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evidence from the Covid-19 shock

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MAFIA INFILTRATIONS IN TIMES OF CRISIS: EVIDENCE FROM THE COVID-19 SHOCK

by Marco Castelluccio* and Lucia Rizzica**

Abstract

We analyse the risk of mafia infiltration into firms operating in the legal economy. To address potential endogeneity concerns, we exploit the sharp drop in revenues caused by the Covid-19-related lockdowns imposed in Italy in spring 2020. We find that the induced sudden and significant deterioration in firms' financial conditions increased the likelihood of infiltration by mafia-connected entrepreneurs: a 10 per cent drop in revenues leads to a 4.9 per cent increase in the probability of mafia infiltration. Although the overall prevalence of – and therefore the induced increase in – infiltrated firms is limited in absolute terms, the estimated effect is non-negligible given its implications for the legal economy. We further show that firms are more likely to resort to mafia-linked lending when they face temporary difficulties in repaying their debts.

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* University College London and Institute for Fiscal Studies (email: marco.castelluccio.20@ucl.ac.uk).

** Bank of Italy (email: lucia.rizzica@bancaditalia.it).

1   Introduction[*]

The relation between mafia growth and the economy is complex and goes in both directions. On the one hand, the presence and expansion of mafia in a given area deeply influences its economic and social development: evidence suggests that the overall long-term impacts on GDP or social development indicators, such as literacy rates, are negative and sizable (Peri, 2004; Pinotti, 2015a,b; Acemoglu et al., 2020). On the other hand, weaker economic conditions, in combination with other socio-political contingencies, can provide a more fertile ground for the mafia to establish: historically, and in all countries, mafia-type organizations have appeared and gained power in more deprived areas (dalla Chiesa, 2017). However, also temporary economic shocks are relevant, even if short-lasting, they can set the ground for a long-term expansion of the mafia in the legal economy. Although there is growing evidence describing the strategies that criminal networks have used to exploit vulnerabilities that may appear in the social and economic environment to gain ground,[1] these analyses are mainly based on the available investigative evidence and on scattered case studies. There lacks, to our knowledge, a consistent systematic estimate of the causal relation between business cycle fluctuations and mafia penetration in the legal economy.

This paper contributes to filling this gap by investigating the role of mafia organizations as lenders to firms in financial distress. To this end, we use Italian firm-level data and estimate the relationship between firm performance – specifically when affected by a temporary negative economic shock – and the likelihood of mafia entry in the firm's share capital. This exercise allows us to establish whether and to what extent a worsening in a firm's economic and financial situation increases the demand for mafia liquidity, facilitating the takeover of the firm by a criminal organization and thus the expansion of mafia in the legal

[1]See, for example, UNODC (2010) and Commissione Parlamentare di Inchiesta sul Fenomeno delle Mafie e sulle altre Associazioni Criminali, anche Straniere (2018) but also Gambetta and Reuter (1995) and Varese (2011).

economy. Moreover, we take stock of the government interventions aimed at supporting firms in distress after the Covid shock to shed light on the conditions and mechanisms that drive distressed firms towards mafia capitals rather than formal legal credit.

To provide a contextual background, imagine that legal firms in financial distress can resort to two types of lenders: commercial banks providing formal credit and illegal mafia-type liquidity providers. In this setting, entrepreneurs face a trade-off when selecting their funding source. On the one hand, banks operate within the boundaries of the law, but demand firms to meet specific requirements in order to receive credit. On the other hand, illegal liquidity providers have fewer requirements for firms in the short run but, by means of threats and violence, may eventually take control of the firm and push it into illegal activities, even when holding a small share of it. In normal circumstances, legal firms would therefore typically prefer to resort to banks. However, illegal lenders may be preferred during times of financial distress in case firms face an unexpected and urgent need for liquidity and are not able to meet the criteria required by banks.

Our analysis draws from detailed microdata on Italian incorporated firms, combining panel balance sheet data with information on the full shareholder structure of firms for the years 2018-2020. The infiltration of mafia into a given firm is proxied following the methodology introduced by Mirenda et al. (2022). Because the focus of our analysis is the possible provision of liquidity by mafia-connected individuals, in this paper we consider only the entry of new shareholders, who effectively bring new capital into the firm, and not that of new administrators. Moreover, while we do apply our methodology to all the Italian mafia organizations, our main focus will be the 'ndrangheta, for which we are better able to identify criminal connections within the firm's ownership.[2] Using this methodology, we find that about 0.84% of firms in our sample were connected to the 'ndrangheta in 2020, 0.79% in 2018.

A natural concern is that a firm's performance and the likelihood of it being connected to mafia may be endogenously related. This would be the case if, for instance, more capable

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[2]The 'ndrangheta, as argued in Mirenda et al. (2022), is characterized by a tight family structure so that clans and families largely overlap. As the methodology is based on the predictive power of family names, it is more accurate in the case of 'ndrangheta than for other mafia organizations. In Appendix B we extend our analysis to other mafias.

entrepreneurs were also generally more honest, so that better performing firms would be less likely to be infiltrated. Moreover, to the extent that mafia acts as a liquidity provider to firms that have more difficulty in accessing formal credit, better performing firms will be less likely to be in need of such loans. In order to overcome such endogeneity concerns, we employ an Instrumented Difference-in-Differences (DDIV) strategy where we exploit the closing of firms operating in *non-essential activities* ruled by the Italian government in response to the Covid-19 pandemic as an instrument for the change in firm performance. Italy was the first country, after China, that faced the pandemic through lockdowns, so the measures, enacted from March 2020, were completely unexpected. Moreover, the closures did not affect all types of businesses, but only the *non-essential* ones, as defined on the basis of a 4- or 6-digit sectoral classification made at the beginning of the emergency. The closures lasted more than two months and implied an immediate massive drop in revenues for the firms involved.

Our main estimates show that: (i) being affected by the forced closures of March 2020 produced a large significant worsening in all indicators of firm performance and financial soundness (*first stage*); revenues dropped by almost 10%, profitability by about 2.6%, current assets (a measure of available liquidity) by 2.7%, equity by 4.2%, the risk score increased by 0.12 points on a 1 to 10 scale (where a higher score indicates a less reliable firm) and labor productivity decreased by 4.6%; (ii) such exogenous worsening of firm performance increased the probability of mafia infiltration in the firm. Our preferred specification shows that a 10% drop in revenues raises the probability of a firm being infiltrated by about 0.04 percentage points. While small in absolute value, this coefficient corresponds to an increase in infiltrations of almost 5% over the baseline. Similar results are obtained when substituting revenues with other economic and financial indicators, such as profitability, available liquidity, equity, risk score, and labor productivity; (iii) moreover, we find some heterogeneity in treatment effects with larger effects for firms located in areas of Northern Italy known to be characterized by a greater mafia presence, which are also among the most productive areas of the country, and for firms operating in the service sector, retail in particular, where investing requires less competences and at the same time it is easier to conceal the revenues of illicit activities.

Finally, we offer insights into the factors influencing legal firms' reliance on mafia lending.

