



# The Economic Impact of Organized Crime Infiltration in the Legal Economy: Evidence from the Judicial Administration of Organized Crime Firms

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## Abstract

We analyze the economic consequences on firm profitability, performance, and investments of having another firm in the same market affiliated with a criminal organization. We do so by evaluating the spillover effects of a law providing the judicial administration of organized crime firms through the imposition of external managers in order to remove the connection to the criminal organization, and at the same time guarantee the continuity of production. By using detailed information on more than 180,000 companies, we exploit the firms' yearly variation in the exposure to criminal firms' judicial administration in their market (in the same province and industry). The empirical design allows us to control for confounding effects at the firm, market, and year levels. The results show that there is a large, positive spillover from the enforcement law, suggesting that the burden the organized crime firms impose on other firms is very large. Firms' performance and turnover increases by 2.2 and 0.7%, respectively, in the first 4 years after an organized crime firm enters the status of judicial administration. Investments measured by tangible and intangible assets increase with the number of firms entering into judicial administration by 0.75%. These results suggest that intensifying confiscation measures against criminal organizations has a strong positive effect on the economy.

**Keywords** Organized crime · Firm level data · Policy evaluation

**JEL Classification** H00 · H32 · J00 · K14

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## 1 Introduction

Criminal organizations' infiltration in the legal economy are a major obstacle to social and economic development (UNICRI 2016). Pinotti (2015) estimates a loss of about 16% of the GDP due to the presence of criminal organizations in Southern Italian regions. One prominent channel for this is because organized crime's infiltration in the economy disincentivizes private investments. Using firm level data, we provide empirical evidence that corroborates the idea that the presence of organized crime negatively affects firms' investment choices. We do so by evaluating the effect of an enforcement measure that confiscates the productive assets of organized crime firms.

In particular, in our empirical exercise we try to evaluate the indirect economic effects of an enforcement law passed in 1982 targeting firms connected to criminal organizations in Italy that introduced, for the first time in the penal code, the mafia-type unlawful association. This law and a number of subsequent modifications allow the legal authority to confiscate the productive assets of members affiliated with the mafia. With regard to productive firms, the first step of the expropriation measure is the instillation of external managers, thereby removing the affiliation of the firms with the criminal organization. Under the provision of the law, the organized crime firm enters the status of judicial administration with an external administrator nominated by a judge that manages the firm and guarantees the continuity of the production activities of assets seized in criminal proceedings. In practice, a criminal firm entering the status of judicial administration continues to exist but breaks any link with the criminal organization.<sup>1</sup>

We estimate the spillover effects of judicial administration on "legal" firms (firms that were not infiltrated or colluded with criminal organizations) that operate in the same relevant market of the criminal ones. From this empirical exercise, we quantify the economic effects of the enforcement law providing judicial administration in the local economy. Hence, we shed light on the burden that organized crime firms impose on non-criminal firms. There are several reasons for spillover effects from the judicial administration of a criminal firm (Duplat et al. 2012; Gambetta and Reuter 1995; UNICRI 2016). The presence of an organized crime firm may influence the investment and strategy choices of their competitors through intimidation and violence. For example, organized crime firms intimidate their competitors into not entering specific sectors or not participating in public procurement procedures. Criminal firms are typically large and, together with criminal organizations, may exert a disproportionate market power that alters the competitive market (Ferrante et al. 2020). In addition, organized crime firms may corrupt public officials to gain favorable market conditions. Thus, the removal of the criminal nature from a former organized crime firm may have an impact on the performance and investment choices of the firm's competitors. It is worthwhile to emphasize that in our empirical design, we estimate the effect of a change in the nature of an organized crime firm, rather than the closure or the exclusion of such a

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<sup>1</sup> In a recent paper, Mirenda et al. (2019) study the mechanisms through which criminal organizations (in particular the '*ndrangheta*') infiltrates into the legal economy and the consequences of infiltration on firms captured by the criminal organization in the Center and North of Italy. Organized crime typically targets firms in financial distress and potentially subject to shocks from the public sector demand. Mirenda et al. (2019) find that the firms captured by organized crime strongly increase their revenues.

firm, since judicial administration does not imply the removal of the firm from the market but the removal of its connection with organized crime.

In this paper, we use yearly financial data from 2004 to 2016—from *Aida* provided by Bureau Van Dijk—on criminal and legal firms in the fourth largest regions in the south of Italy (Apulia, Campania, Calabria, and Sicily) where there is a strong presence of organized crime. Under the period of analysis we detected 429 firms subject to judicial administration. Most of the information on firms under judicial administration comes from *Aida*. Since not all firms present in *Aida* and undergoing judicial administration have this information reported in the database, we exploited other sources of data. We utilized news on judicial administration in online newspapers, cross-checked this information with other sources, and finally matched the firms found online with the *Aida* database to recover their financial information. For each firm, data on turnover, EBITDA, number of employees, revenue, tangible and intangible assets, and total assets are available. In addition, we know the province where the firm is located and the industry in which it operates. The total number of firms that were never targeted by judicial administration in our analysis is 183,302. Overall, the richness of the data in terms of observations and information allows us to exploit several margins of variation and the panel structure of the data.

We assume that any potential spillover effect from judicial administration takes place in the same province and in the same industry of the criminal firm. Hence, we also assume that province and industry identify a market where firms compete. With this in mind, the empirical design utilizes firms' yearly variation in the exposure to criminal firms' judicial administration in the same market, controlling for yearly common shocks affecting all firms (year fixed effects), firm time invariant characteristics (firm fixed effects), and yearly industry-specific shocks (industry-by-year fixed effects). The identifying assumption is that the criminal firms' timing of entry into JA is exogenous to the performance of legal firms once we control for the large set of fixed effects. We estimate the impact of criminal firms' judicial administration on legal firms' measures of performance, size, and investments. Specifically, we study the impact on the EBITDA normalized by total assets (a measure of performance), the revenues over total assets (a measure of size), and the sum of tangible and intangible assets over total assets (a measure of investments). Identification is based on the assumption that the year in which a criminal firm enters the status of judicial administration is exogenous to his competitors' performance, controlling for the large set of fixed effects. Several diagnostic tests and the institutional background support the identifying assumption.

The main results indicate that the entry into the status of judicial administration (JA) by an organized crime firm in the same relevant market causes an average increase of firms' performance by about 2.2% in the following four years, and an increase in the legal firm's turnover by about 0.7%. We find that this effect increases with the number of firms entering into JA and it is larger in markets characterized by a relatively low number of firms. As for tangible and intangible assets, we find that the entry into JA of each firm increases investments by 0.75% in markets with few firms, but only after a critical number of entries into JA. Considering that for each market identified by industry and province the number of firms is several hundred,

the aggregate effects are sizeable.<sup>2</sup> The results in this paper imply that the burden organized crime firms place on the economy is substantial. These results are consistent with aggregate estimates on the cost of organized crime (Detotto and Otranto 2010; Pinotti 2015). The main policy implication emerging from this study is that intensifying confiscation and expropriation measures against criminal organizations has a strong positive effect on the economy. An important limitation of our work, however, is that we are not able to identify the channel through which the judicial administration of criminal firms benefits other competitors in the market. There are several possible mechanisms at work such as change in expectations, change in the price of production, or increased access to procurement. The paper is silent about these mechanisms and future research should investigate how organized crime firms negatively impact their competitors.

