The Economic Costs of Organized Crime: Evidence from Southern Italy*

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January 2014

Abstract

I examine the post-war economic development of two regions in southern Italy exposed to mafia activity after the 1970s and apply synthetic control methods to estimate their counterfactual economic performance in the absence of organized crime. The synthetic control is a weighted average of other regions less affected by mafia activity that mimics the economic structure and outcomes of the regions of interest several years before the advent of organized crime. The comparison of actual and counterfactual development shows that the presence of mafia lowers GDP per capita by 16%, at the same time as murders increase sharply relative to the synthetic control. Evidence from electricity consumption and growth accounting suggests that lower GDP reflects a net loss of economic activity, due to the substitution of private capital with less productive public investment, rather than a mere reallocation from the official to the unofficial sector.

Keywords: organized crime, economic development, synthetic control methods.
JEL codes: K42, R11, O17

1 Introduction

Organized crime is commonly perceived as the main obstacle to the economic development of several regions around the world, for instance Latin American countries such as Mexico and Colombia, or former communist republics such as Russia and Albania. Turning to high-income countries, the Italian case stands out in several respects. From an historical perspective, mafia-type organizations operating in some regions of southern Italy (the Mafia in Sicily, the Camorra in Campania, and the 'Ndrangheta in Calabria) were born with the Italian state itself, about 150 years ago, and survived

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different stages of economic and social development.[1] Indeed, during the post-war period they even expanded toward south-eastern regions (Apulia and Basilicata), acquired strong economic interests in the center-north, and maintained pervasive ramifications in countries such as the US and Germany.

In this paper I empirically estimate the economic costs of organized crime in southern Italy during the post-war period. Preliminary evidence in Figure 1 suggests that such costs are potentially very large: the five Italian regions with the highest presence of mafia-type organizations are also the poorest of the country.[2] However, this univariate relationship likely reflects causality going in both directions. In particular, the level of development could itself be an important factor behind the rise of criminal organizations.

For this reason, I focus on the peculiar experience of Apulia and Basilicata, which suffered a huge increase in the presence of organized crime during the last few decades. Until the beginning of the 1970s, these two regions were in fact characterized by levels of criminal activity and a social environment similar to the other areas of southern Italy not affected by mafia activity. During the following years, however, a series of events largely independent from the socio-economic environment of such regions – notably the conflict for the control of tobacco smuggling among the criminal organizations from other regions – resulted in a sudden increase of mafia activity also in Apulia and Basilicata.

To address the causal effect of organized crime on economic activity, I thus compare the economic development of Apulia and Basilicata, before and after the increase in crime, with a control group of regions not significantly exposed to the presence of criminal organizations. Following the approach originally devised by Abadie and Gardeazabal (2003) to estimate the economic costs of terrorism in the Basque country, I weight units in the control group to construct a *synthetic control* that mimics the initial conditions in Apulia and Basilicata several years before the advent of organized crime. As long as the weights reflect structural parameters that would not vary in the absence of organized crime (at least over the medium period), the synthetic control provides a counterfactual scenario for the evolution of the treated region in the absence of mafia activity.[3]

The comparison between the actual and counterfactual scenario shows that the advent of organized crime coincides with a sudden slowdown of economic development. Starting from the highest growth record across Italian regions until the early 1970s, in the course of just a few years Apulia and Basilicata move down to an inferior growth path, accumulating an increasing delay over the following decades. Over a thirty-year period, the two regions experience a 16% drop in GDP per capita relative to the synthetic control, at the same time as the difference in murder rates increases from 0 to 3 additional homicides per 100,000 inhabitants (twice as much the average murder rate in Italy during the post-war period). Based on the distribution of placebo estimates for all other regions not significantly affected by organized crime, such changes in GDP and murders turn out to be extremely unlikely under the null hypothesis of zero effect of organized crime.

In principle, the estimated economic loss may depend on a variety of channels through which organized crime affects economic activity. To distinguish among those, I first examine the dynamics of electricity consumption during the same period as an alternative outcome that depends on economic

[1] From now on, the term "Mafia" will denote the specific organization active in Sicily, while "mafia" will refer more generally to all organizations with a similar structure.

[2] The measures of organized crime and economic activity are described in great detail in the next sections.

[3] See Abadie et al. (2010) for a throughout presentation of synthetic control methods, and Acemoglu et al. (2010), Montalvo (2011), Hinrichs (2012) and Billmeier and Nannicini (2012) for recent applications. The surveys of Imbens and Wooldridge (2009) and Lechner (2010) discuss the merits of this approach, while Donald and Lang (2007) and Conley and Taber (2011) propose alternative methods for dealing with small numbers of treated and control units in difference-in-difference models.

activity both in the official and unofficial sector. The evidence in this respect points at an even larger drop relative to the synthetic control, thus excluding that divergence in GDP per capita after exposure to mafia activity is explained by a mere reallocation of resources from the official to the unofficial sector. Distinguishing between different components of GDP, sluggish economic performance seems triggered instead by a strong contraction of private investment in the wake of increasing violence in Apulia and Basilicata, accompanied by a gradual replacement of private with public capital. The gap accumulated relative to the synthetic control is then explained by the lower productivity of public investment, documented by several previous studies (see e.g. Bonaglia et al., 2000) and confirmed by production function estimates presented in this paper.

One tentative interpretation of these findings is that criminal organizations discourage productive investment by private entrepreneurs, while being able at the same time to secure profit opportunities in public procurement. Indeed, according to the Italian judge Giovanni Falcone, who leaded the "Maxi Trial" against the Sicilian mafia in 1987 and was later killed by the organization, "more than one fifth of Mafia profits come from public investment" (Falcone, 1991). My results speak also to recent work by Barone and Narciso (2011), who show that criminal organizations may distort the allocation of public investment subsides toward their areas of influence.

The present work adds to the literature on the economics of crime. Following early work by Becker (1968) and Ehrlich (1973), such literature has produced estimates of the cost of crime in several countries and through a variety of methods: monetary cost accounting, contingent valuation surveys and willingness-to-pay measures (Soares, 2009, provides a recent review). However, none of these studies has addressed explicitly the costs imposed by the presence of large criminal organizations. The present paper fills this gap employing a transparent data-driven methodology to estimate the costs of organized crime in a country most plagued by this phenomenon.

More in general, organized crime has been widely neglected by the empirical literature on crime (Fiorentini and Peltzman, 1997). Among the few exceptions, Bandiera (2003), Dimico et al. (2012) and Buonanno et al. (2012) investigate the historical origins of the Sicilian Mafia, focusing in particular on the racket of private protection at the end of the XIX century, while Frye and Zhuravskaya (2000) examine the case of modern Russia; Mastrobuoni (2013) studies the network structure of the Italian-American organization "Cosa Nostra"; Dell (2011) estimates the effects of law enforcement on drug-trade related violence and drug-trafficking routes; finally, Pinotti (2013) and Geys and Daniele (2013) examine the implications of mafia activity for the quality of the political class. I contribute to this strand of literature by investigating the economic consequences of organized crime for the level and composition of GDP per capita.

The paper is structured as follows. The next Section defines organized crime in the context of the Italian legislative framework, and introduces the data that will be used throughout the paper. Then, Section 3 describes in detail the rise of organized crime in Apulia and Basilicata, and Section 4 presents the identification strategy based on this historical episode. The main empirical results are reported in Section 5, while Section 6 addresses the potential channels through which organized crime impacts on the economy; additional descriptive statistics and robustness exercises are confined to the Web Appendix. Finally, Section 7 concludes.[4]

[4]The Web Appendix can be downloaded from http://mypage.unibocconi.eu/paolopinotti/.

2 Organized crime in Italy

2.1 Definitions and legal framework

Criminal organizations are usually involved in a wide range of illegal activities: they supply illicit goods and services to a variety of consumers; they practice extortion and other predatory activities against other individuals and firms operating in the economy; finally, they offer private protection in contexts where state enforcement is absent or limited. While there is little disagreement about these defining activities, their relative importance has been subject to considerable debate among scholars and policymakers.

Back in the 1960s, the US Commission on Organized Crime emphasized the role of mobs and gangsters in the provision of "gambling, loan-sharking, narcotics and other forms of vice to countless numbers of citizen customers". According to this view, which is reminiscent of the prohibitionist experience during the 1930s, "organized crime exists and thrives because it provides services the public demands (...) it depends not on victims, but on customers".

While the above definition points at important aspects of criminal organizations, it neglects on the other hand their core business, namely violence. Far from being a means of last resort, the extensive use of violence grants criminal organizations with a strong monopoly power in legal and illegal markets, which they use to extract rents from the other agents in the economy (Schelling, 1971).

Such power may grant criminal organizations with a governance role also outside the underworld. Indeed, Gambetta (1993) and Skaperdas (2001) argue that the rise of the Sicilian Mafia filled a vacuum in the protection of property rights in the aftermath of Italian unification (1861), and Bandiera (2003) finds empirical support for this hypothesis using historical data on land fragmentation and mafia activity in Sicily at the end of the XIX century.

Criminal organizations in Italy have been traditionally aggressive in exerting the monopoly of violence. The pervasive control over the territory allows mafia groups to engage in complex criminal activities (e.g. smuggling and drug-trafficking) as well as threatening local politicians and public officials to influence the allocation of public contracts. The basis of this enormous power rests among other things on the *omertá*, a code of behavior that prohibits the members of a criminal organization from even mentioning it. Historically, the code was deeply internalized by mafia members, thus effectively preventing whistle-blowing.[5]

It was only at the beginning of the 1980s that these distinctive features were recognized by the Italian judicial system. Until then, Article 416 of the Penal Code ("*associazione a delinquere*") punished in the same way all groups of three or more people involved in some type of criminal activity. Such a generic norm failed thus to distinguish between, say, small groups of bank-robbers and wide criminal networks exerting a ramified control over the territory. This changed in 1982 with Law 646/82, which introduced Article 416-bis ("*associazione a delinquere di stampo mafioso*") aimed explicitly at mafia organizations, defined as those groups that "exploit the power of intimidation granted by the membership in the organization, and the condition of subjugation and omertá that descends from it, to commit crimes and acquire the control of economic activities, concessions, authorizations, and public contracts". Article 416-bis effectively captures the adherence of Italian mafias to the theoretical

[5] William P. Jennings (1984) includes the enforcement of omertá among the defining activities of criminal organizations. In Italy, one must wait until 1984 (more than a century after the rise of mafia in Sicily) to have the first important *pentito*, Tommaso Buscetta, who described the leadership of the Sicilian Mafia to judge Giovanni Falcone. Acconcia et al. (2009) investigate empirically the effectiveness of leniency programs in Italy, while Spagnolo (2004) and Buccirossi and Spagnolo (2006) provide a more general theoretical analysis of this kind of programs.

framework of Schelling (1971), as well as their interests and infiltrations in the official economy. I next examine the distribution of this type of offense across Italian regions.