To investigate this, we leverage data on three extraordinary policies implemented by the Italian government to support distressed firms during the Covid-19 crisis. These policies aimed to provide either free liquidity or improved access to credit for firms. By interacting firm revenues with dummy variables indicating the receipt of any or specific government aids, we find compelling evidence suggesting that the receipt of these measures reduced the likelihood of mafia infiltration. Among the various government assistance programs, grants, which provided quick, free liquidity to all small firms, proved to be the most effective in deterring infiltration. Also, the introduction of a debt moratorium was particularly effective in preventing infiltration, indicating that firms burdened with existing debts are more susceptible to falling under the influence of the mafia. On the other hand, the receipt of government guaranteed loans did not reduce the likelihood of infiltration, thus suggesting that at least in our setting – i.e., mainly for quite small loans –, the need for collateral to access formal credit is not a significant factor that pushes firms towards mafia lending.

Our baseline results prove robust to a set of checks, namely to (i) comparing mafia infiltration to generic and *clean* shareholders entries; (ii) refining the definition of infiltrated firms by relying only on less frequent family names to reduce misclassification; (iii) refining the sample used by excluding alternatively Calabria and all other historical mafia regions, where our methodology to detect infiltrations may be less precise; (iv) restricting the control group to firms never infiltrated by any other mafia; (v) employing different sets of fixed effects to account for other possible local idiosyncratic shocks. Additionally, our estimates remain consistent when adopting a definition of infiltrated firms more closely aligned with that of Mirenda et al. (2022).

Overall, the findings of this paper prove that mafia takes advantage of situations of firm financial distress. Thanks to its ability to provide prompt liquidity, it exploits negative economic shocks to infiltrate legal firms and widen its presence, especially in most profitable areas and in activities that are more suited to money laundering. The results in the second part of the paper further specify which firms are more at risk of infiltration, pointing in particular to those that, despite a sound debt position, already need to repay outstanding debts.

The remainder of the paper is structured as follows: in Section 2 we review the literature

on the economics of organized crime to better frame our contribution; Section 3 introduces the data used for the analysis and provides some descriptive statistics; Section 4 discusses our identification strategy; Section 5 shows our results; Section 6 investigates the role of the formal lending system; Section 7 is dedicated to our robustness checks; Section 8 concludes.

2   Related literature

That crime could be the object of study also in economics is an idea that dates back to the path-breaking work of Becker (1968). However, in that initial approach, and for a long time since then, most of the economic research on crime has been targeted at individual agents' allocative choice between legal and illegal activities in the face of different deterrence systems and different opportunity costs (see Chalfin and McCrary (2017) for a review).[3]

The economic analysis of organized crime – hence the idea that criminal activity may be studied through the lenses of firm behavior and market functioning – is relatively more recent. Thirty years ago, the volume edited by Fiorentini and Peltzman (1996) collected several novel contributions that documented how the mafia enters legal markets and distorts competition. The work by Gambetta and Reuter (1996), in particular, considered the modes by which the mafia exercises its influence on a number of legitimate industries. Looking at several in-depth case studies in both Sicily – the most ancient area of origin – and the US – an area where mafia was subsequently exported – the authors show that the mafia produces, promotes, and sells protection in legitimate industries.[4] In particular, the racketeers would provide protection to legal firms in the form of "enforcement of a variety of allocation agreements among independently owned firms", i.e., the mafia would enforce cartels relying on its coercive power and suppressive capacity. Crucially, the authors argue, the primary beneficiaries of this activity would eventually be the owners of the firms being coerced. The ability to provide protection against competition or other threats to rent extraction thus allows the mafia to penetrate the legal economy and gain social consensus.

Mafia protection would be particularly valuable in contexts characterized by low levels

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[3]Some notable contributions also provide evidence from Italy, namely Drago et al. (2009); Buonanno and Raphael (2013); Maheshri and Mastrobuoni (2021).

[4]See also Gambetta (1993).

of trust between economic agents and by weak institutions, i.e., when the government is unable to offer adequate protection to property rights and enforcement of contracts. This is in turn the idea underlying several economics papers that investigated the birth and rise of the Sicilian mafia in the nineteenth century (Bandiera, 2003; Buonanno et al., 2015; Dimico et al., 2017; Acemoglu et al., 2020).[5]

Recent literature also focused on the transplantation of mafia outside its areas of origin (Varese, 2006; Sciarrone, 2009; Varese, 2011). This would typically happen via a progressive expansion of criminal organizations in the legal economy and into the political sphere (Savona et al., 2016). With regard to the latter aspect, several papers shed light on how connections between criminal organizations and political entities may distort the allocation of public funds and hence hamper local economic growth (Acconcia et al., 2014; Barone and Narciso, 2015; Di Cataldo and Mastrorocco, 2021).[6] Recent work by Fenizia and Saggio (2024), in particular, provided compelling evidence on the long-run economic impact of dismissing city councils infiltrated by organized crime, pointing to a large surge in local economic conditions via an increase in employment, in the number of firms, and in industrial real estate prices.

At the same time, a growing body of literature, to which this paper belongs, investigates how the mafia makes it into legitimate businesses and what this implies for both the infiltrated firm and the local economy. Several papers leveraged firm-level data to characterize mafia-connected firms. Fabrizi et al. (2017); De Simoni (2022); Bianchi et al. (2022) provide detailed pictures of the economic and financial conditions of mafia-connected firms by analyzing their balance sheets. Overall, it turns out that these firms are on average larger, have more

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[5]Bandiera (2003) shows that the emergence of mafia-type organizations was stronger in areas of Sicily which at the time were characterized by a greater fragmentation of land ownership and, therefore, by a greater demand for protection against brigandage. Buonanno et al. (2015) and Dimico et al. (2017) identified the combination of positive shocks to the demand for some local goods – sulfur in the former case and citrus in the latter – as the cause of the birth of mafia-type organizations in Sicily at the end of the 1800s. The high foreign demand for a particular asset, in the absence of a sufficiently strong rule of law, would have generated a request for protection by private (mafia-type) organizations. Acemoglu et al. (2020) proposed a further explanation of the origin of the mafia in Sicily. The authors identify the shock in a severe drought that struck the region at the end of the 1800s, which led to a significant worsening of agricultural production and of the living conditions of farmers. These difficulties fueled the socialist movement of the *Fasci siciliani dei Lavoratori* demanding higher wages, longer land leases, and a shift in taxes on landowners. In a context characterized by weak institutions, the socialist threat would have prompted landowners and local politicians to turn to mafia- type organizations to resist these claims.

[6]Related to this, several papers have shown that the presence of mafia induces a worse selection of politicians and worse local economic performance (Pinotti, 2013; Daniele and Geys, 2015; De Feo and De Luca, 2017; Alesina et al., 2018; Daniele, 2019) .

debt, and lower liquidity than non-criminal ones. Bianchi et al. (2022) further documents that connected firms have lower profitability – even though they report higher sales and lower labor costs – and are more likely to exit the market. By identifying the exact moment a firm is infiltrated, we are able to add on to these works by analyzing the dynamics of firm balance sheets *before* infiltration, an exercise that can help to anticipate and prevent infiltrations.

Consistent with the evidence above, our results indicate that a liquidity shortage significantly raises the probability that a firm is captured by criminal organizations.[7] In this spirit, we are also close to Le Moglie and Sorrenti (2022), who show that firms located in more mafia-intense areas (provinces) generally suffer less in times of crisis, this being indirect evidence that mafia organizations can act as credit providers to firms in distress. To the best of our knowledge, however, our study is the first to provide causal evidence on the relation between liquidity shortages and mafia infiltrations and to quantify this effect.

