

Daniele, V. (2009). Organized crime and regional development. A review of the Italian case. *Trends in Organized Crime*, *12*, 211-234.

Daniele, V., & Malanima, P. (2011). Il divario nord-sud in Italia, 1861-2011 (Vol. 273). Rubbettino Editore.

Daniele, V., & Malanima, P. (2012). Alle origini del divario. SVIMEZ, Nord e Sud a, 150, 93.

Daniele, V., & Marani, U. (2011). Organized crime, the quality of local institutions and FDI in Italy: A panel data analysis. *European Journal of Political Economy*, *27*(1), 132-142.

De Feo, G., & De Luca, G. D. (2017). Mafia in the ballot box. *American Economic Journal: Economic Policy*, *9*(3), 134-167.

Del Monte, A., & Pennacchio, L. (2012). Agricultural productivity, banditry and criminal organizations in post-unification Italy. *Rivista Italiana degli Economisti*, *17*(3), 347-378.

De Natale, G., De Natale, L., Troise, C., Marchitelli, V., Coviello, A., Holmberg, K. G., & Somma, R. (2020). The evolution of Covid-19 in Italy after the spring of 2020: an unpredicted summer respite followed by a second wave. *International Journal of environmental research and public health*, *17*(23), 8708.

Dickie, J. (2004). *Cosa Nostra: A History of the Sicilian Mafia.* New York, NJ: Palgrave Macmillan.

Di Marco, G., Hichy, Z., & Sciacca, F. (2022). Attitudes towards lockdown, trust in institutions, and civic engagement: A study on Sicilians during the coronavirus lockdown. *Journal of Public Affairs*, *22*, e2739.

Dimico, A., Isopi, A., & Olsson, O. (2017). Origins of the Sicilian mafia: The market for lemons. *The Journal of Economic History*, *77*(4), 1083-1115.

Đorđević, J. M., Mari, S., Vdović, M., & Milošević, A. (2021). Links between conspiracy beliefs, vaccine knowledge, and trust: Anti-vaccine behavior of Serbian adults. *Social Science & Medicine*, *277*, 113930.

Dugato, M., Calderoni, F., & Campedelli, G. M. (2020). Measuring organised crime presence at the municipal level. *Social Indicators Research*, *147*, 237-261.

Duggan, C. (1989). *Fascism and the Mafia*. New Haven: Yale University Press.

Falcone, G. & Padovani, M. (1991). *Cose di Cosa Nostra*. Bur.

Ferrazza, R. (11 August 2021). Obiettivo 80% vaccinati: ecco le regioni più avanti e quelle più indietro. *Il Sole 24 Ore*. Available online at: https://www.ilsole24ore.com/art/obiettivo-80percento-vaccinati-ecco-regioni-piu-avanti-e-quelle-piu-indietro-AE9o1Kc [Accessed 8 May 2023].

Ferro, E. (22 February 2020). Adriano Trevisan, la prima vittima di coronavirus in Italia. *La Repubblica*. Available online at: https://www.repubblica.it/cronaca/2020/02/22/news/adriano_trevisan_la_prima_vittima_di_coronavirus_in_italia-249260446/ [Accessed 8 May 2023].

Finkelstein, M. S. (1998). *Separatism, the Allies and the Mafia: The Struggle for Sicilian Independence, 1943-1948*. Leigh University Press.

Franchetti, L. (1877), Condizioni Politiche e Amministrative della Sicilia, Florence, IT: Barbera.

Fulvetti, G. (2004). The Mafia and the 'Problem of the Mafia': Organised Crime in Italy, 1820-1970. *Organized Crime in Europe: Concepts, Patterns and Control Policies in the European Union and Beyond*, 47-75.

Gambetta, D. (1993), The Sicilian Mafia: The Business of Private Protection, Cambridge, MA: Harvard University Press.

Galullo, R. (17 April 2009). Abruzzo / Le fissure nel muro che le mafie possono far diventare un nuovo terremoto: bandi di gara, corruzione e massimo ribasso. *Il Sole 24 Ore*. Available online at: https://robertogalullo.blog.ilsole24ore.com/2009/04/17/abruzzo-le-fessure-nel-muro-che-le-mafie-possono-far-diventare-un-nuovo-terremoto-bandi-di-gara-corruzione-e-massimo-ribas/?refresh_ce=1 [Accessed 9 May 2022].

Gambetta, D., & Reuter, P. (2000). Conspiracy among the many: the mafia in legitimate industries. *The economic dimensions of crime*, 99-120.

GEDI Visual. (2023). Coronavirus, le vaccinazioni in Italia regione per regione. Available online at: https://lab.gedidigital.it/gedi-visual/2021/report-vaccini-anti-covid-aggiornamento-vaccinazioni-italia/ [Accessed 9 May 2023].

Hakhverdian, A., & Mayne, Q. (2012). Institutional trust, education, and corruption: A micro-macro interactive approach. *The Journal of Politics*, *74*(3), 739–750.

Hitlin, P., & Shutava, N. (2022). Trust in government: A close look at public perceptions of the federal government and its employees. *Partnership for Public Service. https://ourpublicservice. org/publications/trust-in-government*.

Hookway, J. (3 December 2020). Covid-19 Vaccines are "Liquid Gold" to Organized Crime, Interpol says. *The Wall Street Journal*. Available online at: https://www.wsj.com/articles/virus-vaccines-are-liquid-gold-to-organized-crime-interpol-warns-11607000854 [Accessed 20 May 2023].

Imperiale, A. J., & Vanclay, F. (2020). Barriers to enhancing disaster risk reduction and community resilience: Evidence from the L'Aquila disaster. *Politics and Governance*, *8*(4), 232-243.

Italian National Statistical Institute – ISTAT. (2013). Aspetti della vita quotidiana: microdati ad uso pubblico. Available online at: https://www.istat.it/it/archivio/129956 [Accessed 15 May 2023].

Italian National Statistical Institute – ISTAT. (2020). Censimento permanente della popolazione e delle abitazioni, 2020. Available online at: https://esploradati.censimentopopolazione.istat.it/databrowser/#/it/censtest/categories/BULKDOWNLOAD [Accessed 18 May 2023].

Italian National Statistical Institute – ISTAT. (2023). IstatData. Available online at: https://esploradati.istat.it/databrowser/#/en [Accessed 20 May 2023].

Jamison, A. M., Quinn, S. C., & Freimuth, V. S. (2019). "You don't trust a government vaccine": Narratives of institutional trust and influenza vaccination among African American and white adults. *Social Science & Medicine*, *221*, 87-94.

Kanyanda, S., Markhof, Y., Wollburg, P., & Zezza, A. (2021). Acceptance of COVID-19 vaccines in sub-Saharan Africa: evidence from six national phone surveys. *BMJ open*, *11*(12), e055159.

Karaivanov, A., Kim, D., Lu, S. E., & Shigeoka, H. (2022). COVID-19 vaccination mandates and vaccine uptake. *Nature Human Behaviour*, 1-10.

Kroknes, V. F., Jakobsen, T. G., & Grønning, L. M. (2015). Economic Performance and Political Trust: The impact of the financial crisis on European citizens. *European Societies*, *17*(5), 700-723.

Le Moglie, M., & Sorrenti, G. (2022). Revealing "mafia inc."? Financial crisis, organized crime, and the birth of new enterprises. *The Review of Economics and Statistics* 104(1), 142-156.

Ljunge, M. (2014). Social capital and political institutions: Evidence that democracy fosters trust. *Economics Letters*, *122*(1), 44-49.

Lupo, S. (1996). *Storia della Mafia*, Rome, IT: Donzelli Editore.

Lupo, S. (2010). *Potere criminale. Intervista sulla storia della mafia*. Laterza.

Marciante, G. (2023). When nation-building goes South: draft evasion, government repression, and the origins of the Sicilian Mafia. mimeo, University of Warwick.

Margalit, Y. (2019). Political responses to economic shocks. *Annual Review of Political Science*, *22*, 277-295.

McElfish, P. A., Willis, D. E., Shah, S. K., Bryant-Moore, K., Rojo, M. O., & Selig, J. P. (2021). Sociodemographic determinants of COVID-19 vaccine hesitancy, fear of infection, and protection self-efficacy. *Journal of primary care & community health*, *12*, 21501327211040746.

Mennella, A. (2009). Reti sociali, criminalità organizzata e mercati locali del lavoro. *University of Sassari*.

Mills, M. C., & Rüttenauer, T. (2022). The effect of mandatory COVID-19 certificates on vaccine uptake: synthetic-control modelling of six countries. *The Lancet Public Health*, *7*(1), e15-e22.