2.2 Measurement

The yearbook of criminal statistics published by the Italian Statistical Institute (ISTAT) reports the number of cases ex Art. 416-bis every 100,000 inhabitants at the regional level since year 1983 (right after the article was introduced in the Penal Code). Figure 2 shows that the presence of mafia organizations is concentrated into five southern regions: Calabria, Sicily, Campania and, to a lesser extent, Apulia and Basilicata.[6]

In principle, all judicial-based measures of crime are subject to some degree of under-reporting (MacDonald, 2002). This problem may be particularly severe for mafia-related crimes, as omertá and intimidations would prevent judicial investigations exactly where criminal organizations are more powerful. On the other hand, under-reporting is negligible for homicides (Fajnzylber et al., 2002), which constitute the main instrument through which such organizations exert the monopoly of violence. In fact, while most regions in Italy are characterized by an extremely low number of homicides (even in the international comparison), the murder rate is exceptionally high in Calabria (6 murders every 100,000 inhabitants over the 1983-2007 period), Sicily and Campania (about 4 murders), with Apulia and Basilicata lying somewhere in between (2 and 1.3 murders, respectively).[7] Figure 3 shows that, indeed, there is an almost perfect linear relationship between the presence of organized crime and the average murder rate over the period 1983-2007 (the only outlier being the island of Sardinia, which displays more murders than Apulia and Basilicata even in the absence of a well-structured criminal organization). Therefore, one can use the murder rate as an alternative indicator for the presence of criminal organizations. Importantly, such measure is also available for the period before 1983, when Article 416-bis had not been introduced yet.

Figure 4 compares the homicide rate in Apulia and Basilicata with that in the other regions, distinguishing between three areas: the historical settlements of mafia organizations (Sicily, Campania and Calabria), the other southern regions (Abruzzo, Molise and Sardinia), and the Centre-North. The series exhibit significant co-movements, which are driven to a large extent by important episodes in the recent history of Italian mafias. The first spike, between the 1970s and 1980s, coincides with the so-called "second mafia war", originating in Sicily but rapidly propagating into other regions. Indeed, it was during this period that elements of the Mafia and Camorra "emigrated" into Apulia and Basilicata, either to escape assassination or to establish a beach-head toward other (illicit) markets.

As a consequence, Apulia and Basilicata also experienced a sharp increase in homicides. Figure 4 shows that until the mid-1970s the murder rate in these two regions was in fact very similar to that in the other regions of Southern Italy without a significant presence of mafia organizations (if anything, it was *lower*). In 1975 it climbs instead to a much higher level, and it remains there during the following years. Such an increase coincides with a growing presence of criminal organizations, as discussed in the next section.[8]

[6] Italian regions correspond to level 2 in the Eurostat Nomenclature of Territorial Units for Statistics (NUTS) classification. In year 2010, the average and median population across regions were about 3 and 1.85 million, respectively. The complete list is reported in Table A1 of the Web Appendix.

[7] According to the UN International Homicide Statistics database, the average murder rates since 1995 (the first year for which the harmonized homicide data are available) in European Union countries and in OECD member countries were 1.6 and 3.7, respectively. Former socialist countries ranged between 1.8 murders in Slovenia and 5.6 in Poland, while one has to go to developing countries in Africa and Latin America to find murder rates greater than 6.

[8] The other spike in homicides, around the turn of the 1990s, corresponds instead to the violent backlash of the

3 Historical background

As discussed in the previous section, the origin of the Mafia in Sicily dates back to the XIX century, and the same is true for the Camorra in Campania and the 'Ndrangheta in Calabria. Since the history of these three regions is so inextricably connected with the presence of criminal organizations, it might be difficult to identify the effect of the latter separately from other factors affecting economic growth.

This is not the case for Apulia and Basilicata, which experienced such presence only one century later, as a consequence of events that were largely independent of their economic and social conditions. Such events constitute a watershed between the periods "before" and "after" organized crime. This is indeed what makes the case of these two regions particularly useful for the present analysis, relative to other regions that have also been witnessing an increasing activity of groups linked with mafia organizations during the very last decades. Indeed, the experience of Apulia and Basilicata is just part of a longer-term expansion of mafia organizations outside their historical settlements in Sicily and Campania.

3.1 Economic growth and crime in Southern Italy

During the first decades of the post-war period, the economic performance of Apulia and Basilicata represented a success story among Italian regions. Figure 5 compares the growth rate of such regions with that of the other areas already considered in Figure 4. The data come from the research institute CRENOS, which maintains time series of real GDP, population, and labor force participation in Italian regions for the period 1951-2007; value added by sector – agriculture, industry, market and non-market services – schooling, and investment are also available since 1960. The disaggregation between private and public investment, as well as the corresponding capital stocks (reconstructed through the perpetual inventory method) are provided on a consistent basis for the years 1970-1994.[9]

While the 1960s where characterized by a general convergence between northern and southern regions, Apulia and Basilicata retained the highest growth rates until the early 1970s, when the process of convergence was over for most other regions (see Paci and Pigliaru, 1997; Terrasi, 1999; Maffezzoli, 2006). This scenario changed dramatically over the following decade. Over the course of just a few years, between the end of the 1970s and the beginning of the 1980s, the growth rate of the two regions dropped from being the highest to become the lowest of the country. Historical and judicial evidence suggests that this period coincides with the outbreak of organized crime in Apulia and Basilicata, leading to the formation of the so-called "fourth and "fifth mafia", respectively.

Sicilian Mafia against the state, which culminated with the killings of the anti-mafia judges Giovanni Falcone and Paolo Borsellino in 1992, and the terrorist attacks in Rome, Milan, and Florence during the following year. Besides homicides, the presence of criminal organizations is strongly correlated with other types of crime, particularly extortions and kidnappings. Unfortunately, official statistics on most offenses other than murders are available at the regional level on a consistent basis only since 1975 (extortions, kidnappings, non-mafia organizations, drug-trafficking, arsons, robberies) or 1983 (smuggling); as such, they are not useful as indicators of (changes in) criminal activity in Apulia and Basilicata before and after exposure to mafia activity. The only exception are data on thefts, which are available since 1956. However, petty crimes such as car thefts and shoplifting, which account for the bulk of this category, bear little or no relationship with the presence of criminal organizations; moreover, their measurement is subject to severe under-reporting. The correlation between mafia activity and different types of crime over the period 1983-2007 is discussed in the Web Appendix.

[9]Non-market services are mainly those provided by the public sector. The data set and all related information are publicly available through the website www.crenos.it. They have been previously used, among others, by Ichino and Maggi (2000) and Tabellini (2010).

3.2 The rise of organized crime in Apulia and Basilicata

The main source of information on organized crime in Italy are the official reports of the Parliamentary Antimafia Commission (PAC), established in 1962. The reports most concerned with organized crime in Apulia and Basilicata are those issued between the X and XII legislature of the Italian Parliament (1987-1996).[10] Secondary sources relying mostly on the PAC reports and other official documents include Ruotolo (1994), Sciarrone (1998), Masciandaro et al. (1999) and Sergi (2003). In general, both primary and secondary sources conclude that the expansion of mafia organizations toward the South-East was primarily due to the unfortunate combination of geographic proximity with the historical settlements of organized crime (Sicily, Campania and Calabria) and a series of events largely independent from the socio-economic context of the two regions.

The single most important factor for the expansion of organized crime toward the south-east was the growing importance of tobacco smuggling during the 1970s (Sciarrone, 1998; PAC, 1993c, p. 11). After the closure of the free port of Tangier in 1960 and the subsequent transfer of tobacco companies' depots into Eastern European countries, the Italian crime syndicates most involved in smuggling abandoned the "Tyrrhenian route" (from Morocco to Marseilles, through Sicily and Naples) in favor of the "Adriatic route" (from Albania and Yugoslavia toward Turkey and Cyprus, PAC, 2001, p. 10). However, it was only one decade later that mafia organizations expanded beyond the reach of their traditional areas of influence in Sicily, Campania, and Calabria. During the 1970s, in fact, smuggling became the most profitable criminal business in Italy, overtaking other illegal activities (such as gambling, loan-sharking and kidnappings) and anticipating the large-scale trafficking of narcotics, which also followed the same routes. In the words of the former mafia boss Antonino Calderone, "cigarette smuggling was the biggest thing back in the 1970s. It started in the early 1970s and it increased a lot in 1974-75" (Sciarrone, 1998).

As a consequence, Mafia, Camorra and 'Ndrangheta moved to search for new bases in Apulia, often using Basilicata as a corridor between the Tyrrhenian and Adriatic coasts. Such traffics received an impulse after the collapse of the Eastern bloc, with the increasing openness to international illegal markets by former communist countries on the other side of the Adriatic (PAC, 2001, pp. 46-59).

The second important event leading to an increasing presence of organized crime in Basilicata was the major earthquake that hit the region on November 1980, striking an area of 10,000 square miles at the border with Campania and Apulia (Sergi, 2003). In the wake of the disaster, the massive amounts of relief money and public investments attracted the interest of criminal organizations. In particular, the absence of a sound legislative and administrative framework for crisis management left local public administrations with a great deal of discretion, which in many cases favored widespread mafia infiltrations in procurement contracts (PAC, 1993a). Several judicial investigations and a parliamentary commission uncovered the embezzlement of a big chunk of the 25 billions of euros allocated for the reconstruction, by intimidating or corrupting local politicians and public administrators.[11] Eventually, the main consequence of the flood of public funds was to increase the influence of mafia organizations in the regions struck by the earthquake, especially in Basilicata where organized crime had been almost absent until then (PAC, 1993a).

Finally, another event that contributed to the rooting of organized crime in Apulia and Basilicata

[10] Scanned copies of all reports mentioned in the paper (in Italian) can be downloaded from http://dl.dropbox.com/u/7380649/PACreports.zip.