The presence of mafia-connected firms also affects market functioning. Leveraging on the law that imposes the judicial administration of firms connected to mafia, Calamunci and Drago (2020) study the impact of mafia-infiltrated firms on competitors, finding that the exit of a connected competitor raises a firm's revenues and level of investments. In a similar vein, Acconcia and Scarinzi (2022) show that the seizure of mafia-owned firms generates an increase in markups for differentiated products, while it has no effect for standardized manufacture goods, where competition is more open. Slutzky and Zeume (2024), exploit the enforcement of municipality-level anti-mafia actions to show that the presence of organized crime limits competition among firms and for public procurement contracts. Piemontese (2023), finally, quantifies the cost of mafia racketeering on firms in terms of loss of aggregate value added due to resource misallocation.

In this context of firm-level evidence, our work is especially connected to that of Mirenda et al. (2022), whose empirical methodology to detect infiltrations in legitimate businesses we borrow. In line with the descriptive evidence in previous papers, they show that mafia

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[7]Some descriptive evidence that mafia targets firms suffering a liquidity shortage is also available in Mirenda et al. (2022); Arellano-Bover et al. (2024). Naím (2012) also provide convincing arguments that cash-rich criminal organizations acquire financially distressed but potentially valuable companies to extend their scope of action.

infiltrations causally generate an increase in revenues, coupled, though, with an acceleration of market exit. This would signal aggressive competitive strategies or the masking of illicit activities. The authors provide evidence that both motives may be in place in different industries: in the construction sector, for example, the impact of infiltration on balance sheet indicators is more consistent with a mechanism of rent extraction; in the wholesale and retail trade, with one of money laundering. With a similar empirical strategy but leveraging on a different data source, also recent ongoing work by Arellano-Bover et al. (2024), analyzes the entry of criminal organizations in legitimate businesses.[8] Their findings suggest that in most cases the entry of mafia-connected individuals in the ownership or governance structure of a firm generates no extra revenues compared to other entries, hence criminal organizations would contaminate legitimate businesses for a *pure* investment motive, rather than for reasons connected to their criminal activity or to extract rents thanks to their coercive power and availability of illegal liquidity.[9] Our work departs from these two papers mainly in that we analyze the drivers rather than the effects of mafia infiltrations. In doing so, we take the perspective of the firm being infiltrated rather than that of the criminal organization: we show which firms and under which circumstances are more likely to be predated by criminal clans rather than analyzing what happens to firms after being captured and thus infer the motives behind criminal organizations' choices. Indeed, no matter whether this may bring short-run benefits or not, most entrepreneurs would still prefer to maintain control of their business rather than tie their hands to the will of criminal organizations. By showing that an unexpected and severe drop in liquidity can push a well-run firm into the hands of criminal organizations, we point to a condition of vulnerability that should be addressed by the

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[8]In the same vein of what is done in Mirenda et al. (2022), Arellano-Bover et al. (2024) match the data on Italian corporations' ownership and governance with a list of individuals presumably connected to criminal organizations. The latter data are provided to the authors by the Bank of Italy Financial Intelligence Unit and comprise individuals who have been signaled for financial illicit activities and also appear on anti-mafia investigation records.

[9]Net of the differences in the data used – which comprise different time spans, geographical areas and definition of connected firms – the results of the two papers likely diverge for the different definition of the control group considered: while Mirenda et al. (2022) compare infiltrated firms to all other firms with similar balance sheet dynamics, Arellano-Bover et al. (2024) choose to compare them only with those who also experienced some change in the ownership or governance structure in the same year. As such changes typically entail an increase in revenues and liquidity, the authors find little impact of mafia entry on firm performance. However, these changes may be very different from those implied by mafia entry, indeed, when Mirenda et al. (2022) compare their findings on mafia entry with the effects of *similar* changes in governance, they still find that mafia raises firms revenues while the other (similar) changes don't.

policy-maker to contain the expansion of mafia.

In this vein, our work also relates to the literature on formal versus informal borrowing, with the latter referring here to credit obtained from family and friends. This type of informal credit is often considered a last resort for borrowers facing credit constraints, as informal lenders may possess information or enforcement advantages that help mitigate contracting frictions, such as moral hazard and adverse selection. However, informal lenders typically have limited financial resources, and borrowing from family and friends may carry unobserved social costs (Lee and Persson, 2016). Indeed, the use of informal credit to finance business activities is most widespread in developing countries, where formal credit markets are less developed and small-scale investments are more common.[10] In Italy, some studies have documented significant use of informal credit among households (Benvenuti et al., 2022), while family firms often rely on internal capital markets within business groups (Peruzzi, 2015). Although the availability of credit from family and friends could, in principle, mitigate the impact of a liquidity crisis on mafia lending — by acting as a substitute — we argue that such a mechanism is unlikely to have operated in this context. The liquidity shock experienced by firms was substantial, and the crisis itself was both unpredictable in its development and widespread across virtually all businesses. Under these circumstances, mafia lenders were likely the only actors willing and able to extend credit to firms in financial distress.

Finally, our work contributes to the research that focused on the effects of the Covid-induced crisis. Numerous studies have documented its impact on business activity, highlighting which type of firms and sectors most suffered the demand and supply shocks that were triggered by the various restrictions to economic and social activity (Carletti et al., 2020; Wang et al., 2021; Gourinchas et al., 2024; Lamorgese et al., 2024; Barrot et al., 2024). Several contributions further analyzed the efficacy of the policy tools that were put in place (Autor et al., 2022; Cullen et al., 2021; Gourinchas et al., 2021). Finally, some studies pointed to the link between the crisis and the possibility of mafia takeover of firms in distress (UNODC,

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[10]According to the World Bank Enterprise Survey, the proportion of investment that firms finance through "other" sources amounts to approximately 3.6% worldwide, falling below 3% in Europe and Central Asia and in North America. This evidence suggests that SMEs tend to rely on informal credit to cover their smaller financing needs (Hanedar et al., 2014).

2020; Bosisio et al., 2021; Riccardi, 2022).[11]

3 Data and Descriptive Statistics

3.1 Data

Our paper combines several data sources on Italian incorporated firms to estimate the relationship between firm performance and mafia infiltration.

First, we exploit the Company Account Data Service (CADS), which contains balance sheet information for the universe of Italian corporations. We extract yearly information covering the time span 2016-2020 on a wide sector of variables including sector of economic activity, age, revenues, debts, equity, assets, measures of profitability – EBIT, EBITDA and Return On Assets (ROA) –, proxies of liquidity (e.g. current assets), leverage and a risk score – which is assigned by the CADS on a scale from 1 to 10, where a higher score indicates a less reliable firm.[12]

Second, we retrieve information on the full ownership structure of Italian firms from the Italian Chamber of Commerce database (*Infocamere*). Imposing the lower bound on ownership to 0.01% of a firm's shares, we reconstruct the ownership structure by tracking the owners of the owning companies up to eight levels. In such a way, we consider both direct and indirect shareholders.

Third, we make use of the information published by the Anti-Mafia Investigation Directorate (DIA), the Italian multi-force investigation body that works under the Ministry of the Interior with the aim of contrasting mafia-related organized crime. We extract from its first (of two) 2021 report[13] the family names of clans' components from four Italian mafias ('ndrangheta, Camorra, Sacra Corona Unita, and Mafia Lucana). We exclude Cosa Nostra as the report does not contain information on the family names of the affiliates.

Fourth, we exploit the division of business activities between *essential* and *non-essential*

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[11]See also Italian Ministry of Interior (2021).

