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THE ECONOMIC COSTS OF ORGANISED CRIME: EVIDENCE FROM SOUTHERN ITALY*

Paolo Pinotti

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 economic performance in the absence of organised crime. The comparison of actual and counterfactual development shows that the presence of mafia lowers GDP *per capita* by 16%. 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 of resources from the official to the unofficial sector.

Organised crime is commonly perceived as a major obstacle to the economic development of several countries around the world – prominent 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. Since the Unification of the Italian state, about 150 years ago, the mafia-type organisations born in some regions of the south-west (the Mafia in Sicily, the Camorra in Campania, and the Ndrangheta in Calabria) have survived through several stages of economic and social development.[1] Indeed, during the post-war period they even expanded towards south-eastern regions (Apulia and Basilicata), and acquired strong economic interests in the centre-north as well as in other countries such as the United States and Germany.

In this article, I estimate the economic costs of organised crime in southern Italy during the post-war period empirically. Preliminary evidence in Figure 1 suggests that such costs are potentially very large: the five Italian regions with the highest presence of mafia-type organisations are also the poorest of the country.[2] However, this univariate relationship likely reflects causality going in both directions. In particular,

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This project was initiated on behalf of the Italian Antimafia Commission and the Bank of Italy, some of the results have been presented to the Italian Parliament, the discussion (in Italian) is available at =405316 http://www.parlamento.it/. A first draft of the article was written while I was visiting the Department of Economics at Harvard University whose kind hospitality is gratefully acknowledged. I am particularly indebted to Alberto Abadie for sharing his computer code and providing constant advice and encouragement throughout the course of this project, and to the editor, Stephen Machin, and three anonymous referees for very constructive comments on the earlier version of the article . I also received useful comments from Daron Acemoglu, Alberto Alesina, Magda Bianco, Francesco Caselli, Philip Cook, Pedro Dal Bó, John Donohue, Vincenzo Galasso, Javier Gardeazabal, Jeffrey Grogger, Luigi Guiso, Caroline Hoxby, Giovanni Mastrobuoni, Nathan Nunn, Shanker Satyanath, Andrei Shleifer, Rodrigo Soares, conference participants at the Winter Meetings of the Econometric Society in Chicago, CESifo Summer Institute 2011, Transatlantic Workshop on the Economics of Crime, Dondena-Bank of Italy Workshop on Public Policy and seminar participants at the University of the Basque Country, IMT Institute for Advanced Studies in Lucca, Maastricht University and University La Sapienza in Rome.

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

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

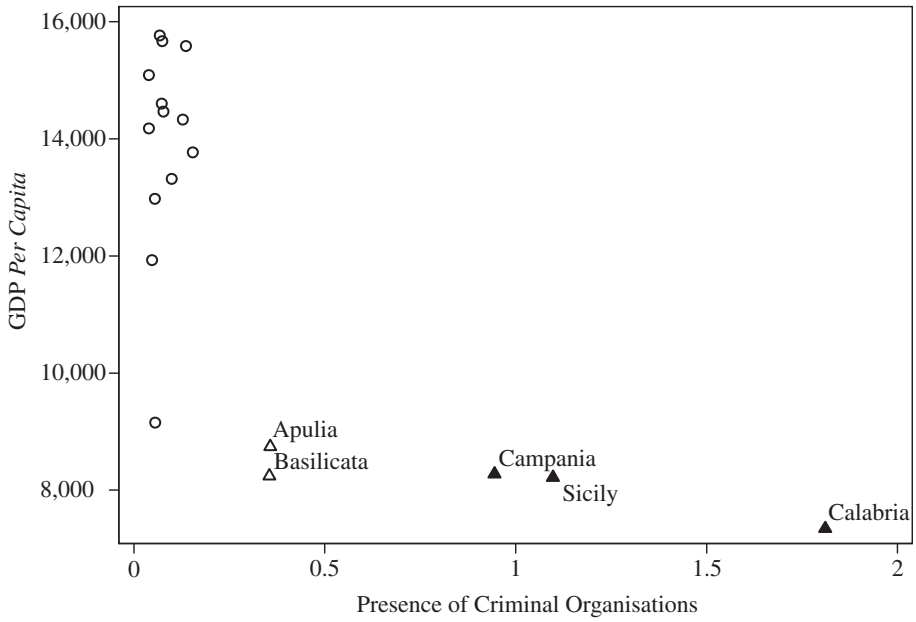

Fig. 1. *Mafia-type Criminal Organisations and GDP Per Capita Across Italian Regions, Average Over the Period 1983–2007*

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

the level of development could itself be an important factor behind the rise of criminal organisations.

For this reason, I focus on the peculiar experience of Apulia and Basilicata, which suffered a huge increase in the presence of organised crime in recent decades. Until the beginning of the 1970s, these two regions were in fact characterised by levels of criminal activity and a level of economic development similar to the other areas of southern Italy unaffected by mafia activity. Things changed when a series of events largely independent from the socio-economic environment of such regions, notably a shift in the entry point for smuggled tobacco arriving in Italy (from the Tyrrenian to the Adriatic Sea), resulted in a sudden increase of mafia activity also in Apulia and Basilicata.

To address the causal effect of organised 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 organisations. 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 presence of

organised crime. As long as the weights reflect structural parameters that would not vary in the absence of organised 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 organised crime coincides with a sudden slowdown of economic development. In the course of just a few years Apulia and Basilicata fell from being among the highest growing Italian regions to among some of the worst performers the negative impact of which was felt for decades to come. Over a thirty-year period, the two regions experienced a 16% drop in GDP *per capita* relative to the synthetic control, whilst suffering an increase of 3 additional homicides per 100,000 inhabitants annually (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 organised crime, such changes in GDP and murders turn out to be extremely unlikely under the null hypothesis of no effect of organised crime.

In principle, the estimated economic loss may depend on a variety of channels through which organised 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 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 (Bonaglia *et al.*, 2000) and confirmed by production function estimates presented in this article.

One tentative interpretation of these findings is that criminal organisations discourage productive investment by private entrepreneurs, while distorting and corrupting the public procurement process. Indeed, according to the Italian judge Giovanni Falcone, who led the 'Maxi Trial' against the Sicilian mafia in 1987 and was later killed by the organisation, 'more than one fifth of Mafia profits come from public investment' (Falcone, 1991). My results speak also to recent work by Barone and Narciso (2013), who show that criminal organisations may distort the allocation of public investment subsides towards their areas of influence.

[3] See Abadie *et al.* (2010) for a throughout presentation of synthetic control methods and Montalvo (2011), Acemoglu *et al.* (2013) and Billmeier and Nannicini (2013) for recent applications. The surveys of Imbens and Wooldridge (2009) and Lechner (2011) 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.

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 organisations. The present article fills this gap employing a transparent data-driven methodology to estimate the costs of organised crime in a country that is severely plagued by this phenomenon.

Moreover, organised 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.* (2015) investigate the historical origins of the Sicilian Mafia, focusing in particular on the racket of private protection at the end of the nineteenth century, while Frye and Zhuravskaya (2000) examine the case of modern Russia; Mastrobuoni (2015) studies the network structure of the Italian-American organisation 'Cosa Nostra'; Dell (2011) estimates the effects of law enforcement on drug-trade related violence and drug-trafficking routes; finally, Pinotti (2013) and Daniele and Geys (2015) 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 organised crime for the level and composition of GDP *per capita*.

