# The Effect of Mafia on Public Transfers

Guglielmo Barone and Gaia Narciso

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Guglielmo Barone*

and

Gaia Narciso**

**Abstract:** Organized crime is a worldwide, widespread phenomenon, which affects developing as well as developed countries, and entails deep economic and social consequences. The purpose of this study is to enhance our understanding of organized crime activities. By using an innovative data set on Sicilian mafia activity available at municipality level, we test whether firms located in municipalities with mafia-related crimes obtain more public subsidies. In order to deal with the endogeneity of the relationship, we explore the origins of mafia. We instrument current mafia activity with exogenous historical and geographical shifters of land productivity, *i.e.* rainfall in the XIX century and geographical features at municipality level. We provide evidence that the presence of mafia affects the allocation of public transfers: municipalities with mafia activity receive larger public funding. The estimated impact of mafia is also economically relevant and equals one standard deviation of the dependent variable. According to our estimates the presence of mafia increases the total amounts of funds by about 35% on average. A series of robustness checks confirms the above findings.

Keywords: organized crime, public transfers.

JEL classification: H4, K4, O17.

* Bank of Italy, Economic Research Department, Branch of Bologna, Piazza Cavour 6, 40124, Bologna, Italy. Email: guglielmo.barone@bancaditalia.it.

** Trinity College Dublin, IIIS and CReAM, Department of Economics, 3012 Arts Building, Dublin 2, Ireland. Email: narcisog@tcd.ie.

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# 1. Introduction

Organized crime is a worldwide, widespread phenomenon, which affects developing as well as developed countries, and entails deep economic and social consequences. According to The Economist (2009), the Japanese Yakuza *"[...] is estimated to haul in as much as 2 trillion Yen (around 21 billion US dollar) annually"*. Italian mafia's activities amounted to 7% of GDP in Italy in 2007 and crime business flourishes even during economic crisis periods. In 2009, while Italy's GDP fell by 5%, organized crime increased in turnover terms by 3.7% (Financial Times, 2010). As Allum and Sieber (2003) point out, organized crime has become highly pervasive and fully integrated in everyday socio-economic and political life. The BBC (2000) reports that "*organized crime controls 1 in 5 businesses in Italy*".[1] Similarly, in 1998, the Russian government estimates that the Russian *mafiya* controlled 40% of private business and 60% of state-owned companies".[2]

The purpose of this study is to enhance our understanding of organized crime activities. Is organized crime able to divert and grab public transfers? By using an innovative dataset on crime at municipality level, this study tests whether firms located in municipalities with more mafia-related crimes obtain more public subsidies. The empirical evidence refers to the Italian mafia. The Italian case is a suitable environment for this study for three reasons. First, Italian mafia, like other types of organized crime such as the Japanese Yakuza, is rooted in the political and socio-economic life and its origins can be traced back to the XIX century. Second, among developed countries, Italy is one of the most mafia-ridden countries, as organized crime is diffusely present in at least 5 of the 20 Italian regions. Third, it raises a relevant policy question: how can a government prevent that public funding aimed to lagging areas is diverted by organized crime? This policy issue is also relevant for other countries, such as Russia and Colombia, where the presence of organized crime interferes and impedes the government's ability to govern (Godson and Williams, 1998; Allum and Siebert, 2003). More generally, our results indicate that the design of geographically targeted aid policies should be supported by detailed analysis of local crime activities.

In accordance with the UN Convention against Transnational Organized Crime (2004), organized crime is defined as a "*[...] structured group of three or more persons, existing for a period of time and acting in concert with the aim of committing one or more serious crimes or offences [...] in order to obtain, directly or indirectly, a financial or other material benefit*".

[1] http://news.bbc.co.uk/2/hi/europe/1023221.stm.
[2] http://news.bbc.co.uk/2/hi/special_report/1998/03/98/russian_mafia/70095.stm

We focus on the allocation of public transfers to firms at municipality level, with the aim of testing whether mafia can determine funding allocation. The presence of mafia is measured using an innovative data set made available by the Italian Ministry of Justice, which provides detailed information on crime at municipality level, by article of the Italian Penal Code. We test the impact of mafia on public transfers, measured by the amount of funds transferred to firms according to Law 488/92. These funds have been for many years the main policy instrument for reducing territorial disparities in Italy, by offering a subsidy to firms willing to invest in lagging areas.

In order to deal with the endogeneity of the relationship between mafia presence and funds' allocation, we explore the origins of mafia. Gambetta (1993) defines mafia as *"[...] an industry that produces, promotes and sells private protection*". Private protection was historically needed in Sicily for two main reasons: First, starting from 1812, a number of anti-feudal laws slowly favoured the opening up of the market for land, thus leading to an increase in the number of landowners. Second, in the wake of the new Italian State, a lack of property rights protection, together with a vacuum of power, allowed the emergence of mafia as a land protection industry. Bandiera (2003) provides evidence that land fragmentation, which followed the end of feudalism, propped up mafia activity through an increase in the demand for property right protection. Assuming that the supply of protection is elastic, we expect that in equilibrium mafia was more likely to emerge in areas where the value of land was higher. Therefore, we instrument current mafia activity with exogenous historical and geographical shifters of land productivity, *i.e.* rainfall in the XIX century and geographical features at municipality level.

We provide evidence that the presence of mafia affects the allocation of public transfers: firms located in municipalities with mafia activity receive larger public funding. According to our estimates, mafia averted about 35% of the total amount of public transfers on average over the period 2004-2009. The estimated impact of mafia is also economically relevant and equals one standard deviation of the dependent variable. A series of robustness checks confirms these findings. The results are robust to alternative econometric specifications, different measures of mafia, and diverse estimation methods. We also provide evidence that the findings hold when we take into account the potential issue of weak instruments.

