DISCUSSION PAPER SERIES

DP16732

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PUBLIC ECONOMICS

CEPR

ISSN 0265-8003

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Discussion Paper DP16732
Published 18 November 2021
Submitted 28 October 2021

Centre for Economic Policy Research
33 Great Sutton Street, London EC1V 0DX, UK
Tel: +44 (0)20 7183 8801
www.cepr.org

This Discussion Paper is issued under the auspices of the Centre's research programmes:

- Public Economics

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JEL Classification: K4, O17, R12

Keywords: EU Funds, organized crime, Public Funds Misappropriation, Sicily

Marlene Thomas - marlenethomas@outlook.it
Nova School of Business and Economics, Universidade Nova de Lisboa

João Pereira dos Santos - joao.santos@novasbe.pt
Nova School of Business and Economics, Universidade Nova de Lisboa

José Tavares - jtavares@novasbe.pt
Nova School of Business and Economics, Universidade Nova de Lisboa and CEPR

Acknowledgements
The authors are indebted to Guglielmo Barone and Guido De Blasio for their helpful suggestions and access to data. We thank Alex Armand, Ekaterina Borisova, Sarah Schneider-Strawczynski, Pedro Vicente, and participants at the HSE University seminar on Political Economy, the IAAE 2021 conference and the XXXIII SIEP 2021 conference for their comments. This work was funded by Fundação para a Ciência e Tecnologia (UID/ECO/00124/2013, UID/ECO/00124/2019 and Social Sciences DataLab, LISBOA-01-0145-FEDER-022209), POR Lisboa (LISBOA-01-0145-FEDER-007722, LISBOA-01-0145-FEDER-022209) and PORNorte (LISBOA-01-0145-FEDER-022209) and the research project PTDC/EGE-ECO/31213/2017. All errors are our own.

Does Organized Crime Attract EU Funding? Evidence from the Sicilian Mafia[ϕ]

Marlene Thomas[1]
Nova School of Business and Economics

João Pereira dos Santos[2]
Nova School of Business and Economics

José Tavares[3]
Nova School of Business and Economics and
Centre for Economic Policy Research (CEPR)

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[1] Nova School of Business and Economics, Universidade Nova de Lisboa, Campus de Carcavelos, Rua da Holanda 1, 2775-405 Carcavelos, Portugal. Email: marlenethomas@outlook.it.

[2] Nova School of Business and Economics, Universidade Nova de Lisboa, Campus de Carcavelos, Rua da Holanda 1, 2775-405 Carcavelos, Portugal. Email: joao.santos@novasbe.pt..

[3] Nova School of Business and Economics, Universidade Nova de Lisboa, Campus de Carcavelos, Rua da Holanda 1, 2775-405 Carcavelos, Portugal, and Centre for Economic Policy Research (CEPR), London, U.K. Email: jtavares@novasbe.pt.

1. Introduction

In the wake of the Covid-19 pandemic and EU plans to invest €1.8 trillion to rebuild a post-COVID-19 Europe, the largest stimulus package ever financed through the EU budget, it is important to understand how and whether local institutions condition the impact of place-based policies. This is especially relevant for convergence regions like Sicily, heavily dependent on activities such as tourism, and particularly hurt by restrictions on mobility during the current crisis. Clearly, the allocation of EU funds is subject to fraud and vulnerable to corruption at the local level. According to the European Anti-fraud Office (OLAF), 254 recommendations were issued in 2019 concerning the recovery of nearly 485 million EU funds.

A key characteristic of local context is the presence of criminal organizations. Recent estimates put total yearly revenues of the Italian Mafias at around 10.7 billion euros.[4] While the main source of earnings for Italian criminal organizations are illegal activities such as corruption, drug trafficking, and extorsion, at least since the 1970s organized crime started to re-invest its profits in the legal-economy, infiltrating politics and administration at the local level (Di Cataldo and Mastrorocco, 2020). Since then, an important source of revenues for criminal organizations has been the misappropriation of public funds. In January 2020 alone, authorities have arrested 94 members associated with Mafia clans in Sicily suspect of targeting EU rural development funds worth 5.5 million euros (European Observatory for Crime and Security 2020).[5]

In this paper, we analyze how the presence of criminal organizations in Sicily affects EU disbursements to local projects. We aggregate the amount of EU funds and projects received by each of the 390 Sicilian municipalities during the 2007 – 2019 period, which covers two complete

[4] See Transcrime (2013). Mafias comprise the Camorra, from Campania, 'Ndrangheta, from Calabria, Sacra Corona Unita in Apulia, and the Sicilian Mafia.

[5] Barone and Narciso (2015) show that municipalities with stronger Mafia presence are between 62 and 64 percentage points more likely to receive public subsidies and, on average, have access to larger amounts of funds.

EU funding programs each operating through a seven-year cycle.[6] We focus on subsidies from EU Structural funds, which usually require a national co-funding amount, but we consider only the fraction financed directly by the EU. In these EU based programs, the set-up of the program is exogenous to the region, but local private and public actors, including organized crime, can pursue their interest within the restrictions set by regional, national, and European institutions.

Assessing the relationship between organized crime and EU funding is relevant for at least two reasons. First, Southern-Italian regions receive a larger than average fraction of EU Structural funds, mainly EU regional development funds, as a consequence of their per capita GDP lying below the threshold of 75% of the EU27 average. Sicily received a large proportion of the 170 billion euros awarded to Italy by Cohesion policy programs since 2007, namely more than 36 billion euros including both EU and National resources (*Opencoesione* 2020). Second, Mafia presence is traditionally stronger in Southern regions[7] and, as Mafia developed initially in Sicily[8], we are able to make use of exogenous variation, both along the geographical and historical dimensions, which we can use to examine causal links between Mafia presence and the allocation of EU funds. The high incidence of organized crime and dependence on EU funding in Sicily allows us to examine the causal effect of Mafia presence on the distribution of EU transfers.

To identify the causal relationship between organized crime and EU funding we need to deal with endogeneity concerns due to measurement errors, omitted variable bias, and reverse causality. We first proxy for Mafia presence, at the municipal level, aggregating data on confiscations of real estate properties from organized crime during the period under considerations. We believe real estate to be an appropriate measure of Mafia presence as it reflects a continued relevant economic

[6] We exclude 2020 to avoid possible confounding factors arising due to the Covid-19 shock.
[7] See Transcrime (2013).
[8] Gambetta (1993) shows that the origins of the Mafia date back, at least, to the end of the XIX century.

interest by the Mafia in a specific municipality. Second, we use the identification strategy proposed by Barone and Narciso (2015) and instrument Mafia presence with exogenous shifters of land value, namely rainfall shocks in the 19th century, altitude, and slope, conditional on province dummies and a vector of socio-economic controls. We then rely, for robustness purposes, on an alternative specification where current Mafia presence is instrumented with an historical indicator collected by Damiani in 1885, which captures the geographical roots of Mafia across Sicily. This variable is used in a different setup in Acemoglu, De Feo, and De Luca (2019).[9]

We find Mafia presence to have a positive impact on both the number of EU projects and the amount of EU funds assigned a given municipality. The estimated impact of organized crime on EU funding is present for different types of investments, including infrastructure, goods and services, grants to individuals, and incentives to firms. Additionally, we show that it is the local presence, not Mafia presence in neighboring municipalities, that drives our results. Our results are robust to the exclusion of province capitals or municipalities where city councils were dissolved by the national government for (presumed) Mafia infiltration.[10] This suggests our results are not driven by large cities and still prevail in less extreme cases of (perceived) corruption.

The remainder of the paper is structured as follows. Section 2 discusses the most relevant related literature; Section 3 describes our data sources and some descriptive statistics; Sections 4 presents our empirical framework; Section 5 presents our results and robustness checks; Finally, Section 6 concludes.

[9] Acemoglu, De Feo, and De Luca (2019) document how the expansion of Mafia, after these initial allocations, drew on the rise of the first socialist movement in Italy, the *Fasci*.

[10] For more information on the effects of the law issued to combat political corruption and Mafia infiltration see Acconcia, Corsetti,and Simonelli (2014), Daniele and Geys (2015), and Di Cataldo and Mastrorocco (2020).