[11] Less than a month after the disaster, the mayor of a town in Campania was killed for refusing to award the contract for clearing the detritus to a company connected with the Camorra. Similar episodes recurred frequently over the following years.

was the presence of several criminals from other regions sent there in *confino*, a measure often imposed on individuals that had been either convicted or were strongly suspected of belonging to the mafia. Although aimed at breaking the linkages between the members of the organization, the main consequence of such policy was to favor the transplantation of mafia into other regions, as recognized in several occasions by the Antimafia Commission (e.g. PAC, 1994). It turns out that, between 1961 and 1972 (official records for subsequent years have been destroyed), Apulia was the southern region hosting the greatest number of criminals in confino, while in Basilicata their number was particularly high relative to the initial population (Tranfaglia, 2008). Also, during the 1970s the two regions received several prison inmates transferred from Campania, in order to avoid fights in jail between opposing factions of the Camorra. Subsequent judiciary investigations proved that these individuals constituted an important link with the criminal organizations of other regions (PAC, 1991, pp. 52-53).

All these factors contributed to the outbreak of organized crime in Apulia and Basilicata at the end of the 1970s. Illegal businesses were first conducted directly by Mafia, Camorra and 'Ndrangheta, however such arrangement proved unstable, as very soon local groups acquired independence by organizing themselves into autonomous crime syndicates, the most important of which were the Sacra Corona Unita in Apulia and the Basilischi in Basilicata.[12]

4 Empirical methodology

The previous section described how the rise and expansion of organized crime in Apulia and Basilicata, between the end of the 1970s and the beginning of the 1980s, was largely driven by factors independent from the economic and social context of these two regions, namely the switch of smugglers toward eastern routes, the political turmoil in eastern European countries, and the earthquake of 1980. The empirical strategy adopted in this paper exploits this historical change to estimate the effect of organized crime by comparing Apulia and Basilicata with a control group of regions not (or less) affected by organized crime. To reduce the scope for omitted variable bias, I follow the approach of Abadie and Gardeazabal (2003) and Abadie et al. (2010), weighting units in the control group to construct a synthetic counterfactual that replicates the initial conditions and the growth potential of the regions of interest before exposure to mafia activity.

4.1 The synthetic control method

Framing the problem in the context of Rubin's (1974) potential outcome model, let Y be an outcome of interest whose realization depends on the presence of organized crime. In particular, the realization in a given region during year t is equal to Y_t^1 if the region is exposed to organized crime and Y_t^0 otherwise,

$$Y_t = C_t Y_t^1 + (1 - C_t)\, Y_t^0, \tag{1}$$

[12] At first sight it may seem puzzling that mafia-type organizations are bound by regional (administrative) borders. However, such borders were inherited from the kingdoms and states in which Italy has been divided for centuries: the Kingdoms of Naples and Sicily in the South, the Church State in the Centre, the Granducato of Tuscany, the different city-states in the North, etc. These past institutional divides shaped profoundly the cultural heritage of different regions, which in turn affected the functioning of post-Unitarian institutions (Putnam et al., 1994). In light of these differences, it is not totally unexpected that complex social phenomena, such as organized crime, may take root just on one side of a regional border.

where C_t is an indicator for the presence of organized crime in such region, i.e. $C_t = 1$ ($C_t = 0$) if there is (not) mafia activity. The identification problem is that the *treatment effect* of organized crime,

$$\beta_t = Y_t^1 - Y_t^0, \tag{2}$$

depends on the potential outcome in both states ($C_t = 0$ and $C_t = 1$), while only one state is observed in any given year.

Synthetic control methods exploit variation over time in the outcomes of regions that are either exposed to treatment only after some period $t = T$ or that are never exposed. The estimator compares the actual outcome in the treated region with a weighted average of all units in the control group,

$$\hat{\beta}_t = Y_t - \sum_{i \in I} w_i Y_{it}, \tag{3}$$

where w_i is the weight attached to each i-th region in the control group I. Since treated and control regions are observed in different states after T (with and without organized crime, respectively), the expression in (3) becomes

$$\hat{\beta}_t = Y_t^1 - \sum_{i \in I} w_i Y_{it}^0 = \beta_t + \left(Y_t^0 - \sum_{i \in I} w_i Y_{it}^0 \right), \quad \forall t > T. \tag{4}$$

The precision of $\hat{\beta}_t$ as an estimate of β_t depends thus on the difference between Y_t^0 and $\sum_i w_i Y_{it}^0$. Intuitively, over (under) estimating the growth potential of the treated region, Y_t^0, leads a downward (upward) biased estimate of the treatment effect, $\hat{\beta}_t$.

Therefore, the estimation problem amounts to choosing the vector of weights that minimizes the last difference on the right-hand side of equation (4). A natural choice consists in minimizing the difference between treated and control regions over the period in which none of them had been exposed to the treatment, i.e. before T. As long as the weights reflect structural parameters that would not vary in the absence of organized crime (at least over the medium period), the synthetic control approximates the (unobserved) counterfactual evolution of the potential outcome Y_t^0 after T. Notice that an analogous identifying assumption, namely that unobserved differences between treated and non-treated units are time-invariant, is routinely imposed on difference-in-differences models.[13]

Turning to the choice of the minimand, Abadie and Gardeazabal (2003) adopt a two-step procedure that minimizes the distance between the treated and control regions in terms of pre-treatment outcomes and predictors for post-treatment outcomes. Specifically, let X and X_i^0 be the $(K \times 1)$ vectors of predictors for the treated region and for each i-th region in the control group, respectively; also, let V be a $(K \times K)$ diagonal matrix with non-negative entries measuring the relative importance of each predictor. Conditional on V, the optimal vector of weights, $W^*(V)$, must minimize the squared

[13] Abadie et al. (2010) show that synthetic control methods generalize difference-in-difference models by allowing the effect of unobserved confounders to vary over time according to a flexible factor representation of the potential outcomes of the i-th region.

$$Y_{it}^1 - \beta_t = Y_{it}^0 = \delta_t + \theta_t X_i + \lambda_t \mu_i + \epsilon_{it},$$

where where δ_t is an unknown common factor with constant factor loadings across units, X_i is a $(r \times 1)$ vector of observed covariates (not affected by the intervention), θ_t is a $(1 \times r)$ vector of unknown parameters, λ_t is a $(1 \times F)$ vector of unobserved common factors, μ_i is an $(F \times 1)$ vector of unknown factor loadings, and the error terms ϵ_{it} are unobserved transitory shocks. The traditional difference-in-difference imposes that λ_t is constant for all t's.

distance

$$\left(X - \sum_{i \in I} w_i X_i^0\right)' V \left(X - \sum_{i \in I} w_i X_i^0\right) \tag{5}$$

subject to $w_i \geq 0$, $\forall i$ and $\sum_i w_i = 1$; then, the optimal V^* is chosen to minimize the mean squared error of outcomes over some period before the treatment,

$$\frac{1}{T^0} \sum_{t \leq T^0} \left(Y_t - \sum_{i \in I} w_i^* Y_{it}\right)^2, \tag{6}$$

for $T^0 \leq T$.

4.2 Implementation

The Italian case lends itself naturally to estimate the effect of organized crime adopting a synthetic control approach, for two main reasons discussed at length in the previous section. First, the presence of criminal organizations is concentrated in a few regions. Second, within this restricted group, Apulia and Basilicata experienced such presence only during the last decades. I will thus compare such regions to all other Italian regions with the exception of Sicily, Campania and Calabria. The latter are dropped from the sample because they neither provide an adequate control group (due to the pervasive presence of criminal organizations in such regions), nor they can be used as additional treated units (because mafia activity dates back to the creation of the Italian state, so pre-treatment outcomes can not be observed).[14]

As to the choice of the variables of interest, and the time window over which to minimize (5) and (6), I follow strictly Abadie and Gardeazabal (2003). In particular, the outcome of interest will be real GDP per capita (at constant 1990 euro-equivalent prices) and the vector X will include the main predictors of economic growth identified by the economics literature, namely the initial level of GDP per capita, investment rate, human capital, population density, and sectoral shares of value added (Barro and Sala-i-Martin, 2004). Yearly data on GDP and population are available since 1951, while the time series for the other variables start in 1960. To compute the weights in (5), I thus include in the vector X the average GDP per capita and population density over the period 1951-1960, together with the initial values of human capital, investment rate and sectoral shares of value added; the mean squared error in (6) is also minimized over the period 1951-1960. This choice provides a reasonably long validation period over which to evaluate the ability of the synthetic control to mimic the treated region before the advent of organized crime in the mid-1970s.

The next section presents the results obtained using the synthetic control method just described.

5 Results

5.1 Matching and validation

The minimization of (5)-(6) delivers positive weights for Abruzzo (0.624) and Molise (0.376). Interestingly, even though no geographical variable is explicitly included in X, the data-driven procedure assigns all the weight to the two southern regions in the control group that are closest to Apulia and Basilicata. Given the stark territorial divides that characterize economic development in Italy, the

[14] Abadie et al. (2010) discuss the criteria for excluding potential control units from the donor pool.

fact that the algorithm picks regions that are geographically very close adds to the credibility of the synthetic control as a predictor for the (ex-ante) growth opportunities of the treated region.[15]

Table 1 confirms that the synthetic control matches well the treated regions in terms of initial GDP per capita, human capital, and sectoral shares. On the other hand, investment is much higher in Apulia and Basilicata, which would suggest a greater growth potential for the treated region over the following years; population density is also higher. In the end, however, the credibility of the synthetic control approach hinges crucially on its ability to match the outcome of interest, namely GDP per capita, between the matching period (in which the distance between the two series is minimized by construction) and the treatment period. This is exactly the case here, as shown in Figure 6. The graph compares the evolution of GDP per capita in the treated regions and in the synthetic control over the years 1951-2007. The two series are indeed identical until the early 1970s, well beyond the end of the matching period (1951-60). Yet, the situation changes dramatically during the following years.

5.2 Baseline results

Figure 6 shows that, starting with the second half of the 1970s, the treated regions move down to an inferior growth path and accumulate an increasing delay relative to the synthetic control. The evolution of the estimated gap is reported in Figure 7, along with the difference in homicide rates. The gap between the actual and counterfactual GDP per capita changes from around zero, over the 1950s and 1960s, to 16% during the last years of the sample period.

Table 2 shows how the difference evolves over subsequent periods. The mid-1970s are a clear turning point, as the gap in GDP per capita changes from about 0 to 7% between the first and the second half of the decade. It then increases further to 15% during the 1980s, and remains constant thereafter. The last rows of the table also show the differential in some years of interest, namely the last year before the outbreak of mafia activity in the two regions (1974), the last year of the sample period (2007), the year before the earthquake in Basilicata (1979), and the year before the collapse of the Eastern bloc (1989). The results for these last two years exclude that the economic slowdown reflects either the direct effect of the earthquake (in this respect, see also the separate results for Apulia and Basilicata in Figure 8 and Table 3 below) or major economic events at the international level.