Ministero della Salute (27 April 2023a). Covid-19 – Situazione in Italia. Available online at: https://www.salute.gov.it/portale/nuovocoronavirus/dettaglioContenutiNuovoCoronavirus.jsp?area=nuovoCoronavirus&id=5351&lingua=italiano&menu=vuoto [Accessed 8 May 2023].

Ministero della Salute. (8 May 2023). Report Vaccini Anti COVID-19. Available online at: https://www.governo.it/it/cscovid19/report-vaccini/ [Accessed 8 May 2023].

Ministero dell'Economia e delle Finanze. (2023). Open Data Dichiarazioni. Available online at: https://www1.finanze.gov.it/finanze/analisi_stat/public/index.php?search_class[0]=cCOMUNE&opendata=yes [Accessed 20 May 2023].

Ministero dell'Interno. (2020). Relazione semestrale sull'attività svolta e i risultati conseguiti dalla Direzione Investigativa Antimafia nel primo semestre del 2020.

Ministero dell'Interno. (2022). Relazione semestrale sull'attività svolta e i risultati conseguiti dalla Direzione Investigativa Antimafia nel primo semestre del 2022.

Miyachi, T., Takita, M., Senoo, Y., & Yamamoto, K. (2020). Lower trust in national government links to no history of vaccination. *The Lancet*, *395*(10217), 31-32.

Morris, S. D., & Klesner, J. L. (2010). Corruption and trust: Theoretical considerations and evidence from Mexico. *Comparative political studies*, *43*(10), 1258-1285.

Nardin, L.G., Andrighetto, G., Conte, R., Székely, Á., Anzola, D., Elsenbroich, C., Lotzmann, U., Neumann, M., Punzo, V. & Troitzsch, K.G. (2016). Simulating protection rackets: A case study of the Sicilian mafia. Autonomous Agents and Multi-Agent Systems, 30, 1117-1147.

Natilli, M., Rossi, A., Trecroci, A., Cavaggioni, L., Merati, G., & Formenti, D. (2022). The long-tail effect of the COVID-19 lockdown on Italians' quality of life, sleep and physical activity. *Scientific data*, *9*(1), 250.

Neumann, M., Lotzmann, U., & Troitzsch, K. G. (2017). Mafia war: simulating conflict escalation in criminal organizations. *Trends in Organized Crime*, *20*(1-2), 139-178.

Nielsen, J. H., & Lindvall, J. (2021). Trust in government in Sweden and Denmark during the COVID-19 epidemic. *West European Politics*, *44*(5-6), 1180-1204.

OECD. (2020). The territorial impact of COVID-19: Managing the crisis across levels of government. Available online at: https://www.oecd.org/coronavirus/policy-responses/theterritorial-impact-of-covid-19-managing-the-crisis-across-levels-ofgovernment-d3e314e1/ [Accessed 15 May 2023].

OECD. (2021). Enhancing public trust in Covid-19 vaccination: The role of governments. Available online at: https://www.oecd.org/coronavirus/policy-responses/enhancing-public-trust-in-COVID-19-vaccination-the-role-of-governments-eae0ec5a/ [Accessed 15 May 2023].

Paoli, L. (2008). *The decline of the Italian Mafia* (pp. 15-28). Springer New York.

Paoli, L. (2014). *The Oxford Handbook of organized crime*. Oxford Handbooks.

Peeters, R., Trujillo Jimenez, H., O'Connor, E., Ogarrio Rojas, P., Gonzalez Galindo, M., & Morales Tenorio, D. (2018). Low-trust bureaucracy: Understanding the Mexican bureaucratic experience. *Public Administration and Development*, *38*(2), 65-74.

Pew Research Center. (6 June 2022). Public trust in government. Available online at: https://www.pewresearch.org/politics/2022/06/06/public-trust-in-government-2/ [Accessed 15 May 2023].

Postiglione, A. (13 March 2010). Affari e terremoti: Svelate le trame che hanno ricostruito l'Abruzzo. *Verso L'Aquila*. Available online at: https://versolaquila.wordpress.com/2010/03/13/svelate-le-trame-che-hanno-ricostruito-l%E2%80%99abruzzo/ [Accessed 9 May 2023].

Presidente del Consiglio dei Ministri. (2020). Disposizioni urgenti per il potenziamento del Servizio sanitario nazionale in relazione all'emergenza COVID-19. 9 March 2020, n. 14. *Gazzetta Ufficiale della Repubblica Italiana*, n. 62. Available online at: https://www.gazzettaufficiale.it/eli/id/2020/03/09/20A01558/sg [Accessed 8 May 2023].

Putnam, R., D. (1993). *Making Democracy Work: Civic Tradition in Modern Italy*. Princeton: Princeton University Press.

Quotidiano di Sicilia. (16 April 2021). Niente rosso, la Sicilia zona arancione fino al 26 aprile. Available online at: https://qds.it/covid-sicilia-zona-arancione-26-aprile/ [Accessed 8 May 2023].

Reece, J. E. (1973). Fascism, the Mafia, and the emergence of Sicilian separatism (1919-43). *The Journal of Modern History*, *45*(2), 261-276.

Richey, S. (2010). The impact of corruption on social trust. *American Politics Research*, *38*(4), 676-690.

Rieger, M. O., & Wang, M. (2022). Trust in government actions during the COVID-19 crisis. *Social Indicators Research*, *159*(3), 967-989.

Roberts, H. (9 April 2021). Italy fears mob has infiltrated vaccination campaign. *Politico Pro*. Available online at: https://www.politico.eu/article/italy-mafia-coronavirus-vaccination-mob-infiltrated/ [Accessed 20 May 2023].

Rosen, K. (14 June 2020). The Mafia's Long-Shot Payout from a Medical Industry Takeover. Pulitzer Center. Available online at: https://pulitzercenter.org/stories/mafias-long-shot-payout-medical-industry-takeover [Accessed 15 May 2023].

Roth, F. (2009). The effects of the financial crisis on systemic trust. *Intereconomics*, *44*(4), 203–208.

Roth, F. (2011). The Eurozone crisis and its effects on citizens' trust in the national parliament. *FMA Bulletin*, *34*, 29–30.

Roth, F., Nowak-Lehmann D, F., & Otter, T. (2022). Has the financial crisis shattered citizens' trust in national and European governmental institutions? Evidence from the EU member States, 1999–2010. In *Public Support for the Euro: Essays on Labor Productivity, Monetary Economics, and Political Economy, Vol. 2* (pp. 187-217). Cham: Springer International Publishing.

Rzymski, P., Zeyland, J., Poniedziałek, B., Małecka, I., & Wysocki, J. (2021). The perception and attitudes toward COVID-19 vaccines: A cross-sectional study in Poland. *Vaccines*, *9*(4), 382.

Sabahelzain, M. M., Hartigan-Go, K., & Larson, H. J. (2021). The politics of COVID-19 vaccine confidence. *Current Opinion in Immunology*, *71*, 92-96.

Saglietto, A., D'Ascenzo, F., Zoccai, G. B., & De Ferrari, G. M. (2020). COVID-19 in Europe: the Italian lesson. *The Lancet*, *395*(10230), 1110-1111.

Saporiti, R. (16 April 2019). Comune per comune, ecco chi ha un lavoro e chi no. *Il Sole 24 Ore*. Available online at: https://www1.finanze.gov.it/finanze/analisi_stat/public/index.php?search_class[0]=cCOMUNE&opendata=yes [Accessed 20 May 2023].

Saviano, R. (2020). Il Coronavirus è l'ideale per le mafie, lo stato intervenga. Interview available online at: https://www.youtube.com/watch?v=agxjwYQ3YAY [Accessed 9 May 2023].

Sebastiani, G., Massa, M., & Riboli, E. (2020). Covid-19 epidemic in Italy: evolution, projections and impact of government measures. *European journal of epidemiology*, *35*, 341-345.

Seindal, R. (1998). Mafia: Money and Politics in Sicily, 1950-1997. Museum Tusculanum Press.

Servegnini, C. (31 March, 2020). Coronavirus, primi due casi in Italia. "Sono due cinesi in vacanza a Roma". Sono arrivati a Milano il 23 gennaio. *Corriere della Sera*. Available online at: https://www.corriere.it/cronache/20_gennaio_30/coronavirus-italia-corona-9d6dc436-4343-11ea-bdc8-faf1f56f19b7.shtml [Accessed 8 May 2023].

Sherman, L. W. (2002). Trust and confidence in criminal justice. *National Institute of Justice Journal*, *248*, 22-31.

Suro, R. (1987). 338 Guilty in Sicily in a Mafia Trial; 19 Get Life Terms. *New York Times*, *17*. Available online at: https://www.nytimes.com/1987/12/17/world/338-guilty-in-sicily-in-a-mafia-trial-19-get-life-terms.html [Accessed 7 May 2023].