2. Organized crime and regional development

Our paper contributes to the literature documenting the impact of place-based policies on local growth. There is convincing evidence regarding the efficacy of place-based policies such as the US Tennessee valley - Kline and Moretti (2014), the Chinese special employment zones - Alder et al. (2016), the German Zonenrandgebiet - Ehrlich and Seidel (2018), and UK industrial policy Criscuolo et al. (2019). As our focus is organized crime and the allocation of EU funds, we relate to existing empirical contributions assessing the effect of European regional policies on economic performance of treated regions, such as Becker, Egger and von Ehrlich (2010, 2012), Santos and Tavares (2016), Barone, David and de Blasio (2016), and Becker, Egger and von Ehrlich (2017). Several studies, including Giua (2016) and Di Cataldo (2017), focus on Objective 1 regions[11] – such as Sicily and the southern regions of Italy, which absorb the largest fraction of EU resources. Our paper adds to this literature showing that the specific context, such as the presence of organized crime, matters for the performance of place-based policies.

Another line of research closely related to our paper investigates the economic effects of organized crime on public transfers. Daniele and Di Poppa (2019) study mafia-infiltrated firms applying for EU funding. They rely on an Italian law requiring companies applying for more than 150.000 euros to undergo screening and find that companies operating in mafia-affected cities and mafia-affected sectors tend to sort just below the cut-off value that avoids investigation. Notably, Barone and Narciso (2015) show that Mafia presence is a key factor in the spatial allocation of public transfers. Endogeneity concerns related to organized crime activity are overcome by instrumenting Mafia in Sicilian municipalities with rainfall in the 19th century and geographical shifters of land productivity. The authors conclude that Mafia presence is positively related to the

[11] Regions whose GDP per capita is below 75% of the European average.

amount of public funds allocated at the local level. Our paper differs from Barone and Narciso (2015) in that we use the number of properties seized from organized crime rather than the number of mafia-related crimes to proxy for Mafia presence. We argue that seized property reflects a more permanent and significant economic presence at the local level than the incidence of crime since crimes can be committed in places other than those where the economic interest of Mafia relies. Additionally, we focus entirely on the effect of Mafia activity on the number of EU projects and associated disbursements. As this type of public projects stem from a supranational organization which has its own, strict, and centrally determined criteria for the allocation of funds, as well as specific supervisory mechanisms they are likely to be more difficultly captured by criminal parties.

Our study further relates to other existing research lines. Several authors have examined the economic consequences of organized crime on public expenditures and public policy. For instance, Pinotti (2015) applied synthetic control methods to provide a counterfactual for the economic performance of Puglia and Basilicata in the absence of organized crime. He argues that the rise of organized crime caused an aggregate economic loss of 16% of GDP per capita. Scognamiglio (2015) documents the effect of a legislative provision allowing for the relocation of mafia members across Italy, finding that relocation to northern regions has a positive and significant effect on employment in the construction sector in the region where the member comes originally from.

Another strand of related literature focuses on how organized crime impacts firms. Le Moglie and Sorrenti (2020) use the shock to the Italian credit market in the 2007 crisis, and assuming that illicit sources of funding remained almost unaffected by the economic turmoil they illustrate that the registration of new enterprises in provinces with more presence of organized crime decreased relatively less during the recession. Mirenda, Mocetti, and Rizzica (2019) document patterns associated with ‘Ndrangheta infiltrations in business enterprises located in northern and central Italian regions, suggesting that Mafia targets firms that are relatively unstable financially, or more

reliant on public sector demand. However, despite the fact the revenues of these infiltrated firms increase, the presence of this criminal organization decreases local economic growth in the long-run. Finally, Slutzky and Zeume (2019) provide evidence that Mafia presence acts as a market entry barrier and lowers competition.

Finally, a related literature has explored the economic impact of policies that fight corruption. Several authors analyze one of the most aggressive anti-corruption policies in Italy, the "city council dismissal", which consists on the removal of all public officials of a city council when a municipality is perceived to be infiltrated by Mafia. Acconcia, Corsetti, and Simonelli (2014) find that these episodes often result in public spending contractions and use these events as instruments to study the effect of spending cuts on provincial level output. Daniele and Geys (2015), using a difference-in-differences approach, argue that this law increased the education of elected politicians. Di Cataldo and Mastrorocco (2020) examine the impact of Mafia on the assignment of public resources. Their estimates provide evidence that infiltrated municipalities do not change the total amount of public spending, while its composition is differently affected: more is spent on construction and waste management, and less in municipal police forces.

3. Data

3.1 EU funding variables

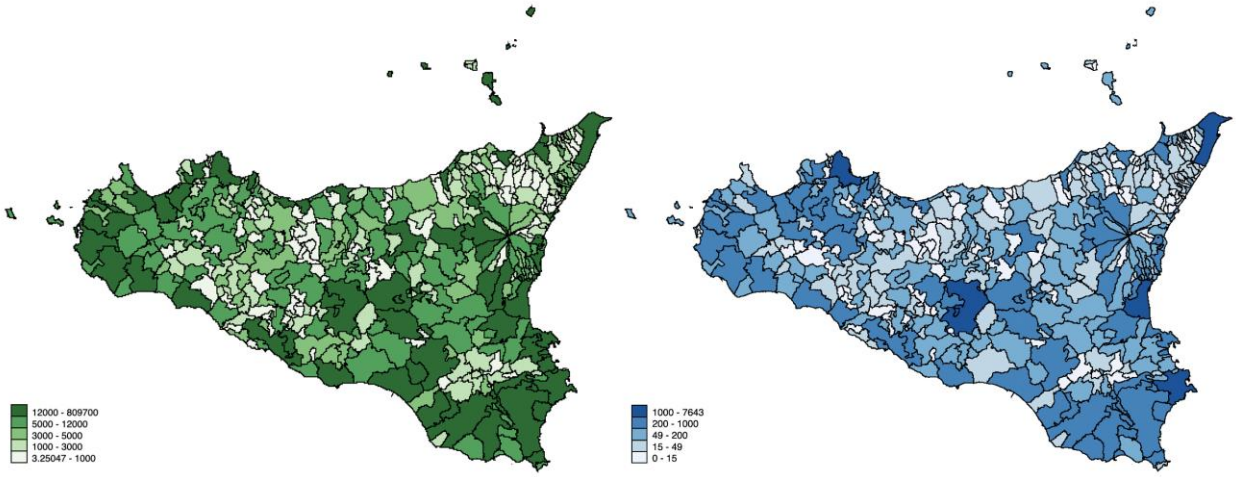
The measures of European funds are based on data made publicly available by *OpenCoesione*, an open government initiative managed by the Department of Cohesion Policy at the Presidency of the Council of Ministers. The portal provides access to all Cohesion Policy projects financed both by EU and national resources.[12] Cohesion policy aims at reducing the regional disparities in

[12] Cohesion policy is financed under the European Structural Funds (EU resources), the National Development and Cohesion Fund and the Cohesion Action Plan (both national resources).

the level of development between regions by strengthening economic and social cohesion, and Southern Italian regions (on average poorer than the rest of Italy) are an area that has been receiving large amounts of EU financing. We focus specifically on the portion of financing originating from EU resources, namely EU Structural and Investment funds for the cycles 2007-2013 and 2014-2020, that comprise the European Regional Development Fund, the European Social Fund and the Cohesion Fund. According to *OpenCoesione*, Italy attracted around 57 billion euros for the first cycle and 46 billion for the second, without including additional national resources. The available information includes: nature of investment (infrastructure, goods and services procurement, incentives to firms or individuals and capital contributions), the theme (which sector receives funding), the localization (which municipality receives funding), the beneficiaries (public or private entities residing in the municipalities), the EU funding, and the national co-financing amount.