[12]While we extract information over a five-year window, our main analysis focuses on a shorter period (2018–2020) to preserve sample breadth. Maintaining a balanced panel is a demanding requirement, especially for smaller firms.

[13]An online version can be found at `https://direzioneinvestigativaantimafia.interno.gov.it/relazioni-semestrali/` and it is available in Italian.

activities ruled by the Italian government in March 2020 with the objective of preventing the diffusion of the Covid-19 pandemic. The division is based on 4- or 6-digit sectoral classifications and it is used to create the *Closing* instrumental variable that we describe in Section 4.

Finally, we have information on the take-up of three extraordinary policies that the Italian government launched to help firms in financial distress after March 2020 – grants, a debt moratorium, and government guaranteed loans. The data sources for these measures are described in detail in Pelosi et al. (2021). For our purposes, one caveat is that data on the use of the debt moratorium cover only firms that appear in the Anacredit registry – more than half of the firms in our sample – i.e., only firms with ongoing credit relations with banks. Hence, the analyses which use these data will be based on this subsample.

The infiltration of mafia into a firm is proxied following the methodology introduced by Mirenda et al. (2022). This indicator exploits the predictive power of family names by combining data on firms' governance and ownership with reports from anti-mafia investigations. The indicator flags as infiltrated any firm that, in a given year, lists among its administrators or shareholders at least one person who is (i) born in a mafia region, and (ii) whose family name coincides with one of those listed by DIA among mafia families. Whenever these two conditions are jointly met, the firm is flagged as infiltrated from that year onward.[14] As in Mirenda et al. (2022), our main focus will be the 'ndrangheta, a mafia organization that originates from the Italian region of Calabria and that is characterized by a tight family structure so that clans and families largely overlap. Unlike Mirenda et al. (2022), however, our indicator focuses on shareholders only and disregards changes in the board of administrators of the firm. This choice is dictated by our specific interest in the channel of liquidity provision by mafia organizations. Indeed, it is only shareholders who effectively bring new capital into the firm, whereas administrators will likely be able to provide mainly other types of advantages to firms, such as connections with other infiltrated firms or with corrupted politicians. To corroborate the validity of the indicator in this context, we perform several robustness checks in Section 7.

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[14]For a more comprehensive discussion of the indicator see Mirenda et al. (2022) and, in particular, Online Appendix B.

3.2 Descriptive Statistics

Our final sample for the main analysis covers the period 2018-2020 and is a balanced panel made of 508,286 corporations that are observed during the entire period. We only consider a narrow time window around the Covid shock to better isolate the immediate direct effect of closings on firms' revenues and avoid more general equilibrium effects which would likely deploy over a longer run.

We match firms on their fiscal code, which is a unique identifier for every Italian firm. The reasons why we are not including the universe of corporations in the sample are the following: (i) we include only firms for which we have complete 6-digit sectoral classification in 2020, in order to accurately impute the forced closure, (ii) we keep firms which are observed in the entire 3-years period to estimate how criminal organizations infiltrate *existing* firms after negative economic shocks. Imposing these two conditions leads us to drop 299,247 (37%) firms among those covered by CADS data in 2018.[15] Note that among firms experiencing the entry of mafia-connected shareholders in 2018, 69% were existing firms and just 31% new born firms.

According to our methodology, 4,207 firms had at least one shareholder connected to 'ndrangheta in 2020. In relative terms, this amounts to 0.84% of the total number of active corporations and partnerships, a figure that rose from 0.79% in 2019.[16,17]

We observe that the 'ndrangheta concentrates in the construction sector (19% of all infiltrated firms), followed by wholesale and retail trade, real estate, manufacturing, and accommodation and food services (Figure 1). However, when looking at the variation in the sectoral distribution between 2019 and 2020 we notice that the 'ndrangheta expanded its presence in all macrosectors (industry, market and non-market services), and that its

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[15]Restriction (i) leads us to drop 10% of firms covered by CADS in 2018; restriction (ii) leads us to drop 27% of firms covered by CADS in 2018. These data adjustments were implemented to obtain a consistent and accurate sample; however, our estimates are robust even in their absence – the main result differs by only 0.002 percentage points with that obtained with the larger sample.

[16]We can compare these figures to those in Mirenda et al. (2022) and Arellano-Bover et al. (2024). Comparison of absolute numbers is little informative because the three papers consider different time spans, geographical areas, and criminal organizations. Looking at the relative incidence, instead, the figures are highly comparable: Mirenda et al. (2022) report 0.7% for the Centre and North, Arellano-Bover et al. (2024) 2% in the whole country considering all mafias rather than just the 'ndrangheta.

[17]Appendix Table A.1 reports mean, standard deviation, median, and quartile values for every variable employed in the analysis.

growth did not display in the most infiltrated sectors but rather was led by manufacturing, professional business services, information and communication and utilities.

[Figure 1]

Geographically, the 'ndrangheta concentrates in Calabria – the region of origin – and in the North-West of Italy, where the business is more profitable and thus attractive (Figure 2, left panel). The high share observed in Calabria (more than 20%) suggests that either Calabrian firms are largely infiltrated by 'ndrangheta, or that our methodology tends to overestimate infiltration in the region of origin.[18] Interestingly, the share of 'ndrangheta infiltrated firms is very low in many Southern regions (Sicily, Puglia, Campania, Sardegna and Basilicata), suggesting that mafias shield their territories of origin from external criminal organizations and that there is competition between criminal organizations.[19] The right panel of Figure 2 then illustrates the regional distribution of *new* infiltrations recorded in 2020. These are heavily concentrated in Lombardia – the country's second-richest region – followed by other areas in Northern Italy, as well as Calabria and parts of Central Italy. Notably, this geographic pattern closely aligns with the heterogeneity in treatment effects discussed in Section 5.3.

[Figure 2]

4   Identification: the Covid-19 shock

A legitimate concern is that there could be an endogenous relationship between a firm's performance and its likelihood of being infiltrated by mafia. This concern arises because, for example, more capable entrepreneurs might also tend to be more honest, resulting in better-performing firms being less susceptible to infiltration. Likewise, firms that perform well may have less need for illicit sources of funding, as they can more readily access formal lending channels. Given these considerations, using an OLS regression to estimate the relationship

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[18]To mitigate this concern, in Section 7, we show that our results are robust to running our estimates excluding the region of origin.

[19]See Appendix Figure B.1 for comparison with the geographical distribution of other mafias.

between a firm's performance and its likelihood of mafia infiltration may not yield unbiased results.

4.1 Instrumented Difference-in-Differences

In order to overcome these endogeneity concerns, we leverage the closure of businesses engaged in *non-essential activities* mandated by the Italian government in March 2020, aimed at curbing the spread of the Covid-19 pandemic. Italy was among the first countries, following China, to confront the pandemic by implementing lockdowns, making these measures entirely unforeseen. Furthermore, these closures selectively impacted specific types of businesses, specifically those categorized as *non-essential* based on a 4- or 6-digit sectoral classification.

The closures were established, through Decrees of the Prime Minister, on March 8, March 11, March 25, April 14, and April 26. Each decree provided a list of activities that could not be operated, hence the duration of the closing period varied across sectors. On May 3, all bans were lifted and all firms could get back in business. To impute firm closings, we use the sector of activity indicated in the 2020 balance sheets, as this was what defined the closing during the Covid period.[20] In 2020, more than 60% of firms in our sample had been closed for at least 19 calendar days, the maximum length being 67 days.