The article is structured as follows. Section 1 defines organised crime in the context of the Italian legislative framework, and introduces the data that will be used throughout the paper. Then, Section 2 describes in detail the rise of organised crime in Apulia and Basilicata, and Section 3 presents the identification strategy based on this historical episode. The main empirical results are reported in Section 4, while Section 5 addresses the potential channels through which organised crime impacts the economy; additional descriptive statistics and robustness exercises are confined to the online Appendix. Finally, Section 6 concludes.

1. Organised Crime in Italy

1.1. *Definitions and Legal Framework*

Criminal organisations 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 Organised Crime emphasised 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 organisations, on the other hand it neglects their core business – namely violence. Far from being a means of last resort, the extensive use of violence grants criminal organisations 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 organisations 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 nineteenth century.

Criminal organisations 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 behaviour that prohibits the members of a criminal organisation from even mentioning it. Historically, the code was deeply internalised by mafia members, thus preventing whistle-blowing.[4]

It was only at the beginning of the 1980s that these distinctive features were recognised 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 organisations, defined as those groups that 'exploit the power of intimidation granted by the membership in the organisation, and the condition of subjugation and *omertá* that descends from it, to commit crimes and acquire the control of economic activities, concessions, authorisations, 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 offence across Italian regions.

1.2. *Measurement*

The yearbook of criminal statistics published by the Italian Statistical Institute (ISTAT) reports the number of cases ex Article. 416-bis for every 100,000 inhabitants at the regional level since year 1983 (right after the article was introduced in the Penal

[4] William and Jennings (1984) includes the enforcement of *omertá* among the defining activities of criminal organisations. 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.* (2014) investigate empirically the effectiveness of leniency programme in Italy, while Spagnolo (2004) and Buccirossi and Spagnolo (2006) provide a more general theoretical analysis of this kind of programme.

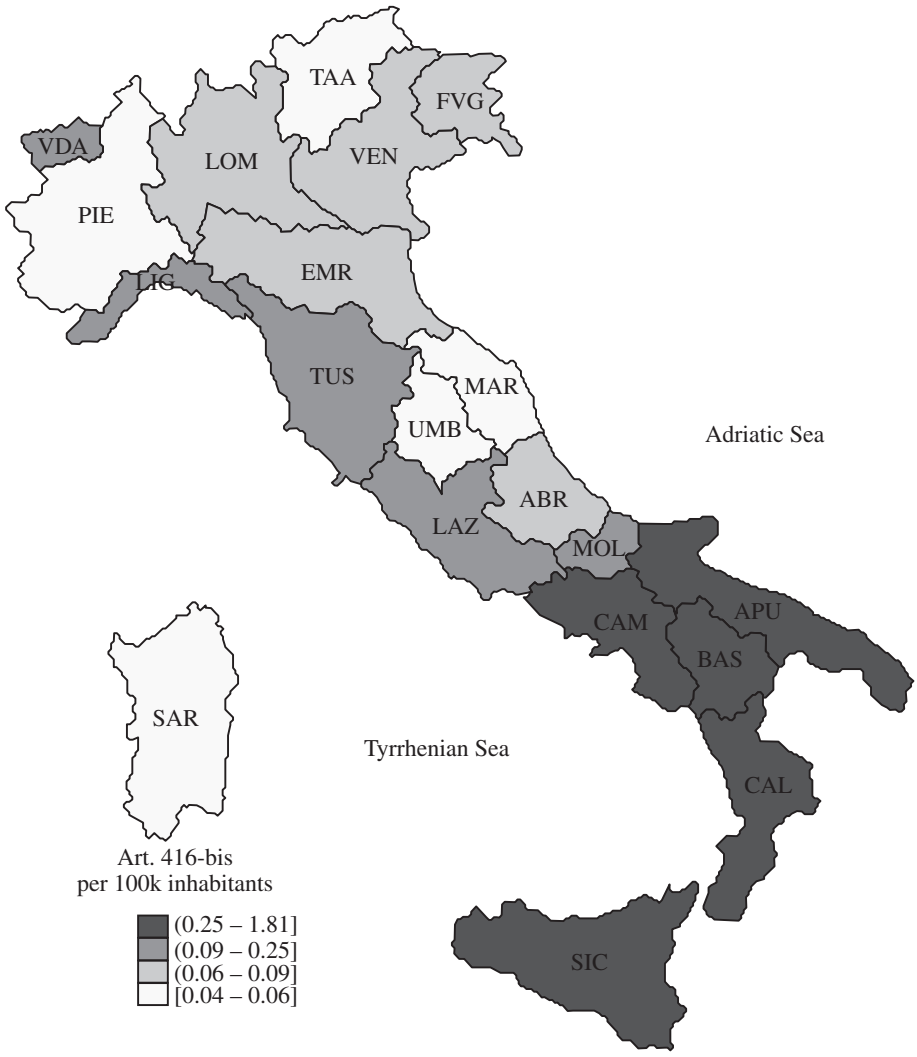

Fig. 2. *Presence of Mafia-type Criminal Organisations Across Italian Regions, Average Over the Period 1983–2007*

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

Code). Figure 2 shows that the presence of mafia organisations is concentrated into five southern regions: Calabria, Sicily, Campania and to a lesser extent, Apulia and Basilicata.[5]

[5] 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 online Appendix.

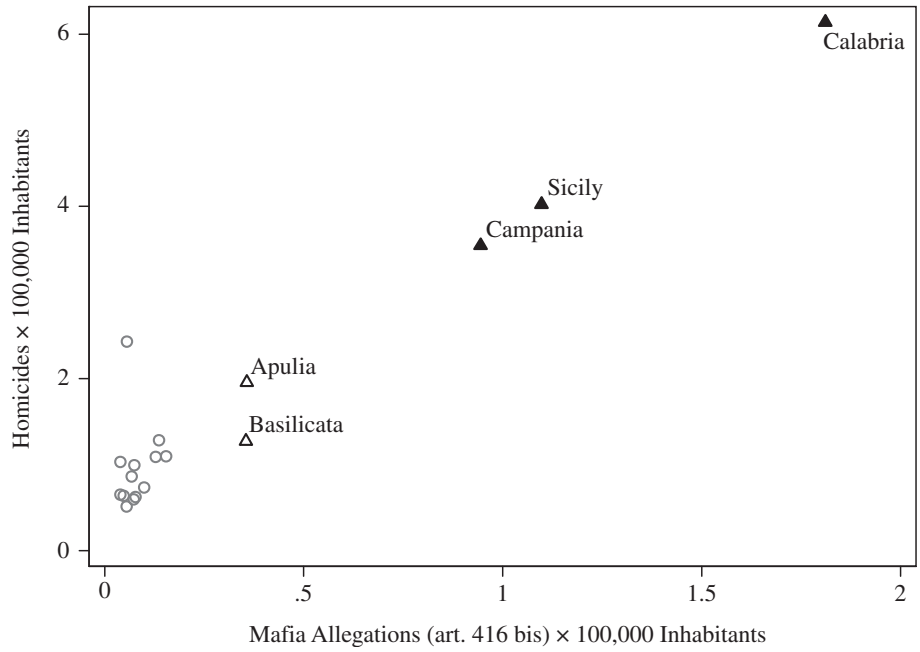

Fig. 3. *Mafia-type Criminal Organisations and Murders Across Italian Regions, Average Over the Period 1983–2007*

Notes. This graph shows the relationship between organised crime and murders across Italian regions. Solid triangles denote regions with a historical presence of mafia organisations, hollow triangles denote regions with a more recent presence while circles denote all other regions. The presence of criminal organisations is measured by the number of cases ex Article 416-bis of the Penal Code (mafia-type criminal organisation) 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.