We restrict our analysis to the Cohesion projects from 2007 to 2019 awarded to beneficiaries living in Sicilian municipalities, namely around 9.7 billion euros. Furthermore, as one project may

Figure 1 *Funds and Projects.*



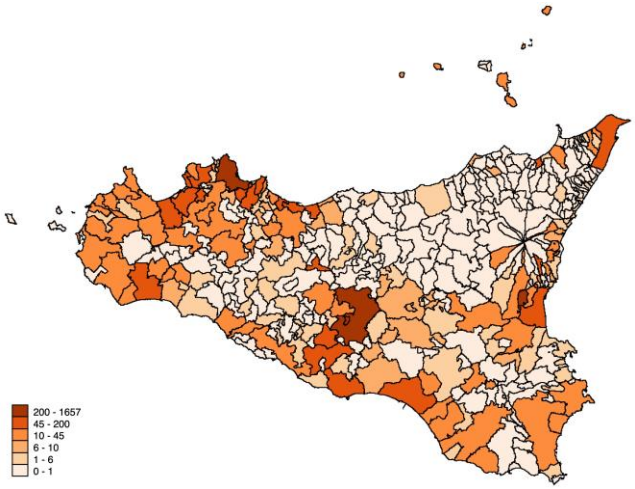
involve multiple municipalities, making it difficult to uncover the share of payment received by

each single municipality, we focus on projects involving exclusively one municipality. We aggregate the data for the whole period. In the upper panel of table 1 we can see the different summary statistics for each measure of EU transfers, namely around 5 billion euros divided across 57000 projects. In figure 1, we observe respectively how EU funds and EU projects are spatially distributed among the 390 Sicilian municipalities.

3.2 Mafia measures

There are many publicly available measures of criminal organization presence at the provincial level, e.g. the number of Mafia related crimes (ISTAT) or the Transcrime Mafia Index (Calderoni 2014), while measuring the presence of organized crime at a more specific level, as at the municipal level, is not easy. Many authors used confidential datasets made available by the Italian Ministry of Interior, that merged information about: mafia-related crimes, seized assets from criminal organizations and dismissed city councils infiltrated by Mafia (Barone and Narciso 2015; De Angelis, De Blasio, and Rizzica, 2017; Daniele and Geys 2015). To the best of our knowledge, the only publicly available measures of Mafia at the municipal level are dismissed-municipalities and seized assets from criminal organizations. We decide to adopt the latter as our proxy for Mafia presence: the confiscation of a property can be an accessory penalty when you are found guilty of Mafia related crimes, thus the confiscation order is strong evidence for the presence of organized crime on the territory up until the confiscation occurs.

Figure 2 *Mafia.*



The data consists of confiscated firms and real estate properties and is provided by the National Italian Agency Responsible for the Administration and Destination of Assets Seized and Confiscated from organized crime (ANBSC). We restrict our analysis to confiscated real estate properties in Sicilian municipalities from 2007 to 2019. We can observe in figure 2 how our measure is spatially distributed on the Italian island. Furthermore, these events are not concentrated at the beginning or in the end of the period, but they are distributed homogenously in time (Appendix, figure 1A). In table 1, we see that there are on average 13.4 seized properties per municipality over the period. The number of confiscated real estate properties in Sicily amount to more than 5000 from 2007 to 2019, relatively to around 16000 seized real estate properties on the whole national territory, since year 2000. This is consistent with the fact that most of the confiscations occurred in southern regions where organized crime is traditionally stronger (Transcrime, 2013).

3.3 Instrumental variables and controls

We extract the data on rainfall in the 19th century from a study by Pauling et al. (2005) that

reconstructs seasonal precipitation in Europe for the period 1500-1900 on the basis of paleoclimate measures.[13] The data is available at $0.5° \times 0.5°$ grid resolution, each Sicilian Municipality is allocated into a cell by minimizing the distance between the municipality and the center of the cell, proceeding as in Barone and Narciso (2015). In total the 390 Sicilian municipalities are assigned to 25 different precipitation cells. In particular, we measure the rainfall shocks in the 19th century as the proportion of the average annual rainfall in 1851-60 on the long-run average annual rainfall over 1800-50. The data on altitude and slope, are extracted from the Italian National Bureau of Statistics (ISTAT).

The measure of the historical roots of Mafia presence, collected in 1885, comes from the Damiani-Jacini parliamentary enquiry, and was retrieved from Acemoglu, De Feo and De Luca (2019). It was part of a nation-wide enquiry conducted from 1880 to 1885 to get to know the conditions on the peasantry under the recently Unified Italian state. Besides the data on agriculture related variables, the inquiry also contains information on the intensity of Mafia on a scale from zero to three (with three being the measure for the highest presence) in the 160 Italian districts existing at that time[14]. According to Buonanno et al. (2015) the intensity of Mafia was collected through a questionnaire submitted to Sicilian lower-court magistrates.

[13] We are grateful to G. Barone for helping with the extraction of the data.
[14] We have less observations for *Mafia 1885*, as we had to merge the data on municipalities existing in 1885 (within the 160 judicial districts) with those existing nowadays.

Table 1 *Summary statistics.*

Variable	Obs.	Mean	S. D.	Min	Max
Panel A: ***Dependent variables***					
EU Funds (000's)	390	11642.835	53471.556	3.250	809500
EU Projects	390	147.731	481.002	2	7643
Panel B: ***Explanatory variable***					
Mafia	390	13.364	87.271	0	1657
Panel C: ***Control variables***					
Population Density	390	0.332	0.626	0.003	5.215
Employment rate	390	0.301	0.035	0.223	0.399
Human Capital	390	0.328	0.067	0.177	0.609
Panel D: ***Instrumental variables***					
Rainfall	390	0.982	0.014	0.959	1.026
Slope	390	0.221	0.14	0.018	0.799
Altitude	390	0.419	0.27	0.018	1.37
Mafia 1885	325	0.567	1.011	0	3

Finally, we use additional variables referring to local population density, local employment rate and local educational attainment(i.e. number of high school and college graduates/on total population, excluding children 6 years old or younger). These control variables are extracted from the 2011 Italian Census carried out by ISTAT. The summary statistics for controls and instruments are reported in the lower panel of table 1.

4. Identification Strategy

We aim at estimating the effect of Mafia presence on the allocation of EU transfers in Sicilian municipalities. First, we try to estimate the effect by OLS, then we carry out an instrumental variable analysis to correct for the possible endogeneity of Mafia. Our analysis exploits cross-sectional/municipality variation.

We rely on two measures of EU funds as our dependent variables, respectively the total amount of funds in euros $EUfunds_i$ and the total number of projects $EUprojects_i$, allocated to a Sicilian

municipality from 2007 to 2019. Our explanatory variable is a proxy for *Mafia* activity at the municipal level, namely the number of seized real estate properties from organized crime by the Italian government. We consider the natural logarithmic form of both the dependent and the explanatory variables.

Our two main specifications are respectively:

$$\ln(EUfunds)_{ip} = \beta_p + \beta_2 \ln(Mafia)_{ip} + X'_{ip}\beta_3 + u_{ip} \quad (1)$$

$$\ln(EUprojects)_{ip} = \gamma_p + \gamma_2 \ln(Mafia)_{ip} + X'_{ip}\gamma_3 + v_{ip} \quad (2)$$

where X is a vector that comprises educational attainment, employment and population density to account for heterogeneity across municipalities. Furthermore, as the Sicilian island is subdivided in nine provinces, we include province fixed effects. The standard errors are clustered at the rainfall-cell level, since as previously mentioned, the Sicilian municipalities are located within 25 cells to measure precipitation shocks.

An advantage of focusing on one southern Italian region rather than on the whole South, is that the sample is restricted to an homogenous area in terms of unobservable effects such as culture and social capital, in a country where this elements are considered very diversified (Di Cataldo and Mastrorocco 2020).

The relation between the dependent variables and organized crime could be endogenous for three reasons. First, receiving more EU transfers (or being assigned a higher number of EU projects) could have a positive impact on the expansion of Mafia: in this case the identification would suffer from reverse causality. Second, the measure of organized crime, namely real estate properties confiscated by the government could suffer from measurement error. For instance, in municipalities where Mafia activity is stronger, part of the evidence that could have resulted in a confiscation order could have been covered up or not reported (Pinotti, 2014). Third, endogeneity

could also origin from omitted variable bias, this is the case if determinants of EU transfer allocation are unobserved and correlated to Mafia activity, thus causing Mafia to be correlated with the error term of the regression.

