

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

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Abstract

I examine the post-war economic growth 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. Historical series of electricity consumption suggest that lower GDP reflects a net loss of economic activity, rather than a mere reallocation from the official to the unofficial sector. Growth accounting attributes the slowdown to the substitution of private capital with less productive public investment after the advent of organized crime.

Keywords: organized crime, economic growth, synthetic control methods

JEL codes: K4, R11, O17

1 Introduction

Starting with [Becker \(1968\)](#), the analysis of crime has grown to become an important research agenda in economics. However, most of this work has been concerned with individual offenders while organized crime has been largely neglected, especially from an empirical point of view; indeed, criminal organizations are not even mentioned in the surveys of [Freeman \(1999\)](#), [Dills et al. \(2008\)](#) and [Ehrlich \(2010\)](#).

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Yet, organized crime has profound economic consequences, in addition to obvious social and psychological costs. Over the short period, violence and predatory activities destroy part of the physical and human capital stock, whose allocation may be further distorted by the infiltration of criminal organizations into the official economy and the political sphere. In a dynamic perspective, these phenomena increase the riskiness and uncertainty of the business environment, which in turn may hinder the accumulation process and lower the long-run growth rate of the economy.

As a matter of fact, organized crime is commonly perceived as the main obstacle to the economic development of several regions around the world; examples include 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 different stages of economic and social development. 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. Also, Italian mafias constitute the prototype for criminal organizations active in other countries, like the Yakuza in Japan.¹

In this paper I empirically investigate the economic consequences of organized crime in Italy during the post-war period. Preliminary evidence in Figure 1 suggests that such effects are potentially very large; indeed, the five Italian regions where the presence of criminal organizations is more widespread are also the poorest of the country.² However, the 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 historical 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 context of such regions, combined with the expansion of historical mafia organizations beyond their traditional settlements in Sicily, Campania and Calabria, 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 some structural parameters that do not vary too much 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

¹The term “mafia”, originally denoting the specific organization active in Sicily, has been later used to refer to criminal organizations in general, both inside and outside Italy (see e.g. [Gayraud, 2005](#)).

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

³See [Abadie et al. \(2010\)](#) for a throughout presentation of synthetic control methods and [Mosser \(2005\)](#), [Billmeier and](#)

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 a growth record in line with the other southern regions not significantly exposed to mafia activity, in the course of just a few years around the mid-1970s 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 a distribution of placebo estimates for all other Italian 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 years as an alternative outcome that depends on economic activity both in the official and unofficial sector. The evidence in this respect points at an even larger drop relative to the synthetic counterfactual, 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 counterfactual is then explained by the lower productivity of the latter, documented by several previous studies 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 led the “Maxi Trial” against the Sicilian mafia in 1987 and was killed by the organization a few years later, “more than one fifth of Mafia profits come from public investment” (Falcone, 1991).⁴

This work adds to the literature on the economics of crime. 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 focused explicitly on the costs imposed by the presence of large criminal organizations. More in general, organized crime has been widely neglected by the empirical literature on crime (Fiorentini and Peltzman, 1997).⁵ The present paper fills this gap employing a transparent data-driven methodology to estimate the economic costs of organized crime in a country most plagued by this phenomenon. In this respect, my work is complementary to Acemoglu et al.

Nannicini (2009), Hinrichs (2011) and Montalvo (2011) 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.

⁴According to an extensive anecdotal and judicial evidence, infiltrations in public procurement occur through the intimidation of politicians and public officials. In a companion paper (Pinotti, 2011) I provide additional evidence on this channel.

⁵Among the few exceptions, Frye and Zhuravskaya (2000) and Bandiera (2003) estimate the determinants of demand for private protection in different contexts (Sicily in the XIX century and today’s Russia, respectively), while Mastrobuoni and Patacchini (2010) study the network structure of crime syndicates.

(2009), who focus instead on the political consequences of another organization exerting a strong monopoly of violence outside the control of the state, namely the paramilitaries in Colombia.

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 6 concludes.⁶

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).

Competition over the monopoly of violence 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 at the dawn of the Italian state. 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*, which for a long time effectively prevented whistle-blowing by the members of the organization.⁷

⁶The Web Appendix can be downloaded from <https://sites.google.com/site/paolopinotti/orgcrime-supplmaterials>.

⁷William 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 Buccrossi

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 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). Figures 2 and 3 show that the presence of mafia organizations is concentrated into five southern regions: Calabria, Sicily, Campania and, to a lesser extent, Apulia and Basilicata.⁸

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 in the middle (2 and 1.3 murders, respectively).⁹ Figure 4 shows that, indeed, there is an almost perfect linear relationship between the presence of organized crime and the average murder rate over the period 1983-2007.¹⁰

Therefore, I will use the murder rate as an alternative indicator for the presence of criminal organizations. Importantly, this also provides a measure of the evolution of organized crime across regions for the period before 1983, when Article 416-bis had not been introduced yet.

Figure 5 highlights some interesting facts about the dynamics of homicides across different areas in Italy. First, 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

and Spagnolo (2006) provide a more general theoretical analysis of this kind of programs.

⁸Italian 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 A of the Web Appendix.

⁹For comparison, in year 2000 Western European countries such as Germany and the United Kingdom exhibited about 1-1.5 murders per 100,000 inhabitants, while former communist countries ranged between 1.8 murders in Slovenia and 5.6 in Polonia. Murder rates of 6 or more are instead typical of developing regions in Africa and Latin America.

¹⁰The only outlier in this respect is Sardinia, which displays more murders than Apulia and Basilicata even in the absence of a strong criminal organization.

with the so-called “second mafia war”, originated 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 experienced as well a sharp increase in homicides. Figure 5 shows that until the mid-1970s the murder rate in these two regions was in fact *lower* than in the other regions of Southern Italy without a significant presence of mafia organizations (namely Abruzzo, Molise and Sardinia). In 1975 it climbs instead to a much higher level and remains on average higher for the rest of the period. Such an increase coincides with a growing presence of criminal organizations, as discussed in the next section.

The other spike in homicides, around the turn of the 1990s, corresponds instead to the violent backlash of the 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 one year later.¹¹

3 Historical background

The origin of the most powerful criminal organizations in Italy dates back, at least, to the unification of the country in 1861. Indeed, the growing importance of the Mafia in Sicily and the Camorra in Campania responded to a societal demand for an informal governance structure, in the wake of the political and social turmoil following the annexation of southern regions to the newborn Reign of Italy (Gambetta, 1993; Bandiera, 2003). Even though more uncertainty remains about the history of 'Ndrangheta in Calabria, its origin is also traced back to the second half of the XIX century.

Since the history of these three regions over the last 150 years is so inextricably connected with that 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 a significant presence of organized crime only one century later and for reasons that are mostly independent of their economic and social background.