Our paper contributes to an emerging literature on organized crime (Acemoglu et al. 2017; Alesina et al. 2018; Barone and Narciso 2015; Buonanno et al. 2015; Ferrante et al. 2019; Daniele and Dipoppa 2018; Daniele and Geys 2015; Fiorentini and Peltzman 1997) and attempts to quantify the effects of the infiltration of criminal organizations in the economy (Bandiera 2003; Albanese and Marinelli 2013; Fabrizi et al. 2019; Le Moglie and Sorrenti 2019; Bianchi et al. 2017; Pinotti 2015; Lavezzi 2014). A distinctive feature of our paper is the focus on the spillover effects of an enforcement law in the economy. The closest paper to ours is by Fabrizi et al. (2019) who analyzed, using a difference-in-difference strategy, the effects of criminal firms on the economic performance of legal firms in central and northern Italy. They identify criminal firms exploiting information on board members, police operations and court trials. As we will explain in detail, our paper differs from Fabrizi et al. (2019) by the geographical area that we analyze, the empirical strategy, and the identification object (the effect of an enforcement law in our case, the presence of criminal firms in theirs).

The paper is structured as follows. Section 2 introduces the institutional framework and Sect. 3 describes the data. In Sect. 4 we present the empirical strategy and in Sect. 5 we present the results. Section 6 concludes the paper.

## 2 Institutional Background

In the 1980s in Italy, the infiltration of organized criminal groups into the regular economy required the establishment of a new legal framework that allowed the government to confiscate the assets of these groups. The breakthrough legislation was the Rognoni–La Torre law of 1982 with the introduction of article 416-bis into the Italian penal code. This article recognized, for the first time in Italy, mafia-type unlawful association as a criminal act. The law changed the way to fight criminal organizations, not only sanctioning them through personal preventive measures (imprisonment), but also confiscating the organized crime's economic and financial assets.

The law and its subsequent modification provide that, in any situation where there is mafia-type unlawful association, both the legal action procedure (the start of a

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<sup>2</sup> Obviously, the loss that a criminal firm experiences through JA is more than offset by the increase in the performance of legal firms.

trial) and preventive measures targeting the involved individuals' productive assets (if any) must be activated simultaneously. The judicial administration is the first step of the preventive measure targeting the assets and eventually leading to confiscation.<sup>3</sup> Essential to implementing judicial administration is that the firm must be involved in the criminal organization's broad design. The aim of JA is to break the links between the firm and the criminal organization and at the same time to guarantee the continuity of the production activities of assets seized in criminal proceedings. Hence, the measure aims to subtract the assets from the criminal circuit. Importantly, the productive assets are not eliminated from the market but continue to exist without the link to the criminal organization.

A judge and subsequently a court decides the entry of a firm into JA, which implies the temporary seizure of the assets. The timing of JA depends on many factors including the year in which the investigation begins, the complexity of the court case, and the disposition time that varies across districts. When JA has been approved an administrator responsible for the management of the seized assets is nominated. The administrator must be a professional enrolled in a special register with expertise in business management. The manager is endowed with the same power as the owners of the assets and has to manage the assets and organized the factors of production to guarantee maximum profit, with a particular attention to preservation and custody. The law provides the possibility to increase the level of profitability, defining a new legal organizational structure that is able to guarantee the survival of the company. In addition, the judicial administrator must break up all of the relationships and favorable conditions that the previous criminal management had given to the business activities.<sup>4</sup>

### 3 Data

We collected data on firms in the four largest regions in the south of Italy, namely Apulia, Calabria, Campania, and Sicily. The data are provided by Aida, the Italian Bureau Van Dijk database. The database contains balance sheet information from more than 700,000 companies in Italy from 2004 to 2016. In particular, it covers 100% of the Italian companies that are required to deposit the balance sheet without distinction of size and sector.<sup>5</sup> For each company, Aida offers, the name of the registered company, province of registration, fiscal code, sector in which the firm operates, and detailed financial variables and the optical balance for a period of 10 years.

Table 1 reports the summary statistics on key variables used in the empirical analysis of these firms and their geographical distribution. These are the firms that were never targeted by judicial administration. We analyzed 183,302 firms for a total of 892,770 observations over the period 2004–2016. There is large variation with respect to total

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<sup>3</sup> Confiscation takes place after a final judgement which involves the productive assets of the criminal organization has been taken.

<sup>4</sup> For a detailed analysis of the legal framework and the implications of judicial administration see Donato et al. (2013) and Calamunci (2019).

<sup>5</sup> The Italian companies that are required to deposit the balance sheet are the limited companies.

**Table 1** Summary statistics and geographical distribution—firms never targeted by judicial administration

Firm characteristics	Mean	St Dev	Min	Max
<i>Panel A</i>				
EBITDA/total assets	- 0.0757	142.8453	- 134892	2731.913
Turnover/total assets	1.4333	93.445	2.03e-08	86245
(Tangible + Intangible Assets)/ total assets	0.5364	9.2280	- 17.9360	5606.304
Employees	8.7581	164.4324	0	143017
Geographical distribution	Number of obs	Percentage	Number of firms	Percentage
<i>Panel B</i>				
Apulia	246,596	27,63	46,268	25.24
Calabria	89,824	10,07	17,577	9.59
Campania	295,423	33,08	69,937	38.15
Sicily	260,927	29,23	49,520	27.02
Total	892,770	100	183,302	100

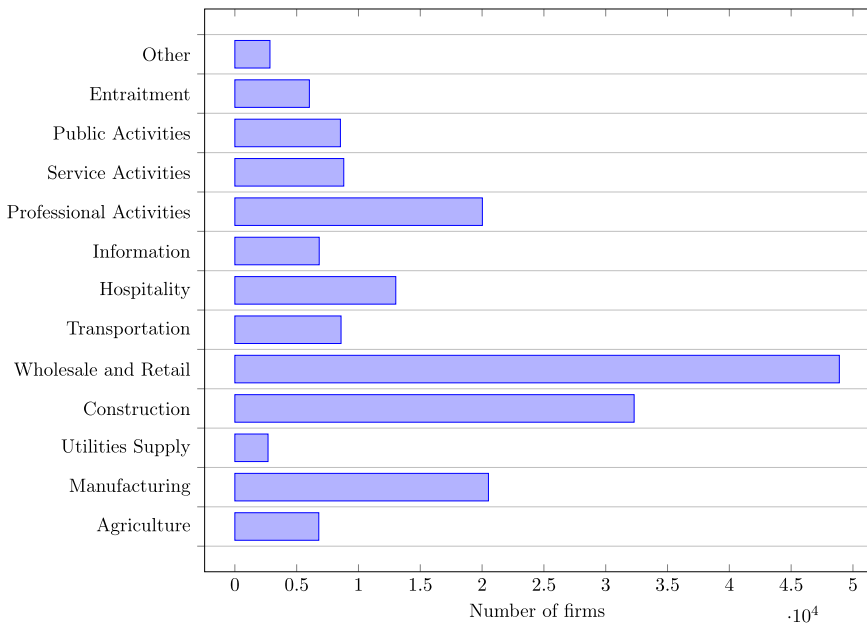
Summary statistics and geographical distribution for firms never targeted by judicial administration are reported

assets, number of employees, turnover, and other financial variables.<sup>6</sup> From Table 1, the geographical distribution of the firms reflects the relative size in terms of population of the fourth region. Figure 1 shows the industry in which the firms operate according to the two-digit industry code. The first two industries are wholesale and retail and construction.