The World Bank. (8 June 2020). The Global Economic Outlook During the COVID-19 Pandemic: A Changed World. Available online at: https://www.worldbank.org/en/news/feature/2020/06/08/the-global-economic-outlook-during-the-covid-19-pandemic-a-changed-world?cid=ECR_TT_worldbank_EN_EXT [Accessed 9 May 2023].

Tramuto, F., Mazzucco, W., Maida, C. M., Colomba, G. M. E., Di Naro, D., Coffaro, F., Graziano, G., Costantino, C., Restivo, V., & Vitale, F. (2021). COVID-19 emergency in Sicily and intersection with the 2019-2020 influenza epidemic. *Journal of Preventive Medicine and Hygiene*, *62*(1), E10.

Transcrime. (2013). Project NOP Security 2007-2013: Mafias Investments. Report Line 1. Rome: : Italian Ministry of Interior.

Treccani (2023). Definition of "Omertà". Available online at: https://www.treccani.it/vocabolario/omerta/ [Accessed 11 May 2023].

Trent, M., Seale, H., Chughtai, A. A., Salmon, D., & MacIntyre, C. R. (2022). Trust in government, intention to vaccinate and COVID-19 vaccine hesitancy: A comparative survey of five large cities in the United States, United Kingdom, and Australia. *Vaccine*, *40*(17), 2498-2505.

Ulloa, P. C. (1838), Considerazioni sullo Stato Economico e Politico della Sicilia, in E. Pontieri, ed., 'Il Riformismo Borbonico nella Sicilia del Sette e dell'Ottocento', 1965, Naples, IT: Edizioni Scientifiche Italiane.

United Nations - Office on Drugs and Crime (13 July 2020). Organized crime groups are infiltrating the legal economy following COVID-19 crisis, says latest UNODC Research Brief. Available online at: https://www.unodc.org/unodc/en/frontpage/2020/July/organized-crime-groups-are-infiltrating-the-legal-economy-following-covid-19-crisis--says-latest-unodc-research-brief.html [Accessed 15 May 2023].

Uslaner, E. M. (Ed.). (2018). *The Oxford handbook of social and political trust*. Oxford University Press.

Van der Meer, T. W. (2017). Democratic input, macroeconomic output and political trust. In *Handbook on political trust* (pp. 270-284). Edward Elgar Publishing.

Van Oost, Pascaline, et al. "The relation between conspiracism, government trust, and COVID-19 vaccination intentions: The key role of motivation." *Social Science & Medicine* 301 (2022): 114926.

Venetoklis, T. (2021). Exogenous shocks and citizens' satisfaction with governmental policies: can empirical evidence from the 2008 financial crisis help us understand better the effects of the COVID-19 pandemic? *Quality & quantity*, *55*(6), 1973-2000.

Wang, Z. (2005). Political trust in China: forms and causes. *Legitimacy: Ambiguities of political success or failure in East and Southeast Asia*, *1*, 113e140.

Wang, J., Jing, R., Lai, X., Zhang, H., Lyu, Y., Knoll, M. D., & Fang, H. (2020). Acceptance of COVID-19 Vaccination during the COVID-19 Pandemic in China. *Vaccines*, *8*(3), 482.

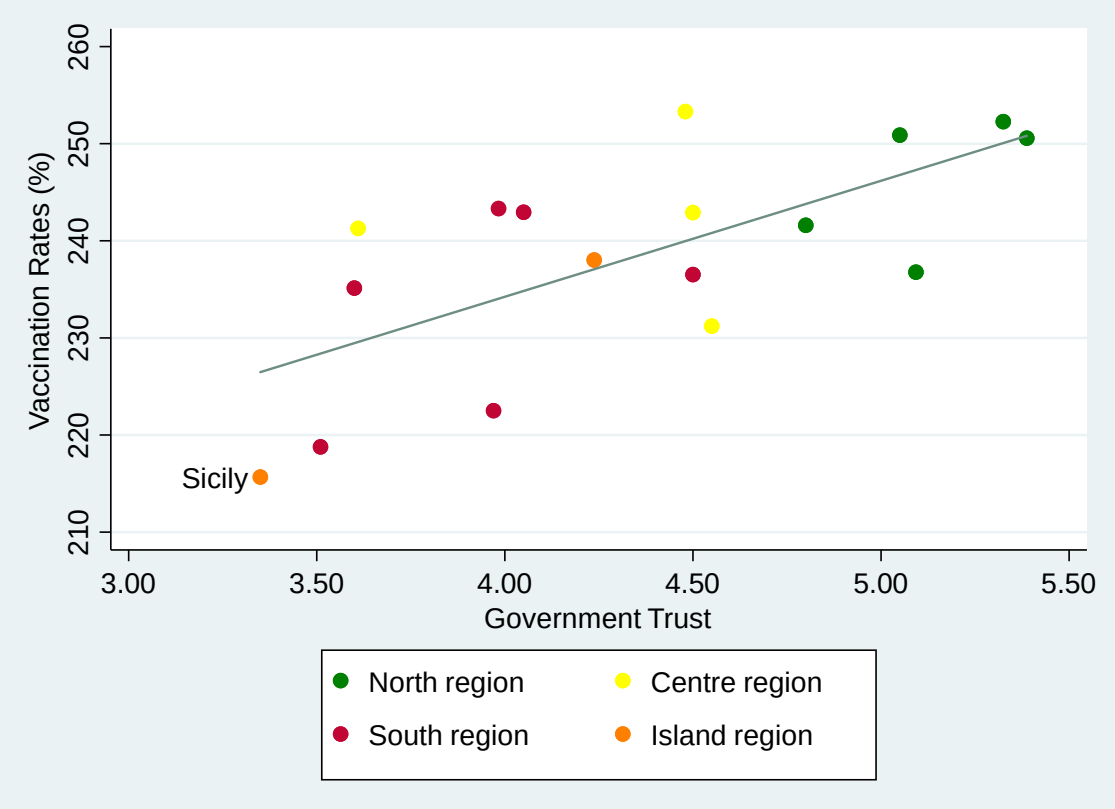
Weng, W. W., Woo, C. K., Cheng, Y. S., Ho, T., & Horowitz, I. (2015). Public trust and corruption perception: disaster relief. *Applied Economics*, *47*(46), 4967-4981.

Wike, R. & Holzwart, K. (15 April 2008). Where Trust is High, Crime and Corruption are Low. Pew Research Center. Available online at: https://www.pewresearch.org/global/2008/04/15/where-trust-is-high-crime-and-corruption-are-low/ [Accessed 15 May 2023].

Zhang, J., Yang, H., Yang, M., & Tan, H. (2022). The role of vaccines in COVID-19 control strategies in Singapore and China. *Health Policy and Technology*, *11*(2), 100620.

APPENDIX

Figure A.1: Correlation between government trust and vaccination rates per region in Italy.



Source: data on government trust are from "Aspects of daily life" (ISTAT, 2013); data on vaccination rates are from OpenData Vaccini – Ministry of Health (last update 27/04/2023).
Note: data from "Aspects of daily life" (ISTAT, 2013) are expressed on a provincial level. From this information, the regional average has been calculated to represent the following graph.

Figure A.2: Sicily and its provinces.