To give the reader a better sense of the identifying variation we are using, consider two manufacturing firms, both working in the 4-digit sector *Repair of machinery* – 33.12. However, one is specialized in the repair of agricultural tractors (33.12.60) and the other in the repair of interchangeable parts for machine tools (33.12.91). The former was exempted from closures because considered an essential activity whereas the latter had to close for 38 days. Another interesting example is that of firms in wholesale of measuring machinery and equipment for scientific use (46.69.91, left open) and firms in wholesale of measuring machinery and equipment for non-scientific use (46.69.92, closed for 19 days).

Figure 3 shows the distribution of firm closings by sector. We define firms under the forced closings as *treated* and the others as *controls*. We notice that there is significant

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[20]Many in Italy have been worried by the fact that firms might have changed their sector code to avoid forced closures. However, we believe this has had a negligible impact on our analysis as not even 2% of firms in our sample eventually changed it, and this number is in line with data from the previous years.

heterogeneity across ISIC sectors, with manufacturing, construction, accommodation and food services, and real estate (C, F, I, L) being the most affected by closings. The definition of activities ruled by the Italian government also provides heterogeneity within ISIC sectors, as many of these are almost evenly split between treated and control firms.

[Figure 3]

Overall, the closures implied an immediate massive drop in revenues for the firms involved. However, the effects may have been mitigated by the spread in the use of work-from-home arrangements, which allowed firms to keep operating even during closures. Moreover, some exceptions to the decrees were ruled by the local (province-level) prefects, allowing more firms to operate. Hence, our coefficients of the effects of closures on firm performance indicators may overall be slightly underestimated.

Regarding the final impact on mafia infiltration, there has been widespread concern that the Covid shock may have facilitated the expansion of criminal organizations in the legal economy. Data from the Bank of Italy's survey on firms show that the fear of mafia infiltration raised significantly after Covid, especially for what concerns operations of anomalous business financing and acquisitions, in particular among entrepreneurs operating in sectors more affected by the shock. The proportion of firms reporting occurrences of phenomena associated with organized crime in their operating market in 2020 showed a notable increase, rising from 9% to 16% with respect to the previous year. Notably, this increase was particularly significant in Northern Italy (Mocetti and Rizzica, 2023).

Our final identification strategy exploits closures as an exogenous source of variation for revenues (or other balance sheet variables). This allows us to identify the causal impact of a drop in revenues on the likelihood of infiltration. Specifically, we implement the following instrumented difference-in-differences strategy (DDIV):

$$NDR_{ijlt} = \alpha_i + \beta X_{ijlt} + \phi_{Jt} + \psi_{lt} + \epsilon_{ijlt} \tag{1}$$

$$X_{ijlt} = \gamma_i + \pi Z_j T_{2020} + \xi_{Jt} + \nu_{lt} + \eta_{it} \tag{2}$$

where Equation 2 is the First Stage equation and Equation 1 is the Second Stage equation

of our model. NDR_{ijlt} is a dummy variable which equals 1 if firm i operating in (6-digit) sector j and located in province l is infiltrated from year t onward. X_{ijlt} is a proxy of firm performance in year t as from balance sheet variables. Z_j is the closing instrument, which is different from zero for firms operating in a sector required to close. In our preferred specification, we employ the closing instrument as a dummy variable, while in Section 5.3 we further explore differences stemming from the intensity of treatment. T_{2020} is a dummy variable for year 2020. ϕ_{Jt} and ξ_{Jt} are 4-digit-sector by year fixed effects and ψ_{lt} and ν_{lt} are province by year fixed effects to account for potential shocks which may affect firms across sectoral and spatial clusters. By controlling for firm fixed effects α_i and γ_i we are also able to account for a set of unobservable and idiosyncratic time-invariant firm characteristics which might be an important driver of mafia infiltration. Robust standard errors are clustered at firm level.[21] The coefficient of interest is β, which represents the *average causal response* of a change in firm performance on the likelihood of mafia infiltration for firms whose revenues are affected by the forced closures.

4.2 Identifying assumptions

As outlined by Imbens and Angrist (1994) and Hudson et al. (2017), our methodology requires two exclusion restrictions and two further assumptions:

- Exclusion Restriction 1 (ER1): *Covid-related closures affect 'ndrangheta infiltration only through the change in firm performance.* This assumption would be violated if, for example, mafia had taken part in the decision process through which essential and non-essential activities were decided - given its seemingly arbitrary nature. That is, it might have convinced policymakers to either list as essential the sectors in which its presence is consolidated, or list as non-essential the sectors in which it aimed to expand. However, two pieces of evidence contrast with this hypothesis. The first one is the nature of the decision. The list was proposed by the Minister of Health and approved by the Italian Prime Minister after consultations with the other Ministers. Unless one suspects that high members of the Italian government were easily manipulable

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[21]See Section 7 for alternative specifications and in particular Appendix Tables A.2 and A.3, where we use robust standard errors without clustering.

by lobbies (and even mafia affiliates) in a situation of great emergency, the division of business activities should not be strategically related to mafia infiltration. As a second point, Table 1 reports some balance tests between control and treated firms in 2019. Column (3) shows the raw difference in means and column (4) shows the difference in means controlling for province and (four-digit) sector fixed effects. It suggests that treated firms are those in which mafia is more present before 2020 and hence, if anything, the division of activities has penalized infiltrated firms. The same holds for the other mafias, both taken all together or separately. Looking at balance sheet variables, we observe that treated firms were generally smaller and less profitable; our identification strategy will deal with such differences with the inclusion of firm fixed effects.

Another potential mechanism which may impair the exclusion restriction is the following: according to *Istituto Superiore di Sanità*, Italy's top health institute, in 2020 75,891 people died because of Covid-19 and Covid-related deaths were more likely among the elderly. The death of a shareholder might make a firm more vulnerable and therefore more easily captured by mafia. We check for this by inspecting whether the average age of shareholders is different across treated and control group. The last row of Table 1 shows indeed that, after controlling for province and sector fixed effects, there is no difference in average shareholders' age, implying that this channel should not be a concern;

[Table 1]

- Exclusion Restriction 2 (ER2): *the closing instrument does not affect past infiltration nor past balance sheets*, which is trivially satisfied as closures were unexpected and completely unrelated to firm's performance before March 2020;

- Parallel Trend Assumption (PTA): parallel trends on the outcome variable and the balance sheet variables can be visually inspected in Appendix Figures A.1 and A.2 where we use data from 2016 and plot the results of an event study regression that employs the same set of fixed effects of our most preferred specification; the figures

show no differences between treated and control firms in the trend of the variables before 2020. Some variables, namely profitability (log EBITDA), labor productivity, and leverage, show a slightly declining pre-treatment trend (dashed red line). However, following Dobkin et al. (2018), we show that the point estimate of 2020 is clearly outside of the projected trend.

- Instrument Monotonicity (IM): the closing instrument affects firm's performance only in one direction, in our case negatively. The plausibility of this assumption is supported by the significance of the coefficient π in the First Stage Equation 2 and by the fact that shutting down activities for a certain period should have consequences only in one direction – for instance, lowering revenues – for every treated firm.