The challenge in the collection of data is to recover information on the criminal firms treated by judicial administration. As a matter of definition, in this paper a firm is a criminal one (or an organized crime firm) if it enters the status of JA in any year in our sample. The first source of information on organized crime firms comes from Aida which provides information on the legal status of each firm, including the status of judicial administration pursuant to the law on the confiscation of criminal assets. Unfortunately, not all of the firms present in Aida and treated by judicial administration have this information reported in the database. Aida sources its information from the Italian Chambers of Commerce, which have difficulties in collecting this information because it is often confused in text fields that are hard to read.

To increase the number of organized firms treated by judicial administration, we used text analysis to automate the recovery of data on firms treated by judicial administration in online newspapers. To reduce errors in the identification of these firms, the data was cross-checked with other official data (official press release from authorities, court documents). The data collected were merged with the financial statements available in Aida, while some companies were deleted because of the lack of data available or discrepancies in term of analyzed years.

<sup>6</sup> Given the large variation and the potential problem of mis-reporting, in the empirical analysis we follow the literature and we winsorize the outcome variables.



**Fig. 1** Firms never targeted by judicial administration by sector. The figure reports the number of firms never targeted by judicial administration by sector

Table 2 reports information on the organized crime firms and the data source. The sample of criminal firms contains 429 firms under preventive measures, and the financial data includes the years between 2004 and 2016. In the same table, we report the summary statistics of the financial variables before and after the event of judicial administration. We observe that the JA status decreases performance (measured by EBITDA over total assets), and decreases the turnover ratio and the sum between tangible and intangible assets with a difference that is hardly statistically significant, given the large variation between firms). A firm entering JA may become weaker for two possible reasons. The first is that it loses the criminal connections thanks to which it was a strong player. The second is that the manager appointed in the process of judicial administration is not able to guarantee the previous level of production (for example he is too conservative or he faces limitations on credit by the banking system (Donato et al. 2013)). While it is very difficult to disentangle between the two potential explanations, we see both intrinsically related to the fact that the firm was connected to the criminal organization and that after JA this connection breaks up. Again, the key issue in both cases is that the firm continues to exist.

As for the geographical distribution of organized crime firms, from Table 2 we observe that Calabria is strongly overrepresented. This is not surprising given the strong presence of criminal organizations in the economy of Calabria and the strong action of the legal authority against these organizations in the region during the last 20 years (Arlacchi 2010). Indeed, results of Transcrime (2013) and Ravenda et al. (2015) on firms under judicial administration confirm the regional ranking with respect to

**Table 2** Organized crime firms—summary statistics and geographical distribution

Firm characteristics	(1) Mean	(2) Before JA	(3) After JA	(4) Difference
<i>Panel A</i>				
EBITDA/total assets	0.0354 (0.47194)	0.0470 (0.52294)	0.0108 (0.3374)	0.0361* (1.71)
Turnover/total assets	1.0725 (4.5634)	1.1539 (5.0685)	0.8994 (3.2329)	0.255 (1.32)
(Tangible + Intangible Assets)/total assets	0.3293 (0.8748)	0.3121 (0.9314)	0.3661 (0.7390)	- 0.0540 (- 1.38)
Employees	15.6149 (91.1245)	17.7973 (110.2086)	11.5384 (33.276)	6.259 (1.56)
Geographical distribution	Region	AIDA source	Other sources	Total Number
<i>Panel B</i>				
	Apulia	4	3	7
	Calabria	252	13	265
	Campania		14	15
	Sicily	43	99	142
Total		300	129	429

Summary statistics in Panel A and geographical distribution for organized crime firms entering the JA status in Panel B are reported. In columns (1)-(2)-(3) of Panel A standard deviation in parenthesis. In column (4) of Panel A t-statistics of the difference between the variables in column (2) and (3). Other sources in Panel B are online newspapers

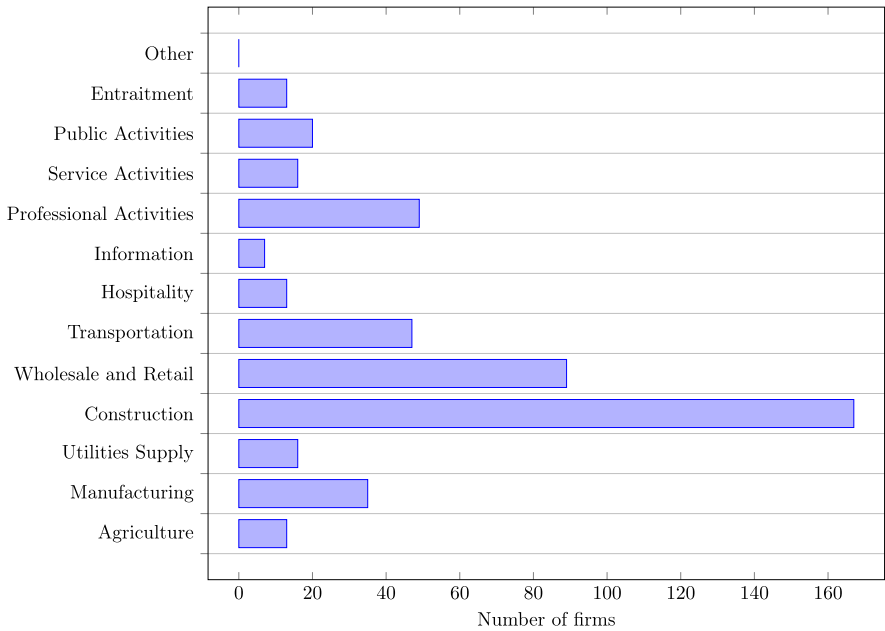
the presence of organized firms in the south of Italy. Admittedly, we do have an issue of underreporting the total number of firms under JA. For example, the number of firms under JA in Campania appears low with respect to the presence of organized crime in the region and to the efforts in prosecuting crime. While this is a concern for the descriptive power of our analysis, it should not imply a major problem for the identification of the effects of JA in the economy if the timing of the missing organized firms is not correlated with unobservables (see model 1 in the next section).

Figure 2 shows the industry in which these firms operate. Most of them are in the construction sector, a finding that is supported by Savona and Berlusconi (2015), but there are a number of other industries in which the number of organized crime firms treated by judicial administration is not negligible. Finally, Fig. 3 reports the temporal distribution of the year in which organized firms entered the status of judicial administration. Overall, we have large variation both in financial outcomes of firms not affiliated to criminal organizations and industry and entry years of organized crime firms into JA.