On these grounds, we adopt two different instrumental variable (IV) approaches and resort both to the instruments used by Barone and Narciso (2015) and to the Damiani measure of the historical roots Mafia in 1885. To find instruments that respect the exogeneity and relevance restrictions, Barone and Narciso (2015) go back to the origins of Sicilian Mafia. In their study, they point out that Mafia is known to be born in the second half of the 19th century, in the passage from the Borbone dynasty to unified Italy (1861). Mafia emerged as an industry for private protection (Gambetta 1993; Bandiera 2003). At the same time, in that historic context there was a great demand for private protection mainly for three reasons. The first was that the end of Feudalism had opened the market of land, and as there wasn't still legislation protecting the property of newly acquired lands, private protection was needed. Second, the Italian state was still not born (until 1861) and the vacuum of power allowed Mafia to emerge without meeting any opposition. Furthermore, the South of Italy inherited a persistent distrust in public protection from the Spanish domination. Given this historical framework, they conclude that value of land seems one of the most important causes of demand for protection. In other words, the more the land was productive in agricultural terms, the more is was valuable and needed protection. Thus, variables affecting the productivity of land would respect the relevance condition and be correlated with Mafia activity. For these reasons, they propose as instruments for current Mafia activity geographical shifters of land productivity, such as: rainfall shocks in the ten years preceding the Italian unification, altitude, and slope.

Regarding the exogeneity of the instruments, they claim that these geographical shifters are unlikely to be correlated to current economic conditions because modern agriculture is much less

dependent on these factors, and nowadays it plays a smaller role in the economy. Nevertheless, the exclusion restriction would not hold if the instrumental variables, conditional on our controls, affected European funding through other channels than organized crime activity, that we are not controlling for. We show that these identification threats are not likely to be overly important in this context showing that results are very similar using an alternative instrument.

Major expansions of Mafia did not take place before the 1890s (Acemoglu, De Feo, and De Luca 2019), when the rise of the first socialist movement in Italy (the Fasci), articulating demands for better pay and land redistribution, led to a strong reaction of landowners turning their demands for security to Mafia. Therefore, we use a previous measure of mafia, not polluted by these expansions due to socioeconomic reasons, as an instrument for the current presence of mafia.

We proceed in our analysis using the same set of instruments for our measure of Mafia presence, thus our model will exploit cross-sectional variation as the instruments we use are time invariant.

After having selected valid instruments, we can recur to 2SLS estimation to overcome the above-mentioned endogeneity concerns. In particular, we will be able to estimate the impact of Mafia on the assignment of EU funds and projects in two stages. In the first stage (3a and 3b) we isolate the exogenous variation of Mafia regressing the endogenous variable on the IVs, while in the second stage (4. and 5.) we exploit the obtained exogenous variation to estimate the effect of organized crime on the dependent variables (EU funds and projects).

$$\ln(Mafia)_{ip} = \delta_p + \delta_2 Rainfall_{ip} + \delta_3 Slope_{ip} + \delta_4 Altitude_{ip} + X'_{ip}\delta_5 + s_{ip} \quad (3a)$$

$$\ln(Mafia)_{ip} = \theta_p + \theta_2 Mafia1885_{ip} + X'_{ip}\theta_3 + s_{ip} \quad (3b)$$

$$\ln(EUfunds)_{ip} = \beta_p + \beta_2 \ln(\widehat{Mafia})_{ip} + X'_{ip}\beta_3 + u_{ip} \quad (4)$$

$$\ln(EUprojects)_{ip} = \gamma_p + \gamma_2 \ln(\widehat{Mafia})_{ip} + X'_{ip}\gamma_3 + v_{ip} \quad (5)$$

Possible concerns with our identification strategy could be that outliers might be driving our results. To control for this issue, we include in the our main tables below the specifications excluding the most populated municipalities (Province capitals), and the cities that experienced an aggressive anti-corruption policy (city council dismissal because of mafia infiltrations), in order to isolate the effect of Mafia on EU funds allocation.

5. Results

5.1 OLS Estimation

In table 2 we present the OLS estimates, respectively equations (1) and (2) mentioned above, for the impact of organized crime on the allocation of EU Projects (columns 1 to 4) and on the allocation of EU funds (columns 5 to 8), assigned to beneficiaries resident in a Sicilian municipality during the period.

Columns 1-2 show a positive and significant impact of organized crime on the issuance of Cohesion Projects financed by European resources, in particular the specification in column 2 including both controls and province fixed effects, shows that a 1% increase in Mafia, increases on average the number of EU Projects allocated to a municipality by 0.407%, holding other factors fixed. The results are consistent when excluding the nine province capitals of Sicily (column 3), showing that the effect of Mafia is not driven by the most populated cities (according to ISTAT the population of the province-capitals is equal to more than ¼ of the total Sicilian population).

Our results are also consistent when excluding the towns that experienced the dismissal of the city council due to organized crime infiltrations, suggesting that presence of Mafia is spread on the territory and its impact on EU resources is not driven by the most extreme cases of connections to organized crime.

The effect of criminal organizations in diverting EU resources is positive and significant also when looking at the impact on the total amount of EU funds received by a city during the period (columns 5-8). For instance, a 1% increase in Mafia, increases on average the amount of EU Funds allocated to a municipality by 0.365% (column 6), holding other factors fixed. The results are again consistent when excluding Province capitals (column 7) and when excluding the municipalities that had their city council removed because of connections to organized crime (column 8).

Table 2 *OLS – Mafia and European funding.*

	EU Projects				**EU Funds**			
	Total sample		No Province Capitals	No Dismissed Councils	Total sample		No Province Capitals	No Dismissed Councils
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Mafia	0.485***	0.407***	0.347***	0.420***	0.432***	0.365***	0.282***	0.393***
	(0.054)	(0.052)	(0.056)	(0.053)	(0.08)	(0.083)	(0.089)	(0.082)
Controls	no	yes	yes	yes	no	yes	yes	yes
Province dummies	yes	yes	yes	yes	yes	yes	yes	yes
Obs.	390	390	381	356	390	390	381	356
R^2	0.354	0.419	0.349	0.430	0.254	0.306	0.238	0.311

The dependent variable and the explanatory variable are measured in logarithms for all specifications. The control matrix includes population density, employment and human capital. The total sample comprises all the 390 Sicilian municipalities. The subsample in columns (3) and (7)excludes the capital-municipalities for each of the nine provinces, while the subsample in columns(4) and (8) excludes all the municipalities that experienced city council dismissal due to Mafia infiltrations. Standard errors are clustered at Rainfall cell level. *Significant at 10% **Significant at 5% ***Significant at 1%

5.2 Instrumental variable analysis

As mentioned in the *Identification Strategy* section, the OLS results could be invalid on the grounds of measurement error, omitted variable bias or reverse causality, since the zero conditional mean assumption $E(u|Mafia) = 0$ would not be holding. To overcome this issue we proceed with instrumental variable analysis by 2SLS estimation.

In table 3 we present the estimates of the First stage, that refers to equations 3a and 3b. According to Barone and Narciso (2015), we would expect Rainfall shocks in 1851-60 to have a positive effect on value of land (thus on Mafia), while Altitude and Slope are expected to have a negative impact. Indeed, we can observe that Rainfall has a positive and statistically significant effect on

Mafia (column 2), while Altitude has a negative statistically significant impact (columns 1-2). Slope is not significant across the different specifications, but it is included to be coherent with Barone and Narciso's (2015) identification strategy. The excluded instruments are jointly statistically significant, in fact the F-test of the exclusion restriction is always greater than 10. These results are consistent in our additional specifications excluding province capital cities and mafia infiltrated city councils during our sample period (columns 5 and 7).