3.1 Economic growth and crime in Southern Italy

During the first decades of the post-war period Apulia and Basilicata were a success story among Italian regions. Figure 6 compares their growth performance with other areas of the country, namely the historical settlements of mafia organizations (Sicily, Campania and Calabria), the other southern regions (Abruzzo, Molise and Sardinia) and the Centre-North. The data come from the research institute CREMOS, 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, services and the public sector), schooling and investment are also available since 1960. The disaggregation between

¹¹Besides homicides, the presence of criminal organizations is strongly correlated with other types of felonies, particularly predatory crimes such as 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 after exposure to mafia presence. 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.

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 1970-1994.¹²

While the 1960s were characterized by a general convergence between northern and southern regions, Apulia and Basilicata retained the highest growth rates of the country 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.

3.2 The rise of organized crime in Apulia and Basilicata

The main source of information on organized crime in Italy are the official records of the Parliamentary Antimafia Commission, henceforth PAC, which was first set up in 1962 and renewed in each subsequent legislation. The documents most concerned with organized crime in Apulia and Basilicata are those issued between the X and XII legislature of the Italian Parliament (period 1987-1996).¹³ 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 agree 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 explaining the expansion of organized crime toward the south-east is 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 "Tirrenian 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 Tirrenian 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).

Another important event leading to an increasing presence of organized crime in Basilicata was

¹²The 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 \(2010\)](#).

¹³Scanned copies of all reports mentioned in the paper (in Italian) can be downloaded from <https://sites.google.com/site/paolopinotti/orgcrime-supplmaterials>.

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, through the intimidation and corruption of local politicians and public administrators.¹⁴ 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 up to that point (PAC, 1993a).

All these events contributed to the breakthrough of organized crime in Apulia and Basilicata. One further element that facilitated its rooting was the presence of several criminals from other regions sent there in *confino*, a precautionary measure often imposed on individuals that had been either convicted or were strongly suspected of belonging to the mafia. While the purpose of such policy was to break the linkages between criminals and the organization, its main consequence 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).

At the beginning, illegal activities in Apulia and Basilicata were conducted directly by Mafia, Camorra and 'Ndrangheta, exploiting local criminal workforce in exchange for protection and financial resources. Such an arrangement proved unstable, as very soon local groups acquired independence by organizing themselves into autonomous crime syndicates, the most important of which are the Sacra Corona Unita in Apulia and the Basilischi in Basilicata.

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

¹⁴Less 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.

of interest before exposure to mafia presence.

4.1 The synthetic control method

Framing the problem in the context of Rubin’s (1976) 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,

$$Y_t = C_t Y_t^1 + (1 - C_t) Y_t^0, \quad (1)$$

where C_t is an indicator for the presence of organized crime in such region. The identification problem is that the *treatment effect* of organized crime,

$$\beta_t = Y_t^1 - Y_t^0, \quad (2)$$

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; regions that are treated in all periods are instead discarded. The estimator compares the actual outcome in the treated region with a weighted average of all units in the control group,

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

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

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

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 “too much” in the absence of organized crime, the synthetic control should approximate the (unobserved) counterfactual evolution of the potential outcome Y_t^0 also 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 estimates. Indeed, [Abadie et al. \(2010\)](#) show that synthetic control methods generalize the latter by allowing the effect of unobserved confounders to vary over time according to a flexible factor representation of potential outcomes.

Turning to the choice of the minimand, [Abadie and Gardeazabal \(2003\)](#) adopt a two-step procedure that minimizes the distance both 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 solve

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

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 pre-treatment outcomes,

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

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 number of 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).

The main outcome of interest will be real GDP per capita (at constant 1990 euro-equivalent prices). As for the choice of control variables, I follow strictly [Abadie and Gardeazabal \(2003\)](#) and include all 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 in agriculture, industry, services and the public sector ([Barro and Sala-i-Martin, 2004](#)). Yearly data on GDP per capita are available since 1951, while the time series for the other variables start in 1960. To compute the weights in (5), I average all variables in X through year 1965 and minimize the mean squared error in (6) over the same period. 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.

4.3 Initial conditions

The data-driven procedure described above delivers positive weights for Abruzzo (0.58), Molise (0.40) and Sardinia (0.02). Interestingly, even though no geographical variable is explicitly included in X , the minimization of (5)-(6) assigns 98% of the weight to the two regions in the control group that are closest to Apulia and Basilicata (Abruzzo and Molise) and the rest to the only other Southern region (Sardinia). Given the stark territorial divides that characterize economic development in Italy, the 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.

Table 1 confirms that, actually, the synthetic control replicates the treated region very closely in terms of initial GDP per capita, human capital and sectoral structure of the economy. 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.

5 Results

This section presents the estimates of the effect of organized crime obtained using the synthetic control method described above.

5.1 Graphical evidence

Figure 7 compares the evolution of GDP per capita in the treated region and in the synthetic control over the years 1951-2007. While the distance is minimized by construction until 1965, the two series remain identical well beyond that point, until the early 1970s. Starting in the second half of the decade, however, the treated region moves down to an inferior growth path, starting to accumulate an increasing delay relative to the synthetic control. The evolution of the estimated gap is reported in Figure 8, along with the difference in homicides between the two regions. The yearly difference 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, see the table below Figure 8.

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 homicides every 100,000 inhabitants in 1975, remaining extremely high until 1982. According to the judicial and historical evidence discussed in Section 3, this period coincides with the violent outbreak of criminal organizations from other regions 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, during a period of turmoil in all regions with greater presence of mafia organizations (see the end of Section 2.2).

5.2 Robustness

In Figure 9 I examine the sensitivity of these baseline estimates to alternative implementations of the synthetic control method; the detailed results are reported in the Web Appendix. In the first two graphs I apply the synthetic control method to Apulia and Basilicata separately, obtaining for each of the two regions results that are very similar to the baseline specification (in which they are combined into a single treated unit). The similarity of the effects between the two regions suggests also that the drop in GDP per capita is likely driven by common factors, among which the advent of organized crime, as opposed to the direct effect of idiosyncratic shocks such as the quake 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 e.g. Abadie and Gardeazabal, 2003, Abadie et al., 2010), one concern is that the estimated differential depends on the particular performance of a small number of regions. In particular, in the present application Molise and Abruzzo attract each about half of the weight in the

baseline specification. Yet, Figure 9.c and 9.d show that the qualitative results are robust to excluding each of these regions in turn. Finally, in Figure 9.e the crime rates over the initial period, 1951-1965, are included among the initial conditions, while in Figure 9.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.

5.3 Inference

Overall, the evidence in Figures 7 and 8 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, and that such estimates remain extremely stable under alternative implementations of the synthetic control method. 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. 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 difference between the treated region and its synthetic control in the post-treatment period is “abnormal” relative to the distribution of placebo estimates. To be as conservative as possible, I exclude the treated region from the sample when computing the placebo estimates, as in Abadie and Gardeazabal (2003).