The relative drop in GDP per capita coincides with a sharp increase in the number of homicides relative to the synthetic control. The difference in the murder rate goes from 0 to 3 additional homicides every 100,000 inhabitants in 1975, remaining extremely high until 1982. According to the judicial and historical evidence discussed in Section 3, this is the period in which criminal organizations from other regions broke into Apulia and Basilicata. Then, for the rest of the sample period, the treated region exhibits sudden swings from a murder rate in line with that of the control regions to much higher levels, up to 4 additional homicides per 100,000 inhabitants in 1991, following a dynamic of "booms and busts" that is typical of mafia-ridden regions.

5.3 Robustness

In Figure 8 I examine the sensitivity of these baseline estimates to alternative implementations of the synthetic control method; the detailed results are reported in Table 3. In the first two graphs I estimate

[15] In Section 5.3 I examine the sensitivity of the results to different vectors of weights.

the effect of organized crime separately for Apulia and Basilicata, obtaining very similar results. This suggests that the drop in GDP per capita is likely driven by factors in common between the two regions, among which the advent of organized crime, as opposed to the direct effect of idiosyncratic shocks such as the earthquake of 1980 (which affected Basilicata but not Apulia).

The following graphs explore the robustness of the main findings to alternative definitions of the control group. Since the synthetic control method usually delivers positive weights for just a few units of the control group (see Abdadie and Gardeazabal, 2003, Abadie et al., 2010), one concern is that the estimates are sensitive to the particular performance of a small number of regions. In particular, in the present application, Abruzzo and Molise attract 2/3 and 1/3 of the weight, respectively. Yet, Figure 8.c and 8.d show that the qualitative results are robust to excluding each of these regions in turn. More in general, the vector of weights varies across all scenarios in Figure 8 (see Table A2 in the Web Appendix) without affecting much the results. Finally, in Figure 8.e the crime rates over the initial period, 1951-1960, are included among the initial conditions, while in Figure 8.f the distance between the treated region and the synthetic control is minimized over a different time window. However, these changes too have little or no impact on the results. The estimated effect remains in most cases around 16%, increasing to 20% after excluding Molise from the control group and to 24% when matching on a longer time span (Table 3).

One issue is the extent to which such changes can be interpreted as the causal effect of organized crime on GDP per capita. Like any other matching estimator, synthetic control methods rest ultimately on the assumption that reducing the heterogeneity in observable characteristics limits the scope for variation in omitted factors. As long as the synthetic control provides an accurate counterfactual for the treated region, any subsequent change to the determinants of GDP per capita in each region (including exposure to mafia activity) should be interpreted as a random shock rather than an endogenous outcome. In this specific case, however, the dynamics of changes in GDP per capita and murders does not help addressing the direction of causality, as the two series change at sudden (in opposite directions) more or less at the same time. In principle, it is then possible that a negative economic shock caused a (persistent) increase in mafia activity.

To rule out this alternative explanation, Figure 9 moves to private investment as an alternative, forward-looking indicator of the relative growth opportunities in treated and control regions. It turns out that investment in Apulia and Basilicata remained sustained until the outbreak of violence, declining only a couple of years later. Therefore, there is no indication that the two regions were experiencing a change in the economic outlook before (or at the same time of) the advent of organized crime.

5.4 Inference

Overall, the evidence in Figures 6-9 and Tables 2-3 suggests that the GDP per capita of the treated region declines by as much as 16%, at the same time as homicides increase sharply relative to a counterfactual scenario without organized crime. One question is whether the estimated effects are also significant in a statistical sense.

Abadie et al. (2010) notice that large sample inferential techniques are not appropriate for comparative case studies with a small number of treated and control units. For this reason, they propose an alternative falsification test based on the distribution of the (placebo) effects estimated for all units in the control group. The null hypothesis that the effect of organized crime is equal to zero can be rejected if the effect estimated for the ("true") treated unit is abnormal relative to the distribution of placebo estimates.

I construct an analogous test by replicating the synthetic control estimate for all possible pairs of adjacent regions in the control group (23 pairs in total), pretending that each placebo pair experienced the treatment in year 1975. Focusing on pairs of adjacent regions makes the placebo units fully comparable to the treated unit, which is also a composite of two regions (Apulia and Basilicata).

The left graph in Figure 10 shows the distribution of estimates for the placebo and treated units. During the 1970s, the difference in GDP per capita between the treated regions and the synthetic control falls from the middle to the bottom end of the distribution. Actually, no other placebo unit experiences a similar change (in absolute value), thus the p-value of rejecting the null hypothesis of no treatment effect would be zero (Abadie et al., 2010). Analogously, the increase in homicides observed in the treated regions during the same period is abnormal relative to the whole distribution, see the right graph in Figure 10.

Overall, the changes in criminal and economic outcomes observed in the treated regions after exposure to mafia activity seem extremely unlikely (based on the distribution of placebo estimates) under the null hypothesis of no effect of organized crime.

6 Channels

The results presented so far suggest that organized crime has a strong, negative effect on economic growth and development, yet they are silent about the mechanisms behind such effect. In this section I provide additional empirical evidence that helps distinguishing between a few alternative explanations.

6.1 Official and unofficial economy

One possible interpretation of the divergence between the treated regions and the synthetic control is that the presence of criminal organizations changes the relative importance of the official sector, as measured by GDP per capita, vis-a-vis the shadow economy. Additional employment opportunities in the unofficial sector could lead in fact to a reallocation of workers and resources outside the scope of official statistics. If this were the case, the differential in official GDP per capita would over-estimate the change in welfare after exposure to mafia activity, as lower GDP per capita would just reflect a different composition (but not a different level) of economic activity.

To address these issues, I move to electricity consumption as an alternative measure of aggregate economic activity. Differently from GDP and other official statistics, energy consumption depends in fact on the level of activity both in the official and unofficial sector. For this reason, it is often used to estimate the size of the shadow economy, see for instance Johnson et al. (1997).[16]

The left graph in Figure 11 shows the time series of yearly kilowatt-hour per capita in treated and control regions. Starting with the first half of the 1960s, energy consumption grows considerably faster in the treated region relative to the synthetic control, slowing down at sudden about one decade later. The right graph shows that the difference between the two series peaks in 1974 and starts falling thereafter, in coincidence with the increase in homicides, eventually becoming negative during the last two decades of the sample period. Indeed, the relative drop is greater, in percentage terms, than the one observed for GDP per capita (about three times as much).

[16] Schneider and Enste (2000) discuss the relative merits of this and other techniques for estimating the size of the unofficial sector. One drawback of using electricity consumption is that different climatic and technological conditions prevent comparability across countries and over time. However, these issues are not a concern when comparing a few neighboring regions over time. Del Boca and Forte (1982) provide an early application of this method to Italy.

One explanation for this finding is that organized crime affects disproportionately sectors that use energy more intensively, like manufacturing. The evidence in Figure 12 provides suggestive evidence in this respect by comparing the shares of value added in agriculture, industry, market and non-market services. The advent of criminal organizations coincides indeed with a decline of the industrial sector, which is arguably more intensive in electricity, and a rise of non-market services, mostly provided by the public sector.

In the remaining part of this section I investigate more thoroughly the reallocation of economic activity from the private to the public sector. In any case there is no evidence that the slowdown in the official sector was compensated for by an expansion of the shadow economy. Therefore, the 16% reduction in GDP per capita corresponds to an analogous (or even greater) economic loss in the treated region.

6.2 Growth accounting

In order to better understand the channels through which organized crime impacts on GDP per capita, I perform a simple growth accounting exercise, decomposing the gap between treated and control regions into differences in factor accumulation and productivity. I stick to the workhorse model adopted in the growth accounting literature, namely the Cobb-Douglas production function with constant returns to scale in capital and labor (see e.g. Barro, 1999),

$$\ln Y_t = \ln A_t + \alpha_L \ln L_t + (1 - \alpha_L) \ln K_t, \tag{7}$$

where α_L is the labor share, L and K are labor and capital inputs, respectively, and A is total factor productivity. The growth differential between treated and control regions is given by the weighted sum of the growth differential for these three components,

$$\Delta(\ln Y_t - \ln Y_{t-1}) = \Delta(\ln A_t - \ln A_{t-1}) + \alpha_L \Delta(\ln L_t - \ln L_{t-1}) + (1 - \alpha_L)\Delta(\ln K_t - \ln K_{t-1}),$$

where Δ denotes differentials between the treated region and the synthetic control.

For the period 1970-1994 the dataset CRENOS reports consistent time series of regional labor workforce and capital stock, reconstructed through the perpetual inventory method. Fixing the labor share, one can back up total factor productivity as a residual. Extensive evidence from national accounts points at labor shares comprised between 2/3 and 3/4 for most countries (see e.g. Gollin, 2002). The OLS regressions in Table 4 suggest that the lower bound of such interval provides a very good approximation for Italian regions, regardless of whether one adopts a GDP or value added specification for the production function. Also, the assumption of constant returns to scale is not rejected by the data. The series in CRENOS also allow to distinguish between private and public capital (Paci and Pusceddu, 2000). When doing so (columns 2 and 4), only private capital enters as a productive input, while the coefficient of public capital is not significantly different from zero. This is consistent with previous empirical evidence on the low productivity of public investment in Italy, see e.g. Bonaglia et al. (2000).

Overall, the estimates in Table 4 can not reject the hypothesis that the labor and private capital shares in (7) are equal to 2/3 and 1/3, respectively, while the contribution of public capital is not significantly different from zero. Based on such estimates, Figure 13 plots the growth of total factor productivity and factor inputs for the treated and control regions over the period 1970-1994. While the dynamics of productivity and labor remains extremely similar over the whole period, the advent

of organized crime in the treated region coincides with a progressive substitution of private for public investment. On a purely accounting basis, the drop in GDP per capita could then reflect the lower productivity of the latter relative to the former source of capital.

6.3 Discussion of the results

The growth accounting exercise depicts a private capital flight from Apulia and Basilicata after the advent of organized crime, followed by an increasing role for public investment. One explanation for this pattern could be that the central government and local public administrations use employment in the public sector to cushion the drop in labor market opportunities after the withdrawal of private investors. However, the last two graphs in Figure 13 show that the replacement of private with public capital is not accompanied by an analogous reallocation of employment, which should be the primary objective of such a policy.