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 organisations 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 organisations exert the monopoly of violence. In fact, while most regions in Italy are characterised by an extremely low number of homicides (even in international comparisons), 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).[6] Figure 3 shows that, indeed, there is an almost perfect linear relationship between the intensity of organised crime and the

[6] According to the UN International Homicide Statistics database, the average murder rates since 1995 (the first year for which the harmonised 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.

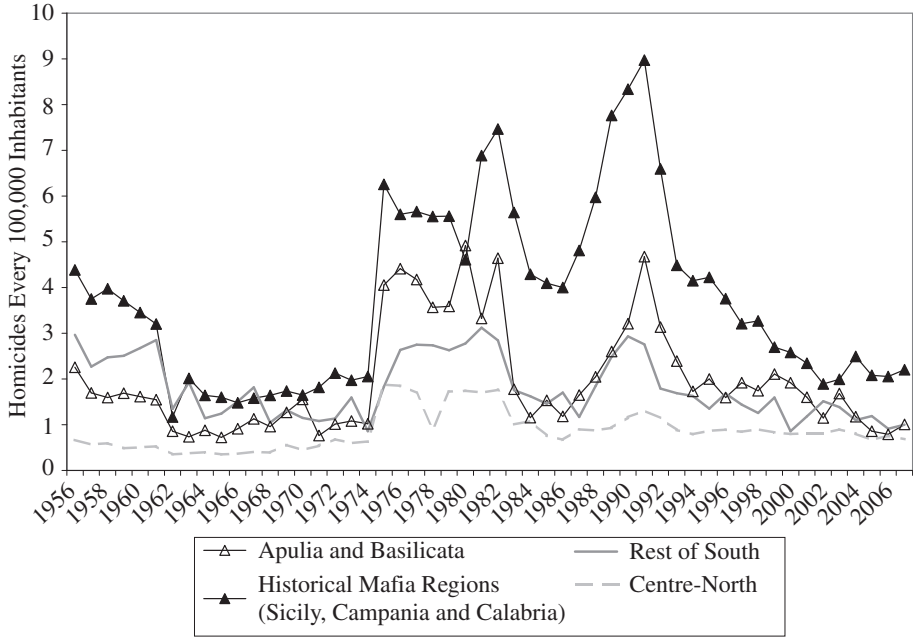

Fig. 4. *Murder Rate Over Time Across Different Areas in Italy, Years 1955–2007*
Notes. The graph shows the homicide rate every 100,000 inhabitants across different areas of Italy: regions with a historical presence of mafia-type organisations (Sicily, Campania, and Calabria), regions with a more recent presence of such organisations (Apulia and Basilicata), other Southern regions (Abruzzo, Molise, and Sardinia) and regions in the Centre-North.

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 organisation). Therefore, one can use the murder rate as an alternative indicator for the presence of criminal organisations. Importantly, such a measure is also available for the period before 1983, when Article 416-bis had not yet been introduced.

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 organisations (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 in 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 organisations (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 organisations, as discussed in the next Section.[7]

2. Historical Background

As discussed in the previous Section, the origin of the Mafia in Sicily dates back to the nineteenth 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 organisations, 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 defining periods 'before' and 'after' organised crime. This is indeed what makes the case of these two regions particularly useful for the present analysis. Indeed, the experience of Apulia and Basilicata is just part of a longer-term expansion of mafia organisations outside their historical settlements in Sicily and Campania.

2.1. *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 labour 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 from 1960 onwards. 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 1970–94.[8]

While the 1960s where characterised by a general convergence between northern and southern regions, Apulia and Basilicata maintained the highest growth rates until

[7] 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 during the following year. Besides homicides, the presence of criminal organisations is strongly correlated with other types of crime, particularly extortions and kidnappings. Unfortunately, official statistics on most offences other than murders are available at the regional level on a consistent basis only from 1975 (extortions, kidnappings, non-mafia organisations, 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 is data on thefts, which are available from 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 organisations; 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 online Appendix.

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

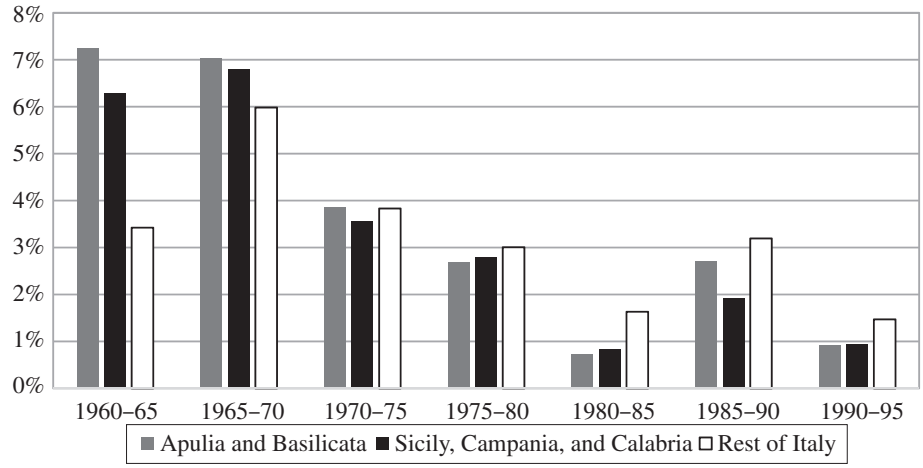

Fig. 5. *Growth Rate of GDP Per Capita Across Different Areas in Italy, Different Sub-periods During the Post-war Years*

Notes. 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 organisations (Sicily, Campania and Calabria), regions with a more recent presence of such organisations (Apulia and Basilicata), other all other Italian regions. The GDP *per capita* is measured in constant 1990 euro.

the early 1970s, when the process of convergence was over for most other regions (Paci and Pigliaru, 1997; Terrasi, 1999; Maffezzoli, 2006). The situation changed dramatically over the following decade. In 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 organised crime in Apulia and Basilicata, leading to the formation of the so-called 'fourth' and 'fifth mafia', respectively.

2.2. *The Rise of Organised Crime in Apulia and Basilicata*

The main sources of information on organised crime in Italy are the official reports of the Parliamentary Antimafia Commission (PAC), established in 1962. The reports most concerned with organised crime in Apulia and Basilicata are those issued between the X and XII legislature of the Italian Parliament (1987–96).[9] 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 organisations towards the south-east was primarily due to the unfortunate combination of geographic proximity with the historical settlements of organised crime (Sicily, Campania and Calabria) and

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

a series of events largely independent from the socio-economic context of the two regions.