Moreover, we propose two falsification tests. First, we test whether the positive relationship between mafia and public transfers is due to a more generous attitude of the State towards areas with mafia presence. We show that, if anything, these areas are underfunded, relative to those where mafia is absent. Second, we test whether crime culture,

rather than mafia, has an effect on funds' allocation. We do not find any evidence that other types of crime influence the allocation of public funds.

So far, we have implicitly assumed that mafia' control over public transfers' allocation is inefficient. But does it really matter if funds' allocation is positively related to mafia? We provide indirect and direct evidence that investment is more likely to be unproductive and corruption in the public administration to be greater where mafia is present.

Our study is related to four strands of literature. First, it contributes to the emerging literature analyzing the economic consequences of organized crime. A study by Pinotti (2011) estimates the spread of organized crime in Italy. Using a methodology introduced by Abadie et al. (2003) for the Basque conflict, Pinotti compares Southern Italian regions on the basis of the dynamics and historical roots of the different organized crime groups. According to his analysis, organized crime is responsible for a 16% loss in GDP over a 30 year period. In a recent study, Bonaccorsi di Patti (2009) provides evidence that crime adversely affects access to credit. Borrowers in high-crime areas are found to pay higher interest rates, pledge more collateral, and resort less to asset-backed loans and more to revolving credit lines.

Second, our paper contributes to the literature on governance and economic outcomes. Kaufman and Kray (2002) consider the role of governance in explaining economic outcomes and provide evidence of a positive relationship between governance and per capita income; whilst Kaufmann (2004) highlights that many countries experience a "governance deficit" which does not allow them to support their growth paths. Hall and Jones (1999) look at the role of social infrastructures, *i.e.* institutions and government policies, instrumented with geography and languages, on output per worker. Along these lines, Acemoglu, Johnson and Robinson (2002) show that settlers' mortality can explain expropriation laws, which have an impact on economic performance. The rationale behind this finding is that institutions set-up by the Europeans were mainly extractive in areas where settlers' mortality was larger.

Third, this paper is linked to the recent literature analyzing the effect of an increase in the availability of public funds on governance and the spread of organized crime. Brollo et al. (2010) study the impact of larger federal transfer in Brazil on political corruption and on the quality of the candidates. They consider a career concern model with endogenous candidate selection and provide empirical evidence that larger transfers induce an increase in corruption, while reducing the quality of the political candidates. Gennaioli et al. (2011) analyze the impact of public transfers on the spread of organized crime. The authors use Italian data for crime conviction and evaluate the spread of organized crime caused by an increase in public funding which followed an earthquake that hit two regions in the centre of

Italy in 1997. Both studies look at the impact of public transfers on the *spread* of organized crime. We view our analysis as complementary to these studies. The purpose of the present work is to analyze how *established* organized crime, such as Italian mafia, Japanese Yakuza or Chinese Triads, can affect the allocation of public transfers.

Finally, as far as the instrumental variable strategy is concerned, this work is related to two papers that study the historical origins of Sicilian mafia. Both of them follow Gambetta (1993)'s original view according to which mafia emerges in the last part of the 19$^{th}$ century as an industry for private protection. Bandiera (2003) empirically support this idea by showing that mafia was more likely to be active in towns where land was more divided; Buonanno et al (2011) document that areas characterized by the most valuable export goods (sulphur and citrus fruits) were also more affected by mafia.

To the best of our knowledge, this is the first study analyzing the causal impact of mafia on public transfers' allocation and to uncover one of the mechanisms through which organized crime affects the economy. By grabbing public funds assigned to lagging areas, organized crime effectively undermines growth, investment and development.

This paper is structured as follows. Section 2 describes the empirical model. Section 3 presents a brief history of mafia and identifies the exogenous determinants of mafia which will be used in the instrumental variable analysis, while Section 4 describes the data. Section 5 presents the results. Robustness of the results is explored in Section 6. Section 7 presents further interpretation of the results. Finally, Section 8 concludes.

## 2. The empirical model

In this section we outline the empirical framework and discuss the identification strategy that we adopt. First, we estimate a simple model of the relationship between public funds and mafia presence. The econometric specification reads as follows:

$$Public\ funds_i = \alpha_1 + \alpha_2 mafia_i + \boldsymbol{X'}_i\boldsymbol{\beta} + \varepsilon_i \qquad (1)$$

where the variable $Public\ funds_i$ measures the total amount of public funds per employee assigned to firms located in municipality $i$ in the period 2004-2009. The indicator variable $mafia_i$ takes the value 1 if municipality $i$ experienced a mafia-related crime in the same period and 0 otherwise; while $\boldsymbol{X_i}$ is the vector of controls. In order to account for heterogeneity across municipalities, we control for the degree of economic development, measured by the unemployment rate at municipality level; sector composition, evaluated by

the industry share; population density and social capital. The impact of organized crime on public funding as specified above may suffer from endogeneity on three grounds. First, the identification of the impact of mafia on public transfers may suffer from reverse causality: public funds may feed into the expansion of organized crime. This should lead to an upward bias. Second, our measure of mafia may suffer from measurement error. The dummy variable *mafia* is constructed using reports of mafia activity to the Police. As pointed out by Pinotti (2011), underreporting is likely to be greater in municipalities with mafia presence due to *omertà* or fear of mafia's retaliation. Third, the econometric specification may suffer from omitted variables: this is potentially very relevant with cross-sectional data, as in our case. The direction of the bias related to the latter two sources of endogeneity is undetermined. In order to overcome these three issues problem, we adopt an instrumental variable approach and, in search for valid instruments, we revert to the origins of mafia.