## 4 Empirical Strategy

The empirical strategy takes advantage of the panel structure of the data and in particular the variation across provinces, industries, and years in which an organized crime firm enters the status of judicial administration (JA). Let  $i$  denote the generic firm that is never subject to JA and with  $j$  the organized crime firm that is subject at some point



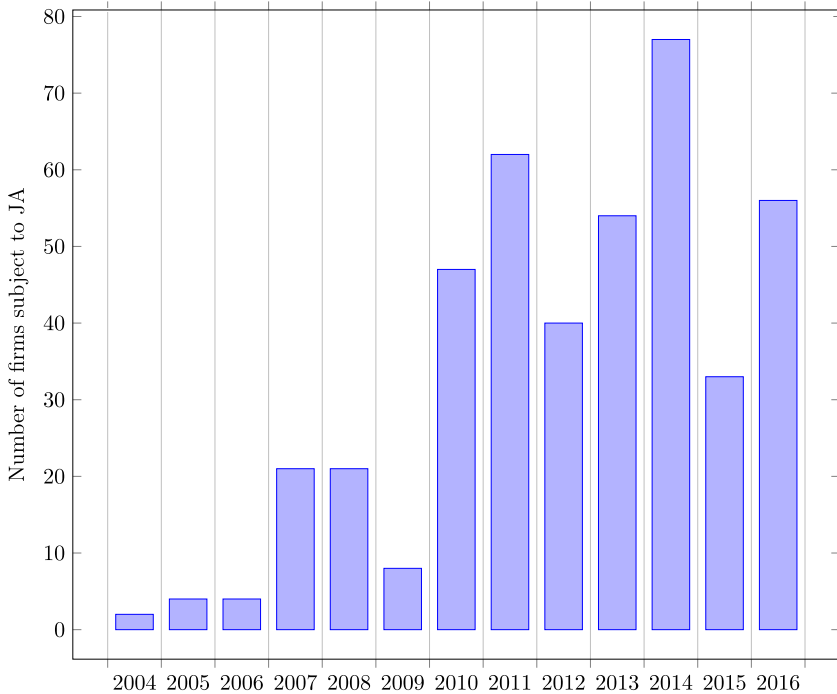


**Fig. 2** Firms subject to judicial administration by sector. The figure reports the number of firms subject to judicial administration by sector

in time to JA. We define the relevant market of each firm with the industry ( $s$ ) and the province ( $p$ ) in which the firm operates and is located. Thus, firms  $i$  and  $j$  operate in the same relevant market if they are located in the same province  $p$  and operate in the same industry  $s$ . Since the object of the empirical analysis is to estimate the spillover effect of JA on firms never targeted by JA, in our analysis we only focus on the financial outcomes of firms  $i$ . We stress that we are not interested in estimating the impact on firms  $i$  of having a firm  $j$  in the same market. Instead, we are interested in estimating the economic spillovers of JA—a provision of an enforcement law combating criminal organizations—on firms  $i$ . To the extent that firms  $i$  are not affiliated to criminal organizations, we believe that this exercise is a first step to learn the impact that organized crime has on the economy at the local level through their affiliated firms. Indeed, a firm subject to JA is likely a criminal firm well before the implementation of JA, while we do expect the number of firms  $i$  affiliated to criminal organizations but never targeted by JA in our sample to be negligible (in most of the cases zero) relative to the total number of firms  $i$  in a relevant market. Thus, our estimations should be interpreted as the effect of JA on firms  $i$ , conditional on having at least one criminal firm  $j$  in the same market.

Our main model follows the methodology of an event study analysis in which we estimate discrete change in the presence of at least one firm subject to JA:

$$y_{ipst} = \alpha_{st} + \gamma_t + \delta_i + \sum_{\tau=-4}^4 \beta_{\tau} JA_{ps(t-\tau)} + \epsilon_{ipst}. \tag{1}$$



**Fig. 3** Number of firms subject to judicial administration by year. The figure reports the number of firms subject to judicial administration by year

where  $y_{itps}$  is a time variant outcome variable (performance, turnover, tangible and intangible assets) of firm  $i$  in year  $t$ , operating in province  $p$  and industry  $s$ , identified by the two-digit industry code. The first set of fixed effects  $\alpha_{st}$  controls for any unobserved industry specific shock taking place in each year (industry-by-year FE), such as demand shocks. The other set of fixed effects are  $\gamma_t$  and  $\delta_i$ , specifically year and firm FE. The key variable,  $JA_{itps}$ , is zero if no firm  $j$  in industry  $s$  and province  $p$  of firm  $i$  was subject to JA. It is equal to one in the year in which at least one firm  $j$  entered the status of JA. In this specification, the coefficients  $\beta_\tau$  for  $\tau < 0$  test for the presence of pre-trends, as they reflect the relationship between current changes in JA status and past firm outcomes. The coefficients  $\beta_\tau$  for  $\tau > 0$  capture dynamic indirect treatment effects of JA (if any), as they reflect the relationship between current changes in JA and future firm outcomes. Finally,  $\beta_\tau$  for  $\tau = 0$  captures the on-impact change in JA on firm performance.<sup>7</sup> Note that we omit any other time variant firm characteristics in

<sup>7</sup> As we mentioned in the section describing the data, we have a potential issue of underreporting of firms entering JA. In practice, we may have firms entering JA, with this information not present in our data. Under our model specification, the estimated coefficient would be upward biased if the timing of the unobserved firms entering the status of JA is systematically concentrated in markets where are less firms observed entering JA. In all the other cases, the estimated coefficients represent a lower bound estimate of the true effects of JA on competitors. Issues of underreporting are common in the economics of crime (see for example Buonanno et al. 2018)

model 1 because any real or financial variable would be endogenous in the model (a bad control).<sup>8</sup>

The estimated coefficients  $\beta_\tau$  for  $\tau \geq 0$  in model 1 measure the spillover effect of JA for non-organized crime firms. They are estimated by exploiting within-firm variation over time controlling for unobserved shocks at the year and industry-by-year level. In practice, the treatment and the control group here are represented by the same firms whose performances are compared before and after an organized crime firm enters the status of JA in their market. The causal interpretation is based on a conditional independence assumption: conditional on the set of FE  $\alpha_{st}$ ,  $\gamma_t$  and  $\delta_i$ , the year of entry of an organized crime firm  $j$  into JA is exogenous to the performance of its competitors  $i$ . There are several facts that support this assumption. Investigations about criminal firms last several years. The moment which a criminal firm enters JA is determined by the involvement of the firm into criminal organization. The status of JA is ultimately decided by a committee of judges on the basis of the penal code and the evaluation of the specific case. It is important to point out that the Italian criminal justice system has a high variability in the disposition time across and within districts. For instance, in the 2003 the disposition time varied between 307 days in the judicial district of Trento to 1242 days in the judicial district of Ancona (della Giustizia and di Statistica 2003).<sup>9</sup> Hence, we expect that part of the variation in the timing of entry into JA across sectors and provinces is due to exogenous judicial offices and judge fixed effects.