5 Results

5.1 Reduced form estimates

First, we investigate the relation between firm closures and the likelihood of being infiltrated by 'ndrangheta by estimating the reduced form of our DDIV model (Equations 1 and 2):

$$NDR_{ijlt} = a_i + bZ_jT_{2020} + c_{Jt} + d_{lt} + e_{ijlt} \tag{3}$$

Table 2 shows the estimates of the reduced form regression under two specifications. The closing instrument is a dummy variable – $Z_j = \{0, 1\}$ – in Panel A, and the number of closing days – $Z_j \in [0, 67]$ – in Panel B. The firm fixed effects are added only in column (4), to show the cleanest estimate we have available. The coefficient shown is b and it is positive and significant, suggesting that closing was associated with an increase in the likelihood of being infiltrated. In addition, although estimates are less precise, Panel B shows that every extra closing day is associated with an increase in the likelihood of infiltration.

[Table 2]

5.2 DDIV results

Table 3 presents the key findings of our study, with revenues serving as the primary variable of interest. The relation between revenues (or another firm performance indicator) and the likelihood of infiltration is ex-ante ambiguous: on the one hand, we expect criminal organizations to be better able to capture firms in distress, on the other hand, they will preferably target sound activities so as to make profits.

In column (1) we report our OLS estimates. We find that higher revenues are associated with a slightly higher likelihood of mafia infiltration. This positive, though small, coefficient can be interpreted as the signal of the interest of criminal organizations in profitable activities. However, in order to attach a causal interpretation to our estimates, we need to resort to the 2SLS estimates in columns (2) to (4).

First, in Panel C, we document a significant and substantial negative impact on firm revenues resulting from the forced closures of Spring 2020. Relative to (otherwise very similar) essential activities, firms that were forced to close their business for some period of time, experienced a drop in revenues of about 9 to 10% depending on the specification.

Second, this exogenous shock to revenues is found to increase the likelihood of infiltration by the 'ndrangheta (Panel B). The F-statistic indicates that our measure is not weak according to the commonly used rule of thumb (Staiger and Stock, 1997), as it is largely above 10. Furthermore, our coefficient estimates remain highly significant, though slightly smaller in magnitude, even after incorporating firm fixed effects. In our preferred specification (column 4), which includes firm fixed effects, we find that the Covid-related closures led to a 9% decrease in revenues. The induced variation in revenues caused an increase in the probability of 'ndrangheta infiltration: the estimated effect is of 0.039 percentage points (pp) increase in the likelihood of infiltration for a 10% decrease in revenues.[22] While apparently small in magnitude, if we compare these coefficients to the baseline likelihood of infiltration, we can argue that a drop in revenues of 10% increases the probability of a firm getting infiltrated by 'ndrangheta by almost 5%, in absolute terms in our sample this amounts to about 200 more firms getting infiltrated. Reassuringly, the product of our first and second

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[22]Results are very similar, $\beta = 0.00332$ with a p-value of 8%, if we consider firms from 2016 rather than 2018.

stage coefficients returns the reduced form coefficient estimated in Table 2.

[Table 3]

5.3 Other results

We then explore the relationship between firm performance and infiltration through several other balance sheet variables that include both economic and financial indicators. Specifically, in Table 4, we include in our model alternatively EBITDA, current assets,[23] equity, a credit risk score, and labor productivity. Overall, we find that the forced closures caused a significant and substantial deterioration in all indicators of firm performance and financial stability. Profitability experienced a decline of about 2.6%, current assets decreased by 2.7%, equity decreased by over 4%, the risk score increased by more than 0.1 points on a scale of 1 to 10 (where a higher score indicates a less reliable firm), and labor productivity decreased by 4.6%. Importantly, a worsening in financial conditions led to an increase in the likelihood of 'ndrangheta infiltration. Specifically, a decrease in profitability by 10% increases the likelihood of infiltration by 0.14 pp. A decrease in current assets of the same amount increases the likelihood of infiltration by 0.13 pp. A decrease in equity by 10% leads to an increase in the likelihood of infiltration by 0.09 pp. An increase in the risk score of 1 leads to an increase in the likelihood of infiltration by 0.003 pp. Finally, a decrease in labor productivity of 10% raises the likelihood of infiltration by 0.08 pp. Given the size of the first stage coefficients and the baseline incidence of mafia infiltrations, these estimates suggest that the magnitude of the shock caused by Covid-19 related closings coherently implied an increase in the likelihood of infiltration in the order of 4.6% for the loss in profitability, 4.5% for the loss in current assets, 4.8% for the loss in equity, 4.5% for the increase in the risk score, and 4.5% for the drop in productivity.

[Table 4]

In Table 5, then, we investigate whether the intensity of the shock, specifically the duration of the forced closure, affects the probability of infiltration. To explore this, we

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[23]Current assets represent the most accurate proxy for liquidity available to us, given that they are defined as cash or cash equivalents that can be converted to cash through liquidation, use, or sales within one year.

substitute the instrument dummy of our main specification with a continuous instrument that takes values between 0 and 67 depending on the number of closing days. These estimates reveal the importance of the closing period length, as they imply that going from the 10th percentile to the 90th percentile in terms of closing days (38 to 67) increased the likelihood of infiltration from 2.8% to 4.9%. Note that the implied estimated elasticity between revenues and the likelihood of infiltration remains very similar to the one of the main specification.

[Table 5]

Table 6 reports the estimates of some heterogeneous effects. First, in columns (1) and (2) we split our sample of firms between those operating in industry (manufacturing, agriculture, and mining) and those operating in the service sector. Our findings indicate that 'ndrangheta exploited the exogenous shock to expand its presence in the service sector. The likelihood of infiltration in this sector increases by about 6%, which is higher than the baseline estimate. The preference for the service sector, here especially driven by retail, can be explained both by the fact that these activities are generally easier to take over and run in that they require less competences and by the fact that they are also more prone to money laundering in that they are more labor intensive and display a high ratio of variable costs over revenues (Pellegrini et al., 2020; Mirenda et al., 2022).

In columns (3) to (6), finally, we explore differences related to the geographical area in which firms are located. In columns (3) and (4) we analyze the provinces in the North of Italy by splitting them into two groups, namely those provinces with a proven consolidated presence of 'ndrangheta (DIA, 2018) vis-á-vis the others; in columns (5) and (6), then, we look respectively at provinces in the Center and South. While less precisely estimated, the coefficients of the second stage point to a clear preference for investing in the areas in the North with an already consolidated presence of 'ndrangheta. The increase in infiltrations in these provinces reaches 8.5% , while it is negligible in the other areas of the North and in the South; it is around 2.6% in the Center. This is an interesting result implying that 'ndrangheta mainly increased its presence where the business is most profitable *and* it already has a consolidated structure. This set of results is also consistent with the findings in Bosisio et al. (2021), for which, after the Covid-19 shock, a much larger share of firms located in

Northern Italy changed their ownership structure – a phenomenon considered a red flag for mafia infiltration.