## 3. In search of valid instruments: a brief history of mafia

According to a rather consolidated view, mafia emerged in the second half of 1800 in Sicily, during the transition from the Borbone dynasty and the emergence of the unified Italy (1861). In his 1993 book, Gambetta defines mafia as *"[...] an industry that produces, promotes and sells private protection*" (page 1). According to the author, the demand for private protection arises from two main motives: an endemic distrust and the vacuum of power that followed Italian unification. This endemic lack of trust can be considered as a legacy of the Spanish domination, characterized by a *divide et impera* strategy. Under the Spaniard dominion, commerce and the accumulation of wealth were dampened, superstition was encouraged, and a society based on a strict hierarchy was promoted, while public trust was replaced by private trust (Gambetta, 2000). Already in 1814, Alexander de Tocqueville during his journey to Sicily remarks the lack of trust among the Sicilian community (Gambetta, 2000). In his seminal work on social capital, Putnam (1993) supports the view that different levels of social capital between the North and the South of Italy are rooted in the historical heritage of the two areas.[3]

The end of Feudalism is the second motive for the increase in the demand for private protection. Starting from 1812, the market for land was opened up and a number of anti-feudal laws slowly favoured the increase in the number of landowners. Between 1812, the end

[3] Guiso, Sapienza and Zingales (2008) provide extensive empirical evidence of the long lasting effect of social capital in the Centre and North of Italy.

of the feudalism, and 1861, the year of Italian unification, the number of landowners increased from 2,000 to 20,000 (Gambetta, 1993). This number probably increased even more rapidly in the subsequent years because of the sale of parts of land and tenements belonging to the Vatican State ("Liquidazione dell'Asse Ecclesiastico", 1867). Given the absence of settlements in the countryside and the lack of property rights legislation, protection was needed to defend the newly acquired plots. At the same time, in the wake of the new Italian State, a vacuum of power allowed the emergence of mafia as a land protection industry. Therefore, the armed guards which had provided their protection to *latifondisti* could expand their activity by providing their service to small land owners. As early as 1875 the issue of mafia was acknowledged by the newborn Italian Parliament, which mandated the Bonfadini Inquiry. According to the Bonfadini Inquiry, *"[...] where wages are low and peasant life is less comfortable, [...], there are no symptoms of mafia [...]. By contrast, [...] where property is divided, where there is plenty of work for everyone, and the orange trees enrich landowners and growers alike – these are the typical sites of mafia influence."*[4]

In this context, the value of land appears to be one of the main determinants of the demand for protection. If the supply of protection is elastic, we expect that in equilibrium mafia emerged in areas where the value of land was higher. Therefore, our set of instruments for current mafia activity includes rainfall in the decade before 1861 (the year of Italian Unification), together with historical and geographical shifters of land productivity: population density in 1861, slope and altitude at municipality level. We do not have a prior over the expected sign of the rainfall variables on current mafia presence. First, the optimal quantity of water depends on the crop type. Second, agriculture economists agree that the effect of rainfall on the farm values is not monotonic (e.g. Mendelsohn et al. 1994; Kurukulasuriya and Mendelsohn 2007). Third, historians claim that mafia controlled water wells (e.g. Santino 2002): as far as water wells are concentred in areas with less rainfall (where the wells' smoothing role is more important), we could expect a negative association between rainfall and the presence of mafia. Overall, we include in our first stage regression rainfall and its squared value to capture the indeterminateness the sign. On the other hand, we expect that the altitude and slope should exert a negative effect of the land value, while the sign of the population density is undefined on a priori ground.

Besides offering statistical evidence about instrumental variables' exogeneity, we also argue that land value in the second half of the 19$^{th}$ century is unlikely to affect local current economic conditions because (*i*) even if the spatial distribution of rainfall is time-persistent,

[4] Gambetta (1993).

modern and mechanized agriculture is much less dependent on rainfall and (*ii*) the current role of agriculture in the economy is very small: according to the Italian National Statistics Institute the share of employment in agriculture was about 70% in 1861 while it equalled 3.8% in 2009.[5]

# 4. Data

The first source of data is an innovative data set made available by the Italian Ministry of Justice (*Ministero della Giustizia*), which provides detailed information on crime at municipality level, by article of the Italian Penal Code (*Codice penale*). The dummy variable *mafia* takes the value 1 if a mafia-related crime, defined by the article *416-bis* of the Penal Code, was reported over the period 2004-2009, augmented with official data from the Minister of Interior (*Ministero degli Interni*) on whether the municipality council was dissolved due to mafia infiltration. About 16% of the municipalities in Sicily experienced at least one mafia-association episode between 2004 and 2009. Article 416-*bis* defines an association as being of Mafia-type nature "*when those belonging to the association exploit the potential for intimidation which their membership gives them, and the compliance and omertà which membership entails and which lead to the committing of crimes, the direct or indirect assumption of management or control of financial activities, concessions, permissions, enterprises and public services for the purpose of deriving profit or wrongful advantages for themselves or others*".

Our analysis makes use of disaggregated information on public transfers at municipality level. As a measure of public transfers, we employ the official Law 488/92 data set provided by the Italian Ministry of Industry, which regulates the issuance of project-related capital grants. The Law 488/92 funds have been used as the main policy instrument for reducing territorial disparities in Italy, by offering a subsidy to firms willing to invest in lagging areas. Funds are assigned on the basis of five criteria: matching funds; number of jobs as percentage of the investment; value of assistance; score related to the priorities in terms of location, sector and project type at regional level; score related to the environmental impact. The investment can be used for the following motives: relocation, modernization, setting-up, extension, restructuring, reactivation and reconversion (Bronzini and de Blasio, 2006).[6] The

[5] Istat, Italia in cifre 2011.(http://www.istat.it/it/archivio/30329).