Table 3 First Stage

	Mafia							
	Total sample				No Province Capitals		No Dismissed Councils	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Altitude	-1.602***	-0.943***	-0.963***		-1.136***		-0.949***	
	(0.232)	(0.312)	(0.287)		(0.272)		(0.324)	
Slope	-1.005	-1.305	-1.125		-0.793		-0.951	
	(0.799)	(0.833)	(0.704)		(0.802)		(0.810)	
Rainfall	19.638	20.674*			20.518*		20.040	
	(14.481)	(12.163)			(11.584)		(12.774)	
Rainfall 1751-60			3.512					
			(8.073)					
Mafia1885				0.360***		0.325***		0.360***
				(0.108)		(0.095)		(0.103)
Controls	no	yes	yes	yes	yes	yes	yes	yes
Obs.	390	390	390	328	381	319	356	300
F-stat	21.74	20.21	20.10	11.02	17.01	11.62	12.30	12.21

The endogenous variable -*Mafia*- is measured in logarithms. The control matrix includes population density, employment and human capital. The total sample comprises all the 390 Sicilian municipalities. The subsample in column (5) and (6) excludes the capital-municipalities for each of the nine provinces, while the subsample in columns (7) and (8) excludes all the municipalities that experienced city council dismissal due to Mafia infiltrations. Standard errors are clustered at Rainfall cell level. *Significant at 10% **Significant at 5% ***Significant at 1%

In column 3, we offer an informal test for the hypothesis that rainfall shocks in the ten years preceding the Italian unification are expected to be a good predictor of Mafia activity, by showing that, on the other hand, rainfall shocks in the 18th century, i.e., about one century before the Italian Unification, are not a good instrument for Mafia presence. For instance, we estimate the first stage using rainfall shocks in 1751- 60 instead of rainfall shocks in 1851-60, and show that the estimated coefficient of rainfall in 1751-60 is indeed not statically significant.

Additionally, we show that Mafia in 1885 is also a good predictor for our contemporary measure

of Mafia, for instance it has a positive and statistically significant impact on contemporary Mafia (column 4), with a reported F-stat above 10 (Stock and Yogo 2005). These results seem to hold in both additional specifications excluding province capital cities (column 6) and mafia infiltrated city councils (column 8).

Having explored the link between the endogenous variable *Mafia* and the instruments, we now address the results of the second stages in table 4a and 4b; these are the estimates of equations (4) and (5) using the two mentioned IV strategies.

Table 4a *Second stage - EU projects.*

EU Projects								
IVs	Geographical shifters				Mafia 1885			
	Total Sample		No Province Capitals	No Dismissed Councils	Total sample		No Province Capitals	No Dismissed Councils
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Mafia	0.776*** (0.152)	0.731*** (0.211)	0.610*** (0.201)	0.738*** (0.241)	0.549*** (0.099)	0.556*** (0.105)	0.561*** (0.117)	0.615*** (0.096)
Controls	no	yes	yes	yes	no	yes	yes	yes
Province dummies	yes	yes	yes	yes	yes	yes	yes	yes
Obs.	390	390	381	356	328	328	319	300
R^2	0.274	0.330	0.286	0.344	0.383	0.432	0.331	0.429

The dependent variable and the explanatory variable are measured in logarithms for all specifications. The control matrix includes population density, employment and human capital. The total sample comprises all the 390 Sicilian municipalities. The subsample in columns (3) and (7) excludes the capital-municipalities for each of the nine provinces, while the subsample in columns(4) and (8) excludes all the municipalities that experienced city council dismissal due to Mafia infiltrations. Standard errors are clustered at Rainfall cell level. *Significant at 10% **Significant at 5% ***Significant at 1%

In table 4a, we look at the impact of Mafia on one of our measures of EU funding, namely the number of projects; in general the estimated coefficients indicate an upward revision of the OLS estimates. On the left panel (columns 1-4) of table 4a we find the 2SLS estimates employing the IVs proposed by Barone and Narciso (2015), while on the right panel (columns 5-8) we can see the estimates applying Mafia1885 as an IV. The estimated coefficient of the impact of Mafia on the number of projects for both identification strategies is positive and significant when including controls (columns 2 and 6), when excluding the nine most populated cities (columns 3 and 7), and

when excluding the extreme cases of Mafia infiltrated city councils (columns 4 and 8), suggesting once again that our results are neither driven by the most populated cities and neither by the most corrupted municipalities included in our data set. In particular, in column 2, there is an upward revision of 0.32 percentage points of the impact on organized crime on the number of projects per municipality, while looking at the Mafia1885-estimates the upward revision is around 0.15 percentage points.

Similarly, table 4b presents the estimates for the specification measuring the impact of Mafia on EU funds. Again, both the geographical-shifters estimates and the historical routes IV estimates confirm the positive effect of the presence of Mafia on the allocation of EU funding. In particular, in column 2 the 2SLS estimates present an upward revision of the OLS estimate of 0.20 p.p., while looking at the 2SLS estimates employing Mafia1885 as IV the second stage estimates show an upward revision of 0.14 p.p. (column 6); the results are consistent across the different samples (column 3,4 and 7,8).

Table 4b *Second stage - EU funds.*

	EU Funds							
IVs	Geographical shifters				Mafia 1885			
	Total Sample		No Province Capitals	No Dismissed Councils	Total sample		No Province Capitals	No Dismissed Councils
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Mafia	0.643*** (0.187)	0.573** (0.235)	0.474** (0.217)	0.575** (0.246)	0.487*** (0.143)	0.504** (0.147)	0.501** (0.217)	0.612*** (0.128)
Controls	no	yes	yes	yes	no	yes	yes	yes
Province dummies	yes	yes	yes	yes	yes	yes	yes	yes
Obs.	390	390	381	356	328	328	319	300
R^2	0.220	0.276	0.211	0.289	0.268	0.305	0.205	0.293

The dependent variable and the explanatory variable are measured in logarithms for all specifications. The control matrix includes population density, employment and human capital. The total sample comprises all the 390 Sicilian municipalities. The subsample in columns (3) and (7) excludes the capital-municipalities for each of the nine provinces, while the subsample in columns(4) and (8) excludes all the municipalities that experienced city council dismissal due to Mafia infiltrations. Standard errors are clustered at Rainfall cell level. *Significant at 10% **Significant at 5% ***Significant at 1%

As pointed out by Barone and Narciso (2015), the main source of downward bias in the OLS estimates could be measurement error (i.e. underreporting of proofs against mafia in municipalities where mafia presence is stronger could lead to less real estate confiscations) or the presence of an omitted variable that is positively correlated with organized crime activity and negatively correlated to the dependent variables.

5.3 Spatial Correlation

In the next section, we want to take into account the possibility that Mafia is spatially correlated across municipalities, if that were the case we would expect property confiscations spillovers across municipalities and ignoring these would result in omitted variable bias (Barone and Narciso 2015).

We replicate our baseline results adding as a control the natural logarithm of $Neighbor\text{-}Mafia_{i,}$ that measures the number of seized real estate properties in confining municipalities. Table 5 shows that *Mafia* is still positive and statistically significant consistently with our baseline results, while the measure of spatial correlation $Neighbor\text{-}Mafia_{i,}$ is not statistically significant in both specifications regarding EU projects (columns 1-2) and EU funds (columns 3-4), ruling out the mafia spillovers across municipalities.

In other words, we are capturing the impact of local organized crime and not the impact of neighboring organized crime on EU disbursement; These results suggest that there is no effect on EU resources from Mafia coordinating across municipalities, thus the choice of including in our analysis projects allocated exclusively to one municipality seems reasonable. On the other hand, it could be that projects allocated to multiple municipalities are indeed impacted by mafia coordinating across municipalities. Unfortunately the data provided by OpenCoesione doesn't allow to determine to exact share of funding going to each involved municipality.

Nonetheless it would be interesting for further research to look at the impact of Mafia and, in particular, of *Neighboring-Mafia*$_i$ on EU subsidies directed to multiple municipalities. In fact, from 2007 to 2019 almost half of the total amount allocated to Sicily was directed to shared projects across cities and provinces; as these projects benefit a large number of cities they usually involve a larger amount of money, which could attract the interest of criminal organizations. For example, the implementing bodies that receive most funding in Sicily are the Italian railway company (RFI) and the Italian road company (ANAS), that work mainly on shared projects (e.g. highways connecting different cities).