A less benevolent explanation is that public money represents a profit opportunity for criminal organizations. For instance, mafia rackets often force firms to purchase over-priced inputs or hire individuals that are close to the organization. Such practices increase production costs and are therefore easier to impose on firms that may offload such costs or are somehow shielded from market competition (Schelling, 1971); contractors for public works fit perfectly into these categories. Also, firms connected with the mafia may adjudicate directly public contracts (Reuter, 1987; Caneppele et al., 2009), or influence somehow the allocation of public investment subsides (Barone and Narciso, 2011).

For all these reasons, criminal organizations in Italy may want to attract public investment toward their areas of influence. To this purpose, they do not hesitate to corrupt and/or threaten politicians and public officials (PAC, 1993b,a), with adverse effects on the selection of the ruling class. Dal Bó et al. (2006) argue in fact that the personal risks to which public officials are exposed in the areas most pervaded by criminal organizations may discourage individuals with better outside opportunities from entering a political career. While a throughout analysis of the influence of organized crime on the political sphere goes beyond the scope of the present work, in a companion paper I document indeed a strong deterioration in the outside labor market opportunities of the politicians appointed in Apulia and Basilicata (relative to the synthetic control) after the advent of organized crime (Pinotti, 2013).

Therefore, a tentative interpretation for the increase in public expenditure is that, amidst greater violence and worse economic prospects, local politicians were "captured" by criminal organizations. This interpretation would be consistent with recent work by Geys and Daniele (2013) on the selection of Italin local politicians in mafia-ridden municipalities.

7 Conclusion

The present study provides the first available evidence on the economic costs of organized crime. The empirical exercise applies a transparent and intuitive policy evaluation method, originally devised by Abadie and Gardeazabal (2003) and Abadie et al. (2010), to study the economic effects of organized crime in two Italian regions recently exposed to this phenomenon. The results suggest that the aggregate loss implied by the presence of organized crime amounts to 16% of GDP per capita and goes mainly through a reallocation from private economic activity to (less productive) public investment.

One limitation of the macroeconomic approach adopted here is that it does not lend itself easily to explore these mechanisms in greater detail. Another limit concerns the external validity of the

estimates, which is constrained by the specificities of a complex phenomenon such as organized crime in different countries and periods. Finally, the outcomes examined here (primarily GDP per capita and its components) capture only some of the effects of organized crime on social welfare. Utility losses along many other dimensions (human, psychological and social) have no direct counterpart into observable quantities, even though indicators such as life expectancy and housing prices may go a long way in this direction (see, respectively, Thaler, 1978; Soares, 2006).

For all these reasons, the present study should be seen as a first step toward a better understanding of the economic effects of organized crime, as well as an indication that such effects might be large enough to deserve further attention in the future.

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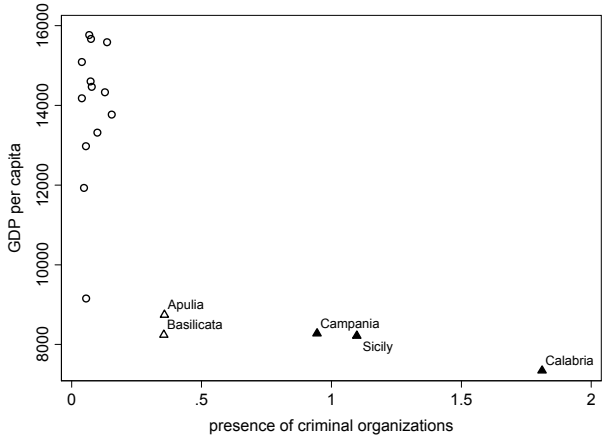
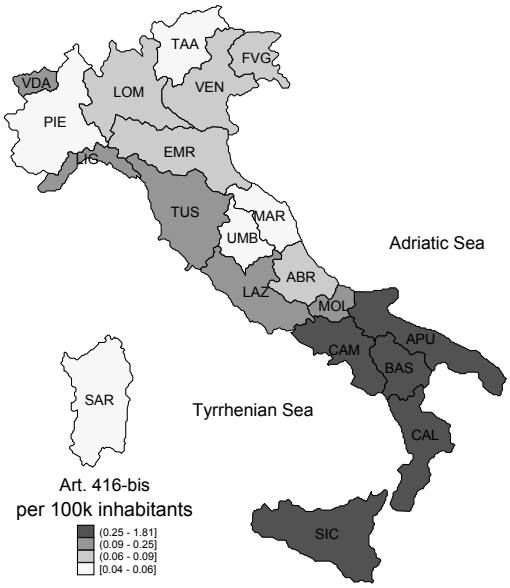
Figures and Tables

Figure 1: mafia-type criminal organizations and GDP per capita across Italian regions, average over the period 1983-2007



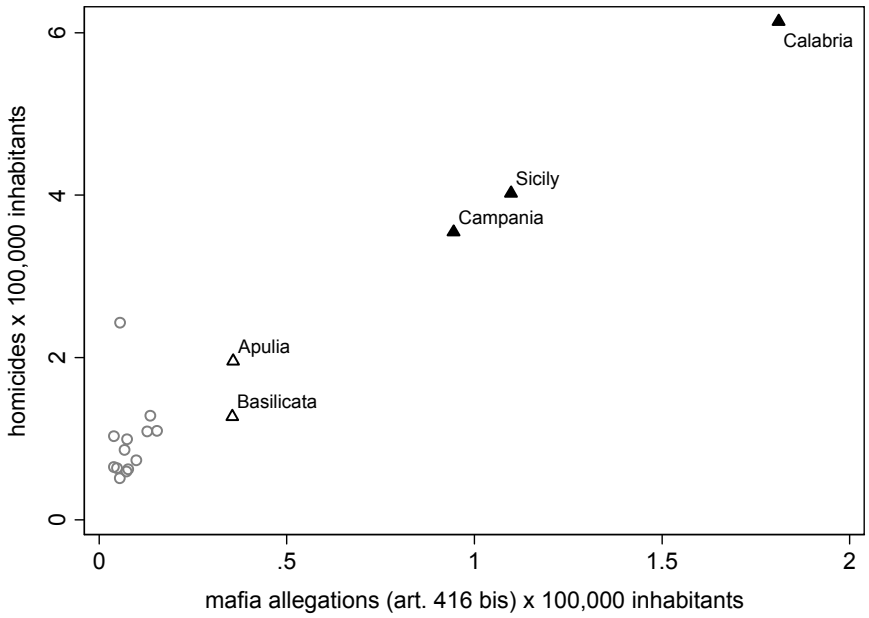
Note: This graph shows the relationship between organized crime and GDP per capita across Italian regions. Bold triangles denote regions with a historical presence of mafia organizations, hollow triangles denote regions with a more recent presence while circles denote all other regions. Organized crime is measured by the number of cases ex Article 416-bis of the Penal Code (mafia-type criminal organization) reported by the police to the judiciary authority, every 100,000 inhabitants. The GDP per capita is measured in constant 1990 Euros. Both variables are averaged over the period 1983-2007.

Figure 2: presence of mafia-type criminal organizations across Italian regions, average over the period 1983-2007



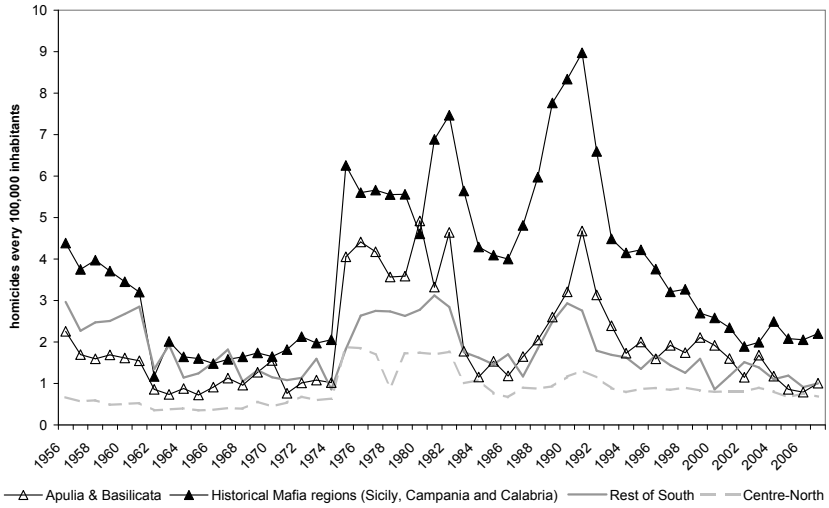
Note: The map shows the presence of organized crime across Italian regions, as measured by the number of cases ex Article 416-bis of the Penal Code (mafia-type criminal organization) reported by the police to the judiciary authority, every 100,000 inhabitants. The variable is averaged over the period 1983-2007.

Figure 3: mafia-type criminal organizations and murders across Italian regions, average over the period 1983-2007



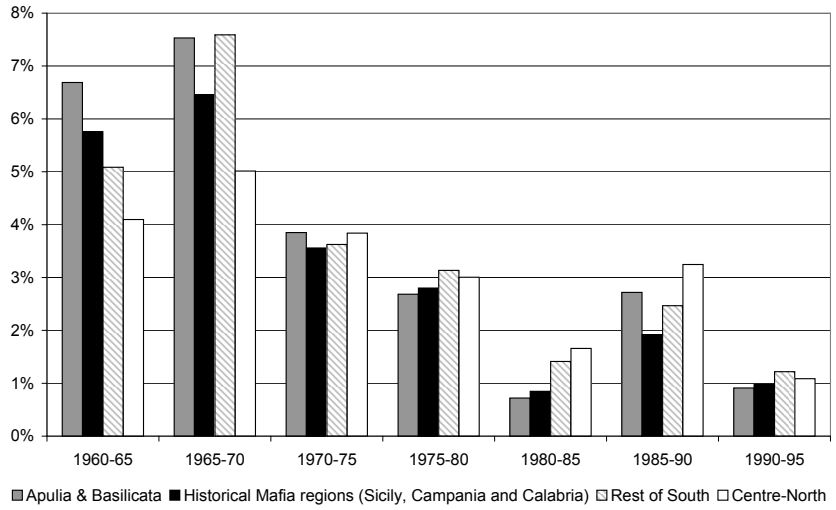
Note: This graph shows the relationship between organized crime and murders across Italian regions. Bold triangles denote regions with a historical presence of mafia organizations, hollow triangles denote regions with a more recent presence while circles denote all other regions. The presence of criminal organizations is measured by the number of cases ex Article 416-bis of the Penal Code (mafia-type criminal organization) reported by the police to the judiciary authority. Both variables are expressed as ratios over 100,000 inhabitants and averaged over the period 1983-2007.