The left graph in Figure 10 shows that, during the 1970s, the difference in GDP per capita between the treated region and the synthetic control drops from the upper to the lower tail of the distribution of placebo estimates. Even though the gap is not the highest one in absolute value (the island of Sardinia does worse), a relative drop in GDP per capita like the one observed in the treated region remains unlikely under the null hypothesis of no treatment effect. The evidence is even more clear-cut for homicides (right graph in Figure 10), as the increase observed during the last three decades is abnormal relative to the whole distribution.

Overall, the sizable changes in criminal and economic outcomes observed in the treated region after exposure to mafia activity seem extremely unlikely, on the basis of the distribution of placebo estimates, under the null hypothesis of no effect of organized crime. One issue is the extent to which such changes can be interpreted as the causal effect of organized crime on GDP per capita.

5.4 Causality

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. However, this fundamental identifying assumption can hardly be tested. Also, in this specific case 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.

For this reason, Figure 11 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 breakthrough of violence and declined 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.

To address causality in a more systematic way, I employ regression analysis and exploit changes in criminal activity in the regions with historical mafia presence excluded from the control group (Sicily, Campania and Calabria) as a source of variation in the intensity of mafia activity in Apulia and Basilicata. As shown in Figure 5, the dynamics of homicides across Italian regions exhibits significant co-movements induced by major events in the recent history of the Sicilian Mafia (see the end of Section 2.2). As long as such events depend only to a minor extent, if at all, on the economic development of Apulia and Basilicata relative to the synthetic control, it is possible to estimate the effect of mafia activity in a Two-Stage Least Squares (2SLS) framework.

The results of regression analysis are presented in Table 2. The dependent variable is the percentage GDP per capita gap between the treated region and the synthetic control, regressed on the difference in homicide rates,

$$\Delta \ln GDP_t \times 100 = \gamma \Delta murders_t + \epsilon_t, \quad (7)$$

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

As a preliminary step, the first four columns of the table present the OLS estimates, which already display some interesting results. Consistently with the graphical evidence, the univariate regression is negative and strongly statistically significant (column 1); the estimated coefficient is qualitatively unaffected, although lower in absolute value, after controlling for the first lag of the dependent variable (column 2).¹⁵ Interestingly, such result reflects a negative relationship only after the sharp increase of homicides in 1975; over the previous period, the two variables were in fact positively correlated (columns 3 and 4). While not very intuitive at a first sight, positive correlation between economic activity and murders is in line with extensive evidence for the United States during the post-war period (see for instance [Raphael and Winter-Ebmer, 2001](#)). Most importantly, the reversal in slope around 1975 points at the existence of a structural change in the economic effects of crime after the advent of mafia organizations.

The last four columns move to 2SLS estimates in which the difference in homicides between treated and control regions is instrumented by the murder rate in the other regions with high mafia presence outside the control group, $murders_t^*$. The results of the first stage regression are presented in the bottom panel of Table 2 and provide additional evidence about the existence of a structural break after the advent of organized crime. Homicides in Sicily, Campania and Calabria predict the “excess” (relative to the rest of Southern regions) criminal activity in Apulia and Basilicata only after 1975, while the two series are not significantly related in the previous period. Incidentally, this implies that the equation in column (7) is not identified, as there is a unique source of variation ($murders_t^* \times Post1975$) for two endogenous variables ($\Delta murders_t$ and $\Delta murders_t \times Post1975$). In spite of the high F-statistics for the excluded instruments, the Angrist-Pischke test fails in fact to reject the null hypothesis of under-identification.

In all the other 2SLS specifications, the effect of $\Delta murders_t$ is statistically significant and twice as much the OLS estimates in terms of magnitude. This is suggestive, again, of a positive feedback from economic activity to homicides, which is evident also from the coefficient of the lagged dependent variable in the first stage.

¹⁵All the findings are robust to richer dynamic specifications.

Such results must be taken with caution, as the exclusion restriction behind 2SLS estimates could be invalidated by direct effects of criminal activity in Sicily, Campania and Calabria on the GDP per capita of the treated regions through channels other than criminal activity in the latter. Still, the dependent variable is the *differential* economic performance of treated and control regions, which are all located at similar distance from the high-mafia regions, so it is not clear why spillover effects should be asymmetric between treated and control units. More in general, the results in Table 2 seem at least suggestive of the existence of positive reverse causality effects, from greater growth opportunities to higher mafia presence. If this is the case, the synthetic control estimate would provide a lower bound for the economic costs 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 thus 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 region 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. Under this alternative explanation, 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 the empirical relevance of this hypothesis, I move to electricity consumption as an alternative measure of aggregate economic activity. Differently from GDP and other official statistics, in fact, energy consumption depends on demand by firms and individuals operating 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) (Del Boca and Forte, 1982, provide an early application of this method to Italy).¹⁶

The left graph in Figure 12 shows the time series of yearly kilowatt-hour per capita in treated and control regions. Starting in 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 graphs 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). One explanation is that organized crime affects disproportionately sectors that use energy more intensively, like manufacturing, relative to others such as agriculture or household production.

¹⁶Schneider 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 regions within the same country that are geographically very close.

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) aggregate 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),

$$\ln Y_t = \ln A_t + \alpha_L \ln L_t + (1 - \alpha_L) \ln K_t, \quad (8)$$

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 again 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 3 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 3 can not reject the hypothesis that the labor and private capital shares in (8) 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 capital. The lower productivity of the former could then explain the drop in GDP per capita during the last decades of the sample period.

6.3 Discussion of the results

According to the growth accounting exercise, public intervention takes over an increasing share of economic activity after the presence of criminal organizations hampers private 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 in the labor market.

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 levitate 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 by threatening the other potential bidders in procurement auctions.¹⁷

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), which in turn affects 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, 2011).

Therefore, a tentative interpretation for the increase in public expenditure observed during the same period is that, amidst greater violence and worse economic prospects, local politicians were “captured” by criminal organizations. Such interpretation would also be consistent with recent work by Acemoglu et al. (2009) on Colombian politicians appointed in the areas most exposed to the activity of paramilitary groups.

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), 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

¹⁷See Caneppele et al. (2009) for a systematic discussion of the methods used by criminal organizations to infiltrate public contracts. Reuter (1987) provides an interesting case study for the garbage collection industry in New York.