[6] The Law 488/92 requires that the winning firms receive the first annual investment within 2 months. The amounts are paid out in three equal instalments. The second and the third instalment are paid on the same date in subsequent years.

data set contains micro data on each funding application. We aggregate the amount of funds assigned to firms located in each municipality during the period 2003-2009 according to the Law 488/92, normalized by the total number of employees in the same municipality. Table 1 reports the summary statistics. The mean amount of public funds across the 390 municipalities is € 584 per employee, and about 49% of the municipalities did not receive any funding over the period considered.

**Table 1: Summary statistics**

| Variable | Description and unit of measurement | Obs. | Mean | Median | S.D. | Min | Max |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| Public Funds | ('000s) Euros per employee | 390 | 0.584 | 0.012 | 1.256 | 0.000 | 8.585 |
| Density_2001 | ('000s) persons / $km^2$ in 2001 | 390 | 0.327 | 0.096 | 0.618 | 0.004 | 5.526 |
| Unemployment Rate | # unemployed / labour force in 2001 | 390 | 0.256 | 0.253 | 0.068 | 0.084 | 0.496 |
| Industry share | # employees in industry / total # employees in 2001 | 390 | 0.128 | 0.105 | 0.090 | 0.000 | 0.654 |
| Social capital | # of employees in the no profit sector / total # employees in 2001 | 389 | 0.024 | 0.016 | 0.030 | 0.000 | 0.291 |
| Rainfall | Average mm per year 1851-1860 | 390 | 602.835 | 595.455 | 68.570 | 402.762 | 785.680 |
| Slope | Metre/ $km^2$ | 390 | 28.791 | 18.716 | 32.926 | 0.776 | 371.053 |
| Altitude | ('000s) metres | 390 | 0.391 | 0.395 | 0.277 | 0.001 | 1.275 |
| Population density 1861 | (000) persons / $km^2$ in 1861 | 390 | 0.136 | 0.096 | 0.135 | 0.005 | 1.258 |

The upper panel of Table 1 also reports basic features at municipality level, such as unemployment rate, population density, a measure of social capital and industry share. The unemployment rate variable and population density are measured according to the 2001 Italian Census by ISTAT, while the share of industry, the measure of social capital and the unemployment rate at municipality level arise from the 2001 Census of Italian firms conducted by ISTAT. The mean unemployment rate across the 390 municipalities is around 25%, with a maximum value of 49% reached in Giuliana, a municipality located in the

province of the Sicilian capital, Palermo. Following Putnam (1993) and Guiso et al. (2008), we measure social capital as the percentage of employees in the non-profit sector over the total number of employees in 2001.[7]

Data on rainfall in the XIX century are taken from the European Seasonal Temperature and Precipitation Reconstruction database. Rainfall data are reconstructed on the basis of paleoclimate proxies such as tree ring chronologies, ice cores, corals, a speleothem, and documental evidence (Pauling, Luterbacher, Casty, Wanner, 2006). Data on seasonal precipitation are available for Europe for the period 1500-1900 at a 0.5° x 0.5° grid resolution. Each Sicilian municipality is mapped into a cell by minimizing the distance between the capital city of the municipality and the centre of the cell. We map the 390 Sicilian municipalities into 25 different cells (15.6 municipalities per cell on average). The lower panel of Table 1 presents the summary statistics for the rainfall variable.

The lower panel of Table 1 also reports the slope and altitude of each municipality capital according to ISTAT and the municipality's population density in the year of Italian Unification, as of the first ISTAT Census in December 1861.

Table 2 presents the results of a simple exercise. We split the municipalities between those which experienced mafia-related crimes and those which did not. The median amount of funds is greater in municipalities which experienced mafia-related crime in the period considered, than in municipalities which did not witness any mafia-related crime. The difference between the medians is statistically different at the 5% level. This first result is consistent with the idea of a positive relationship between public funds and mafia.

**Table 2: Public funds by mafia presence**

| | *Mafia = 0* (1) | *Mafia = 1* (2) | Difference (2) – (1) |
|---|---|---|---|
| Public Funds | 0.000 (327 obs.) | 0.187 (63 obs.) | 0.187** |

** significant at 5%.

[7] Results hold when using an alternative measure of social capital, *i.e.* voter participation.

# 5. Empirical results

### 5.1 OLS results

First, we investigate the impact of mafia presence on public funds using simple OLS estimation. As outlined in Section 2, we always include the unemployment rate and the share of industry at municipality level among our control variables. The indicator variable mafia is never statistically significant and the estimation results are not affected when we control for population density (column 2 and 4) and social capital (column 3 and 4).

**Table 3: Public funds and mafia – OLS estimates**

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| | *Public funds* | | | |
| Mafia | 0.010 | 0.018 | 0.016 | 0.024 |
| | (0.149) | (0.149) | (0.148) | (0.149) |
| Unemployment Rate | -2.854*** | -2.843*** | -2.889*** | -2.877*** |
| | (0.977) | (0.977) | (0.977) | (0.977) |
| Industry share | 2.855*** | 2.855*** | 2.822*** | 2.823*** |
| | (0.877) | (0.877) | (0.880) | (0.880) |
| Population density | | -0.054 | | -0.050 |
| | | (0.044) | | (0.044) |
| Social Capital | | | -1.597 | -1.555 |
| | | | (1.618) | (1.624) |
| Observations | 390 | 390 | 389 | 389 |
| R-squared | 0.07 | 0.07 | 0.07 | 0.07 |

Robust standard errors in parentheses.
* significant at 10%; ** significant at 5%; *** significant at 1%

### 5.1 Instrumental variable analysis

As discussed in Section 2, the OLS analysis presented in the previous subsection might suffer from endogeneity on three grounds: measurement error, reverse causality and omitted variable. To this end, we instrument the variable *mafia*. Table 4 presents the estimation results for the 2SLS analysis. The excluded instruments are average rainfall in the period preceding Italian Unification (1850-1861), rainfall squared, altitude, slope and population density in 1861. Exogeneity of our instruments may not hold if past rainfall shapes public transfers through other channels different from mafia. This would invalidate the exclusion

restriction assumption. We argue that even in the presence of time correlations of rainfall, exogeneity relies on the fact that modern agriculture is less sensitive to weather conditions, whilst economic development is less dependent on agriculture. Also, by including the set of controls $\boldsymbol{X_i}$ we take into account for other possible transmission channels.[8] Besides, given our overidentified model, we can test for overidentification restrictions. Regarding the relevance of our instruments, on *a priori* grounds, rainfall and geographical characteristics shaped crops and agricultural output before agricultural mechanization (Mendelsohn et al. 1994).