[Table 6]

6 Formal credit versus mafia lending

In this section, we leverage some specific public policy interventions aimed at providing financial support to distressed firms during the Covid-19 crisis to identify which features of the formal lending system most explain why firms resort to mafia lending.[24]

During the financial distress caused by the COVID-19 pandemic, the Italian government implemented several extraordinary measures to provide liquidity and facilitate the granting of credit to firms, particularly Small and Medium Enterprises (SMEs). We focus on three specific policies enacted between March and May 2020: (i) grants (*contributi a fondo perduto*); (ii) debt moratorium; and (iii) government guaranteed loans. Grants were subsidies given to SMEs with no obligation of repayment; they amounted to 10% to 20% of the difference in revenues between April 2019 and April 2020 and were given to SMEs if their assets in 2019 were below 5,000,000 € and either had experienced a large (at least one third) drop in revenues between April 2019 and April 2020 or were not born before 2019. Debt moratorium was a temporary suspension of outstanding debts repayments; it was available to all SMEs[25] that did not have any non-performing loan. Government Guaranteed Loans, finally, were schemes that provided public insurance to private loans for up to the full value of the loan. In particular, for loans below 30,000 €, the scheme provided for automatic granting with a 100% coverage ratio.[26] The maximum guaranteed amount could not exceed 25 per cent of the borrower's revenues. The scheme was available to all firms with fewer than 500 employees.

The three policies were promptly announced by the government, within two months from the onset of the Covid-19 pandemic. They are considered the most significant actions

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[24]Note that the results for this section are ran on the subsample of firms which have been surveyed by Anacredit which are on average larger and with higher infiltration in 2019, as shown in Appendix Table A.4.

[25]According to the European Union definition, this implies having a number of employees below 250 and either revenues below 50,000,000 € or total assets below 43,000,000 €.

[26]For larger loans, prior screening and authorization were needed for lenders to obtain the guarantee, and the guarantee was limited to 80% or 90%.

taken by the Italian government to support Italian firms in response to the shock caused by the pandemic. It is important to note that there were significant overlaps in the eligibility criteria for these policy instruments. Many firms were eligible for and received multiple forms of assistance, as the government aimed to target all SMEs in financial distress. Figure 4 shows the share of firms that benefited from these policies by length of their closing period: while treated firms were generally more likely to receive some type of government aid, there is sufficient variation in the take-up across groups to estimate our DDIV model. We thus augment our baseline DDIV model (Equation 1) by interacting revenues with indicators for having received some, or a specific, government aid.[27]

[Figure 4]

First, our analysis provides evidence on the overall effectiveness of the measures adopted by the government in preventing mafia infiltration; second, and most interestingly in this context, it allows us to infer the specific needs of firms in financial distress by examining the effectiveness of the different policies. Indeed, grants highlight the need for free and quick liquidity without constraints nor requirements. Debt moratorium sheds light on the challenges posed by the pre-existing burden of debt to repay. Government guaranteed loans respond to the need for collateral.

The results from our augmented DDIV regression, as shown in Table 7, explore the role of receiving at least one form of government aid (column 1) and (at least) every specific aid type (columns 2-4), in preventing mafia infiltration. First, we find that receiving any form of aid significantly mitigates the negative impact of revenue decline on the likelihood of infiltration, nearly halving its effect. Second, among the different aids, grants proved the most effective. This suggests that in a situation of financial distress, firms benefit from the possibility of receiving liquidity in very short time (money was given within two weeks from the filing of the request) and with no constraints attached, even if the amount is not very large. Also debt moratorium proved effective, suggesting that firms are more likely to end up in the hands of mafia when they have difficulties in repaying their outstanding debts. Providing

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[27]This implies estimating a 2SLS regression in which we instrument revenues and the interaction between revenues and aids with the instrument and the interaction between the instrument and aids (Wooldridge, 2001).

flexibility in repayment schemes allows firms to make it on their own. Conversely, we find that access to guaranteed loans did not reduce the risk of infiltration. This is consistent with two possible stories: on the one hand it may be suggestive that it is not the case that firms resort to mafia lending rather than formal credit because they lack collateral; on the other hand, it may be simply due to the fact that most loans granted were below the 30,000 € threshold, a rather low amount (Bonaccorsi di Patti et al., 2024).[28,29]

[Table 7]

Overall, these findings thus mainly highlight the importance of (i) injecting liquidity into firms *promptly* and at a low cost and (ii) relaxing repayment duties for sound firms when they are hit by a large negative shock in order to effectively reduce the likelihood of them being captured by mafia organizations.

7 Robustness Checks

In this section we provide several robustness checks to assess the validity of our causal estimates.

First, there may be concerns regarding a general reorganization of the shareholder ownership during periods of crisis. Indeed, it may be the case that mafia-connected investments increase as much as others in a general process of market readjustment. To rule out such concerns, in Table 8, we re-estimate our DDIV model using several alterations of the baseline model:

(i) in column 1, we change the outcome variable from NDR_{ijlt} to $ENTRY_{ijlt}$, which is a dummy that takes value one from the date in which there is the entry of *any* shareholder onward. This allows us to examine the overall trend of shareholder entries in financially constrained firms; (ii) in column 2, we change the outcome variable by considering $ENTRY$

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[28]This was especially true in the very first months in which the policy was implemented: as of June 2020, almost 90% of the applications for the government guaranteed loans was for amounts below 30,000 € (Bank of Italy, 2020).

[29]Looking at the various possible combinations of aids received, we find that grants and debt moratorium reinforce each other so that receiving both decreases the probability of infiltration more than receiving only one of the two. In the case of guaranteed loans, instead, results are generally not significant and seem to point to a lack of effectiveness of the instrument in preventing mafia infiltration, as shown in Appendix Table A.5.

$CLEAN_{ijlt}$, which captures the entry of shareholders who, according to our methodology, are not affiliated with any mafia. This modification allows us to investigate whether mafia-connected and clean shareholders pursue similar or different investment strategies; (iii) in columns 3 and, we make an alteration of our indicator for clean entrepreneurs relaxing, respectively, the region of birth and the family name criteria. Hence, column 3, will consider the entry of shareholders born in any region of the country but with no mafia-flagged family name, column 4 will consider the entry of shareholders born anywhere but in Calabria, irrespective of their family name; column (5), conversely, considers the entry of *only* shareholders born in Calabria; finally, column (6) looks at the entry of shareholders born in Southern regions with no tradition of mafia presence, i.e., Basilicata and Sardinia.

Our findings reveal that financial distress actually reduces the likelihood of shareholder entry, regardless of whether we consider all entrants or only *clean* entrepreneurs (columns 1 and 2). This finding is robust to the use of alternative definitions of clean entries in columns 3-4 while we find no effect at all on the investment behavior of southern investors (either Calabrian in column 5 or from other southern regions in column 6). This suggests that in general the presence of financial distress discourages new shareholder involvement – the likelihood of entry decreases by over 10% with respect to baseline (column 2). This is a relevant finding which points to substantial differences in the investment strategies of clean versus mafia-connected individuals, the latter being cash-rich enough to invest in periods of general crisis and high uncertainty. Moreover, for them, the expected benefit of entering a new (legal) business is presumably higher.

[Table 8]

Second, in Table 9, we check the robustness of our estimates to several refinements of our mafia infiltration definition. Specifically, we acknowledge that: (i) our indicator might systematically overestimate 'ndrangheta infiltration if some last names of 'ndrangheta families are particularly widespread in the country; (ii) our indicator might be overestimating 'ndrangheta infiltration in its region of origin, where the affiliates family names are more frequent compared to the rest of Italy; (iii) the control group may include firms that are infiltrated by other mafias and (iv) there may be other regional shocks, in particular related

to the *second phase* of the pandemic which differentially affected firms. Indeed, during the *second phase* (i.e., October 2020 - March 2021), a new Decree of the Prime Minister approved restrictions which had to be implemented at the regional level according to the local contagion index R_t. These rules were mainly restricting the freedom of movement of inhabitants (e.g., curfews at 11pm), rather than the regular course of business activities and for this reason we do not believe they impair the validity of our main specification.