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 to better understand 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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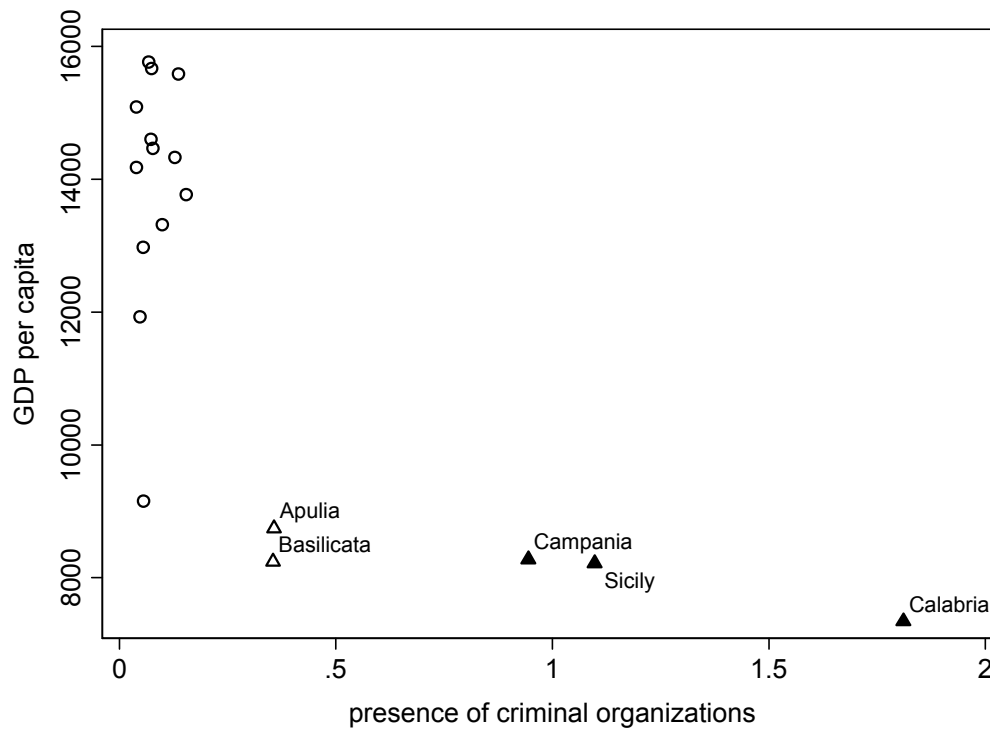
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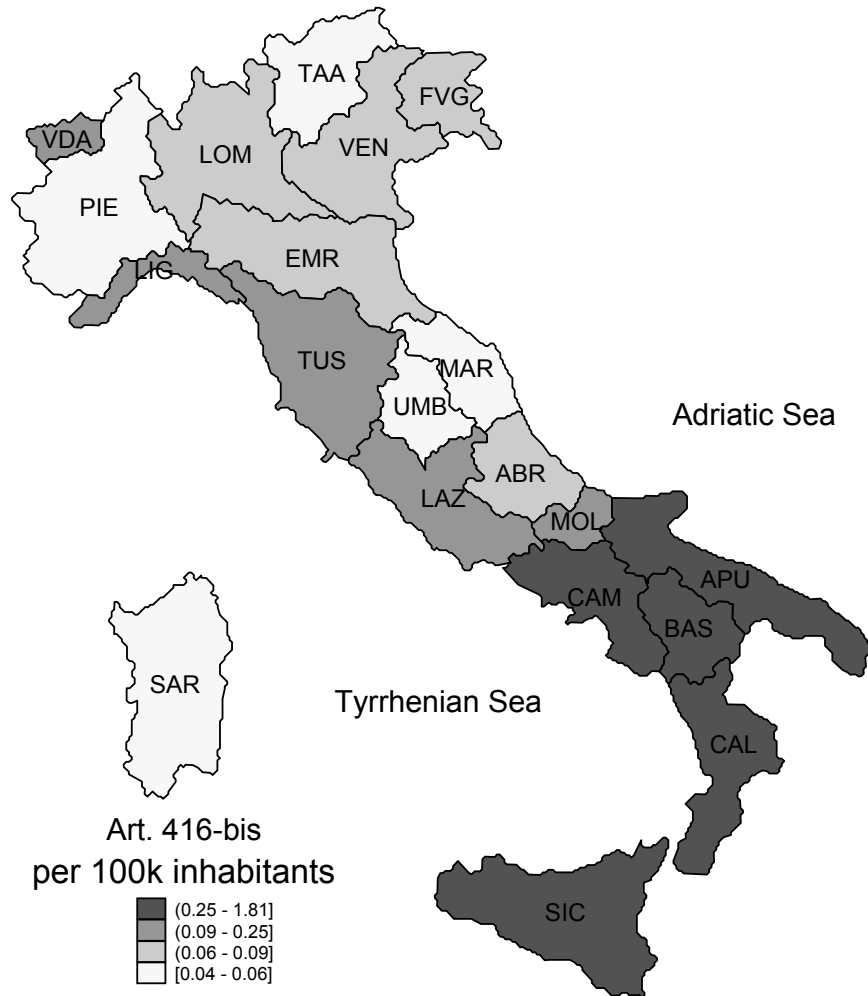
Figures and tables

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



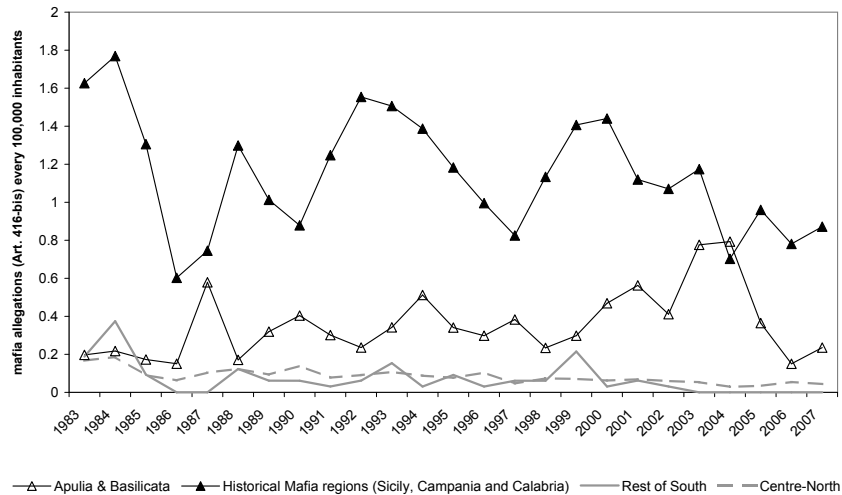
Note: This graph shows the relationship between organized crime and GDP per capita across Italian regions. Bold triangles denote regions with a historical presence of mafia organizations, hollow triangles denote regions with a more recent presence while circles denote all other regions. Organized crime 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



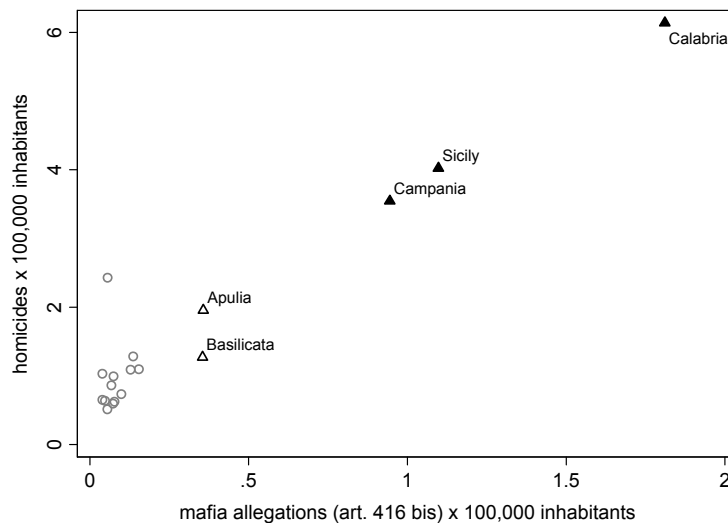
Note: The map shows the presence of organized crime across Italian regions, as measured by the number of cases ex Article 416-bis of the Penal Code (mafia-type criminal organization) reported by the police to the judiciary authority, every 100,000 inhabitants; darker colors correspond to a higher number of cases, see also the legend on the bottom-left corner of the figure. The variable is averaged over the period 1983-2007.