Table 5 *Neighboring Mafia – Measuring spatial correlation*

IVs	EU Projects		EU Funds	
	G. shifters	Mafia1885	G. shifters	Mafia 1885
	(1)	(2)	(3)	(4)
Mafia	0.725***	0.552***	0.579**	0.518***
	(0.231)	(0.118)	(0.245)	(0.173)
Neighbor-Mafia	-0.023	0.044	-0.046	-0.014
	(0.05)	(0.051)	(0.052)	(0.083)
Controls	yes	yes	yes	yes
Province dummies	yes	yes	yes	yes
R^2	0.344	0.430	0.28	0.300
First stage F	26.22	9.980	26.22	9.980
Obs.	385	324	385	324

The dependent variable and both the explanatory variables measured in logarithms. Only Mafia is instrumented. The control matrix includes population density, employment and human capital. We excluded five municipalities that are islands. Standard errors are clustered at Rainfall cell level. *Significant at 10% **Significant at 5% ***Significant at 1%

5.4 Impact on different types of investment

Until now we proved that Mafia has a positive and significant effect on the assignment of EU funding in Sicily. However, the impact of organized crime on EU subsidies may differ according to the economic sectors they are allocated to. The investments of Mafia in the legal economy usually affect sectors that require low technological development, have very little regulation, include small-medium enterprises and have a great availability of public resources (Transcrime

2013). Furthermore, looking at the Firms seized from organized crime in Sicily during 2007-2019 (figure 3A Appendix) the most affected sectors seem to be construction and wholesale and retail commerce.

To assess whether organized crime has a different impact on EU subsidies depending on the type of investment the project is assigned to, we repeat our analysis dividing the projects by nature of investment as provided by *OpenCoesione*. The projects are classified in 1) *Procurement of goods and services, 2) Infrastructure 3) Incentives for Firms 4) Grants to individuals 5) Capital contributions.* Most projects assigned to Sicilian municipalities are allocated to the first two typologies of investments. We leave the last type of investment out as there are not enough observations included when looking at Cohesion projects assigned exclusively to one municipality.

Table 6a and 6b present the OLS and 2SLS estimation results for the impact of Mafia on the allocation of EU projects and EU funds by types of investments; we obtain the estimates applying the same specifications discussed in our baseline results, however we substitute the dependent variable with *EU projects* and funds *EU funds* for each investment type.

In order to compare the effect of *Mafia* across different investments we standardize the coefficients, obtaining the effect of Mafia on EU funding in standard deviation units. Consistently with our previous results the effect of Mafia on the allocation of EU funds is positive and significant across most types of investments, suggesting that organized crime in Sicily is interested in attracting EU resources across different sectors. The effect of Mafia seems to be strong on *Infrastructure* related projects, but also on *Goods and Services Procurement* and *Incentives to Firms.* These results appear to be against the common knowledge that organized crime attracts mainly big infrastructure projects, but it is important to underline that we are excluding from our analysis most of these projects as they usually belong to the resources directed to multiple municipalities. To visually compare the magnitude of the effect of Mafia across projects we

include in the appendix the graph of the standardized coefficients with both sets of instruments (figures 4a and 4b).

Table 6a *Standardized impact on Investment Types – EU projects*

	EU Projects							
	Geographical Shifters				Mafia1885			
	Infrastructure	Goods and services	Grants to individuals	Incentives to firms	Infrastructure	Goods and services	Grants to individuals	Incentives to firms
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Mafia - OLS	0.433***	0.343***	0.380***	0.325***	0.433***	0.343***	0.380***	0.325***
	(0.073)	(0.036)	(0.066)	(0.043)	(0.073)	(0.036)	(0.066)	(0.043)
R^2 - OLS	0.297	0.431	0.362	0.381	0.297	0.431	0.362	0.381
Mafia - 2SLS	0.614**	0.638***	0.460***	0.714***	0.544**	0.484***	0.410**	0.380***
	(0.255)	(0.186)	(0.171)	(0.215)	(0.113)	(0.087)	(0.178)	(0.126)
R^2 - 2SLS	0.279	0.336	0.355	0.209	0.307	0.465	0.385	0.432
Obs. 2SLS	388	353	288	349	327	296	243	292

The dependent variable and the explanatory variable are measured in logarithms. The control matrix includes population density, employment and human capital. The first stage F-stat is above 10 for all specifications. Standard errors are clustered at Rainfall cell level. *Significant at 10% **Significant at 5% ***Significant at 1%

Table 6b *Standardized impact on Investment Types – EU funds*

	EU Funds							
	Geographical Shifters				Mafia1885			
	Infrastructure	Goods and services	Grants to individuals	Incentives to firms	Infrastructure	Goods and services	Grants to individuals	Incentives to firms
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Mafia - OLS	0.282***	0.160***	0.132***	0.128***	0.282***	0.160***	0.132***	0.128***
	(0.065)	(0.021)	(0.030)	(0.027)	(0.065)	(0.021)	(0.030)	(0.027)
R^2 - OLS	0.217	0.370	0.304	0.256	0.217	0.370	0.304	0.256
Mafia - 2SLS	0.379*	0.276**	0.259***	0.288***	0.353***	0.266**	0.167***	-0.064
	(0.194)	(0.107)	(0.063)	(0.093)	(0.123)	(0.050)	(0.060)	(0.156)
R^2 - 2SLS	0.204	0.328	0.196	0.163	0.220	0.372	0.319	0.127
Obs. 2SLS	388	353	288	349	327	296	243	292

The dependent variable and the explanatory variable are measured in logarithms. The control matrix includes population density, employment and human capital. The first stage F-stat is above 10 for all specifications. Standard errors are clustered at Rainfall cell level. *Significant at 10% **Significant at 5% ***Significant at 1%

5.5 Additional Robustness Checks

In this section we present a series of additional robustness checks to provide additional evidence for our main findings. We start from our baseline estimates in table 4a and 4b (columns 2 in both

tables) and implement the econometric specifications with alternative subsets of instruments and then with other measures of organized crime.

Columns 3 and 6 of table 5A (Appendix) show that our previous geographical-shifters estimates are consistent when including only a subset of instruments, namely altitude and slope. Furthermore, we construct a specification with an alternative measure of Mafia, namely firms seized from organized crime, the results are presented in Columns 1, 2 and 4, 5. Both robustness tests presented provide additional evidence in favor of a downward bias of the OLS estimates (table 2, columns 2 and 6).

Additionally, we decide to run our baseline specification employing as measure of Mafia only the confiscations that occurred in the second half of the period (2014-2020); we want to ensure that our analysis holds even if we consider that Mafia was not active in a municipality after the confiscation occurred, thus looking only at the confiscations in the second period ensures that Mafia was very present in the first period of analysis (2007-2013); table 6a in the Appendix shows that our results are still consistent, and the impact of Mafia remains positive on the allocation of EU funding, even if considering only the confiscations that occurred in the second half of the period.

Another main concern of our analysis is that it focuses on one Italian region, making it difficult to infer external validity of the results in other Italian or European regions. On the other hand, the Italian mafia can be seen as the "prototype" for other criminal organization around the world, such as drug cartels in South America and the Yakuza in Japan (Pinotti 2015), thus we could assume that the results presented in this study can contribute to understand the effect of organized crime presence also in a broader context.

6. Concluding remarks

An emerging literature suggests that organized crime and corruption distort the well functioning of democratic systems as they have the potential to influence key determinants of economic activity (Di Cataldo and Mastrorocco 2020).

In this paper we focus on one way of affecting the economy, namely through the misappropriation of public funding, and in particular EU funding. In September 2020, the executive director of *Europol* warned the EU that Mafia "might have set their eyes" on the Recovery Funds, urging all member states to monitor carefully where the funding goes. Thus, in this moment in time, it is key to provide evidence on the impact of organized crime on the assignment of EU funding.

According to our estimates, municipalities with a stronger Mafia presence receive a higher amount of EU funds and of EU projects. The results hold, when excluding from the analysis the province capitals and the municipalities that had their city council dismissed because of connections to organized crime. This suggests that most populated cities, and cities experiencing a severe anti-corruption policy are not driving the results.

Additionally, our results are consistent when looking at the impact of organized crime on different types of investment of EU transfers. Furthermore, our results suggest that Mafia in neighboring municipalities has no role in the diversion of EU subsidies assigned to one municipality.