The single most important factor for the expansion of organised crime towards the south-east was the growing importance of tobacco smuggling during the 1970s (PAC, 1993*c*; Sciarrone, 1998). 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 favour of the 'Adriatic route' (from Albania and Yugoslavia to Turkey and Cyprus, through the south-eastern Italian coasts of Apulia; PAC). However, it was only one decade later that mafia organisations expanded beyond their strongholds in Sicily, Campania and Calabria, to search for new bases in Apulia, often using Basilicata as a corridor between the Tyrrhenian and Adriatic coasts. 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) – before the arrival of 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 1974–5' (Sciarrone, 1998).

The second important event leading to an increasing presence of organised 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, massive inflows of relief money and public investments attracted the interest of criminal organisations. 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 favoured widespread mafia exploitation of procurement contracts (PAC, 1993*a*). Several judicial investigations and a parliamentary commission uncovered the embezzlement of a large chunk of the 25 billion euro allocated for reconstruction. Such funds were misappropriated through the systematic intimidation and corruption of local politicians and public administrators.[10] Ultimately, the main consequence of the flood of public funds was to increase the influence of mafia organisations in the regions struck by the earthquake, especially in Basilicata where organised crime had been almost absent until then (PAC, 1993*a*).

Another event that contributed to the rooting of organised crime in Apulia and Basilicata 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 organisation, the main consequence of such policy was the transplantation of mafia into other regions, as recognised on several occasions by the Antimafia Commission (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

[10] 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.

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 organisations of other regions (PAC, 1991).

All these factors contributed to the outbreak of organised crime in Apulia and Basilicata at the end of the 1970s. Illegal businesses were first controlled directly by the Mafia, Camorra and Ndrangheta, however such arrangements proved unstable, as very soon local groups acquired independence by organising themselves into autonomous crime syndicates, the most important of which were the Sacra Corona Unita in Apulia and the Basilischi in Basilicata.[11]

3. Empirical Methodology

The previous Section describes how the rise and expansion of organised 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 towards eastern routes, the political turmoil in eastern European countries, and the earthquake of 1980. The empirical strategy adopted in this article exploits this historical change to estimate the effect of organised crime by comparing Apulia and Basilicata with a control group of regions not (or less) affected by organised 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.

3.1. *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 realisation depends on the presence of organised crime. In particular, the realisation in a given region during year t is equal to y_t^1 if the region is exposed to organised crime and y_t^0 otherwise,

$$y_t = c_t y_t^1 + (1 - c_t) y_t^0, \tag{1}$$

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

[11] At first sight it may seem puzzling that mafia-type organisations 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 organised crime, may take root just on one side of a regional border.

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

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 organised 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 to a downward (upward) biased estimate of the treatment effect, $\hat{\beta}_t$.

Therefore, the estimation problem amounts to choosing the vector of weights that minimises the last difference on the right-hand side of (4). A natural choice consists in minimising the difference between treated and control regions over the period in which none of them had been exposed to the treatment, that is, before T. As long as the weights reflect structural parameters that would not vary in the absence of organised 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.[12]

Turning to the choice of the minimand, Abadie and Gardeazabal (2003) adopt a two-step procedure that minimises the distance between the treated and control regions in terms of pre-treatment outcomes and predictors for post-treatment outcomes. Specifically, let $\mathbf{x}$ and $\mathbf{x}_i^0$ 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 $\mathbf{V}$ be a $(K \times K)$ diagonal matrix with non-negative entries measuring the relative importance of each predictor. Conditional on $\mathbf{V}$, the optimal vector of weights, $\mathbf{W}^*(\mathbf{V})$, must minimise the squared distance

[12] Abadie *et al.* (2010) show that synthetic control methods generalise 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 treated region.

$$\left(\mathbf{x} - \sum_{i \in I} w_i \mathbf{x}_i^0\right)' \mathbf{V} \left(\mathbf{x} - \sum_{i \in I} w_i \mathbf{x}_i^0\right), \tag{5}$$

subject to $w_i \geq 0$, $\forall i$ and $\sum_i w_i = 1$; then, the optimal $\mathbf{V}^*$ is chosen to minimise 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 $T^0 \leq T$.

3.2. *Implementation*

The Italian case lends itself naturally to estimating the effect of organised crime using a synthetic control approach, for the two main reasons discussed at length in the previous section. First, the presence of criminal organisations 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 organisations 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 cannot be observed).[13]

As to the choice of the variables of interest, and the time window over which to minimise (5) and (6), I follow Abadie and Gardeazabal (2003) strictly. In particular, the outcome of interest will be real GDP *per capita* (at constant 1990 euro-equivalent prices) and the vector $\mathbf{x}$ 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 $\mathbf{x}$ the average GDP *per capita* and population density over the period 1951–60, together with the initial values of human capital, investment rate and sectoral shares of value added; the mean squared error in (5) is also minimised over the period 1951–60. 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 organised crime in the mid-1970s.[14]

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

[13] Abadie *et al.* (2010) discuss the criteria for excluding potential control units from the donor pool.
[14] All data used in this paper are available online.

4. Results

4.1. *Matching and Validation*

The minimisation 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 characterise 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.[15]

Table 1 confirms that the synthetic control matches the treated regions well 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*, after the matching period (in which the distance between the two series is minimised by construction) and before 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.

Table 1

Pre-treatment Characteristics in Apulia and Basilicata and in the Synthetic Control, Average Over the Period 1951–60

			All control regions			
	Apulia and Basilicata	Synthetic control	Average	SD	Minimum	Maximum
GDP *per capita*	2,395	2,403	3,974	1,400	1,843	8,537
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	0.04	0.18
VA services	0.40	0.39	0.41	0.06	0.26	0.51
VA public	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
Population density (p/kmq)	134.78	105.63	145.77	77.13	28.78	317.08

Notes. The Table shows the characteristics of Apulia and Basilicata, the synthetic control and all regions in the control group during the period 1951–60. The synthetic control is a weighted average of the other Italian regions excluding those with a historical presence of mafia-type organisations (Sicily, Campania and Calabria). The weights used to construct the synthetic control are chosen to minimise 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 1951–60; see Section 2 for the details.

[15] In subsection 4.3, I examine the sensitivity of the results to different vectors of weights.

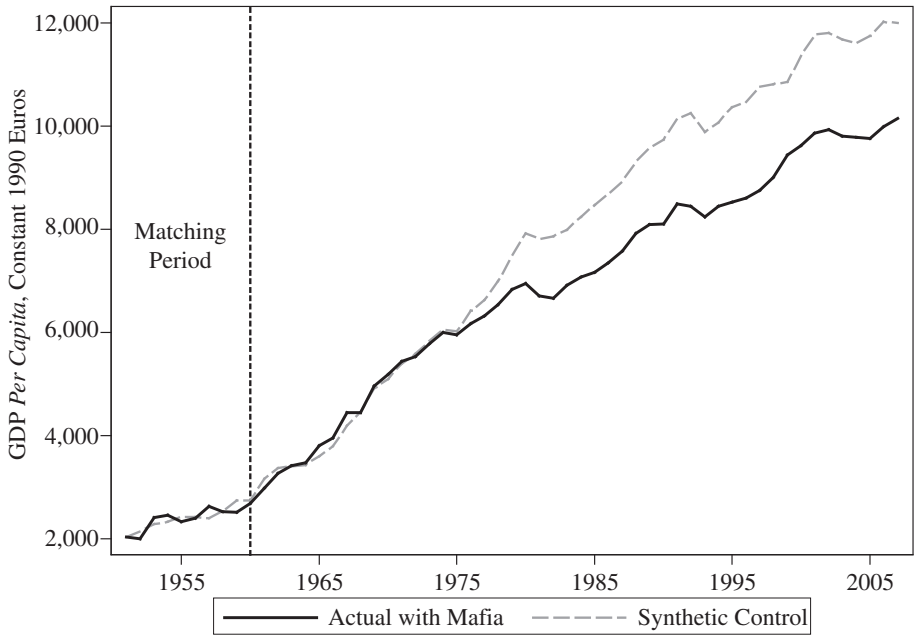

Fig. 6. *GDP Per Capita in the Treated Region and in the Synthetic Control, Years 1951–2007*
Notes. The graph compares the time series of GDP *per capita* in Apulia and Basilicata ('actual with mafia') and in a synthetic control that is a weighted average of the other Italian regions excluding those with a historical presence of mafia-type organisations (Sicily, Campania and Calabria). The weights used to construct the synthetic control are chosen to minimise 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 1951–60; see Section 2 for the details.