Figure 3: presence over time of mafia-type criminal organizations in different areas in Italy, years 1983-2007



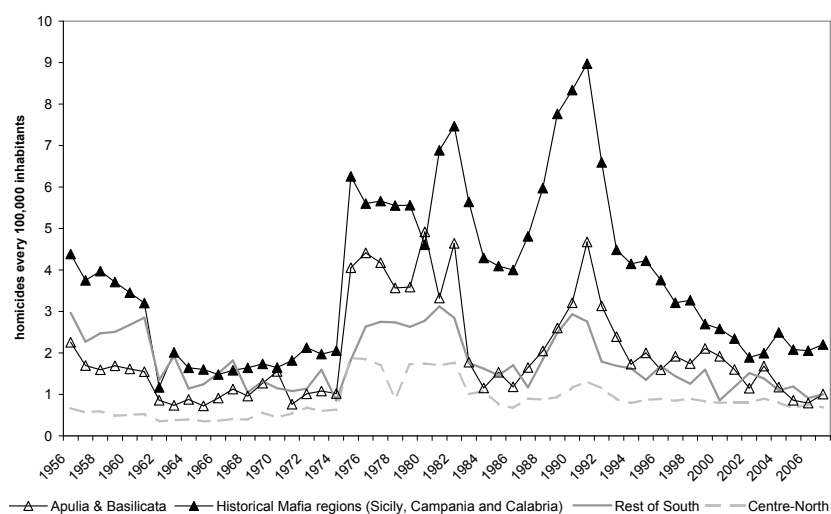
Note: The graph shows the time series of cases ex Article 416-bis of the Penal Code (mafia-type criminal organization) reported by the police to the judiciary authority, every 100,000 inhabitants, in different areas of Italy: regions with an historical presence of mafia-type organizations (Sicily, Campania and Calabria), regions with a more recent presence of such organizations (Apulia and Basilicata), other Southern regions and, finally, regions in the Centre-North.

Figure 4: mafia-type criminal organizations and murders across Italian regions, average over the period 1983-2007



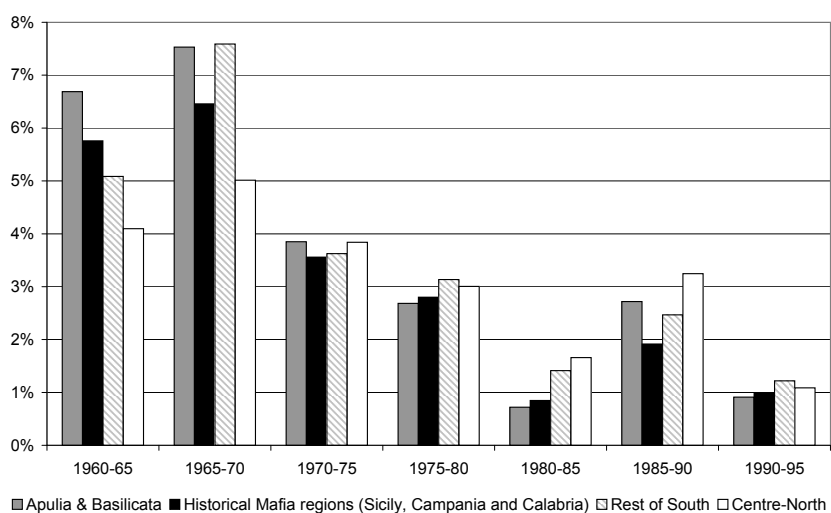
Note: This graph shows the relationship between organized crime and murders across Italian regions. Bold triangles denote regions with a historical presence of mafia organizations, hollow triangles denote regions with a more recent presence while circles denote all other regions. The presence of criminal 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 5: murder rate over time in different areas in Italy, years 1983-2007



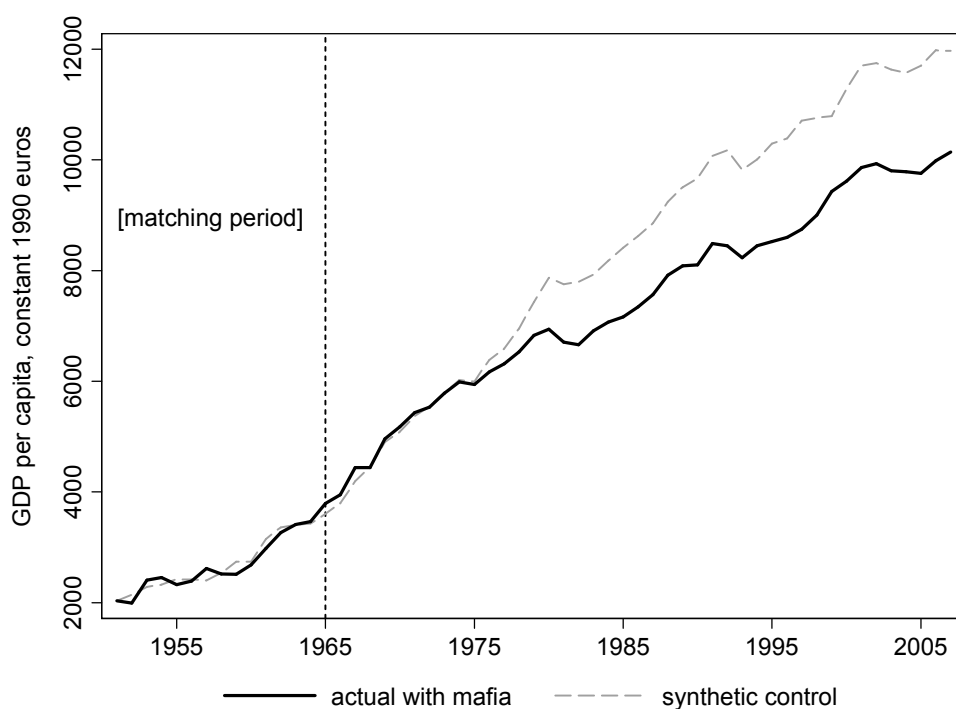
Note: The graph shows the time series of homicides, every 100,000 inhabitants, in different areas of Italy: regions with an historical presence of mafia-type organizations (Sicily, Campania and Calabria), regions with a more recent presence of such organizations (Apulia and Basilicata), other Southern regions and, finally, regions in the Centre-North.