In conclusion our paper provides an assessment of Mafia as key factor in the spatial allocation of EU transfers, and suggests to take into account its presence in a given territory when designing funding policies. The majority of EU funding aims at strengthening economic and social cohesion, helping mostly European regions, such as Sicily, with a GDP per capita below the 75% of the EU average. As long as the poorest areas are also those with a higher presence of organized crime,

EU funding policies should take into consideration the possibility that part of the funding may be attracted by criminal organization. A possible policy implication could be to accompany funding with stronger anti-corruption policies, not only at the national but also at the European level.

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Appendix

Table 1a *Summary Statistics - Units of measurement*

Variable	*Description and unit of measurement*	*Obs.*	*Mean*	*S. D.*	*Min*	*Max*
EU Funds	(000's) Euros	390	11642.835	53471.556	3.250	809500
EU Projects	# of Projects	390	147.731	481.002	2	7643
Mafia	# of Confiscated Real Estates	390	13.364	87.271	0	1657
Alternative measure of Mafia	# of Confiscated Firms	390	1.026	6.737	0	127
Population Density	(000's) persons/km^2 in 2011	390	0.332	0.626	0.003	5.215
Employment rate	# of employed/population in 2011	390	0.301	0.035	0.223	0.399
Human Capital	# of high school and college graduates / total population > 6 years old in 2011	390	0.328	0.067	0.177	0.609
Rainfall	(Mean Rainfall mm 1850-1861)/(Mean Rainfall mm 1800-1849)	390	0.982	0.014	0.959	1.026
Slope	$\tan^{-1}(\frac{Range\ Km}{\sqrt{area/\pi}})$	390	0.221	0.14	0.018	0.799
Altitude	(000's) meters	390	0.419	0.27	0.018	1.37
Mafia1885	Dummy from 0 to 3	325	0.567	1.011	0	3