4.2. *Baseline Results*

Figure 6 shows that, starting from the second half of the 1970s, levels of output in treated regions increasingly fall behind levels of output of 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* widens from around zero, during the 1950s and 1960s, to 16% during the last years of the sample period.

Table 2 shows the evolution of the gap. The mid-1970s are a clear turning point, as the gap in GDP *per capita* expands rapidly from around 1%, in 1974, to 7% by the end 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 year before the earthquake in Basilicata (1979), the year before the collapse of the Eastern bloc (1989), and the last year of the sample period (2007). The results for 1979 and 1989 preclude that the economic slowdown reflects either the direct effect of the earthquake (in this respect, see also the separate results for Apulia

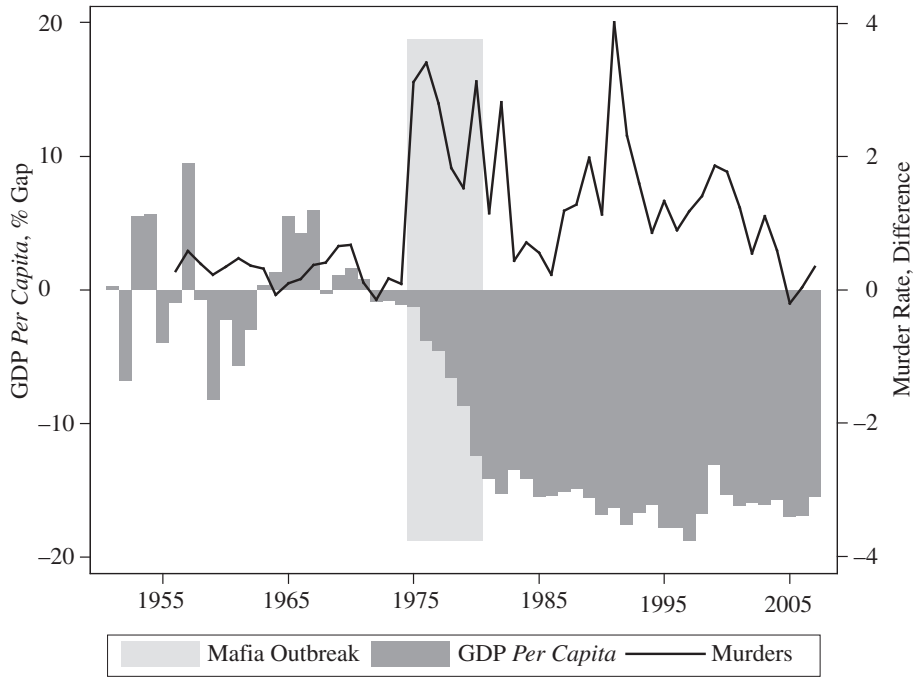

Fig. 7. *GDP Per Capita and Murder Rate in the Treated Region and in the Synthetic Control, Estimated Gap, Years 1951–2007*

Notes. 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 organisations (Sicily, Campania and Calabria). The weights used to construct the synthetic control are chosen to minimise 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 1951–60; see Section 2 for the details.

and Basilicata in Figure 8 and Table 3) or major economic changes related to the end of the Cold War.

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 three additional homicides every 100,000 inhabitants in 1975, remaining extremely high until 1982. According to the judicial and historical evidence discussed in Section 2, this is the period in which criminal organisations 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 four additional homicides per 100,000 inhabitants in 1991, a pattern that is typical of the booms and busts often seen in mafia-ridden regions.

4.3. *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 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 × 100,000 inhabitants		
Years	Treated	Synthetic	Different (%)	Treated	Synthetic	Different
1951–60	2,395	2,403	−0.2	1.8	1.4	0.4
1961–70	3,989	3,938	1.1	1.1	0.7	0.3
1971–75	5,737	5,776	−0.6	1.6	0.9	0.7
1976–80	6,559	7,084	−7.2	4.1	1.6	2.5
1981–90	7,353	8,656	−15.0	2.3	1.2	1.1
1991–2000	8,754	10,493	−16.6	2.3	0.6	1.7
2001–7	9,895	11,802	−16.2	1.2	0.7	0.5
1974	5,990	6,054	−1.1	1.0	0.9	0.1
1979	6,833	7,478	−8.6	3.6	2.1	1.5
1989	8,084	9,573	−15.6	2.6	0.6	2.0
2007	10,141	11,998	−15.5	1.0	0.7	0.3

Notes. 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 organisations (Sicily, Campania and Calabria). The weights used to construct the synthetic control are chosen to minimise 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 1951–60; see Section 3 for the details.

Table 3. In the first two graphs I estimate the effect of organised crime separately for Apulia and Basilicata, obtaining very similar results. This suggests that the drop in GDP *per capita* is likely to be driven by factors common to the two regions, primarily the influx of organised 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 (Abadie 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 are assigned weights equal to 2/3 and 1/3, respectively. Yet, Figure 8(*c*) and (*d*) show that the qualitative results are robust to excluding each of these regions in turn. Moreover, the vector of weights varies across all scenarios in Figure 8 (see Table A2 in the online Appendix) without affecting the results considerably. Finally, in Figure 8(*e*) the crime rates over the initial period, 1951–60, are included among the initial conditions, while in Figure 8(*f*) the distance between the treated region and the synthetic control is minimised over a different time window. However, these changes also have little or no impact on the results. The estimated effect remains in most cases around 16%, increasing to 20% 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 organised 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