Column 1 reports the estimates of the basic 2SLS specification. The excluded instruments are jointly statistically significant and the F-test of exclusion restriction is equal to 12.9, while the test of overidentified restrictions does not cast doubt on the validity of the instrument. Mafia has a positive and statistically significant impact on public transfers. These results hold also when we control for additional regressors, such as population density (columns 2 and 4), and social capital, as measured by the percentage of employees in the not-for-profit sector (columns 3 and 4). According to these results, the presence of mafia manages to attract almost 3.5 million euro of public funds on average.[9] The economic effect is economically relevant: it adds up to about one standard deviation of the dependent variable. Our estimates show that the presence of mafia increases the total amount of funds by about 35%. We have undertaken a series of robustness checks by varying the set of control variables to include human capital (measured by the number of college graduates) at municipality level and employment share by two-digit sector. The overall explicative power of these alternative specifications (not reported here to save space) does not outperform the more parsimonious representation shown in Table 4. [10]

[8] For instance, Durante (2010) shows that *variability* in precipitation stimulates higher level of trust. This, in turn, might influence funds allocation so invalidating our identification strategy. Unfortunately, trust is not available at the municipality level but we can control for another well-celebrated measure of social capital that is share of employees in the no profit sector.

[9] Note that these calculations are obtained by multiplying the value in Column 4 of Table 4 by the average number of employees and by further multiplying by 1,000.

[10] Clustering standard errors at province level or rainfall cell level does not affect the results either. The details of the robustness checks are available from the authors upon request.

**Table 4: Public funds and mafia – IV analysis**

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| | | **Second stage** | | |
| | *Public funds* | | | |
| Mafia | 1.151** | 1.247** | 1.196** | 1.292*** |
| | (0.466) | (0.496) | (0.471) | (0.500) |
| Unemployment rate | -3.546*** | -3.567*** | -3.629*** | -3.649*** |
| | (0.954) | (0.960) | (0.951) | (0.958) |
| Industry share | 2.752*** | 2.746*** | 2.712*** | 2.708*** |
| | (0.924) | (0.926) | (0.928) | (0.930) |
| Population density | | -0.123* | | -0.121* |
| | | (0.071) | | (0.071) |
| Social capital | | | -2.227 | -2.167 |
| | | | (1.729) | (1.735) |
| | | **First stage** | | |
| | *Mafia* | | | |
| Rainfall 1850-61 | -0.019*** | -0.019*** | -0.019*** | -0.019*** |
| | (0.005) | (0.005) | (0.005) | (0.005) |
| Rainfall 1850-61 Squared | 0.015*** | 0.015*** | 0.015*** | 0.015*** |
| | (0.004) | (0.004) | (0.004) | (0.004) |
| Slope | -0.002*** | -0.002*** | -0.002*** | -0.002*** |
| | (0.001) | (0.001) | (0.001) | (0.001) |
| Altitude | -0.207*** | -0.201*** | -0.208*** | -0.204*** |
| | (0.066) | (0.067) | (0.066) | (0.067) |
| Population density 1861 | 0.271* | 0.231 | 0.268* | 0.234 |
| | (0.150) | (0.169) | (0.149) | (0.169) |
| Test overid. P-value | 0.1034 | 0.1459 | 0.1302 | 0.1875 |
| First stage $F$ | 12.9378 | 11.9703 | 12.7537 | 11.8269 |
| Shea Par. R2 | 0.1639 | 0.1566 | 0.1622 | 0.1552 |
| Observations | 390 | 390 | 389 | 389 |

Robust standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

# 6. Robustness checks

In this section we present a series of robustness checks. We start by considering alternative econometric specifications. Then we use alternative measures of mafia to take into account the number of mafia-related crimes within each municipality. Next, we consider different estimation methods, namely GMM estimation and Heckman selection models. We provide evidence that the results hold also when we take into account the potential issue of weak instruments.

### 6.1 Alternative econometric specifications

Table 5 presents the results of an alternative set of specifications. In columns 1 and 2 we report the estimated coefficients of an econometric specification which adds province fixed effects (9 provinces) to the specification presented in Table 4. The impact of mafia on public transfers is still statistically significant at the 5% level. Columns 3 and 4 present the results for an econometric specification in which we control for Local Labor market (LLM) fixed effects. Local Labor markets are defined on the basis of commuting distances according to the 2001 ISTAT Census. There are 77 Local Labor markets in Sicily, with an average of 5 municipalities per local labor market. The estimated coefficient on mafia is still positive and statistically significant at the 5% level.

Finally, columns 5 and 6 present the results of a specification in which we address the possibility that our findings are biased because of spatial correlation. If mafia is spatially correlated, we would expect crime spillovers across municipalities. Neglecting these spillovers would entail an omitted variable bias. The LLM fixed effect specification partially addresses this issue. In order to fully address this issue, we include as a control the variable $mafia\text{-}neighbor_i$ that takes the value 1 if a mafia-related episode has been registered in any municipality (other than $i$) belonging to the local labor market of municipality $i$. The estimated coefficient of mafia is positive and statistically significant at the 1% level, while the measure of spatial correlation does not appear to be statistically significant.