Figure 6: growth rate of GDP per capita across different areas in Italy, different sub-periods during the post-war years



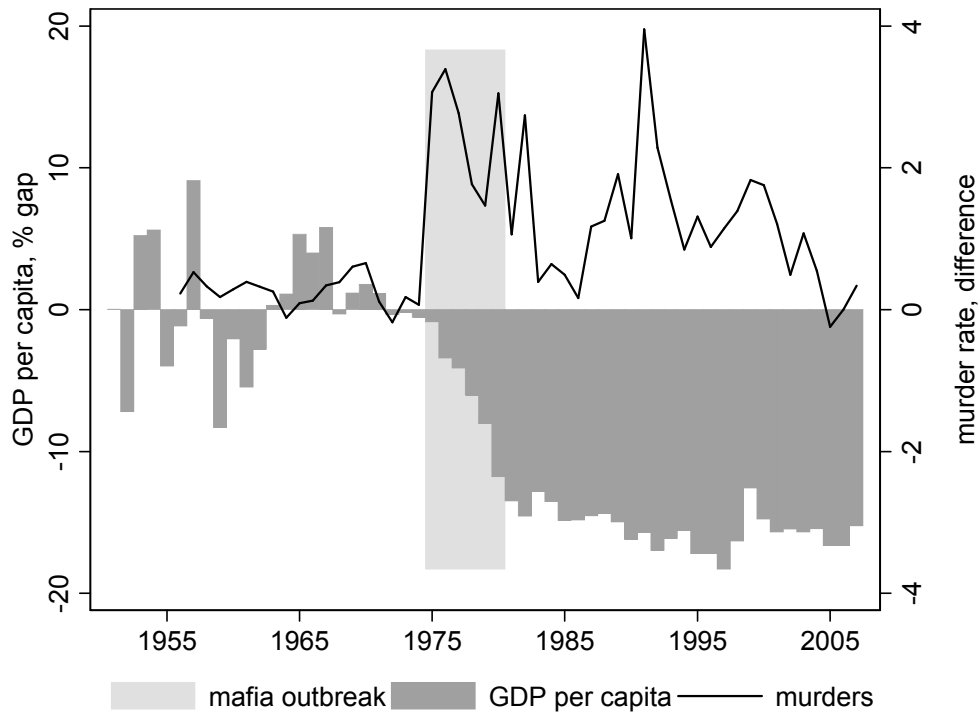
Note: The graph compares the growth rate of GDP per capita over the post-war period across different areas of Italy: regions with a historical presence of mafia-type organizations (Sicily, Campania and Calabria), regions with a more recent presence of such organizations (Apulia and Basilicata), other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

Figure 7: 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 1951-1965; see Section 4 for the details.

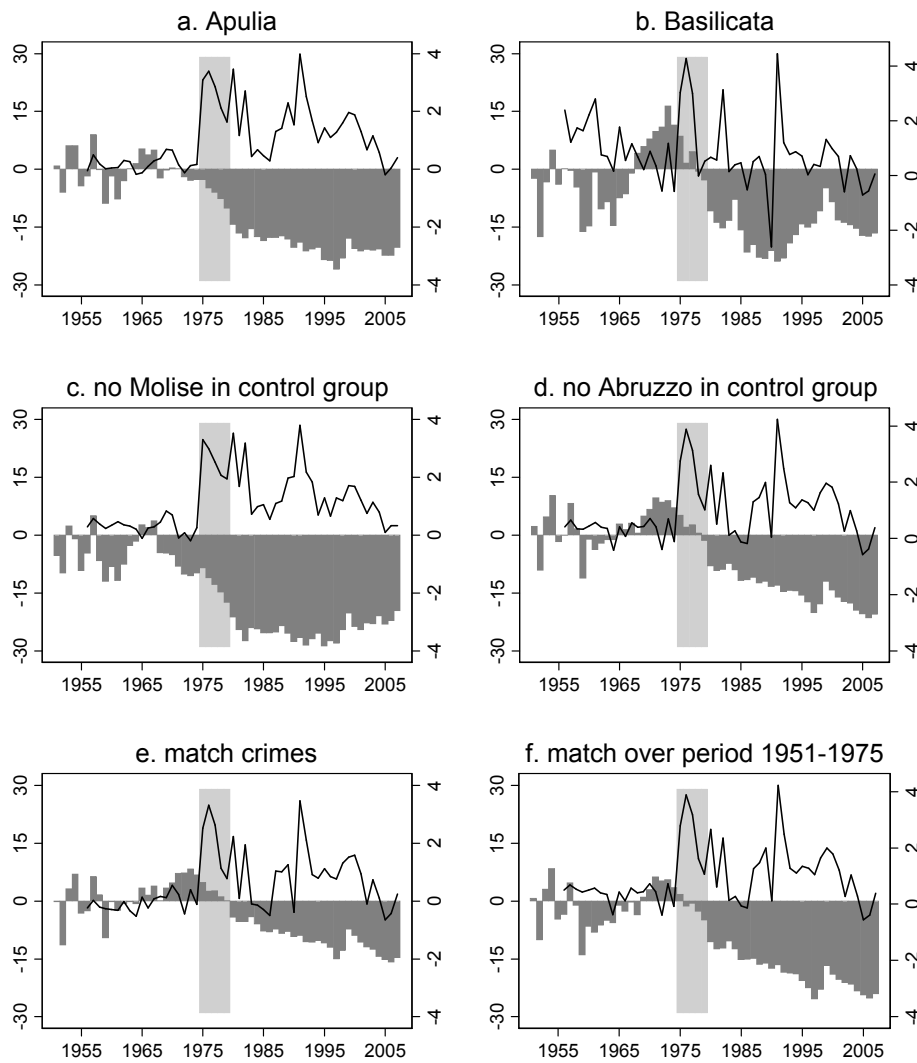
Figure 8: GDP per capita and murder rate in the treated region and in the synthetic control, estimated gap, years 1951-2007



YEARS	GDP per capita level			homicides X 100,000 inhab.		
	TREATED	SYNTH.	DIFF.	TREATED	SYNTH.	DIFF.
1951-1960	2395	2406	-0.3%	1.8	1.5	0.3
1961-1970	3989	3939	1.1%	1.1	0.7	0.3
1971-1975	5737	5748	-0.2%	1.6	0.9	0.7
1976-1980	6559	7047	-6.7%	4.1	1.6	2.5
1981-1990	7353	8598	-14.4%	2.3	1.2	1.1
1991-2000	8754	10431	-16.1%	2.3	0.6	1.7
2001-2007	9895	11757	-15.8%	1.2	0.7	0.5