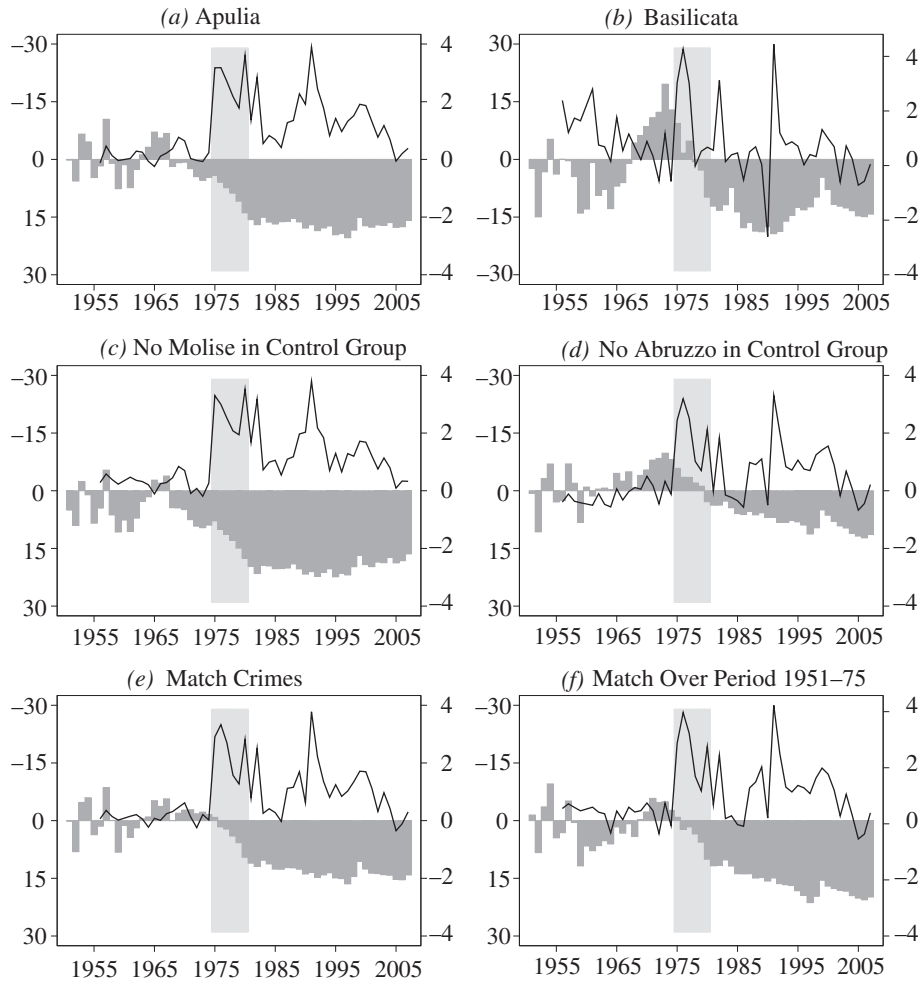

Fig. 8. *GDP Per Capita in the Treated Region and in the Synthetic Control, Estimated Gap, Years 1951–2007 (Robustness)*

Notes. 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 organisations (Sicily, Campania and Calabria). The weights used to construct the synthetic control are chosen to minimise 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 1951–60; see Section 2 for the details.

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 fully address the direction of causality, as the two series

Table 3

Alternative Implementations of the Synthetic Control Method

	Treated	Synthetic	GAP	Treat	Synthetic	GAP	Treated	Synthetic	GAP
	(*a*) Puglia			(*b*) Basilicata			(*c*) No Molise		
GDP *per capita*, 2007	10,147	12,065	−15.89%	10,096	11,772	−14.24%	10,141	12,135	−16.43%
GDP *per capita*, average 1961–71	4,059	4,017	1.03%	3,603	3,668	−1.77%	3,989	4,101	−2.73%
Initial conditions, 1951–65									
GDP *per capita*	2,451	2,456	−0.19%	2,104	2,223	−5.36%	2,395	2,511	−4.63%
Investment/GDP	0.26	0.24	0.02	0.67	0.21	0.47	0.32	0.25	0.07
VA industry	0.21	0.22	−0.01	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	0.40	0.01	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	0.19	−0.01	0.12	0.16	−0.05	0.17	0.19	−0.02
Population density (p/kmq)	171.3	111.0	60.34	63.9	87.3	−23.36	134.8	116.7	18.10
	(*d*) No Abruzzo			(*e*) Match crimes			(*f*) Match over 1951–75		
GDP *per capita*, 2007	10,141	11,445	−11.39%	10,141	11,809	−14.12%	10,141	12,655	−19.86%
GDP *per capita*, average 1961–71	3,989	3,893	2.47%	3,989	3,924	1.66%	3,989	4,108	−2.89%
Initial conditions, 1951–65									
GDP *per capita*	2,395	2,408	−0.56%	2,395	2,406	−0.44%	3,701	3,726	−0.66%
investment/GDP	0.32	0.24	0.08	0.32	0.24	0.08	0.29	0.26	0.02
VA industry	0.22	0.24	−0.02	0.22	0.23	−0.01	0.24	0.26	−0.02
VA agriculture	0.15	0.17	−0.01	0.15	0.16	−0.01	0.14	0.13	0.01
VA services	0.40	0.36	0.04	0.40	0.38	0.02	0.40	0.39	0.01
VA public	0.23	0.24	0.00	0.23	0.23	0.00	0.22	0.22	0.00
Human capital	0.17	0.16	0.00	0.17	0.18	−0.01	0.30	0.33	−0.03
Population density (p/kmq)	134.8	79.5	55.23	134.8	97.3	37.48	139.3	105.8	33.52
Murder rate (× 100k)				1.77	1.64	0.13			
Other mafia-related crimes				9.27	5.39	3.88			

Notes. 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 organisations (Sicily, Campania and Calabria). The weights used to construct the synthetic control are chosen to minimise 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 1951–60; see Section 3 in the paper for the details.

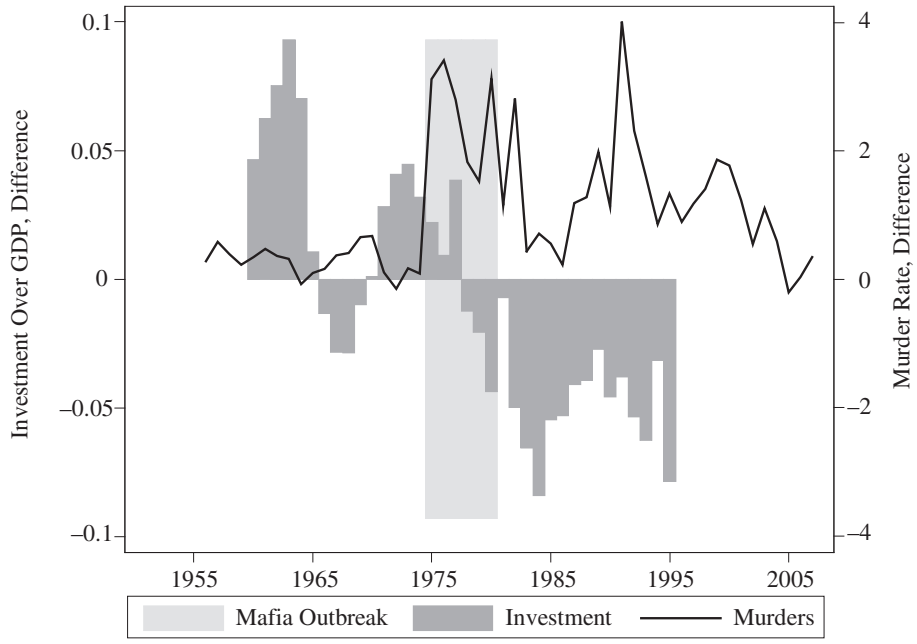

Fig. 9. *Private Investment and Murder Rate in the Treated Region and in the Synthetic Control, Estimated Gap, Years 1956–2007*

Notes. 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 1970–94. The synthetic control is a weighted average of the other Italian regions excluding those with a historical presence of mafia-type organisations (Sicily, Campania and Calabria). The weights used to construct the synthetic control are chosen to minimise 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 1951–60; see Section 2 for the details.

change suddenly (in opposite directions) and at 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 looks at 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 was 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 economic outlook before the initial influx of organised crime.