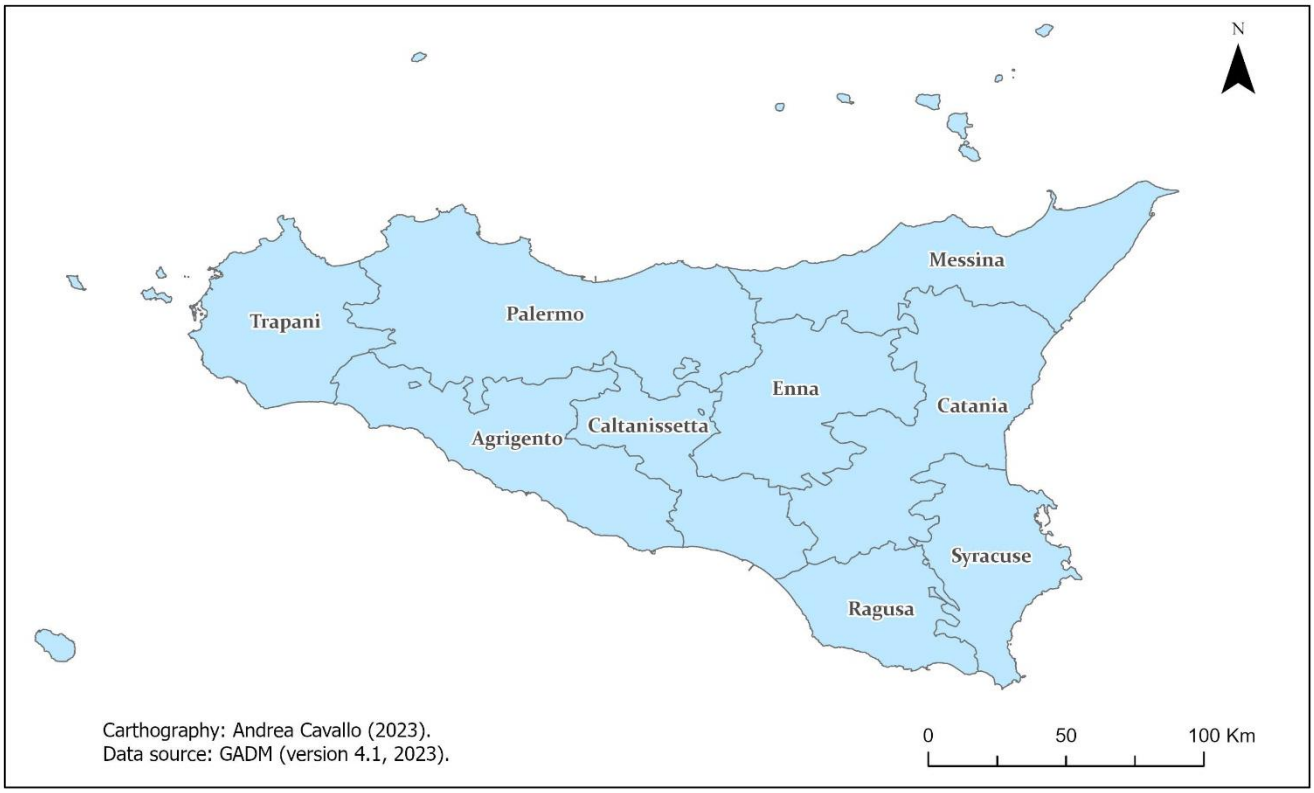


Table A.1: Descriptive Statistics.

Variable	Obs	N. Towns	Mean	Std.Dev.	Min	Max
Administrated doses 1 per week	41,730	390	90.70	582.3	0	43042
Cumulative administrated doses 1 per week	41,730	390	7330	27112	0	535708
Administrated doses 2 per week	41,730	390	84.12	536.6	0	33889
Cumulative administrated doses 2 per week	41,730	390	6509	24500	0	492709
Total population 2020 per municipality	41,730	390	12394	39062	182	637885
Population 2020 per municipality over 12 years old	41,730	390	11076	34760	173	566891
Share of population 0-19 years old per municipality	41,730	390	0.173	0.0272	0.0962	0.261
Share of population 20-39 years old per municipality	41,730	390	0.223	0.0186	0.174	0.294
Share of population 40-59 years old per municipality	41,730	390	0.289	0.0143	0.240	0.335
Share of population over 60 years old per municipality	41,730	390	0.316	0.0451	0.167	0.441
Percentage vaccination rates (dose 1) per municipality, total population 2020	41,730	390	0.595	0.284	0	1.104
Percentage vaccination rates (dose 1) per municipality, population over 12 years old 2020	41,730	390	0.657	0.313	0	1.162
Percentage vaccination rates (dose 2) per municipality, total population 2020	41,730	390	0.529	0.285	0	1.038
Percentage vaccination rates (dose 2) per municipality, population over 12 years old 2020	41,730	390	0.585	0.314	0	1.092
Strength Mafia 1885	38,092	356	0.562	0.999	0	3
Strength Mafia 1900	33,063	309	1.392	1.146	0	3
Dummy Mafia 1900	33,063	309	0.696	0.460	0	1
Dummy Mafia 1987	39,697	371	0.210	0.407	0	1
Dummy Mafia 1994	39,697	371	0.278	0.448	0	1
Dummy dissolved municipalities 1991-2023	41,730	390	0.182	0.386	0	1
Total confiscated assets from Mafia per municipality managed by the State, 1981-2023	41,730	390	25.74	113.5	0	1649
Percentage of confiscated assets from Mafia managed by the State over the population, 1981-2023	41,730	390	0.00253	0.00834	0	0.0790
Total confiscated assets from Mafia per municipality managed by the municipality, 1981-2023	41,730	390	21.57	131.1	0	2492
Percentage of confiscated assets from Mafia managed by the municipality over the population, 1981-2023	41,730	390	0.00257	0.0251	0	0.494
Percentage of total confiscated assets per municipality over the population, 1981-2023	41,730	390	0.00510	0.0301	0	0.571
Taxable income, 2020	41730	390	1.15^8	4.14^8	1739161	6.87^9
Number of taxpayers, 2020	41730	390	7315.154	21896.99	128	355591
Income per capita per municipality, 2020	41,730	390	13683	2119	8909	24355
Logarithm income per capita per municipality, 2020	41,730	390	9.513	0.146	9.095	10.100
Structural Index of the working population, 2020	41,730	390	132.6	13.28	92.29	184.1
Mortality rate per municipality, 2019	41,516	388	13.135	6.436	2.28	64.52
Mortality rate per municipality, 2020	41,730	390	13.25	3.955	5.672	34.18
Change in mortality rate, 2019-2020	41516	388	0.21	0.637	-0.809	3.605
Foreign residents per 100 inhabitants, 2020	41,730	390	3.276	3.000	0.231	29.56
Perc. illiterates (>8 YO), 2020	41,730	390	0.0116	0.0334	0.000104	0.539
Perc. literates with no studies (>8 YO), 2020	41,730	390	0.0563	0.158	0.000417	2.524
Perc. elementary school education (>8 YO), 2020	41,730	390	0.199	0.600	0.00240	9.936
Perc. middle school education (>8 YO), 2020	41,730	390	0.394	1.204	0.00657	19.53
Perc. high school education (>8 YO), 2020	41,730	390	0.380	1.168	0.00595	18.76
Perc. Bachelor's degree (>8 YO), 2020	41,730	390	0.0366	0.116	0.000313	1.877
Perc. Master's degree (>8 YO), 2020	41,730	390	0.112	0.461	0.00177	7.618
Perc. Ph.D. (>8 YO), 2020	41,730	390	0.00356	0.0222	0	0.375
Perc. University or higher education (>8 YO), 2020	41,730	390	0.153	0.598	0.00282	9.871
Commuting people (study) per 100 inhabitants, 2020	41,623	390	14.91	2.543	6.952	22.30
Commuting people (work) per 100 inhabitants, 2020	41,623	390	25.18	2.995	17.89	33.86
Total commuting per 100 inhabitants, 2020	41,623	390	40.10	4.343	25.13	53.38
Employment rate per municipality, 2019	41,730	390	49.61	6.085	36.60	68.89

Table A.2: Information Criteria on the six different measurements of the Mafia presence.

	N. Obs.	Adjusted R squared	RMSE	AIC	BIC
Strength Mafia 1885	31993	0.9899	0.0313	-130903.5	-129262.3
Dummy Mafia 1900	31993	0.9902	0.0310	-131542.1	-130085.1
Strength Mafia 1900	31993	0.9904	0.0306	-132361.2	-129974.8
Dummy Mafia 1987	31993	0.9901	0.0311	-131380	-129956.6
Dummy Mafia 1994	31993	0.9900	0.0314	-130775.4	-129276
Dummy Dissolved Municipalities	31993	0.9899	0.0315	-130654.3	-129398.3
Percentage Confiscated Assets from Mafia	31993	0.9899	0.0316	-130421.9	-128939.9

Table A.3: OLS results, historical presence of the Mafia (Cutrera, 1900) by type of Covid-19 vaccine dose between week 1 and week 30.