**Table 5: Instrumental variable analysis. Alternative specifications**

| | Province fixed effects | | LLM fixed effects | | Mafia in neighbour municipalities | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| | First stage | Second stage | First stage | Second stage | First stage | Second stage |
| | *Mafia* | *Public funds* | *Mafia* | *Public funds* | *Mafia* | *Public funds* |
| Mafia | | 1.308** | | 1.165** | | 1.260*** |
| | | (0.599) | | (0.591) | | (0.470) |
| Mafia - neighbour | | | | | | 0.033 |
| | | | | | | (0.125) |
| Rainfall 1850-61 | -0.014** | | -0.027*** | | -0.019*** | |
| | (0.006) | | (0.008) | | (0.005) | |
| Rainfall 1850-61 Squared | 0.011** | | 0.022*** | | 0.015*** | |
| | (0.005) | | (0.007) | | (0.004) | |
| Slope | -0.002*** | | -0.002* | | -0.002*** | |
| | (0.001) | | (0.001) | | (0.001) | |
| Altitude | -0.261*** | | -0.343*** | | -0.204*** | |
| | (0.074) | | (0.104) | | (0.067) | |
| Population density 1861 | 0.221 | | 0.178 | | 0.233 | |
| | (0.169) | | (0.207) | | (0.170) | |
| Test overid. P-value | 0.1381 | | 0.1679 | | 0.1798 | |
| First stage $F$ | 6.43876 | | 6.01082 | | 10.9238 | |
| Shea Par. R2 | 0.0932 | | 0.0978 | | 0.1415 | |
| Observations | | 389 | | 389 | | 389 |

All regressions include population density, unemployment rate, social capital and industry share. Instrumented variable: mafia. Excluded instruments: Rainfall 1850-1861, Rainfall squared, population density in 1861, slope and altitude. Robust standard errors in parentheses.
* significant at 10%; ** significant at 5%; *** significant at 1%.

### 6.2 Alternative measures of mafia

In this section we present two alternative measures of mafia. First, we introduce a narrow definition of the mafia dummy variable. The new dummy variable, *mafia_narrow*, takes the value 1 if a municipality experienced a mafia-type crime, as defined by the article *416-bis* of the Penal Code, over the period 2004-2009.[11] Second, we replace the mafia

[11] About 13.85% of municipalities experienced a mafia-type episode as defined by the variable *mafia_narrow* in the period 2004-2009.

indicator variable with the actual number of mafia-related episodes per capita according to the Art. 416-*bis* of the Penal Code.[12]

**Table 6: Instrumental variable analysis. Alternative measures of mafia**

| | Mafia narrow | | Mafia per capita | |
|---|---|---|---|---|
| | (1) First stage | (2) Second stage | (3) First stage | (4) Second stage |
| | *Mafia narrow* | *Public funds* | *Number of mafia episodes* | *Public funds* |
| Mafia - narrow | | 1.522** | | |
| | | (0.641) | | |
| Number of mafia episodes | | | | 8.724** |
| | | | | (3.771) |
| Rainfall 1850-61 | -0.014*** | | -0.003** | |
| | (0.005) | | (0.001) | |
| Rainfall 1850-61 Squared | 0.011*** | | 0.002** | |
| | (0.004) | | (0.001) | |
| Slope | -0.002*** | | -0.000* | |
| | (0.001) | | (0.000) | |
| Altitude | -0.152** | | -0.029* | |
| | (0.065) | | (0.017) | |
| Population density 1861 | 0.279 | | -0.003 | |
| | (0.170) | | (0.024) | |
| Test overid. restr. - $p$ | | 0.1335 | | 0.4052 |
| First stage $F$ | | 8.35141 | | 5.16197 |
| Shea Par. R2 | | 0.1207 | | 0.0529 |
| Observations | | 389 | | 389 |

All regressions include population density, unemployment rate, social capital and industry share. Instrumented variable, column 2: Mafia-narrow. Instrumented variable, column 4: Number of mafia episodes. Excluded instruments: Rainfall 1850-1861, Rainfall squared, population density in 1861, slope and altitude. Robust standard errors in parentheses.
* significant at 10%; ** significant at 5%; *** significant at 1%.

Consistent with the previous results, the estimated coefficient on *mafia-narrow* is statistically significant at the 5% level. Not just the presence of mafia, but also the number of mafia episodes significantly affects the amount of public funds. Although the instruments are weakened in this specification, they are still valid, as reported by the P-value of the test for overidentification restrictions.

[12] On average, the number of mafia related episodes per capita is 0.02 per municipality, with the municipality Gurgio (Agrigento) experiencing the highest number of mafia-related episodes over the 2004-2009 period.

### 6.3 Alternative estimation methods

Next, we replicate the econometric analysis by relying on two different estimation methods. Table 7 presents the new estimation results. Column 1 and 2 report the estimates for the GMM analysis. The estimated coefficient on mafia is close to the one presented in Table 4 and it is statistically significant at the 1% level.

In the last two columns we take into account that our endogenous variable is binary, so estimating a probit first stage. Column 3 reports the results of the probit estimation of the first stage, while column 4 presents the second stage. The mafia variable is statistically significant at the 1% level.