Apparently, there is no reason to believe that the moment in which a firm enters JA is correlated to the performance of other firms in the same market. Any concern that this decision is related to the market conditions is accounted by the inclusion in model 1 of industry-by-year, firm and year FE. A first set of diagnostic tests on the identifying assumption are readily available from model 1 since the absence of pre-trends would be consistent with the identifying assumption. Specifically, we should see the leads be close to zero and not statistically significant. A second set of diagnostic and placebo tests are presented after the main results.

For reasons of tractability and to gain efficiency, we further explore the dynamics of the impact of JA on legal firms by estimating a variation of model 1:

$$y_{ipst} = \alpha_{st} + \gamma_t + \delta_i + \beta_1 JA_{ps(t-1,t-4)} + \beta_2 JA_{ps(t-5,t-N)} + \epsilon_{ipst}. \quad (2)$$

<sup>8</sup> One challenge to identification of model 1 is that a JA event may bring about other type of enforcement interventions against crime that we are not able to observe. In this case we would attribute the effect of other interventions to JA, with the estimated effect that would be upward biased. However, unless these interventions are province and industry specific (namely, targeting only some specific industries in some provinces), the effect of other measures against organized crime should be absorbed by the large set of fixed effects.

<sup>9</sup> Even within the same region we observe variation in the disposition time. For instance, in the Lombardy region (the most populated region of Northern Italy) disposition times vary from 400 days in Milano to 860 in Brescia. There are both factors at the district level and the judge level that explains this variability. Indeed, even within districts we observe variation in the length of trial depending, as illustrated by Coviello et al. (2015), on the flexibility that each judge has in the organization of his working time. In a different context, Drago et al. (2020) exploit variation in the disposition times with individual level data.

In this model, the coefficient  $\beta_1$  measures the impact of at least one JA event in short term ( $JA_{ps(t-1,t-4)}$  is equal to 1 in the first 4 years after a JA event and 0 otherwise), while  $\beta_2$  measures the impact of at least one JA event in the long term ( $JA_{ps(t-5,t-N)}$  is equal to 1 in the in the fourth year after a JA event up to the last year in our sample).<sup>10</sup>

In both model 1 and 2, we implicitly assume that the indirect treatment effect of JA is constant over time and across provinces and industries. As shown by de Chaisemartin and D'Haultoeuille (2018), when this assumption is violated (as in most of the applications using event study analysis and difference-in-difference models), the linear regressions estimates a weighted sum of the average indirect treatment effects in each year, province and industry, with the weights that can be potentially negative when the indirect treatment effects are positive. In other words, when indirect treatment effects are not constant across industry, year and province, the point estimate from the linear regression can be biased. While the analysis of the weights following de Chaisemartin and D'Haultoeuille (2018) is beyond the scope of this paper, it is important to point out this potential limitation that is common to all the empirical applications using event study analysis models.

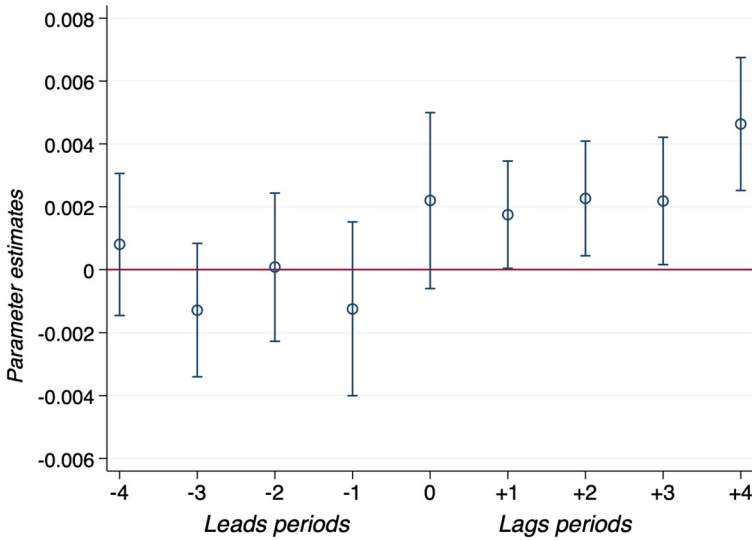
As a final note, we point out the main difference with the empirical design of our closest paper (Fabrizi et al. 2019). In that paper, the authors use a difference-in-difference strategy where the treatment group is composed of firms in cities and industries in which a police operation took place leading to the elimination of a competitor. The control group is composed of firms in the same cities of the treated firms but in different industries. Fabrizio et al. (2019) implicitly assume a parallel trend between firms in the control and treatment groups. Our strategy is different being more similar to an event study analysis that estimates the dynamic effects of an intervention targeting organized crime firms. Indeed, the analysis exploits within-firm variation controlling for a number of shocks at the year and industry-by-year level and focuses only the Italian southern regions. In addition, our object of analysis is the evaluation of the law providing the judicial administration of the organized crime firms that do not lead to the *elimination* of a competitor but rather to the removal of the criminal connections only.

## 5 Results

### 5.1 Basic Results

We start by estimating model 1 using as dependent variable a commonly used measure of performance, namely the earnings before interest, tax, depreciation and amortization (EBITDA) normalized by total assets (for example see Mitton 2006; Andres 2008). In all the estimations errors are clustered at the firm level. Following the literature, we winsorize outliers of the dependent variable at 1%. Finally, model 1 is estimated with OLS.

<sup>10</sup> Note that in model 1 and 2 we treat whether one or more firms enter the status of JA the same way. In the next section we explore the heterogeneity of the effect with respect to the number of criminal firms entering the status of JA.



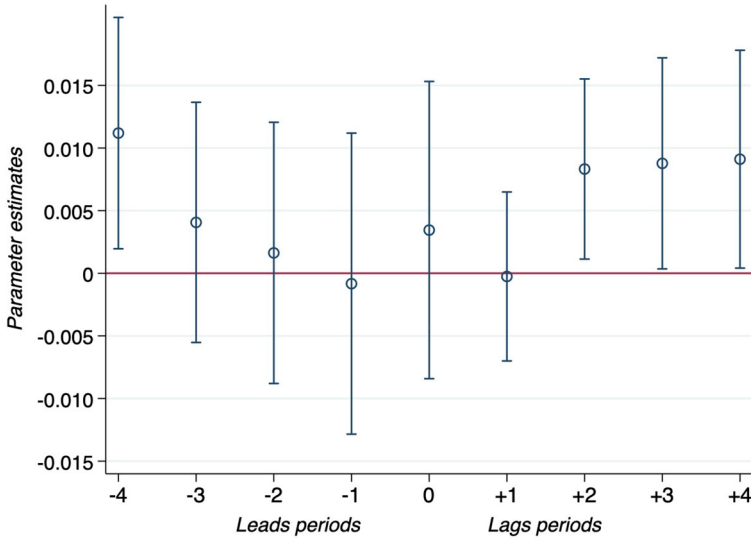
**Fig. 4** EBITDA: dynamic indirect effects on firms never targeted by JA. Dependent variable: EBITDA over total assets. Regression coefficients of 4 (yearly) leads and 4 (yearly) lags with respect to the year of entry of a criminal firm into judicial administration (model 1). Bars represent 90% confidence intervals. Standard errors are clustered at the firm level

In Fig. 4 we report the point estimates on the leads and on the lags of model 1.<sup>11</sup> We observe that there is no clear pattern for the leads: the point estimates are close to zero and not precisely estimated. Unlike the leads, we find that that firm's performance measured by the EBITDA over total assets increases following a JA event. In particular, after the first year (first lag) the EBITDA normalized by total assets increases by 0.0017 (2.2% relative to the average in the sample).