4.4. *Inference*

Overall, the evidence in Figures 6–9 and Tables 2–3 suggests that the GDP *per capita* of the treated regions decline by as much as 16%, at the same time as homicides increase

sharply relative to a counterfactual scenario without organised 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 organised 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.

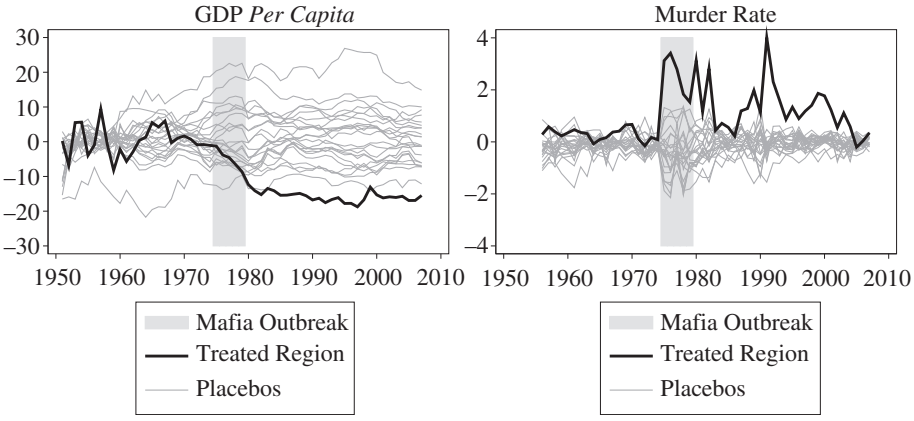

Fig. 10. *Distribution of Synthetic Control Estimates for Each Pair of Adjacent Regions, Years 1951–2007 (Placebo Test)*

Notes. 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 organisations (Sicily, Campania and Calabria). The weights used to construct each synthetic control are chosen to minimise 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 1951–60; see Section 2 for the details.

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 organised crime.

5. Channels

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

5.1. *Official and Unofficial Economy*

One possible interpretation of the divergence between the treated regions and the synthetic control is that the presence of criminal organisations changes the relative importance of the official sector, as measured by GDP *per capita*, *vis-à-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 overestimate 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* consumption 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 suddenly 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).

One explanation for this finding is that organised crime affects disproportionately sectors that use energy more intensively, such as manufacturing. The evidence in Figure 12 provides suggestive evidence in this respect by comparing the shares of value

[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 neighbouring regions over time. Del Boca and Forte (1982) provide an early application of this method to Italy.

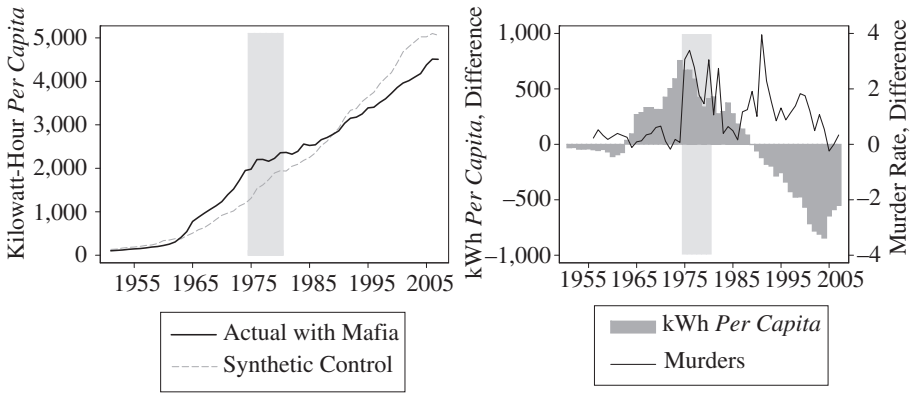

Fig. 11. *Electricity Consumption in the Treated Region and in the Synthetic Control, Years 1951–2007*
Notes. The left graph plots the time series of electricity consumption, as measured by kilowatt-hour *per capita*, in Apulia and Basilicata ('actual with mafia') and in the synthetic control, while 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 organisations (Sicily, Campania and Calabria). The weights used to construct the synthetic control are chosen to minimise 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 1951–60; see Section 2 for the details.

added in agriculture, industry, market and non-market services. The arrival of criminal organisations 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 the reallocation of economic activity from the private to the public sector more thoroughly. 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.

5.2. *Growth Accounting*

In order to understand the channels through which organised crime impacts on GDP *per capita* better, 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 labour (Barro, 1999),

$$\ln y_t = \ln a_t + \alpha \ln l_t + (1 - \alpha) \ln k_t, \tag{7}$$

where α is the labour share, l and k are labour 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,

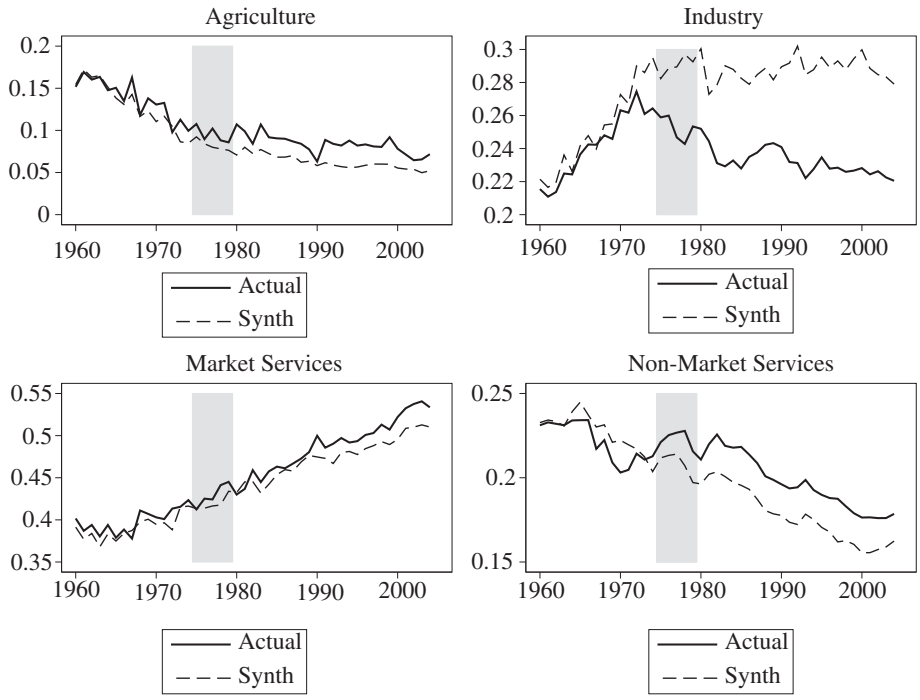

Fig. 12. *Sectoral Shares of Value Added, Years 1960–2004*
Notes. The graphs show the sectoral shares of total value added in agriculture, industry, market and non-market services in Apulia and Basilicata (solid line) and in the synthetic control (dashed line). The weights used to construct the synthetic control are chosen to minimise 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 1951–60; see Section 2 for the details.

$$\Delta(\ln y_t - \ln y_{t-1}) = \Delta(\ln a_t - \ln a_{t-1}) + \alpha\Delta(\ln l_t - \ln l_{t-1}) + (1-\alpha)\Delta(\ln k_t - \ln k_{t-1}), \tag{8}$$

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

For the period 1970–94 the dataset CRENOS reports consistent time series of regional labour workforce and capital stock, reconstructed through the perpetual inventory method. Fixing the labour share, one can back out total factor productivity as a residual. Extensive evidence from national accounts points at labour shares between 2/3 and 3/4 for most countries (Gollin, 2002). The OLS regressions in Table 4 suggest that the lower bound of the 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 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 for example, Bonaglia *et al.* (2000).