**Table 7: Alternative estimation methods**

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| | First stage | Second stage | First stage | Second stage |
| | *Mafia* | *Public Funds* | *Mafia* | *Public Funds* |
| Mafia | | 1.287*** | | 1.563*** |
| | | (0.468) | | (0.251) |
| Rainfall 1850-61 | -0.019*** | | -0.032* | |
| | (0.005) | | (0.019) | |
| Rainfall 1850-61 Squared | 0.015*** | | 0.025 | |
| | (0.004) | | (0.016) | |
| Slope | -0.002*** | | -0.011*** | |
| | (0.001) | | (0.004) | |
| Altitude | -0.204*** | | -1.138** | |
| | (0.067) | | (0.483) | |
| Population density 1861 | 0.234 | | 0.731** | |
| | (0.169) | | (0.351) | |
| Estimation method | GMM | | Heckman selection | |
| Test overid. restr. - $p$ | | 0.1875 | | |
| First stage $F$ | | 11.8269 | | |
| Shea Par. R2 | | 0.1552 | | |
| Observations | | 389 | | 389 |

All regressions include population density, unemployment rate, social capital and industry share. Instrumented variable: mafia. Excluded instruments: Rainfall 1850-1861, Rainfall squared, population density in 1861, slope and altitude. Robust standard errors in parentheses.
* significant at 10%; ** significant at 5%; *** significant at 1%.

### 6.4 Coping with weak instruments

In this section we deal with the potential issue of weak instruments. Although the F-test of exclusion restriction is always above the 10 cut-off value in the main specification (Table 4), we present further analysis to prove the robustness of our results. When instruments are weak, two major problems arise. First, 2SLS estimated standard errors are small and the width of confidence intervals is narrow. As a result, hypothesis testing based on 2SLS estimates is misleading. Second, the 2SLS estimator is consistent, but biased in finite samples.[13]

The first column deals with the issue of narrow confidence intervals and follows the conditional likelihood ratio approach developed by Moreira (2003). Moreira's conditional likelihood ratio test adjusts the critical values for hypothesis testing on the basis of the sample employed and constructs the confidence intervals. The bounds of our confidence intervals (CLRT and Anderson Rubin) presented in column 1 are both positive, thus supporting our previous results.

The second exercise in order to deal with weak instruments entails taking care of the biased estimates. The limited information maximum likelihood is a k-class estimator, which provides an unbiased median. Columns 2 to 4 present the results of the limited information maximum likelihood estimation for different Fuller values. The results confirm the positive impact of mafia on public funds. The estimated coefficient is slightly larger than the 2SLS estimate, thus indicating a greater impact of mafia on public funds, once we correct for the bias.

**Table 8: Coping with weak instruments**

| | (1) CLRT | (2) Fuller1 | (3) Fuller2 | (4) Fuller3 | (5) Fuller4 |
|---|---|---|---|---|---|
| | *Public Funds* | | | | |
| Mafia | 1.292*** | 1.382*** | 1.358*** | 1.335*** | 1.312*** |
| | (0.462) | (0.534) | (0.525) | (0.517) | (0.508) |
| Confidence set | | | | | |
| Conditional LR | [0.501, 2.528] | | | | |
| Anderson- Rubin | [0.302, 2.850] | | | | |
| Observations | 389 | 389 | 389 | 389 | 389 |

All regressions include population density, unemployment rate, social capital and industry share. Instrumented variable: Mafia. Excluded instruments: Rainfall 1850-1861, Rainfall squared, population density in 1861, slope and altitude. Robust standard errors in parentheses.
* significant at 10%; ** significant at 5%; *** significant at 1%.

[13] For a review of the literature coping with weak instruments, see Murray (2006).

# 7. Interpreting the results.

This section presents further evidence on the interpretation of the results. First, we test whether the positive relationship between mafia and public transfers is due to a more generous attitude of the State towards municipalities with mafia presence. Second, we test whether crime culture, rather than mafia, has an effect on funds' allocation. Finally, we provide evidence that investment is more likely to be unproductive and public sector corruption to be greater in municipalities where mafia is present.

### 7.1 Two competing scenarios

So far, we have shown that mafia has a positive and robust causal impact on public funds allocation. However, this finding can be explained according to two different stories. In the first scenario, the State indirectly opposes mafia by boosting employment opportunities through the allocation of funding to firms located in mafia-ridden areas. According to the second scenario, the State offers investment subsidies for general economic development purposes. However, mafia-connected firms intercept part of these transfers and pocket the funds. In the rest of this subsection we disentangle these two interpretations and provide direct evidence in favour of the second scenario.

If the first scenario is valid, then it is reasonable to assume that the State tends to contrast organized crime also with other forms of public spending. Luckily, we can test this hypothesis. We consider public expenditure at municipality level on a set of other items, such as expenditure on culture, nursery services, primary school and lower-secondary school, divided by the corresponding population.[14] We conduct an instrumental variable analysis as in Table 4, where the dependent variable is one of the four expenditure items listed above. Table 9 reports the estimation results. The estimated impact of mafia on expenditure on culture, nursery services and lower secondary school is not statistically significant, while it is negative and statistically significant at the 1% level on primary school. These results contradict the view that the State is more likely to be generous towards municipalities where mafia is present. If anything, these municipalities seem to be underfunded, as in the case of the primary school expenditure, relative to municipalities where mafia is absent.

[14] Only a small set of expenditure items are available at municipality level. For example, expenditure on education above the lower-secondary level is only available at a more aggregate locality level.

**Table 9: Falsification tests**

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| | *Culture* | *Nursery services* | *Primary school* | *Lower-secondary school* |
| Mafia | -10.293 | -127.559 | -234.327*** | 14.018 |
| | (8.343) | (137.155) | (76.218) | (44.264) |
| Test overid. restr. – $p$ | 0.5119 | 0.3716 | 0.1676 | 0.4092 |
| First stage $F$ | 11.8269 | 11.8269 | 11.8269 | 11.8269 |
| Shea Par. R2 | 0.1552 | 0.1552 | 0.1552 | 0.1552 |
| Observations | 389 | 389 | 389 | 389 |

All regressions include population density, unemployment rate, social capital and industry share. Instrumented variable: mafia. Excluded instruments: Rainfall 1850-1861, Rainfall squared, population density in 1861, slope and altitude. Robust standard errors in parentheses.
* significant at 10%; ** significant at 5%; *** significant at 1%.