Figure 4: murder rate over time across different areas in Italy, years 1955-2007



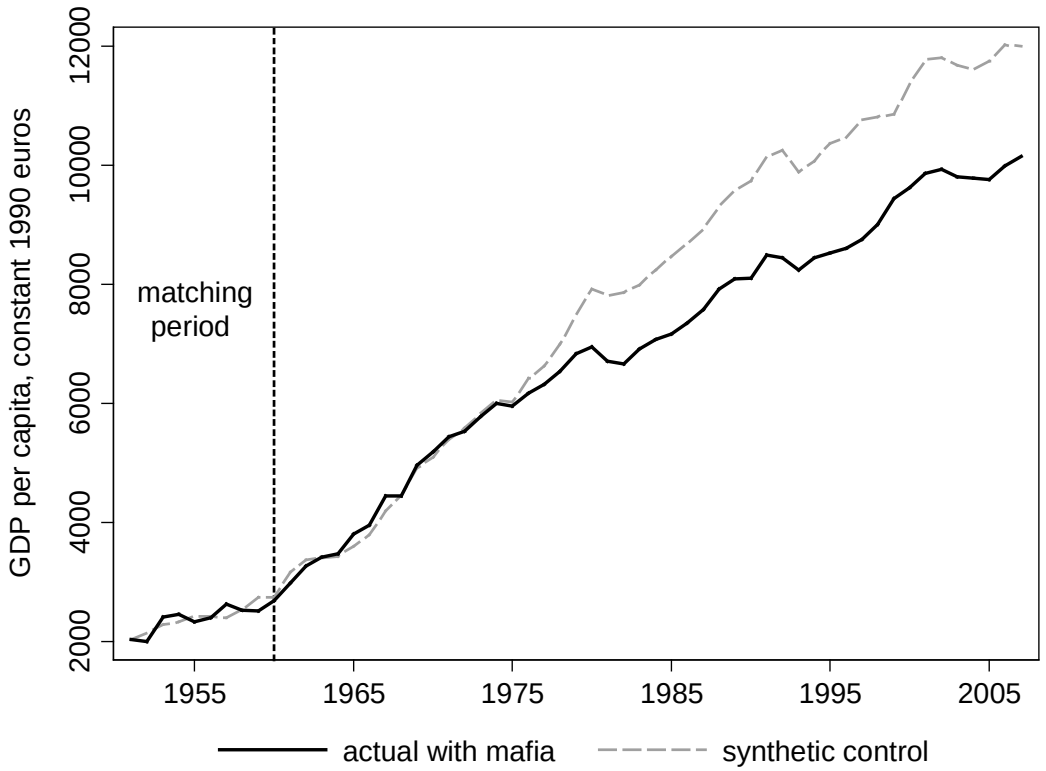
Note: The graph shows the homicide rate every 100,000 inhabitants across different areas of Italy: regions with a historical presence of mafia-type organizations (Sicily, Campania, and Calabria), regions with a more recent presence of such organizations (Apulia and Basilicata), other Southern regions (Abruzzo, Molise, and Sardinia) and regions in the Centre-North.

Figure 5: growth rate of GDP per capita across different areas in Italy, different sub-periods during the post-war years



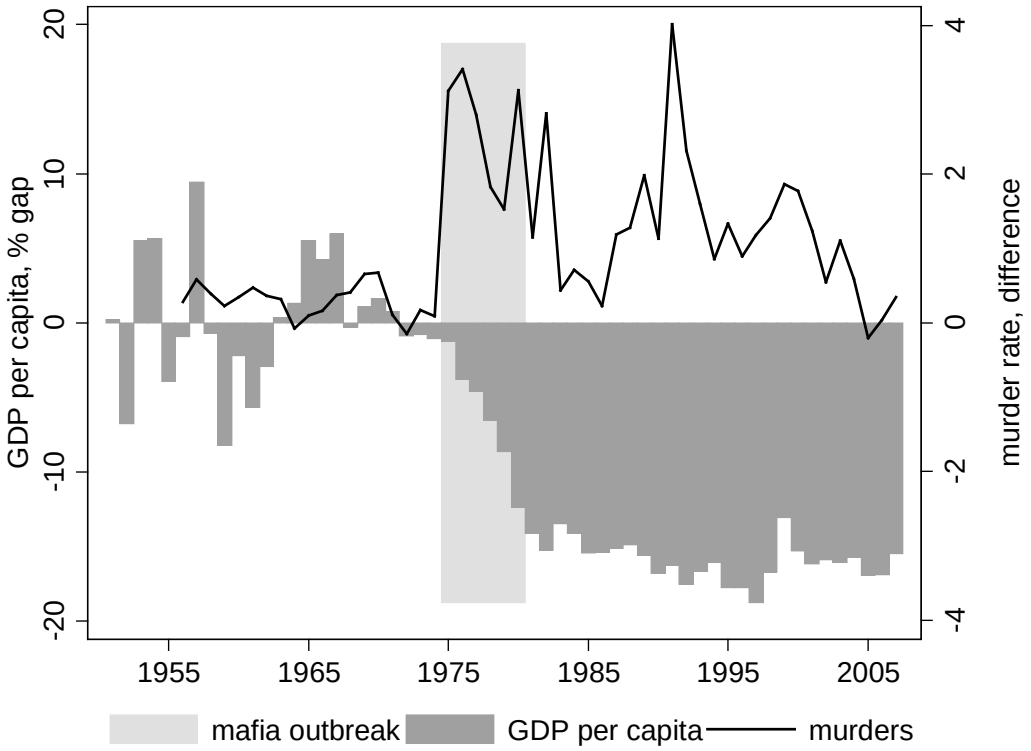
Note: The graph compares the growth rate of GDP per capita over the post-war period across different areas of Italy: regions with a historical presence of mafia-type organizations (Sicily, Campania and Calabria), regions with a more recent presence of such organizations (Apulia and Basilicata), other Southern regions (Abruzzo, Molise, and Sardinia) and regions in the Centre-North. The GDP per capita is measured in constant 1990 Euros.

Figure 6: GDP per capita in the treated region and in the synthetic control, years 1951-2007



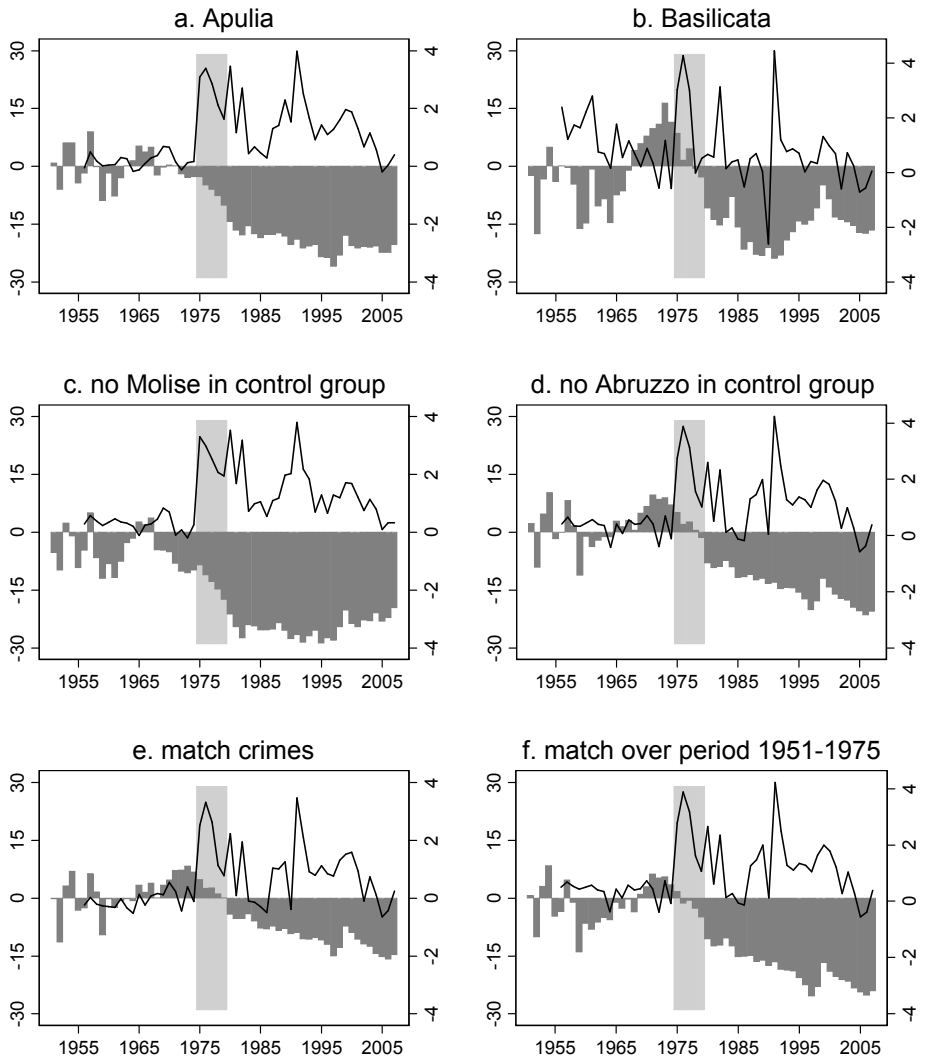
Note: The graph compares the time series of GDP per capita in Apulia and Basilicata ("actual with mafia") and in a synthetic control that is a weighted average of the other Italian regions excluding those with a historical presence of mafia-type organizations (Sicily, Campania and Calabria); the bottom table reports the evolution of the gap between the two series. The weights used to construct the synthetic control are chosen to minimize the distance with Apulia and Basilicata in terms of average GDP per capita and other predictors of subsequent growth (investment rate, sectoral shares of value added, human capital and population density) during the period 1951-1960; see Section 4 for the details.