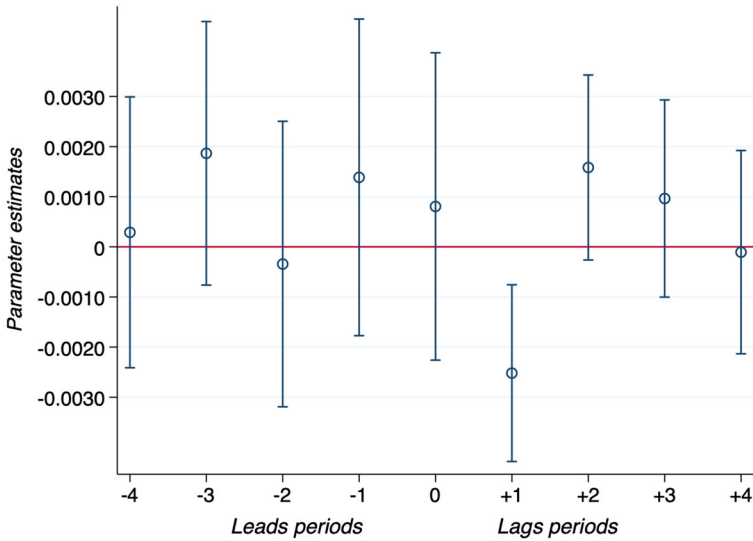
Next, we analyze the impact of JA on turnover normalized by total assets. Figure 5 reports the results of model 1. The estimated coefficients on the leads, with the exception of the fourth one, are not precisely estimated and do not show again any particular empirical pattern. Firm turnover seems to increase 2 years after a JA event. The coefficient on turnover implies an average modest increase between 0.7 and 1% per year. Finally, Fig. 6 shows the results when the outcome is the sum of intangible and tangible assets normalized by total assets. From Fig. 6 we observe that there is no compelling evidence that firms on average increase their tangible and intangible assets after a JA event. If anything, the only coefficient that is precisely estimated is negative. However, we will see that this result masks a substantial degree of heterogeneity: from the results presented in the next section, it appears that when we take into account the number of firms entering JA and the market structure, there are positive spillover effects on assets, too.

From this first set of results we draw two preliminary conclusions. First, the identifying assumption is supported by the data in that there are no clear pre-trends of JA on the three variables that we considered (performance, turnover, and tangible and

<sup>11</sup> Leads and lags are estimated separately to preserve a meaningful number of observations.



**Fig. 5** Turnover: dynamic indirect effects on firms never targeted by JA. Dependent variable: turnover over total assets. Regression coefficients of 4 (yearly) leads and 4 (yearly) lags with respect to the year of entry of a criminal firm into judicial administration (model 1). Bars represent 90% confidence intervals. Standard errors are clustered at the firm level



**Fig. 6** Assets: dynamic indirect effects on firms never targeted by JA. Dependent variable: (tangible assets + intangible assets) over total assets. Regression coefficients of 4 (yearly) leads and 4 (yearly) lags with respect to the year of entry of a criminal firm into judicial administration (model 1). Bars represent 90% confidence intervals. Standard errors are clustered at the firm level

intangible assets). Second, following a JA event, firms become more profitable and modestly increase their turnover. For the moment, it seems that there is no effect on assets. Note that from Figs. 4, 5 and 6, the presence of firm fixed effects in model 1 implies that a positive and precisely estimated lag moves the level of the dependent variable above the average level (unless we observe a negative and precisely estimated effect in subsequent lags).<sup>12</sup>

As an additional step, we investigate if the spillover effect observed in the first 4 years following a JA event vanishes in subsequent years. We did this by estimating model 2, where the first coefficient ( $\beta_1$ ) captures the average effect of the first four lags in model 1 and the second coefficient ( $\beta_2$ ) captures the effect of a JA event in the long term. Table 3 reports the results. To better understand the role of unobserved heterogeneity at the firm and the industry-by-year level, we present three specifications by progressively including firm and industry-by-year FE for each dependent variable. Hence, while the relevant columns to look at are 3, 6, and 9 (in which we control for the full set of FE), the comparison with other columns helps to understand the extent of unobserved heterogeneity. We note that such unobserved heterogeneity—especially at the firm level—is severe and causes a downward bias of the coefficients when we consider firms' performance and turnover (compare column 3 with columns 1 and 2 and column 6 with columns 5 and 4).

When we focus on the relevant columns (3, 6, and 9), regarding the short-term effect (coefficient  $\beta_{short\_term}$  in model 2), we observe a positive and in some cases statistically significant impact of a JA event with the exception of column 9 which is consistent with the results on assets in Fig. 6. Regarding the long-term effect (coefficient  $\beta_{long\_term}$  in model 2), there is some indication that the effect is positive especially for the EBITDA and the turnover but the coefficients are associated with large standard errors (especially in column 9). From these results we conclude that the increase in performance and turnover following a JA event takes place in the first years after the event.

## 5.2 Additional Results

In the previous analysis we analyzed JA events as discrete events without considering the number of entries into JA status per year. This approach makes the analysis more transparent and similar to an event study analysis. At the same time, conceptually, having at least one firm under JA can be relevant per se. At least one firm in JA may represent a signal for the other firms in the same market that the public authority will invest in enforcement. The previous results, however, are silent on whether the number of firms in JA is also relevant.

It is quite common in our sample that in a given year and industry, more than one criminal firm enters the status of judicial administration. Conditional on having at least one firm subject to JA in a given market, the average number of firms in a JA

<sup>12</sup> As for the measurement issue of firms entering the status of JA, present the main results for the subsample present in AIDA and the subsample of additional firms identified from online newspapers. These results are reported in Figures A1–A6 in the appendix and suggest that the results are very similar whether we take only firms in Aida or firms from online newspapers.