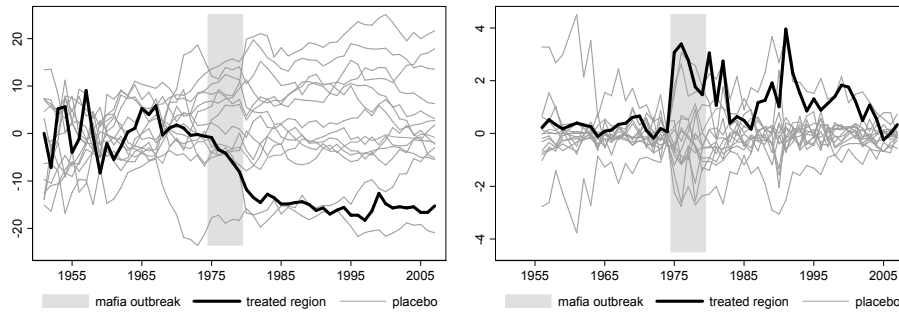
Note: The graphs show the difference between Apulia and Basilicata (“actual with mafia”) and the synthetic control in terms of GDP per capita and murder rate. The synthetic control is a weighted average of the other Italian regions excluding those with a historical presence of mafia-type organizations (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 1951-1965; see Section 4 for the details.

Figure 9: GDP per capita in the treated region and in the synthetic control, estimated gap, years 1951-2007 (robustness)



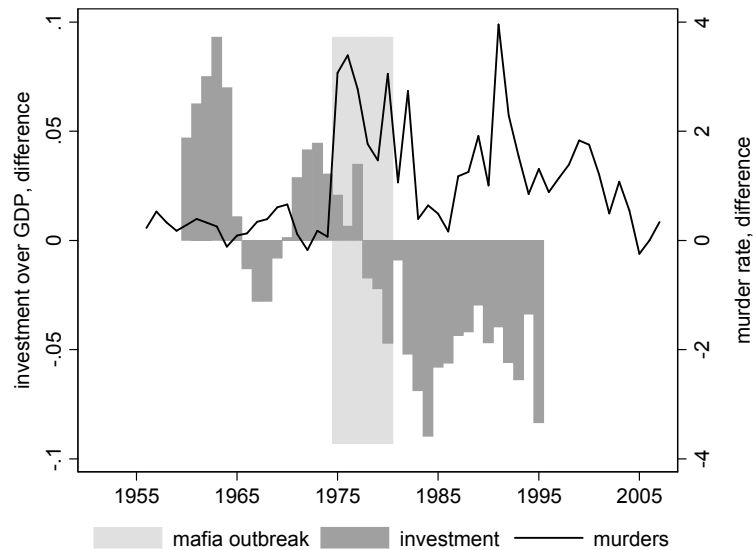
Note: The graphs show the difference between the GDP per capita of Apulia and Basilicata (“actual with mafia”) and a synthetic control, in terms of GDP per capita and murder rate, under different implementations of the synthetic control method. The synthetic control is a weighted average of the other 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 1951-1965; see Section 4 in the paper for the details.

Figure 10: distribution of the estimated gap between each Italian region and its synthetic control in terms of GDP per capita and murders, years 1951-2007 (placebo test)



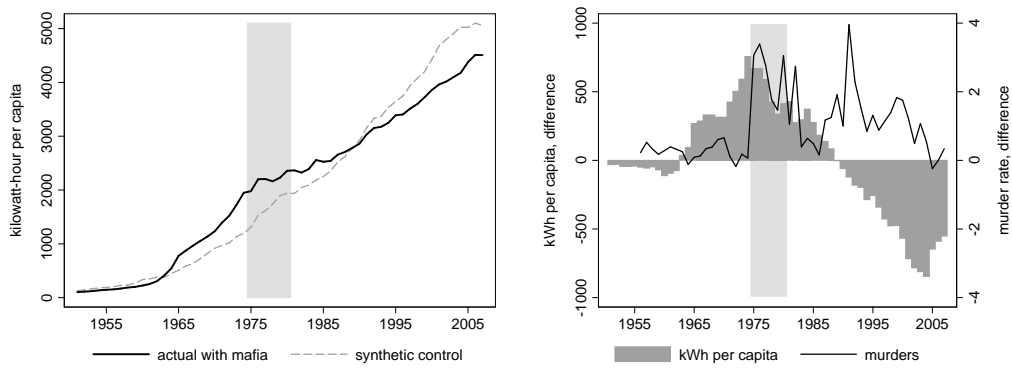
Note: The left and right graphs show the difference between Apulia and Basilicata (“treated region”) and its synthetic control in terms of GDP per capita and murder rate, respectively, as well the same difference for the other Italian regions (“placebo”). The synthetic control for each region is a weighted 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 region 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 1951-1965; see Section 4 for the details.

Figure 11: private investment and murder rate in the treated region and in the synthetic control, estimated gap, years 1956-2007