	Model 1 – Covid-19 dose 1		Model 2 – Covid-19 dose 2	
Week	Time Trend	Time Trend * Dummy Mafia	Time Trend	Time Trend * Dummy Mafia
2	0.0000282***	0.0000326**	-	-
	(0.00000828)	(0.0000130)	-	-
3	0.000838***	0.0000128	5.31e-08	0.000000298
	(0.000157)	(0.000178)	(5.36e-08)	(0.000000349)
4	0.00312***	-0.00171***	0.00000276	-0.00000126
	(0.000347)	(0.000367)	(0.00000272)	(0.00000283)
5	0.00416***	-0.00251***	0.000764***	0.000942***
	(0.000423)	(0.000444)	(0.0000986)	(0.000162)
6	0.00444***	-0.00253***	0.00895***	0.00324***
	(0.000434)	(0.000459)	(0.000573)	(0.000754)
7	0.00543***	-0.00179***	0.0169***	0.00117
	(0.000420)	(0.000465)	(0.00130)	(0.00146)
8	0.0103***	-0.00172**	0.0181***	0.000715
	(0.000601)	(0.000724)	(0.00133)	(0.00149)
9	0.0181***	-0.00232**	0.0191***	0.000333
	(0.000755)	(0.000926)	(0.00135)	(0.00152)
10	0.0310***	-0.00138	0.0201***	0.000730
	(0.00102)	(0.00130)	(0.00140)	(0.00160)
11	0.0515***	-0.00359**	0.0244***	0.000656
	(0.00144)	(0.00177)	(0.00145)	(0.00167)
12	0.0675***	-0.00357	0.0294***	0.000236
	(0.00177)	(0.00219)	(0.00144)	(0.00172)
13	0.0796***	-0.00278	0.0382***	0.000362
	(0.00246)	(0.00285)	(0.00148)	(0.00186)
14	0.0977***	-0.000741	0.0491***	-0.00200
	(0.00304)	(0.00353)	(0.00178)	(0.00217)
15	0.112***	0.00125	0.0570***	-0.00328
	(0.00331)	(0.00395)	(0.00180)	(0.00222)
16	0.128***	0.00305	0.0661***	-0.00233
	(0.00353)	(0.00421)	(0.00206)	(0.00253)
17	0.150***	0.00608	0.0758***	-0.000501
	(0.00422)	(0.00497)	(0.00246)	(0.00294)
18	0.180***	0.00809	0.0867***	-0.00208
	(0.00491)	(0.00574)	(0.00275)	(0.00326)
19	0.210***	0.0149**	0.101***	-0.00281
	(0.00544)	(0.00644)	(0.00294)	(0.00348)
20	0.242***	0.0169**	0.116***	-0.000909
	(0.00629)	(0.00731)	(0.00303)	(0.00365)
21	0.285***	0.0206**	0.138***	0.00416
	(0.00812)	(0.00936)	(0.00352)	(0.00422)
22	0.342***	0.00632	0.160***	0.0121**

	(0.0103)	(0.0118)	(0.00387)	(0.00476)
23	0.385***	0.000681	0.193***	0.0186***
	(0.0115)	(0.0131)	(0.00467)	(0.00563)
24	0.445***	0.00215	0.215***	0.0162**
	(0.0110)	(0.0128)	(0.00539)	(0.00633)
25	0.503***	0.0117	0.227***	0.0147**
	(0.0101)	(0.0120)	(0.00575)	(0.00670)
26	0.532***	0.0209*	0.259***	0.0155**
	(0.00961)	(0.0114)	(0.00679)	(0.00784)
27	0.556***	0.0301***	0.301***	0.0124
	(0.00938)	(0.0112)	(0.00833)	(0.00983)
28	0.572***	0.0347***	0.341***	0.00609
	(0.00922)	(0.0111)	(0.00923)	(0.0109)
29	0.583***	0.0350***	0.400***	0.00425
	(0.00938)	(0.0112)	(0.0105)	(0.0121)
30	0.594***	0.0388***	0.454***	0.0189
	(0.00923)	(0.0110)	(0.00995)	(0.0117)
constant	0.00000444		2.33e-13	
	(0.00294)		(0.00303)	
N	33063		33063	
adj. R^2	0.990		0.990	

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: Model 1 presents the results for the Covid-19 first dose and Model 2 presents the results for the Covid-19 second dose.

Table A.4: OLS results, current presence of the Mafia (ANBSC, 1900) by type of Covid-19 vaccine dose between week 1 and week 35.

	Model 1 Covid-19 dose 1	Model 2 Covid-19 dose 1	Model 3 Covid-19 dose 2	Model 4 Covid-19 dose 2
Week	Time trend * confiscated assets	Time trend * confiscated assets	Time trend * confiscated assets	Time trend * confiscated assets
2	-0.000101**	-0.0000896**	-	-
	(0.0000420)	(0.0000394)	-	-
3	-0.00169***	-0.00156***	0.000000824	0.00000101
	(0.000462)	(0.000449)	(0.00000149)	(0.00000166)
4	-0.00521***	-0.00518***	-0.00000235	-0.000000897
	(0.00189)	(0.00191)	(0.00000343)	(0.00000317)
5	-0.00653***	-0.00669***	-0.00149	-0.000782
	(0.00240)	(0.00256)	(0.00116)	(0.00160)
6	-0.00743***	-0.00761**	-0.0146***	-0.0130***
	(0.00277)	(0.00295)	(0.00340)	(0.00397)
7	-0.00987***	-0.00938***	-0.0228***	-0.0209***
	(0.00264)	(0.00242)	(0.00471)	(0.00512)
8	-0.00989	-0.00936	-0.0246***	-0.0232***
	(0.00661)	(0.00640)	(0.00466)	(0.00490)
9	-0.00561	-0.00474	-0.0253***	-0.0236***
	(0.00875)	(0.00841)	(0.00491)	(0.00526)
10	-0.0185*	-0.0177*	-0.0276***	-0.0253***
	(0.0106)	(0.0105)	(0.00513)	(0.00567)
11	-0.0210**	-0.0178*	-0.0286***	-0.0261***
	(0.0104)	(0.00975)	(0.00479)	(0.00481)
12	-0.0361**	-0.0297**	-0.0261***	-0.0240***
	(0.0156)	(0.0126)	(0.00576)	(0.00546)
13	-0.0529***	-0.0446***	-0.0393***	-0.0368***
	(0.0174)	(0.0137)	(0.00857)	(0.00791)
14	-0.0756***	-0.0644***	-0.0444***	-0.0427***
	(0.0181)	(0.0144)	(0.0106)	(0.0104)
15	-0.0957***	-0.0845***	-0.0467***	-0.0457***
	(0.0204)	(0.0161)	(0.0126)	(0.0129)
16	-0.0948***	-0.0815***	-0.0615***	-0.0608***
	(0.0215)	(0.0166)	(0.0163)	(0.0168)
17	-0.0656**	-0.0488**	-0.0753***	-0.0695***
	(0.0319)	(0.0233)	(0.0149)	(0.0123)
18	-0.0570*	-0.0360	-0.0896***	-0.0849***
	(0.0315)	(0.0228)	(0.0160)	(0.0138)
19	-0.0811**	-0.0572**	-0.0807***	-0.0744***
	(0.0345)	(0.0257)	(0.0180)	(0.0150)
20	-0.0995***	-0.0928***	-0.0430**	-0.0372**
	(0.0321)	(0.0322)	(0.0218)	(0.0188)
21	-0.0836**	-0.0775**	-0.0235	-0.0155
	(0.0350)	(0.0356)	(0.0316)	(0.0273)

22	-0.106**	-0.121***	-0.0511*	-0.0394
	(0.0420)	(0.0464)	(0.0308)	(0.0253)
23	-0.128***	-0.142***	-0.0761***	-0.0549***
	(0.0454)	(0.0489)	(0.0265)	(0.0205)
24	0.283***	0.265***	-0.0759***	-0.0586**
	(0.0739)	(0.0860)	(0.0258)	(0.0227)
25	0.234***	0.214***	-0.0839***	-0.0812***
	(0.0591)	(0.0687)	(0.0265)	(0.0275)
26	0.192***	0.175***	-0.0753**	-0.0748**
	(0.0519)	(0.0592)	(0.0294)	(0.0312)
27	0.137***	0.127**	-0.103***	-0.110**
	(0.0522)	(0.0584)	(0.0394)	(0.0452)
28	0.104*	0.0994*	-0.101**	-0.119**
	(0.0531)	(0.0577)	(0.0403)	(0.0469)
29	0.150***	0.146**	0.252***	0.228**
	(0.0537)	(0.0584)	(0.0747)	(0.0892)
30	0.129**	0.126**	0.187***	0.167**
	(0.0532)	(0.0577)	(0.0676)	(0.0801)
31	0.104*	0.106*	0.124*	0.112
	(0.0533)	(0.0575)	(0.0637)	(0.0729)
32	0.0651	0.0702	0.0704	0.0667
	(0.0540)	(0.0572)	(0.0629)	(0.0686)
33	0.0581	0.0647	0.0448	0.0463
	(0.0499)	(0.0521)	(0.0554)	(0.0585)
34	0.0494	0.0575	0.0681	0.0713
	(0.0474)	(0.0491)	(0.0569)	(0.0597)
35	0.0352	0.0447	0.0553	0.0588
	(0.0480)	(0.0494)	(0.0597)	(0.0627)
constant	0.00000444	0.00000423	-4.79e-14	-1.29e-13
	(0.00301)	(0.00286)	(0.00311)	(0.00289)
N	33063	41730	33063	41730
adj. R^2	0.990	0.988	0.990	0.988

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: in Model 1 and Model 3, observations missing in Cutrera (1900) (***Table A.3***) are dropped to compare the results obtained using confiscated assets with the previous ones with the dummy variable for historical Mafia presence. On the other hand, Model 2 and Model 4 include all 390 Sicilian municipalities.