**Table 3** Dynamic indirect effects of Judicial Administration

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	EBITDA	EBITDA	EBITDA	Turnover	Turnover	Turnover	Assets	Assets	Assets
$JA_{ps(t-1,t-4)}$ (short-run effect)	-0.0074*** (0.0008)	0.0007 (0.0011)	0.0027** (0.0011)	-0.1258*** (0.0055)	-0.0079* (0.0045)	0.0098** (0.0047)	-0.0543*** (0.0021)	0.0002 (0.0014)	-0.0021 (0.0014)
$JA_{ps(t-5,t-N)}$ (long-run effect)	-0.0051*** (0.0011)	0.0025* (0.0015)	0.0056*** (0.0015)	-0.0795*** (0.0072)	-0.0114* (0.0064)	0.0112* (0.0066)	-0.0408*** (0.0024)	0.0033* (0.0018)	0.0022 (0.0018)
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Firm FE	NO	YES	YES	NO	YES	YES	NO	YES	YES
Sector-by-year FE	NO	NO	YES	NO	NO	YES	NO	NO	YES
Observations	892,770	892,770	892,770	892,770	892,770	892,770	892,550	892,550	892,550
R-squared	0.0005	0.5533	0.5537	0.0028	0.7869	0.7874	0.0022	0.8930	0.8931
Number of markets	148	148	148	148	148	148	148	148	148
Number of firms	183302	183302	183302	183302	183302	183302	183282	183282	183282

Dependent variable are indicated in the first row: EBITDA (1–3), turnover over total asset (4–6), and tangible plus intangible assets over total assets (7–9). The estimated coefficients are from model 2 in the text. Models estimated are with OLS. Standard errors clustered at the firm level are in parentheses. The number of markets is the number of industry-by-province cells in the sample. Significance at the 10% level is represented by \*, at the 5% level by \*\*, and at the 1% level by \*\*\*



status is 6. Here, we re-estimate model 2 by adding the number of firms entering JA and interacting this variable with  $JA_{ps(t-1,t-4)}$  and  $JA_{ps(t-5,t-N)}$ . Specifically, the model we estimate is:

$$\begin{aligned}
 y_{ipst} = & \alpha_{st} + \gamma_t + \delta_i + \beta_1 JA_{ps(t-1,t-4)} + \beta_2 JA_{ps(t-5,t-N)} \\
 & + \theta_1 N\_JA_{pst} + \gamma_1 JA_{ps(t-1,t-4)} \times N\_JA_{pst} \\
 & + \gamma_2 JA_{ps(t-5,t-N)} \times N\_JA_{pst} + \epsilon_{ipst},
 \end{aligned} \tag{3}$$

where  $N\_JA_{pst}$  is the number of criminal firms subject to JA (varying at the year-province-industry level) and  $\gamma_1$  and  $\gamma_2$  are the coefficients that capture the “intensive” margin of JA. Note that this specification allows us to estimate in the same model the impact of having at least one firm in JA and the effect of the number of firms into JA. Panel A of Table 4 reports the estimated coefficients of model 3. Recall that  $JA_{ps(t-1,t-4)}$  and  $JA_{ps(t-5,t-N)}$  are dummy equal to 1 in the first 4 years after a JA event and between the fifth year after a JA event until the last year in which a firm is present in the sample, respectively. The interaction of these variables with the number of firms in JA status ( $N\_JA_{pst}$ ) should be interpreted as the effect of the number of JA events on legal firms’ outcome variable in the short and the in the long term. Thus, the coefficients of interest in model 3 are  $\gamma_1$  and  $\gamma_2$ . With one exception, these estimated interaction effects are positive, consistent with the idea that the spillover effect of JA is increasing with the number of firms that were targeted by enforcement law. To understand the total spillover effect of a given number of firm entries in JA in the short term, we should sum up the estimated coefficient  $\beta_1$  and the estimated coefficient  $\gamma_1$  multiplied by the number of firms entering JA. As for the long term, we should sum up  $\beta_2$  and the estimated coefficient  $\gamma_2$  multiplied by the number of firms entering JA. Panel B of Table 4 reports this exercise for a number of firms entering JA equal to 2, 4 and 6. As shown in column 1, we observe strong and statistically significant spillover effects on EBITDA in the long-term, while in the short-term there is a precisely estimated effect only for the first two firms entering JA status. From column 2 where the outcome is turnover, the spillover effects are positive but only marginally significant. Finally, from column 3, where the outcome is investment in tangible and intangible assets, we observe a strong and precisely estimated spillover effect in the first 4 years after a JA event that—given the large interaction effect in Panel A—strongly increases with the number of firms entering JA. For example, the entry of two firms in JA increases investments in tangible and intangible assets by 0.7%.

Next, we show how the spillover effect varies with respect to the market structure in which the organized crime firms targeted by JA operate. We focus on the degree of competition in a market proxied by the number of firms existing in a given province and industry. In particular, for each year and industry we compute the median, the 25th, and the 75th percentile of the number of firms in our sample. We normalize these numbers by the total number of firms in a province. With this procedure we have an industry-province specific distribution of the number of firms normalized by total number of firms in a province. Hence, each firm in a given year, province, and industry has an associated number that reflects the number of competing firms.

**Table 4** Dynamic indirect effects of judicial administration—number of firms under JA

	(1) EBITDA	(2) Turnover	(3) Assets
<i>Panel A</i>			
$JA_{ps(t-1,t-4)}$ (short-run effect)	0.0024** (0.0012)	0.0099* (0.0053)	- 0.0043*** (0.0016)
$JA_{ps(t-5,t-N)}$ (long-run effect)	0.0051*** (0.0016)	0.0120* (0.0070)	0.0009 (0.0020)
N_JA (number of criminal firms in JA)	- 0.0006 (0.0008)	0.0007 (0.0031)	- 0.0039*** (0.0008)
$JA_{ps(t-1,t-4)} \times N\_JA$	0.0005 (0.0008)	0.0001 (0.0033)	0.0040*** (0.0008)
$JA_{ps(t-5,t-N)} \times N\_JA$	0.0003 (0.0004)	- 0.0006 (0.0018)	0.0001 (0.0003)
Year FE	YES	YES	YES
Firm FE	YES	YES	YES
Sector-by-year	YES	YES	YES
Observations	892,770	892,770	892,550
R-squared	0.5537	0.7874	0.8931
Number of markets	148	148	148
Number of Firms	183302	183302	183282
<i>Panel B</i>			
$JA_{ps(t-1,t-4)} + JA_{ps(t-1,t-4)} \times N\_JA$ , (N_JA =2) (total effect of having 2 firms in JA in the first 4 years)	0.0033** (0.0016)	0.0102 (0.0063)	0.0037** (0.0016)
$JA_{ps(t-1,t-4)} + JA_{ps(t-1,t-4)} \times N\_JA$ , (N_JA =4) (total effect of having 2 firms in JA in the first 4 years)	0.0042 (0.0029)	0.0105 (0.0117)	0.0117*** (0.0029)
$JA_{ps(t-1,t-4)} + JA_{ps(t-1,t-4)} \times N\_JA$ , (N_JA =6) (total effect of having 6 firms in JA in the first 4 years)	0.0052 (0.0045)	0.0107 (0.0180)	0.0196*** (0.0044)
$JA_{ps(t-5,t-N)} + JA_{ps(t-5,t-N)} \times N\_JA$ , (N_JA =2) (total effect of having 2 firms in JA from the fifth year)	0.0056*** (0.0015)	0.0107 (0.0068)	0.0012 (0.0018)
$JA_{ps(t-5,t-N)} + JA_{ps(t-5,t-N)} \times N\_JA$ , (N_JA =4) (total effect of having 4 firms in JA from the fifth year)	0.0062*** (0.00178)	.0095 (0.0083)	0.0014 (0.0017)
$JA_{ps(t-5,t-N)} + JA_{ps(t-5,t-N)} \times N\_JA$ , (N_JA =6) (total effect of having 6 firms in JA from the fifth year)	0.0067*** (0.0023)	0.0082 (0.0108)	0.0017 (0.0020)