### 7.2 Mafia or crime culture?

Having ruled out this alternative scenario, we further investigate the role of mafia in attracting public transfers. We question whether we are capturing the impact of mafia on transfers' allocation or whether we are capturing the impact of crime in general, which is suspected to be highly correlated with mafia. In other words, is it mafia or crime culture? Columns 1 and 2 of Table 10 present a simple exercise. We replicate the basic specification of Table 4 for a new measure of crime. Instead of looking at mafia, we consider the number of other types of crime committed at municipality level, namely manslaughter, involuntary manslaughter and infanticide.[15] The new crime variable does not have any statistically significant impact on public transfers either in the OLS estimation (column 1), or in the 2SLS estimation (column 2). Therefore, we can exclude that the crime culture can affect the amount of funding assigned to municipalities.

[15] Articles 578, 589, 584 of the Italian Penal Code.

**Table 10: Public funds and crime culture**

| | (1) | (2) |
|---|---|---|
| | *Public Funds* | |
| Other Crime | 0.067 | 0.069 |
| | (0.105) | (1.012) |
| Estimation method | OLS | 2SLS |
| Test overid. restr. - $p$ | | 0.0051 |
| First stage $F$ | | 3.52344 |
| Shea Par. R2 | | 0.0184 |
| $R^2$ | 0.0688 | |
| Observations | 389 | 389 |

All regressions include population density, unemployment rate, social capital and industry share. Column 2, instrumented variable: Other crime. Column 2, excluded instruments: Rainfall 1850-1861, Rainfall squared, population density in 1861, slope and altitude. Robust standard errors in parentheses.
* significant at 10%; ** significant at 5%; *** significant at 1%.

### 7.3 Unproductive allocation?

Does it matter if funds' allocation is positively related to mafia? In the analysis we have conducted so far, we have implicitly assumed that mafia's effect on funds' allocation reduces productivity and that investment is more likely to be unproductive where mafia is present. This subsection provides indirect and direct evidence that this is indeed the case. Let us consider the indirect evidence. First, there is a large consensus about the inefficacy of Law 488/92. Bronzini and de Blasio (2006) apply a rigorous counterfactual evaluation framework to show that these subsidies did not generate additional investments. The authors show that financed firms simply brought forward investment projects originally planned for the post-intervention period to take advantage of the incentives. Overall, the authors conclude that their exercise "*cast[s] some doubts on the efficacy of Law 488.*" Bernini and Pellegrini (2011) support these findings by demonstrating that Law 488-subsidized firms show a smaller increase in TFP than non-subsidized firms. In the policy arena, Rossi (2006) asserts that government spending in the Italian South has been widely associated with corruption.[16] We hypothesize that mafia averts public funds, which are then diverted to less productive activities or that end up in the hands of mafia directly. Although we cannot show how these funds are actually used, we can however show the causal link between mafia and corruption in the public administration. Empirical evidence in support of this hypothesis is

[16] Some relevant journalistic inquiries further support the idea that many corruption episodes featured the allocation of the funds related to the Law 488/92.
http://www.report.rai.it/dl/Report/puntata/ContentItem-4da16872-1d81-4b3e-a2bc-bdeecb787c29.html.

presented in Table 11. The dependent variable is the number of public sector corruption events per capita, at municipality level, according to the Italian Penal Code.[17] In the 2SLS specification shown in column 1, mafia has a positive and statistically significant impact on the measure of public officials' corruption. This finding provides direct evidence of the negative impact of mafia on public administration's functioning and its long arm in the public sector.

Law 488 assigns public transfers directly to firms. The evidence shown so far sheds light on the link between mafia and public transfers' allocation. Column 2 provides evidence of the missing link between mafia and firms. The dependent variable is the number of firms seized by Italian police due to links to organized crime.[18] Using the 2SLS estimation, we provide evidence of the causal relationship between mafia presence and the number of firms seized in each municipality.

**Table 11: Mafia and corruption**

| | (1) | (2) |
|---|---|---|
| | Corruption per capita | Seized firms |
| Mafia | 0.072* | 0.541*** |
| | (0.041) | (0.144) |
| Test overid. restr. - $p$ | 0.1484 | 0.2034 |
| First stage $F$ | 11.8269 | 11.8269 |
| Shea Par. R2 | 0.1552 | 0.1552 |
| Observations | 389 | 389 |

All regressions include population density, unemployment rate, social capital and industry share. Instrumented variable: mafia. Excluded instruments: Rainfall 1850-1861, Rainfall squared, population density in 1861, slope and altitude. Robust standard errors in parentheses.
* significant at 10%; ** significant at 5%; *** significant at 1%.

# 8. Conclusions

An emerging literature has focused on the economic impact of organized crime on economic outcomes. We contribute to this literature by uncovering one of the mechanisms through which organized crime affects the economy. We provide evidence that organized crime can affect the allocation of public funds. Using an innovative dataset on crime and a pioneering set of instruments for mafia, we provide evidence that mafia influences the

[17] Articles 246, 314, 317, 318, 322, 323, 479, 480, 481, 319, 493, 319 ter, 320, 322 bis, 316.
[18] Source: Agenzia Nazionale per l'amministrazione e la destinazione dei beni sequestrati e confiscati alla criminalita' organizzata (2009).

allocation of public funds. According to our estimate, organized crime increases the total amounts of funds by about 35% on average. By manipulating the assignment of public funds allocated to lagging areas, organized crime effectively undermines growth, investment and development.

Our results have an important policy implication with respect to the design of geographically targeted aid policies. Such policies are very relevant both in developed and in developing countries. As far as the presence of crime is higher in lagging targeted areas, as it is likely the case, funding policies should take into account the risk the at least part of the money feeds organized crime. The results of this study suggest that policies based on monetary incentives should be at least accompanied by actions aimed at contrasting crime.

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