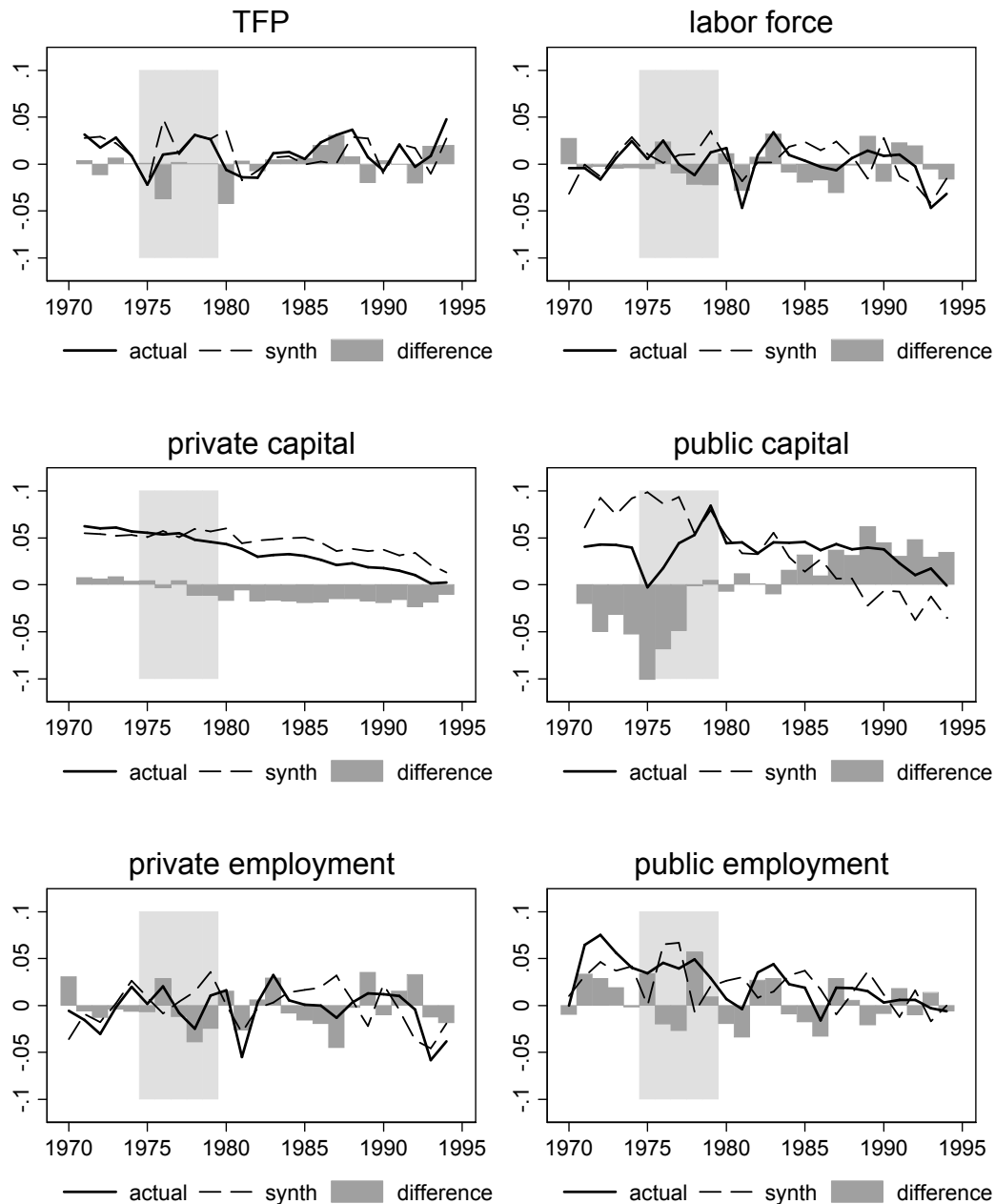
Note: The graphs show the difference between Apulia and Basilicata (“actual with mafia”) and the synthetic control in terms of (private) investment over GDP per capita and murder rate, which is available from the data set CRENOs on a consistent basis over the period 1970-1994. The synthetic control is 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 1951-1965; see Section 4 for the details.

Figure 12: 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 1951-1965; 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 1951-1965; see Section 4 for the details.

Table 1: pre-treatment characteristics in Apulia and Basilicata and in the synthetic control, average over the period 1951-1965

	Apulia and	synthetic	all control regions			
	Basilicata	control	<i>avg.</i>	<i>variance</i>	<i>min</i>	<i>max</i>
GDP per capita	2725	2735	4072	1161	1843	6860
investment/GDP	0.31	0.25	0.27	0.05	0.20	0.41
VA industry	0.22	0.23	0.31	0.07	0.19	0.46
VA agriculture	0.16	0.16	0.10	0.04	0.03	0.20
VA services	0.39	0.38	0.42	0.05	0.31	0.51
VA public	0.23	0.24	0.18	0.05	0.09	0.30
human capital	0.21	0.24	0.22	0.05	0.13	0.34
pop. density (p/kmq)	136	101	156	76	53	334

Note: The table shows the characteristics of Apulia and Basilicata, the synthetic control and all regions in the control group during the period 1951-1965. 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 1951-1965; see Section 4 for the details.

Table 2: effect of mafia activity on the GDP per capita gap between the treated region and the synthetic control, years 1956-2007

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Ordinary Least Squares				Two-stage Least Squares			
$\Delta murders_t$	-2.402** (1.068)	-0.548** (0.270)	5.738 (3.665)		-4.582*** (1.507)	-1.039** (0.495)	6.417 (17.185)	
$\Delta murders_t \times Post1975$			-6.104* (3.589)	-0.648** (0.296)			-7.127 (16.191)	-1.141** (0.454)
$\Delta \ln GDP_{t-1} \times 100$		0.913*** (0.064)	0.843*** (0.068)	0.902*** (0.063)		0.898*** (0.073)	0.819*** (0.153)	0.880*** (0.067)
Constant	-6.132** (1.602)	-0.392 (0.987)	-1.724 (1.032)	-0.447 (0.972)	-3.972** (1.843)	-0.036 (0.824)	-1.676 (3.506)	-0.187 (0.953)
Obs.	52	52	52	52	52	52	52	52
R ²	0.090	0.864	0.876	0.866				
Adj. R ²	0.072	0.858	0.868	0.861				
					<i>first stage for $\Delta murders_t$</i>			
$murders_t^*$					0.343*** (0.061)	0.339*** (0.070)	-0.024 (0.099)	
$murders_t^* \times Post1975$							0.342*** (0.080)	
$\Delta \ln GDP_{t-1} \times 100$						-0.003 (0.013)	0.039** (0.015)	
F-stat (excl. instr.)					31.28	23.62	19.76	
AP under-id. test, p-value					0.00	0.00	0.66	
					<i>first stage for $\Delta murders_t \times Post1975$</i>			
$murders_t^*$							-0.085 (0.097)	
$murders_t^* \times Post1975$							0.414*** (0.080)	0.348*** (0.055)
$\Delta \ln GDP_{t-1} \times 100$							0.35** (0.015)	0.024* (0.014)
F-stat (excl. instr.)							22.34	41.43
AP under-id. test, p-value							0.63	0.00

Note: The table reports the results of OLS and 2SLS regressions of economic activity on crime in Apulia and Basilicata during the period 1956-2007. The dependent variable is the percentage GDP per capita gap in each year relative to the synthetic control; the main explanatory variable is the difference in terms of murder rates, possibly interacted with a binary indicator for the period after 1975. The results of first stage estimates are presented in the bottom part of the table, the instrument $murders_t^*$ is the yearly number of homicides every 100,000 inhabitants in Sicily, Campania and Calabria. The first stage F-statistic for the excluded instrument(s) and the p-value of the Angrist-Pischke under-identification test are reported: the null hypothesis is that the endogenous regressor is unidentified. Robust standard errors are in parenthesis; *, ** and *** denote coefficients significantly different from zero at the 90%, 95% and 99% confidence level, respectively.

Table 3: 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*** (0.055)	0.668*** (0.055)	0.673*** (0.057)	0.670*** (0.057)
$\ln K_t - \ln K_{t-1}$	0.249*** (0.070)		0.210*** (0.072)	
<i>private capital</i>		0.233*** (0.069)		0.198*** (0.068)
<i>public capital</i>		0.015 (0.036)		0.010 (0.036)
constant	0.013*** (0.002)	0.013*** (0.002)	0.015*** (0.002)	0.015*** (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 $\alpha_L = 2/3$ p-value	0.01 0.94	0.00 0.98	0.01 0.91	0.01 0.95
test $\sum_j \alpha_j = 1$ p-value	1.22 0.27	1.35 0.25	2.39 0.12	2.57 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.