Table A.5: Correlation matrix, measures of the Mafia and set of control variables.

	Dummy Mafia, 1900	Confiscated assets, 1980 - 2023	Share of pop. over 60 years old, 2020	Structural index of working pop., 2020	Mortality change, 2019 – 2020	Foreigners per 100 inhabitants, 2020	Log. income per capita, 2020	Employment rate, 2019	Total commuting (work/study), 2020	% of pop. with a university degree or PhD, 2020
Dummy Mafia, 1900	1.0000									
Confiscated assets, 1980-2023	-0.0849	1.0000								
Share of pop. over 60 years old, 2020	-0.0923	0.0603	1.0000							
Structural index of working pop., 2020	-0.1543	0.0516	0.6930	1.0000						
Mortality change, 2019 – 2020	-0.0953	-0.0212	0.2891	0.1238	1.0000					
Foreigners per 100 inhabitants, 2020	-0.3155	-0.0079	-0.2272	-0.2488	-0.0577	1.0000				
Log. income per capita, 2020	-0.0107	-0.0534	-0.2855	0.1243	-0.2066	-0.0452	1.0000			
Employment rate, 2019	-0.3511	-0.0060	0.2823	0.3401	-0.0323	0.2965	0.1928	1.0000		
Total commuting (work or study), 2020	-0.0457	-0.0854	-0.6494	-0.2546	-0.2573	0.1901	0.5444	0.2443	1.0000	
% of pop with a university degree or a Ph.D., 2020	0.0268	-0.0169	-0.1413	-0.0499	-0.0130	0.0711	0.3609	-0.0432	0.1787	1.0000

Table A.6: OLS results with population controls.

	Model 1 – Covid-19 first dose				Model 2 – Covid-19 first dose			
Week	Time trend * dummy Mafia 1900	Structural index of working pop., 2020	Mortality rate change, 2019-20	Foreigners per 100 inhabitants, 2020	Time trend * confiscated assets 1981-2023	Structural index of working pop., 2020	Mortality rate change, 2019-20	Foreigners per 100 inhabitants, 2020
2	0.0000238	-6.28e-08	-0.0000133	-0.00000313**	-0.0000886**	-0.000000301	-0.0000100	-0.00000347***
	(0.0000146)	(0.000000602)	(0.00000864)	(0.00000150)	(0.0000418)	(0.000000427)	(0.00000872)	(0.00000127)
3	-0.000104	-0.00000950**	-0.000175***	-0.0000265	-0.00143***	-0.0000104**	-0.000126**	-0.0000209
	(0.000199)	(0.00000446)	(0.0000661)	(0.0000177)	(0.000434)	(0.00000451)	(0.0000626)	(0.0000157)
4	-0.00152***	0.00000242	-0.000398***	0.000115*	-0.00546***	0.0000106	-0.000207	0.000153***
	(0.000401)	(0.0000105)	(0.000139)	(0.0000634)	(0.00200)	(0.00000821)	(0.000131)	(0.0000480)
5	-0.00222***	0.00000488	-0.000374*	0.000149**	-0.00707***	0.0000177*	-0.000114	0.000203***
	(0.000482)	(0.0000129)	(0.000194)	(0.0000717)	(0.00263)	(0.0000102)	(0.000184)	(0.0000542)
6	-0.00227***	0.00000595	-0.000458**	0.000142*	-0.00804***	0.0000192*	-0.000205	0.000195***
	(0.000498)	(0.0000136)	(0.000206)	(0.0000743)	(0.00304)	(0.0000106)	(0.000190)	(0.0000565)
7	-0.00148***	0.00000583	-0.000412*	0.000153**	-0.00965***	0.00000958	-0.000187	0.000163***
	(0.000512)	(0.0000152)	(0.000239)	(0.0000730)	(0.00251)	(0.0000123)	(0.000223)	(0.0000582)
8	-0.00108	0.0000271	-0.00000194	0.000240**	-0.00966	0.0000162	0.0000454	0.000161*
	(0.000816)	(0.0000253)	(0.000460)	(0.000118)	(0.00651)	(0.0000205)	(0.000422)	(0.0000897)
9	-0.00165	0.0000185	0.000346	0.000242	-0.00470	0.00000521	0.000501	0.000169
	(0.00104)	(0.0000336)	(0.000696)	(0.000167)	(0.00853)	(0.0000287)	(0.000634)	(0.000130)
10	-0.0000171	0.000138**	0.000917	0.000267	-0.0195*	0.000137***	0.00160	0.000170
	(0.00141)	(0.0000546)	(0.00108)	(0.000232)	(0.00996)	(0.0000512)	(0.00112)	(0.000180)
11	-0.00165	0.000323***	0.00234*	0.0000442	-0.0219***	0.000299***	0.00319**	-0.0000977
	(0.00184)	(0.0000695)	(0.00127)	(0.000257)	(0.00778)	(0.0000681)	(0.00128)	(0.000207)
12	-0.000674	0.000492***	0.00338**	0.0000854	-0.0364***	0.000474***	0.00413**	-0.000122
	(0.00224)	(0.0000833)	(0.00166)	(0.000293)	(0.00975)	(0.0000886)	(0.00163)	(0.000277)
13	0.00122	0.000621***	0.00393*	0.000310	-0.0521***	0.000536***	0.00469**	-0.000174
	(0.00285)	(0.000117)	(0.00200)	(0.000369)	(0.0105)	(0.000115)	(0.00187)	(0.000327)
14	0.00386	0.000718***	0.00581**	0.000257	-0.0727***	0.000616***	0.00617***	-0.000452

	(0.00355)	(0.000139)	(0.00253)	(0.000437)	(0.0109)	(0.000130)	(0.00232)	(0.000392)
15	0.00666*	0.000787***	0.00607**	0.000480	-0.0954***	0.000750***	0.00589**	-0.000369
	(0.00403)	(0.000165)	(0.00302)	(0.000498)	(0.0125)	(0.000171)	(0.00275)	(0.000466)
16	0.00894**	0.000886***	0.00516	0.000559	-0.0938***	0.000814***	0.00501*	-0.000433
	(0.00437)	(0.000176)	(0.00326)	(0.000558)	(0.0133)	(0.000177)	(0.00298)	(0.000503)
17	0.0135***	0.00112***	0.00517	0.000787	-0.0649***	0.00103***	0.00488	-0.000497
	(0.00508)	(0.000212)	(0.00366)	(0.000618)	(0.0188)	(0.000222)	(0.00337)	(0.000582)
18	0.0164***	0.00132***	0.00842**	0.000619	-0.0532***	0.00116***	0.00790**	-0.000990
	(0.00575)	(0.000234)	(0.00405)	(0.000700)	(0.0178)	(0.000243)	(0.00367)	(0.000665)
19	0.0235***	0.00141***	0.0109**	0.000372	-0.0738***	0.00118***	0.0103**	-0.00181**
	(0.00657)	(0.000271)	(0.00477)	(0.000798)	(0.0202)	(0.000265)	(0.00432)	(0.000767)
20	0.0247***	0.00148***	0.0119**	-0.000188	-0.115***	0.00142***	0.00743	-0.000225
	(0.00736)	(0.000307)	(0.00536)	(0.000909)	(0.0291)	(0.000321)	(0.00506)	(0.00127)
21	0.0285***	0.00171***	0.00967	-0.000512	-0.107***	0.00176***	0.00389	-0.000284
	(0.00979)	(0.000369)	(0.00607)	(0.00115)	(0.0362)	(0.000448)	(0.00599)	(0.00139)
22	0.0172	0.00219***	0.00832	-0.00000528	-0.154***	0.00198***	0.00494	-0.000721
	(0.0118)	(0.000484)	(0.00818)	(0.00150)	(0.0423)	(0.000557)	(0.00775)	(0.00165)
23	0.0144	0.00274***	0.0124	-0.000100	-0.181***	0.00238***	0.00531	-0.000617
	(0.0129)	(0.000505)	(0.0104)	(0.00154)	(0.0448)	(0.000567)	(0.00984)	(0.00159)
24	0.0155	0.00289***	0.00555	-0.000180	0.224***	0.00243***	0.00328	-0.00122
	(0.0126)	(0.000493)	(0.00975)	(0.00158)	(0.0760)	(0.000532)	(0.00920)	(0.00148)
25	0.0244**	0.00271***	0.00914	-0.000363	0.178***	0.00232***	0.0111	-0.00186
	(0.0124)	(0.000449)	(0.00905)	(0.00150)	(0.0556)	(0.000476)	(0.00810)	(0.00131)
26	0.0346***	0.00243***	0.0127	0.000487	0.144***	0.00210***	0.0136*	-0.00175
	(0.0121)	(0.000434)	(0.00891)	(0.00156)	(0.0470)	(0.000450)	(0.00782)	(0.00129)
27	0.0434***	0.00236***	0.0139	0.000246	0.0999**	0.00187***	0.0146*	-0.00262**
	(0.0119)	(0.000420)	(0.00897)	(0.00149)	(0.0452)	(0.000431)	(0.00781)	(0.00123)
28	0.0469***	0.00221***	0.0171*	-0.000119	0.0757*	0.00171***	0.0167**	-0.00312**
	(0.0118)	(0.000410)	(0.00913)	(0.00145)	(0.0436)	(0.000420)	(0.00790)	(0.00122)
29	0.0470***	0.00218***	0.0171*	-0.000191	0.123***	0.00167***	0.0173**	-0.00323***