Figure 1a *Properties seized from Mafia by year*

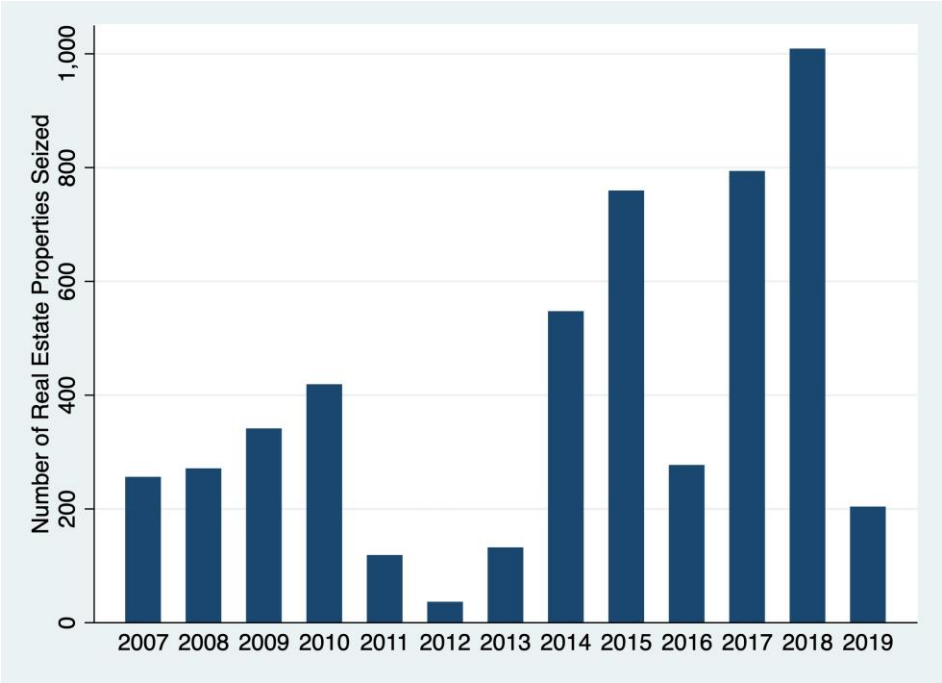

Figure 2a *Real estate properties seized from Mafia by category*

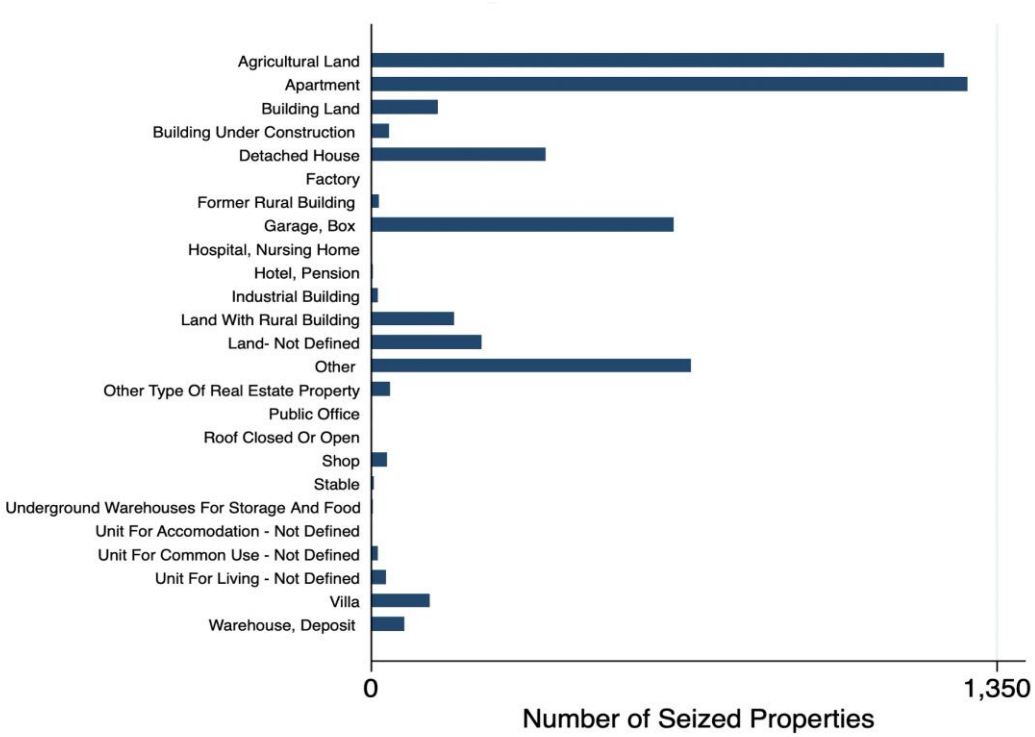

Figure 3a *Seized Firms by category*

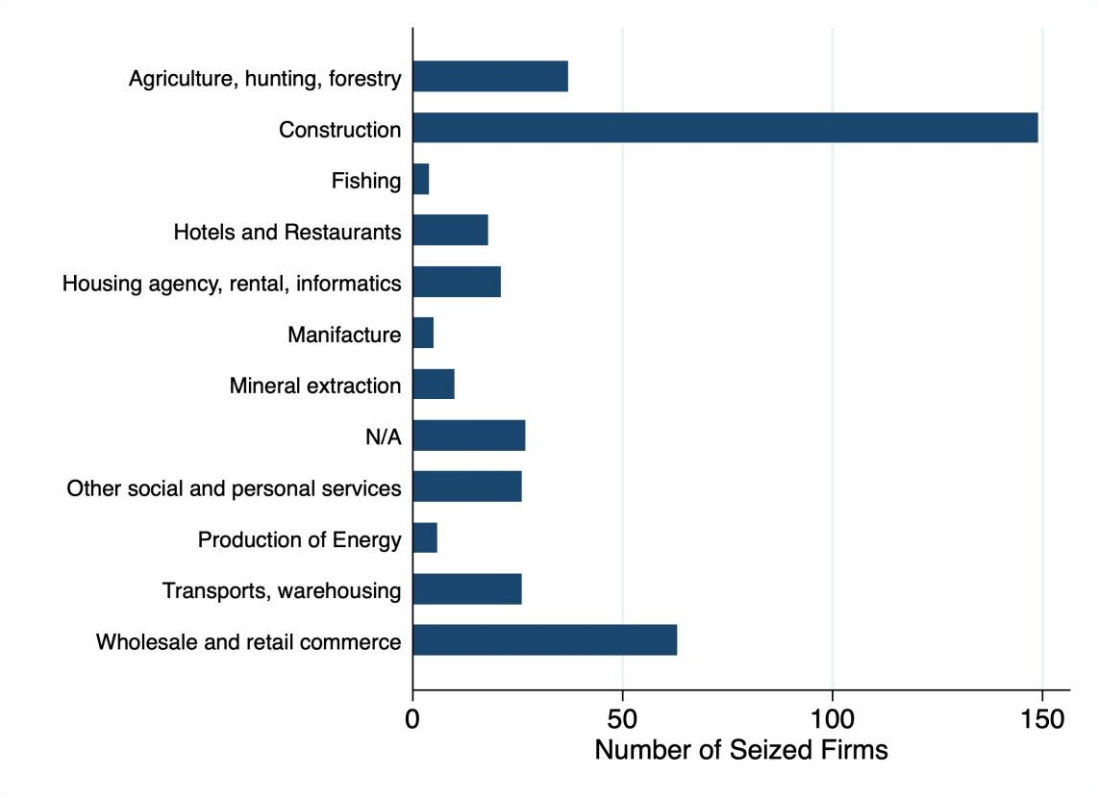

Figure 4a *Mafia Standardized coefficients across investments types (G. shifters estimates)*

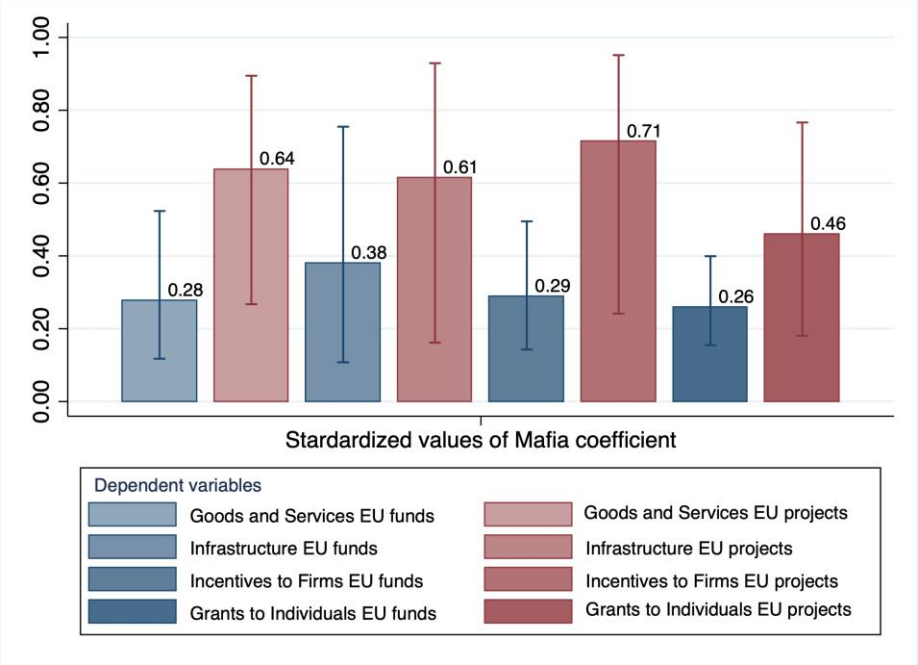

Figure 4b *Mafia Standardized coefficients across investments types (Mafia1885 estimates)*

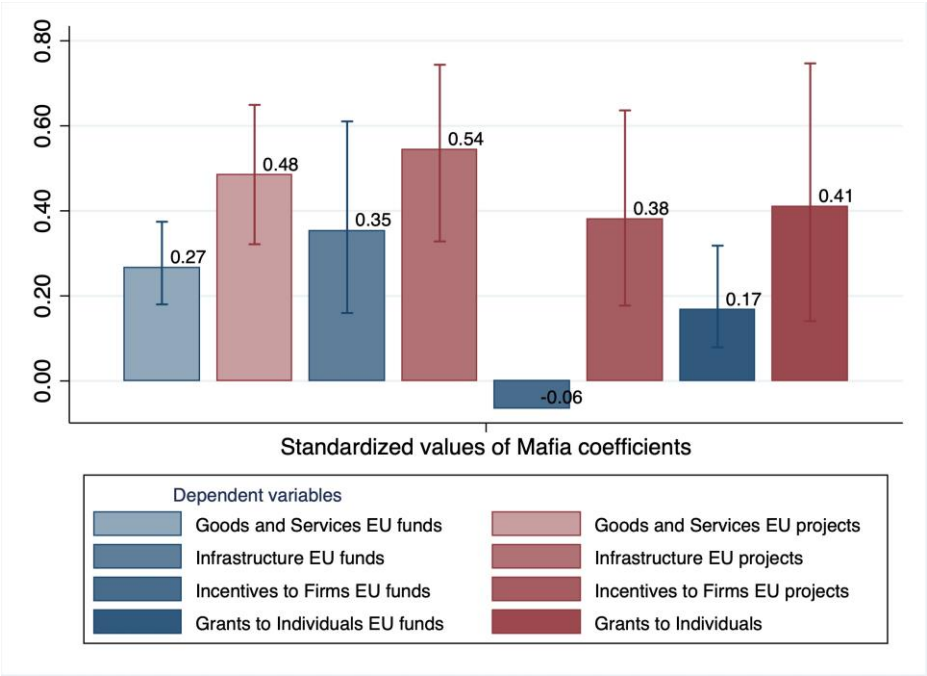

Table 5a *Robustness checks*

	EU Projects			**EU Funds**		
	Alternative mafia indicator Same set of instruments		Same Mafia indicator Different subset of instruments	Alternative mafia indicator Same set of instruments		Same Mafia indicator Different subset of instruments
	(1)	(2)	(3)	(4)	(5)	(6)
Mafia seized firms	0.994*** (0.059)	2.45*** (0.605)		0.999*** (0.084)	1.85*** (0.052)	
Mafia			0.692*** (0.196)			0.659*** (0.237)
Controls	yes	yes	yes	yes	yes	yes
Province dummies	yes	yes	yes	yes	yes	yes
Obs.	390	390	390	390	390	390
R^2	0.443	0.090	0.350	0.348	0.252	0.247
Estimation method	OLS	2SLS	2SLS	OLS	2SLS	2SLS

The dependent variable and the explanatory variable are measured in logarithms. The control matrix includes population density, employment and human capital. Standard errors are clustered at Rainfall cell level. *Significant at 10% **Significant at 5% ***Significant at 1%

Table 6a *Only confiscations from 2014 to 2020*

	EU Projects		**EU Funds**	
	Total Sample		Total sample	
	(1)	(2)	(3)	(4)
	OLS	2SLS	OLS	2SLS
Mafia 2014-2020	0.426*** (0.043)	0.850*** (0.235)	0.380*** (0.072)	0.066** (0.280)
Controls	yes	yes	yes	yes
Province dummies	yes	yes	yes	yes
Obs.	390	390	390	390
R^2	0.420	0.281	0.305	0.260

The 2SLS estimates are derived employing geographical shifters of land productivity as IVs only. Standard errors are clustered at Rainfall cell level. *Significant at 10% **Significant at 5% ***Significant at 1%

Table 7a Instruments and Mafia measure both as regressors

	EU Projects		**EU Funds**	
	Total Sample		Total sample	
	(1)	(2)	(3)	(4)
	OLS		OLS	
Mafia	0.381***	0.400***	0.348***	0.351***
	(0.055)	(0.057)	(0.087)	(0.292)
Rainfall	9.710		-0.812	
	(8.632)		(9.178)	
Slope	-2.510***		-2.045***	
	(.491)		(0.512)	
Altitude	0.534		0.355	
	(0.227)		(0.293)	
Mafia 1885		0.056		0.055
		(0.041)		(0.068)
Controls	yes	yes	yes	yes
Province dummies	yes	yes	yes	yes
Obs.	390	390	390	390
R^2	0.452	0.453	0.323	0.320

The dependent variable and the explanatory variable are measured in logarithms. The control matrix includes population density, employment and human capital. Standard errors are clustered at Rainfall cell level. *Significant at 10% **Significant at 5% ***Significant at 1%