Dependent variable are indicated in the first row: EBITDA (1), turnover over total asset (2), and tangible plus intangible assets over total assets (3). Estimated coefficients from model 2 in the text. Models estimated are with OLS. Standard errors clustered at the firm level are in parentheses. The number of markets is the number of industry-by-province cells in the sample. Significance at the 10% level is represented by \*, at the 5% level by \*\*, and at the 1% level by \*\*\*

**Table 5** Dynamic indirect effects of judicial administration—differential effects and market structure

	(1)	(2)	(3)	(4)
	1st quartile	2nd quartile	3rd quartile	4th quartile
<i>Panel A-EBITDA</i>				
$JA_{ps(t-1,t-4)}$	0.0112*** (0.0036)	0.0039 (0.0045)	0.0004 (0.0020)	- 0.0016 (0.0025)
$JA_{ps(t-5,t-N)}$	0.0092* (0.0055)	0.0009 (0.0061)	0.0105*** (0.0030)	0.0024 (0.0024)
Observations	223,177	223,291	223,014	223,288
R-squared	0.5776	0.5999	0.6060	0.5742
Number of Firms	54161	56816	57656	53313
<i>Panel B-Turnover</i>				
$JA_{ps(t-1,t-4)}$	- 0.0013 (0.0130)	0.0365** (0.0153)	0.0233** (0.0092)	0.0036 (0.0138)
$JA_{ps(t-5,t-N)}$	- 0.0199 (0.0184)	0.0385* (0.0222)	0.0642*** (0.0133)	0.0032 (0.0130)
Observations	223,177	223,291	223,014	223,288
R-squared	0.7945	0.7965	0.8101	0.8141
Number of Firms	54161	56816	57656	53313
<i>Panel C-Assets</i>				
$JA_{ps(t-1,t-4)}$	0.0116*** (0.0043)	- 0.0029 (0.0043)	- 0.0091*** (0.0027)	- 0.0035 (0.0029)
$JA_{ps(t-5,t-N)}$	0.0043 (0.0070)	- 0.0032 (0.0063)	0.0032 (0.0033)	0.0006 (0.0029)
Observations	223,070	223,237	222,977	223,266
R-squared	0.8980	0.9101	0.9137	0.9028
Number of Firms	54147	56812	57652	53311

Notes. Estimated coefficients from model 2 in the text for each quartile of the total number of firms per province and industry normalized by the total number of firms in each province. Dependent variable in Panel A is EBITDA, in Panel B turnover over total asset and in Panel C tangible plus intangible assets over total assets. Models estimated are with OLS. Standard errors clustered at the firm level are in parentheses. Significance at the 10% level is represented by \*, at the 5% level by \*\*, and at the 1% level by \*\*\*

We estimate model 2 along the distribution of market competitiveness. Table 5 reports the results from this empirical exercise. Despite the lack of precision in several estimates, we observe that the spillover effects are never concentrated in markets characterized by the largest number (normalized) of firms. In markets where the degree of competition is high (captured by a high number of firms), the effects are modest and sometimes negative (see for example column 4 of Table 5). There are two possible and non-mutually exclusive explanations for these results. First, markets characterized by few firms are dominated by criminal organizations that succeeded in creating entry barriers. In this type of market, the removal of the connection to a former criminal firm has a larger effect. Second, in a market with few firms the removal of the connection to an organized crime firm is relatively more important than in markets with a large number of firms.

### 5.3 Threats to Identification and Robustness Checks

In the absence of an experimental design, identification of the spillover effects of JA is based on a conditional independence assumption discussed in Sect. 4, namely that conditional on the large set of fixed effects the timing of entry into JA is exogenous to legal firms' outcomes. This assumption excludes the possibility of industry specific province shocks correlated with entry into JA and to the performance of firms not affiliated to criminal organizations. The fact that in Figs. 4, 5, and 6 we do not observe a clear pattern of leads supports the identifying assumption. However, there are several issues with identification. First, we made the hypothesis that a firm is not affiliated with organized crime if it never enters the status of JA. In fact, we may have several organized crime firms not entering the status of JA in our sample period. These firms can benefit from other firms' entry into JA not because they are not affiliated to a criminal organization, but precisely because they are criminal and assume the role of the former organized crime firms. A complementary mechanism is the mafia relocating to other productive firms when one organized crime firm enters JA. These mechanisms are plausible but is difficult to provide evidence in favor of them. In any case we do expect these mechanisms having a low impact on our results that are based on a large number of firms for each province and industry.

Second, the trends in JA at the industry-province-year level may mask unobserved trends in the profitability of legal firms. To affect our results, however, these unobserved trends must be province specific since we already condition for industry-by-year FE. We cannot address this concern by including province-by-industry-by-year FE because that would absorb our key variable, but we can at least include region-by-industry-by-year. Figures A7, A8, and A9 in the Appendix replicate Figs. 4, 5, and 6 but include region-by-industry-by-year FE instead of industry-by-year FE. By comparing the Figs. 4, 5, 6 and A7–A9, we see that we lose precision in the latter figures but the results are essentially unchanged. This type of evidence reassures us that trends in JA are not associated with unobserved factors affecting firms' profitability.

## 6 Conclusions

In this paper we analyzed the effects on a policy targeting organized crime firms. In particular, we evaluated the provision of a law passed in 1982 in Italy that introduced the possibility of confiscating criminal productive assets. Under the provision of the law, the criminal firm enters a status of judicial administration with an external manager nominated by the legal authority. In practice, a criminal firm entering the status of judicial administration continues to exist but breaks any link with the criminal organization.

Using data on the financial measures of all limited companies in the four largest regions of the south of Italy, we have evaluated the impact of a firm entering into the status of judicial administration on the other firms. Evaluating measures such as performance (captured by EBITDA normalized by total assets), size (captured by turnover normalized by total assets), and investments, we have found that a JA event in a given province and industry increases all three measures. The spillover effects are small if we consider the single firm but they are large if we look at the total number of firms in a market. The empirical strategy is based on a yearly variation in the exposure of legal firms to JA events targeting organized crime firms. The panel structure of the data has allowed us to control for a large set of fixed effects at the industry, year, and firm level that should absorb confounding effects.

This paper is a first attempt to estimate the indirect effects of an enforcement law that confiscates productive criminal assets. As such, it contributes to emerging literature on the economic effects of organized crime by using firm level data. The paper presents some limitations. First, several estimated effects trend in the expected direction but are not always precisely estimated, a circumstance that limits the conclusions of the empirical analysis. Second, the causal interpretation of the results is based on the assumption that conditional on firm, year-by-industry, and year fixed effects, the year of entry for organized crime firms into JA is exogenous. While we have produced evidence in support of this assumption, there are a number of scenarios in which this assumption may fail. Third, data limitations and the empirical design do not allow to understand the precise mechanisms behind our preliminary results. Future research should find further consistent evidence that these enforcement measures have a beneficial effect in the legal economy.

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