Table 4

Estimated Factor Shares in the Production Function of Italian Regions, Years 1970–94

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)
Observation	480	480	480	480
R^2	0.306	0.307	0.297	0.298
Adjusted R^2	0.303	0.303	0.294	0.293
Test $\alpha = 2/3$	0.01	0.00	0.01	0.01
p-value	0.94	0.98	0.91	0.95
Test CRS	1.22	1.35	2.39	2.57
p-value	0.27	0.25	0.12	0.11

Notes. The Table reports the results of production function estimates across Italian regions during the period 1970–94. 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 labour and capital stock, also 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 labour 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.

Based on these estimates, Figure 13 plots the growth of total factor productivity and factor inputs for the treated and control regions over the period 1970–94. 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. Taking into account this substitution between private and public capital, total factor productivity is instead unaffected by the arrival of organised crime. Interesting, this last result mirrors the evidence from cross-country development accounting in Pinotti (2015).

5.3. *Discussion of the Results*

The growth accounting exercise depicts a private capital flight from Apulia and Basilicata after the influx of organised 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 labour 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 organisations. For instance, mafia rackets often force firms to purchase over-priced inputs or hire individuals that are close to the organisation. Such practices increase production costs and are therefore easier to impose on firms that may offload

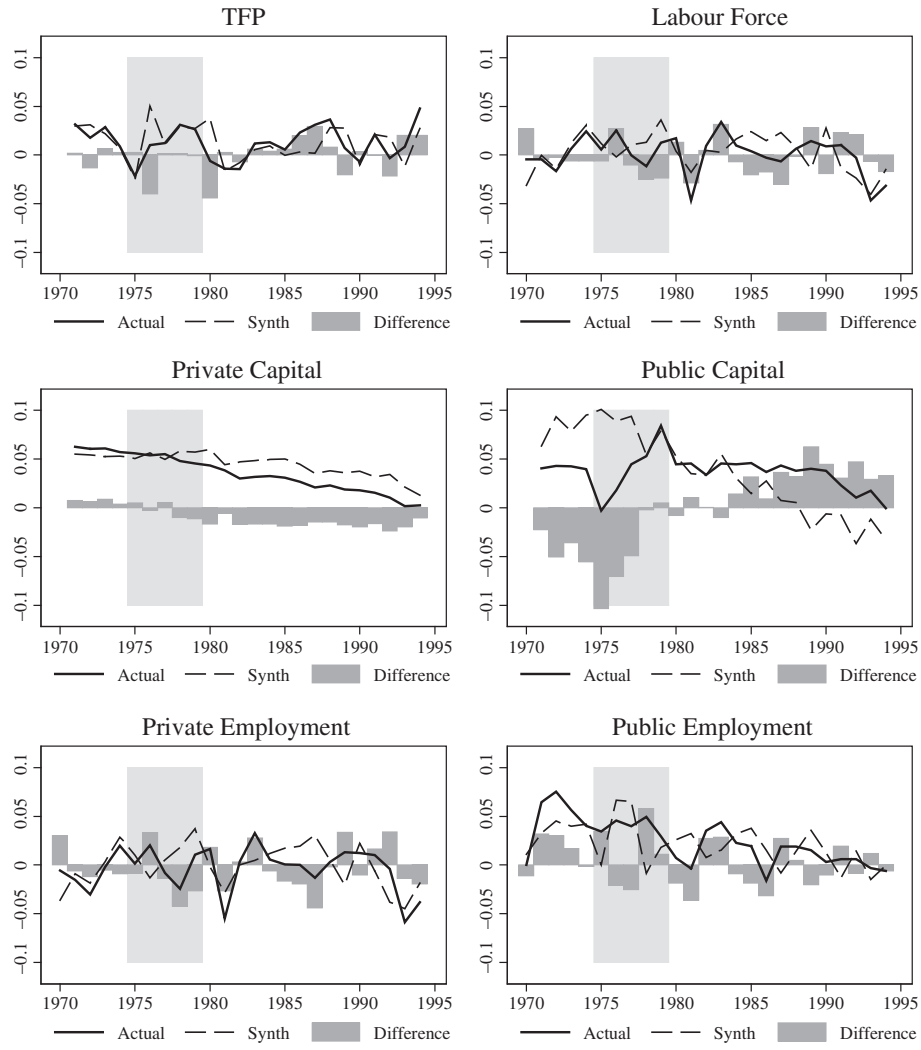

Fig. 13. *Growth of GDP Components in the Treated Region and in the Synthetic Control, Years 1970–94*
Notes. The first four graphs in this Figure decompose GDP growth in terms of growth of total factor productivity, labour force, private and public capital; the last two graphs describe the growth of 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 out as a residual assuming that the factor shares for labour, 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 organisations (Sicily, Campania and Calabria). The weights used to construct the synthetic control are chosen to minimise 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 2 for the details.

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 infiltrate public contracts directly (Reuter, 1987; Caneppele *et al.*, 2009), or influence somehow the allocation of public investment subsides (Barone and Narciso, 2013).

For all these reasons, criminal organisations in Italy may want to direct public investment towards their areas of influence. To this purpose, they do not hesitate to corrupt and/or threaten politicians and public officials (PAC, 1993*a, b*), with adverse effects on the selection of the ruling class. While a thorough analysis of the influence of organised crime on the political sphere goes beyond the scope of the present work, in a companion paper I indeed document a strong deterioration in the quality of politicians appointed in Apulia and Basilicata (relative to the synthetic control) after the advent of organised crime (Pinotti, 2013).

Therefore, a tentative interpretation of the increase in public expenditure is that, amidst greater violence and worse economic prospects, local politicians were 'captured' by criminal organisations. This interpretation would be consistent with recent work by Daniele and Geys (2015) on the selection of Italian local politicians in mafia-ridden municipalities.

6. Conclusion

The present study provides the first available evidence on the economic costs of organised 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 organised crime in two Italian regions recently exposed to this phenomenon. The results suggest that the aggregate loss implied by the presence of organised crime amounts to 16% of GDP *per capita*, and it is due mainly to 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 exploring these mechanisms in greater detail. Another limitation concerns the external validity of the estimates, which is constrained by the specificities of a complex phenomenon such as organised 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 organised crime on social welfare. Utility losses along many other dimensions (human, psychological and social) have no direct counterpart in observable quantities, even though indicators such as life expectancy and housing prices may go a long way in this direction (respectively, Thaler, 1978; Soares, 2006).

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

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Additional Supporting Information may be found in the online version of this article:

Appendix A. Mafia Activity and Other Types of Crime.
Data S1.

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