	(0.0119)	(0.000408)	(0.00923)	(0.00145)	(0.0440)	(0.000418)	(0.00799)	(0.00122)
30	0.0509***	0.00217***	0.0174*	-0.000145	0.105**	0.00162***	0.0174**	-0.00343***
	(0.0119)	(0.000405)	(0.00923)	(0.00144)	(0.0431)	(0.000416)	(0.00799)	(0.00122)
_cons	0.00000447				0.00000426			
	(0.00288)				(0.00283)			
N	32849				41516			
adj. R^2	0.991				0.989			

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: Model 1 shows the results implementing the dummy variable of Mafia presence by Cutrera (1900). Model 2 shows the results implementing the percentage of confiscated assets from the Mafia by ANBSC (2023). The included controls are the structural index of the working population (2020), the mortality rate change between 2019 and 2020, and the number of foreigners per 100 inhabitants (2020).

Table A.7: OLS results, with additional socio-economic controls.

	Model 1	Model 2	Model 3	Model 4
Week	Time Trend * Dummy Mafia	Time Trend * Confiscated assets	Time Trend * Dummy Mafia	Time Trend * Confiscated assets
2	0.0000329**	-0.0000659	0.0000258*	-0.0000635
	(0.0000129)	(0.0000413)	(0.0000151)	(0.0000498)
3	0.0000207	-0.00115***	-0.000140	-0.00159**
	(0.000169)	(0.000362)	(0.000197)	(0.000727)
4	-0.00170***	-0.00447**	-0.00161***	-0.00465***
	(0.000345)	(0.00181)	(0.000384)	(0.00148)
5	-0.00249***	-0.00584**	-0.00224***	-0.00580***
	(0.000418)	(0.00245)	(0.000444)	(0.00168)
6	-0.00251***	-0.00665**	-0.00223***	-0.00661***
	(0.000430)	(0.00283)	(0.000463)	(0.00196)
7	-0.00176***	-0.00808***	-0.00154***	-0.00821***
	(0.000431)	(0.00225)	(0.000479)	(0.00180)
8	-0.00169**	-0.00678	-0.00116	-0.00680
	(0.000684)	(0.00612)	(0.000755)	(0.00542)
9	-0.00227**	-0.00151	-0.00175*	-0.00155
	(0.000878)	(0.00812)	(0.00100)	(0.00790)
10	-0.00130	-0.0128	0.000438	-0.0158*
	(0.00119)	(0.0103)	(0.00137)	(0.00889)
11	-0.00351**	-0.0120	-0.000395	-0.0173**
	(0.00169)	(0.00984)	(0.00189)	(0.00800)
12	-0.00347*	-0.0232*	0.00163	-0.0313***
	(0.00209)	(0.0125)	(0.00233)	(0.00870)
13	-0.00266	-0.0360**	0.00323	-0.0468***
	(0.00273)	(0.0139)	(0.00281)	(0.0107)
14	-0.000611	-0.0549***	0.00488	-0.0679***
	(0.00342)	(0.0152)	(0.00363)	(0.0134)
15	0.00139	-0.0741***	0.00797*	-0.0939***
	(0.00382)	(0.0167)	(0.00408)	(0.0152)
16	0.00317	-0.0723***	0.0113***	-0.0936***
	(0.00410)	(0.0173)	(0.00435)	(0.0156)
17	0.00622	-0.0379	0.0165***	-0.0624***
	(0.00484)	(0.0235)	(0.00502)	(0.0197)
18	0.00820	-0.0263	0.0187***	-0.0531**
	(0.00568)	(0.0235)	(0.00590)	(0.0215)
19	0.0150**	-0.0508*	0.0252***	-0.0802***
	(0.00642)	(0.0263)	(0.00663)	(0.0256)
20	0.0170**	-0.0818**	0.0260***	-0.126***
	(0.00730)	(0.0326)	(0.00764)	(0.0303)
21	0.0207**	-0.0652*	0.0313***	-0.130***
	(0.00936)	(0.0362)	(0.00999)	(0.0371)
22	0.00631	-0.116**	0.0173	-0.196***
	(0.0118)	(0.0474)	(0.0122)	(0.0512)

23	0.000571	-0.147***	0.0138	-0.237***
	(0.0131)	(0.0498)	(0.0135)	(0.0529)
24	0.00194	0.253***	0.0182	0.171**
	(0.0128)	(0.0875)	(0.0133)	(0.0781)
25	0.0114	0.196***	0.0268**	0.122*
	(0.0119)	(0.0690)	(0.0129)	(0.0670)
26	0.0206*	0.154***	0.0359***	0.0847
	(0.0113)	(0.0591)	(0.0122)	(0.0592)
27	0.0297***	0.103*	0.0441***	0.0345
	(0.0111)	(0.0584)	(0.0118)	(0.0597)
28	0.0343***	0.0732	0.0473***	0.00638
	(0.0109)	(0.0572)	(0.0116)	(0.0601)
29	0.0347***	0.119**	0.0475***	0.0524
	(0.0110)	(0.0581)	(0.0117)	(0.0613)
30	0.0384***	0.0981*	0.0510***	0.0332
	(0.0109)	(0.0572)	(0.0116)	(0.0613)
constant	0.00000444	0.00000423	0.00000444	0.00000424
	(0.00291)	(0.00281)	(0.00277)	(0.00266)
N	33063	41730	33063	41623
adj. R^2	0.991	0.988	0.991	0.989

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: Model 1 and Model 2 include the control for the logarithm of income per capita in 2020; on the other hand, Model 3 and Model 4 implement controls for employment rate, the level of commuting (people commuting for work or study reasons every 100 inhabitants) and the percentage of individuals having a university degree or a Ph.D. in 2020. The dependent variable is the percentage of vaccination rates per week of the first dose of the Covid-19 vaccine.

Table A.8: OLS results, robustness checks using historical measures of the Mafia.