Figure 7: GDP per capita and murder rate in the treated region and in the synthetic control, estimated gap, years 1951-2007



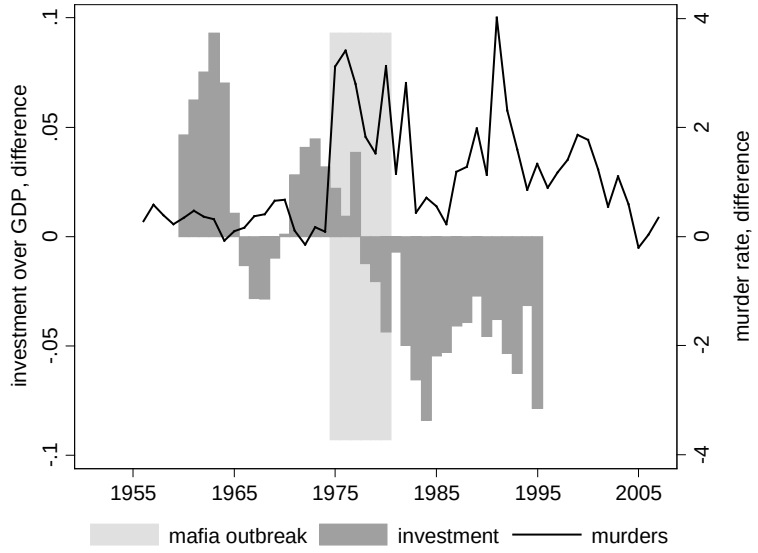
Note: The graphs show the difference between Apulia and Basilicata ("actual with mafia") and the synthetic control in terms of GDP per capita and murder rate. The synthetic control is a weighted average of the other Italian regions excluding those with a historical presence of mafia-type organizations (Sicily, Campania and Calabria). The weights used to construct the synthetic control are chosen to minimize the distance with Apulia and Basilicata in terms of average GDP per capita and other predictors of subsequent growth (investment rate, sectoral shares of value added, human capital and population density) during the period 1951-1960; see Section 4 for the details.

Figure 8: GDP per capita in the treated region and in the synthetic control, estimated gap, years 1951-2007 (robustness)



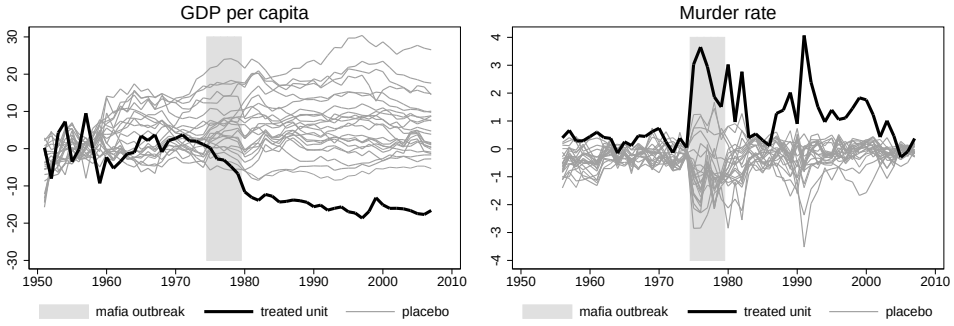
Note: The graphs show the difference between the GDP per capita of Apulia and Basilicata ("actual with mafia") and a synthetic control, in terms of GDP per capita and murder rate, under different implementations of the synthetic control method. The synthetic control is a weighted average of the other Italian regions excluding those with an historical presence of mafia-type organizations (Sicily, Campania and Calabria). The weights used to construct the synthetic control are chosen to minimize the distance with Apulia and Basilicata in terms of average GDP per capita and other predictors of subsequent growth (investment rate, sectoral shares of value added, human capital and population density) during the period 1951-1960; see Section 4 in the paper for the details.

Figure 9: private investment and murder rate in the treated region and in the synthetic control, estimated gap, years 1956-2007



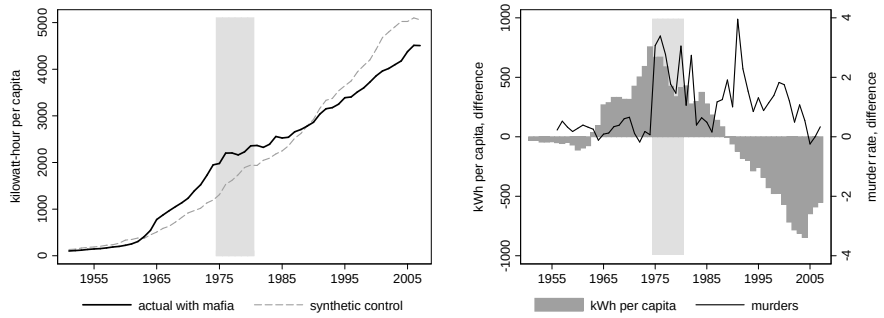
Note: The graphs show the difference between Apulia and Basilicata ("actual with mafia") and the synthetic control in terms of (private) investment over GDP per capita and murder rate, which is available from the data set CRENOS on a consistent basis over the period 1970-1994. The synthetic control is a weighted average of the other Italian regions excluding those with a historical presence of mafia-type organizations (Sicily, Campania and Calabria). The weights used to construct the synthetic control are chosen to minimize the distance with Apulia and Basilicata in terms of average GDP per capita and other predictors of subsequent growth (investment rate, sectoral shares of value added, human capital and population density) during the period 1951-1960; see Section 4 for the details.

Figure 10: distribution of synthetic control estimates for each pair of adjacent regions, years 1951-2007 (placebo test)



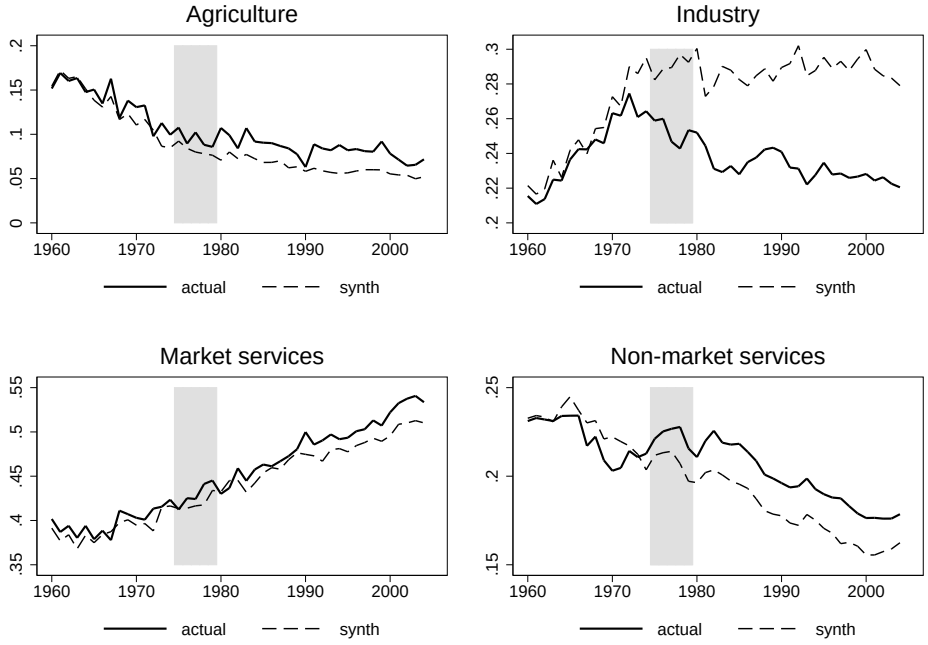
Note: The left and right graphs show the difference between Apulia and Basilicata ("treated unit") and its synthetic control in terms of GDP per capita and murder rate, respectively, as well as the same difference for all other pairs of adjacent regions in the control group ("placebo"). The synthetic control for each region is a weighted average of all other regions excluding those with a historical presence of mafia-type organizations (Sicily, Campania and Calabria). The weights used to construct each synthetic control are chosen to minimize the distance with the regions of interest in terms of average GDP per capita and other predictors of subsequent growth (investment rate, sectoral shares of value added, human capital and population density) during the period 1951-1960; see Section 4 for the details.

Figure 11: electricity consumption in the treated region and in the synthetic control, years 1951-2007



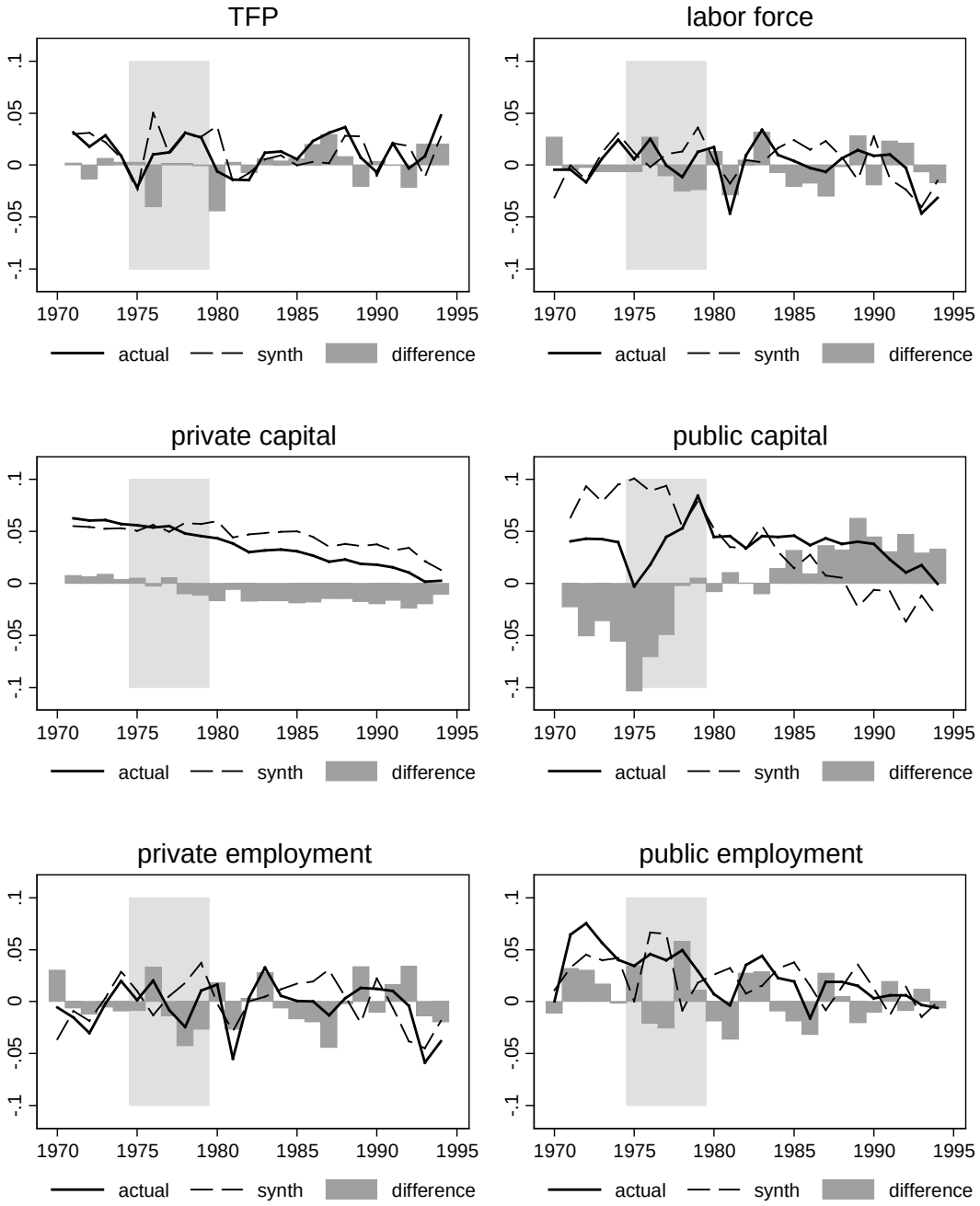
Note: The left graph plots the time series of electricity consumption, as measured by kilowatt-hour per capita, in Apulia and Basilicata ("actual with mafia") and in the synthetic control, while the right graph shows the difference between the two both in terms of electricity consumption and murders. The synthetic control is a weighted average of the other Italian regions excluding those with a historical presence of mafia-type organizations (Sicily, Campania and Calabria). The weights used to construct the synthetic control are chosen to minimize the distance with Apulia and Basilicata in terms of average GDP per capita and other predictors of subsequent growth (investment rate, sectoral shares of value added, human capital and population density) during the period 1951-1960; see Section 4 for the details.

Figure 12: sectoral shares of value added, years 1960-2004



Note: The graphs show the sectoral shares of total value added in agriculture, industry, market and non-market services in Apulia and Basilicata (solid line) and in the synthetic control (dashed line). The weights used to construct the synthetic control are chosen to minimize the distance with Apulia and Basilicata in terms of average GDP per capita and other predictors of subsequent growth (investment rate, sectoral shares of value added, human capital and population density) during the period 1951-1960; see Section 4 for the details.

Figure 13: growth of GDP components in the treated region and in the synthetic control, years 1970-1994



Note: The first four graphs in this figure decompose GDP growth in terms of growth of total factor productivity, labor force, private and public capital; the last two graphs describe the growth of private and public employment during the same periods. All graphs present the values for Apulia and Basilicata (solid line) and the synthetic control (dashed line), as well as the difference between the two series (grey bars). Total factor productivity is backed up as a residual assuming that the factor shares for labor, private and public capital are equal to 2/3, 1/3 and 0, respectively. The synthetic control is a weighted average of the other Italian regions excluding those with a historical presence of mafia-type organizations (Sicily, Campania and Calabria). The weights used to construct the synthetic control are chosen to minimize the distance with Apulia and Basilicata in terms of average GDP per capita and other predictors of subsequent growth (investment rate, sectoral shares of value added, human capital and population density) during the period 1951-1960; see Section 4 for the details.

Table 1: pre-treatment characteristics in Apulia and Basilicata and in the synthetic control, average over the period 1951-1960

	Apulia and Basilicata	**synthetic control**	**all control regions**			
			avg.	*variance*	*min*	*max*
GDP per capita	2395	2402	3974	1370	2223	7784
investment/GDP	0.32	0.23	0.27	0.05	0.21	0.38
VA industry	0.22	0.22	0.32	0.10	0.20	0.56
VA agriculture	0.15	0.15	0.10	0.04	0.03	0.20
VA market services	0.40	0.39	0.41	0.06	0.26	0.51
VA non-market services	0.23	0.23	0.17	0.06	0.10	0.28
human capital	0.17	0.18	0.18	0.04	0.10	0.26
pop. density (p/kmq)	135	106	146	79	30	298

Note: The table shows the characteristics of Apulia and Basilicata, the synthetic control and all regions in the control group during the period 1951-1960. The synthetic control is a weighted average of the other Italian regions excluding those with a historical presence of mafia-type organizations (Sicily, Campania and Calabria). The weights used to construct the synthetic control are chosen to minimize the distance with Apulia and Basilicata in terms of average GDP per capita and other predictors of subsequent growth (investment rate, sectoral shares of value added, human capital and population density) during the period 1951-1960; see Section 4 for the details.

Table 2: difference in GDP per capita and homicides between the treated unit and the synthetic control, average over different time periods

	GDP per capita level			**homicides X 100,000 inhab.**		
YEARS	TREATED	SYNTH.	DIFF.	TREATED	SYNTH.	DIFF.
1951-1960	2395	2403	-0.2%	1.8	1.4	0.4
1961-1970	3989	3938	1.1%	1.1	0.7	0.3
1971-1975	5737	5776	-0.6%	1.6	0.9	0.7
1976-1980	6559	7084	-7.2%	4.1	1.6	2.5
1981-1990	7353	8656	-15.0%	2.3	1.2	1.1
1991-2000	8754	10493	-16.6%	2.3	0.6	1.7
2001-2007	9895	11802	-16.2%	1.2	0.7	0.5
1974	5990	6054	-1.1%	1.0	0.9	0.1
1979	6833	7478	-8.6%	3.6	2.1	1.5
1989	8084	9573	-15.6%	2.6	0.6	2.0
2007	10141	11998	-15.5%	1.0	0.7	0.3

Note: The table compares Apulia and Basilicata (*treated*) to their synthetic control (*synth*) in terms of GDP per capita and homicide rates. The synthetic control is a weighted average of the other Italian regions excluding those with an historical presence of mafia-type organizations (Sicily, Campania and Calabria). The weights used to construct the synthetic control are chosen to minimize the distance with Apulia and Basilicata in terms of average GDP per capita and other predictors of subsequent growth (investment rate, sectoral shares of value added, human capital and population density) during the period 1951-1960; see Section 4 in the paper for the details.

Table 3: alternative implementations of the synthetic control method

	a. Apulia			b. Basilicata			c. no Molise		
	TREATED	SYNTH	GAP	TREATED	SYNTH	GAP	TREATED	SYNTH	GAP
GDP per capita, 2007	10147	11797	-16.30%	10096	11772	-16.60%	10141	12135	-19.70%
GDP per capita, avg. 1961-71	4189	4133	1.30%	3738	3751	-0.40%	4120	4262	-3.40%
initial conditions, 1951-1960:									
GDP per capita	2451	2460	-0.40%	2104	2223	-5.70%	2395	2511	-4.90%
investment/GDP	0.26	0.24	0.02	0.67	0.21	0.47	0.32	0.25	0.07
VA industry	0.21	0.23	-0.02	0.25	0.22	0.03	0.22	0.22	-0.01
VA agriculture	0.15	0.15	0.00	0.15	0.18	-0.03	0.15	0.14	0.01
VA services	0.40	0.38	0.02	0.39	0.37	0.02	0.40	0.40	0.00
VA public	0.23	0.23	0.00	0.21	0.23	-0.02	0.23	0.23	0.00
human capital	0.17	0.18	0.00	0.12	0.16	-0.05	0.17	0.19	-0.02
pop. density (p/kmq)	171.3	99.1	72.3	63.9	87.3	-23.4	134.8	116.7	18.1

	d. no Abruzzo			e. match crimes			f. match 1951-1975		
	TREATED	SYNTH	GAP	TREATED	SYNTH	GAP	TREATED	SYNTH	GAP
GDP per capita, 2007	10141	11729	-15.70%	10141	11821	-16.60%	10141	12587	-24.10%
GDP per capita, avg. 1961-71	4120	4012	2.60%	4120	4052	1.60%	4120	4176	-1.30%
initial conditions, 1951-1960:									
GDP per capita	2395	2396	0.00%	2395	2408	-0.60%	3701	3710	-0.20%
investment/GDP	0.32	0.24	0.08	0.32	0.24	0.08	0.29	0.27	0.02
VA industry	0.22	0.24	-0.02	0.22	0.23	-0.01	0.24	0.26	-0.01
VA agriculture	0.15	0.16	-0.01	0.15	0.16	-0.01	0.14	0.13	0.01
VA services	0.40	0.37	0.04	0.40	0.38	0.02	0.40	0.39	0.01
VA public	0.23	0.23	0.00	0.23	0.23	0.00	0.22	0.22	0.00
human capital	0.17	0.17	0.00	0.17	0.18	-0.01	0.30	0.34	-0.03
pop. density (p/kmq)	134.8	84.1	50.7	134.8	97.4	37.3	139.3	106.1	33.1

Note: The table compares Apulia and Basilicata (*treated*) to their synthetic control (*synth*) under different implementations of the synthetic control method. The synthetic control is a weighted average of the other Italian regions excluding those with an historical presence of mafia-type organizations (Sicily, Campania and Calabria). The weights used to construct the synthetic control are chosen to minimize the distance with Apulia and Basilicata in terms of average GDP per capita and other predictors of subsequent growth (investment rate, sectoral shares of value added, human capital and population density) during the period 1951-1960; see Section 4 in the paper for the details.

Table 4: estimated factor shares in the production function of Italian regions, years 1970-1994

DEPENDENT VARIABLE:	$\ln GDP_t - \ln GDP_{t-1}$		$\ln VA_t - \ln VA_{t-1}$	
$\ln L_t - \ln L_{t-1}$	0.671^{***}	0.668^{***}	0.673^{***}	0.670^{***}
		(0.055)		(0.057)
$\ln K_t - \ln K_{t-1}$	0.249^{***}		0.210^{***}	
	(0.070)		(0.072)	
private capital		0.233^{***}		0.198^{***}
		(0.069)		(0.068)
public capital		0.015		0.010
		(0.036)		(0.036)
constant	0.013^{***}	0.013^{***}	0.015^{***}	0.015^{***}
	(0.002)	(0.002)	(0.002)	(0.002)
Obs.	480	480	480	480
R^2	0.306	0.307	0.297	0.298
Adj. R^2	0.303	0.303	0.294	0.293
test $\alpha_L = 2/3$	0.01	0.00	0.01	0.01
p-value	0.94	0.98	0.91	0.95
test $\sum_j \alpha_j = 1$	1.22	1.35	2.39	2.57
p-value	0.27	0.25	0.12	0.11

Note: The table reports the results of production function estimates across Italian regions during the period 1970-1994. The dependent variables, indicated on top of each column, are the log of GDP and Value Added in each year, the explanatory variables are the log of labor and capital stock, possibly distinguishing between private and public capital. The regression is estimated by OLS on first differences within each region. The bottom part of the table reports the Wald tests for the coefficients of labor being equal to 2/3 and for all factor shares to sum up to unity, respectively. Robust standard errors are in parenthesis; *, ** and *** denote coefficients significantly different from zero at the 90%, 95% and 99% confidence level, respectively.