	Model 1 – Covid-19 first dose			Model 2 – Covid-19 first dose		
Week	Time Trend * Strength Mafia 1885 (=1)	Time Trend * Strength Mafia 1885 (=2)	Time Trend * Strength Mafia 1885 (=3)	Time Trend * Strength Mafia 1900 (=1)	Time Trend * Strength Mafia 1900 (=2)	Time Trend * Strength Mafia 1900 (=3)
2	-0.00000935	0.0000310	0.0000457**	0.0000358	0.0000332*	0.0000245*
	(0.0000136)	(0.0000233)	(0.0000220)	(0.0000231)	(0.0000193)	(0.0000141)
3	0.000209	0.00114*	0.0000950	-0.000189	0.0000958	0.00000564
	(0.000276)	(0.000654)	(0.000123)	(0.000196)	(0.000254)	(0.000193)
4	0.0000783	0.000491	-0.000715***	-0.00182***	-0.00167***	-0.00188***
	(0.000458)	(0.000773)	(0.000213)	(0.000412)	(0.000420)	(0.000380)
5	-0.00000437	0.000217	-0.00119***	-0.00260***	-0.00239***	-0.00278***
	(0.000518)	(0.000895)	(0.000248)	(0.000485)	(0.000517)	(0.000447)
6	-0.000136	0.0000993	-0.00136***	-0.00251***	-0.00254***	-0.00280***
	(0.000530)	(0.000922)	(0.000259)	(0.000517)	(0.000531)	(0.000471)
7	0.000143	0.00198*	-0.00104**	-0.00222***	-0.00189***	-0.00146***
	(0.000599)	(0.00114)	(0.000409)	(0.000534)	(0.000561)	(0.000553)
8	0.000451	0.00430*	-0.00197**	-0.00176**	-0.00224**	-0.00117
	(0.000801)	(0.00249)	(0.000972)	(0.000832)	(0.000923)	(0.00107)
9	0.000862	0.00393	-0.00248*	-0.00246**	-0.00286**	-0.00150
	(0.00124)	(0.00310)	(0.00141)	(0.00117)	(0.00120)	(0.00129)
10	0.000975	0.00518	-0.00398**	-0.000924	-0.00232	0.000387
	(0.00161)	(0.00383)	(0.00172)	(0.00163)	(0.00170)	(0.00182)
11	0.000450	0.00289	-0.00488**	-0.00228	-0.00449**	-0.000869
	(0.00216)	(0.00409)	(0.00204)	(0.00212)	(0.00214)	(0.00227)
12	-0.000401	0.000765	-0.00517*	-0.00104	-0.00460*	-0.000295
	(0.00256)	(0.00453)	(0.00264)	(0.00259)	(0.00259)	(0.00268)
13	-0.00120	0.00179	-0.00331	-0.00101	-0.00398	0.00255
	(0.00295)	(0.00515)	(0.00324)	(0.00321)	(0.00316)	(0.00318)
14	-0.00326	0.00781	-0.000831	-0.00107	-0.000639	0.00690*
	(0.00379)	(0.00615)	(0.00390)	(0.00398)	(0.00399)	(0.00384)
15	-0.00544	0.00906	-0.00122	0.0000914	0.00218	0.00984**
	(0.00439)	(0.00727)	(0.00451)	(0.00457)	(0.00475)	(0.00433)
16	-0.00907*	0.00735	-0.000429	0.00253	0.00479	0.0119***
	(0.00468)	(0.00811)	(0.00479)	(0.00484)	(0.00484)	(0.00449)
17	-0.0132**	0.00973	-0.00156	0.00492	0.00851	0.0167***
	(0.00535)	(0.0104)	(0.00551)	(0.00561)	(0.00557)	(0.00519)
18	-0.00986	0.0159	0.00329	0.00388	0.0110*	0.0240***
	(0.00621)	(0.0120)	(0.00656)	(0.00611)	(0.00626)	(0.00588)
19	-0.00881	0.0211	0.0118	0.00920	0.0207***	0.0320***
	(0.00742)	(0.0129)	(0.00775)	(0.00706)	(0.00704)	(0.00655)
20	-0.0109	0.0197	0.00989	0.0105	0.0227***	0.0363***
	(0.00838)	(0.0146)	(0.00828)	(0.00801)	(0.00776)	(0.00725)
21	-0.0180*	0.00982	0.0108	0.0123	0.0292***	0.0423***
	(0.00992)	(0.0166)	(0.0101)	(0.0102)	(0.0107)	(0.00906)
22	-0.0396***	-0.00353	0.00282	-0.000158	0.0127	0.0313**

	(0.0111)	(0.0148)	(0.0142)	(0.0126)	(0.0131)	(0.0128)
23	-0.0537***	-0.0141	0.00584	-0.00533	0.00792	0.0287**
	(0.0116)	(0.0137)	(0.0145)	(0.0138)	(0.0138)	(0.0134)
24	-0.0440***	-0.0254	0.00735	-0.00333	0.0108	0.0311**
	(0.0135)	(0.0157)	(0.0142)	(0.0135)	(0.0136)	(0.0130)
25	-0.0407***	-0.0131	0.0114	-0.000393	0.0208	0.0460***
	(0.0138)	(0.0162)	(0.0150)	(0.0126)	(0.0128)	(0.0127)
26	-0.0358**	-0.00577	0.0129	0.00967	0.0283**	0.0551***
	(0.0146)	(0.0149)	(0.0148)	(0.0119)	(0.0124)	(0.0124)
27	-0.0247	-0.000627	0.0180	0.0177	0.0362***	0.0678***
	(0.0152)	(0.0158)	(0.0149)	(0.0113)	(0.0121)	(0.0121)
28	-0.0225	0.0122	0.0230	0.0200*	0.0421***	0.0730***
	(0.0154)	(0.0170)	(0.0141)	(0.0113)	(0.0120)	(0.0117)
29	-0.0231	0.0114	0.0237*	0.0186	0.0439***	0.0738***
	(0.0156)	(0.0171)	(0.0141)	(0.0114)	(0.0120)	(0.0118)
30	-0.0227	0.0130	0.0273**	0.0208*	0.0506***	0.0763***
	(0.0160)	(0.0173)	(0.0138)	(0.0113)	(0.0120)	(0.0117)
constant		0.1362***			0.1423***	
		(0.0203)			(0.0210)	
N		38092			33063	
adj. R^2		0.990			0.992	

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: Model 1 includes as the main independent variable the information by Damiani (1885), and Model 2 includes as the main independent variable the information by Cutrera (1900). These two variables for the strength of the Mafia take values from 0 to 3 depending on the intensity of the Mafia per municipality. In addition, the two models also include the control for the share of the population over 60 years old.

Table A.9: OLS results, robustness checks using more recent measures of the Mafia.

Week	Model 1 Time trend * Dummy Mafia 1987	Model 2 Time trend * Dummy Mafia 1994	Model 3 Time trend * Dummy Dissolution Municipalities
2	0.0000113 (0.0000139)	0.00000771 (0.0000131)	0.000000744 (0.0000144)
3	-0.0000243 (0.000122)	0.000177 (0.000158)	0.000141 (0.000167)
4	-0.000792*** (0.000206)	-0.000415 (0.000265)	-0.000303 (0.000291)
5	-0.00122*** (0.000242)	-0.000765** (0.000310)	-0.000558 (0.000341)
6	-0.00137*** (0.000255)	-0.000858*** (0.000327)	-0.000654* (0.000360)
7	-0.000808** (0.000346)	-0.000161 (0.000378)	-0.000421 (0.000427)
8	-0.00146** (0.000634)	0.0000287 (0.000727)	-0.00118 (0.000730)
9	-0.00109 (0.000850)	0.000693 (0.000936)	-0.00143 (0.00104)
10	-0.00124 (0.00124)	0.00270** (0.00133)	-0.00214 (0.00143)
11	-0.00176 (0.00156)	0.00399** (0.00170)	-0.00284 (0.00189)
12	-0.00467** (0.00191)	0.00352* (0.00204)	-0.00443** (0.00214)
13	-0.00268 (0.00239)	0.00566** (0.00244)	-0.00560** (0.00240)
14	-0.000870 (0.00299)	0.00787** (0.00304)	-0.00469 (0.00298)
15	-0.000837 (0.00345)	0.00839** (0.00345)	-0.00520 (0.00342)
16	0.000674 (0.00359)	0.00817** (0.00360)	-0.00426 (0.00365)
17	0.00405 (0.00427)	0.0113*** (0.00407)	-0.00409 (0.00416)
18	0.00938* (0.00481)	0.0169*** (0.00448)	-0.00225 (0.00485)
19	0.0126** (0.00526)	0.0213*** (0.00494)	-0.000440 (0.00561)
20	0.00988 (0.00605)	0.0205*** (0.00582)	-0.00277 (0.00646)
21	0.00836 (0.00740)	0.0200*** (0.00725)	0.00104 (0.00773)
22	-0.00695 (0.00855)	0.00231 (0.00856)	-0.00267 (0.0101)

23	-0.00675	-0.00308	0.00269
	(0.00880)	(0.00881)	(0.0108)
24	0.00153	-0.00225	0.00977
	(0.00949)	(0.00874)	(0.0109)
25	0.0133	0.00505	0.0122
	(0.00985)	(0.00909)	(0.0107)
26	0.0171*	0.00929	0.0122
	(0.00964)	(0.00883)	(0.0102)
27	0.0253***	0.0189**	0.0122
	(0.00935)	(0.00877)	(0.00985)
28	0.0292***	0.0251***	0.0117
	(0.00920)	(0.00881)	(0.00972)
29	0.0315***	0.0265***	0.0117
	(0.00906)	(0.00876)	(0.00965)
30	0.0335***	0.0287***	0.0123
	(0.00896)	(0.00874)	(0.00965)
Constant			
N	39697	39697	41730
adj. R^2	0.990	0.990	0.989

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: Model 1 includes as the main independent variable the dummy of Mafia presence by CG Carabinieri (1987), Model 2 includes as the main independent variable the dummy of Mafia presence by CSDCM (1994), and Model 3 includes the dummy of Mafia presence referred to the dissolution of municipalities by Avviso Pubblico (2023). In addition, the three models also include the control for the share of the population over 60 years old.