To address the first concern, we exploit information on the frequency of family names as retrieved from the 2005 list of taxpayers in Italy.[30] We create two different infiltration dummies, depending on whether the frequency of the last name is above or below the median among 'ndrangheta last names outside Calabria. We find that the coefficient estimated considering only rare last names is close to our baseline result and it is still significant at the 90% level (column 1). On the other hand, the coefficient in case of frequent last names is not statistically different from zero (column 2), implying that our results are only driven by rare last names, which should have a lower likelihood of being false positives. In the same spirit, we acknowledge that the share of false positives may be particularly high in Calabria, where these family names are most common. Hence, in column 3 we exclude Calabria and obtain a coefficient that is smaller and less precisely estimated but not statistically different from our baseline. In columns 4 and 5 we also restrict the sample so as to exclude from the control group firms which may be infiltrated by other mafia organizations: in column 4 we exclude all firms in Calabria, Campania, Puglia and Sicily, while in column 5 we drop all firms which, according to our methodology, we flag as infiltrated by other mafias. The estimated coefficient remain negative and significant and close to the baseline specification. Finally, related to the concern that other region-specific shocks may bias our estimates, in column 6 we add sector-region-year fixed effects that allow us to take into account shocks to firms related to the *second phase*; this further restrictive specification does not affect the estimates.

[Table 9]

In order to further confirm the validity of our proxy of mafia infiltrations, we also tested

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[30]This was the only time such list was ever published.

the robustness of our findings to the use of a definition more aligned with Mirenda et al. (2022), which involves (i) reconstructing ownership structure up to four levels instead of eight ($\beta = -0.00358^{**}$); (ii) limiting the sample to firms in central and northern Italy ($\beta = -0.00238^{*}$), or (iii) restricting the sample to center and north and exploiting only clans identified as conducting business in these regions ($\beta = -0.00234$ with a p-value of 0.103).

Finally, in Table 10, we provide some indirect test of the exclusion restriction. For instance, it might be argued that the 'ndrangheta infiltrated firms that were listed among the forced closings because it anticipated that these would obtain more generous government aid. To check this potential violation of the exclusion restriction, we estimate the following equation keeping only observations in 2020:

$$
\begin{aligned}
Aids_{ijl} = \alpha &+ \beta_1 NDR_{ijl} + \beta_2 Entry\ NDR_{ijl} + \beta_3 Z_j + \beta_4 Z_j \times NDR_{ijl} + \\
&\beta_5 Z_j \times Entry\ NDR_{ijl} + \gamma_J + \delta_l + \epsilon_{ijl}
\end{aligned}
\tag{4}
$$

The dependent variable $Aids_{ijl} \in [0, 1, 2, 3]$ shows the number of government aids obtained by each firm i. $Entry\ NDR_{ijl}$ is a dummy variable which equals one only if the firm has been infiltrated in 2020. We also control for sector and province fixed effects to deal with common spatial and sectoral shocks, and for other possible confounders which are highly correlated with eligibility to government aids (drop in revenues and labor costs between 2019 and 2020, and firm's age). The estimates of this equation may shed light on the validity of the exclusion restriction. In particular, we will interpret the coefficients on 'ndrangheta entry and on the interaction between 'ndrangheta entry and the closing dummy as follows: in case $\hat{\beta}_2$, $\hat{\beta}_5 < 0$, 'ndrangheta infiltration might be considered a substitute of government intervention, implying that mafia provides liquidity which enables firms to survive; in case $\hat{\beta}_2, \hat{\beta}_5 > 0$, 'ndrangheta infiltration can be considered a complement of government intervention, suggesting that 'ndrangheta is attracted by government funds. This might suggest also that 'ndrangheta has more ability to receive extraordinary support. However, this seems highly implausible because of the nature of government aids and because it has been documented that the policy take-up rate has been very high for all measures. For instance, Arnaudo et al. (2022) shows that by the end of 2020, almost two firms out of three

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among those surveyed by Anacredit had received either debt moratorium or government guaranteed loans.

[Table 10]

Table 10 shows the estimates of the above equation. First, both $\hat{\beta}_2$ and $\hat{\beta}_5 < 0$, although they are not statistically different from zero. This implies that 'ndrangheta does not systematically infiltrate firms which obtained government aids. If anything, it suggests the opposite. Second, both $\hat{\beta}_1$ and $\hat{\beta}_3 > 0$, meaning that being infiltrated and being forced to shut down the activities are both positively correlated with the number of aids received. However, the coefficient on their interaction term, $\hat{\beta}_4$, is actually negative, suggesting that infiltrated firms forced to close have a propensity to apply for (and receive) government aids that is lower than the other firms. Finally, notice that the inclusion of fixed effects and control variables do not change the sign nor the significance of our estimates. We also run the above specification substituting the number of aids received with each single aid and the results are along the same lines.[31]

8   Concluding remarks

The expansion of mafia organizations in the legal economy is a major and growing concern. In recent years criminal organizations have turned into multinational businesses where the boundary between illegal affairs and licit investments has become progressively more blurred. By taking over companies that operate in legal businesses, mobsters manage to funnel the money coming from illegal activities into the legal economy and, in some circumstances, make substantial profits. Understanding when and how the mafia takes over legal activities is thus of primary importance to restrict the boundaries of its power and action.

This paper analyzes the relationship between firms' financial conditions and the likelihood of being infiltrated by the mafia. In order to overcome the possible endogeneity concerns, we exploit the shock to firm revenues caused by the outburst of the Covid-19 pandemic and the subsequent sudden closure of all non essential activities in Italy in Spring 2020. We adopt a

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[31]See Appendix Tables A.6, A.7 and A.8.

short-term perspective focusing on the period 2018-2020 only. While this somehow limits the scope of our analysis – in that the expansion of the mafia in the legal economy may have taken some longer time – it shields us from more general equilibrium effects which may bias our estimates. Indeed, in a longer run, the closures of spring 2020 may have affected the presence of mafia in the economy through more channels, e.g., via a more general repositioning of the mafia in the context of the turbulent market dynamics that followed the crisis.

Our main results show that an unexpected substantial drop in revenues, like the one caused by the anti Covid-19 restrictions, increases the likelihood of being infiltrated by the mafia significantly. Specifically, a 10% drop in revenues generates an increase in the likelihood of infiltration of almost 5%. Accordingly, in our sample, the Covid-19 induced drop in revenues caused the infiltration of almost 200 legitimate firms. This increase was concentrated in the areas of the North with previous established mafia presence, thus signaling that the mafia is better able to take advantage of unexpected business opportunities there where it already has some consolidated structure. Moreover, in doing so, it seeks to expand its presence in relatively rich areas, where business is more profitable. We further show that the expansion of mafia in the legal economy was concentrated in the service sector rather than manufacturing. This is in line with the idea that services – here especially retail – provide more mafia-prone activities both because their productive structure is more fit for money laundering and because, relative to manufacturing, they are easier to take over and to run.

To understand why firms resort to mafia lending allowing mobsters to infiltrate their businesses rather than using formal legal credit, we exploit the availability of some extraordinary government measures aimed at quickly providing liquidity to firms in distress. Generally, our results show that access to any form of extraordinary government aid halved the impact of revenue decline on the likelihood of infiltration. Most interestingly, by assessing the effectiveness of each single instrument, our results allow us to provide some indirect evidence about the underlying mechanisms behind firms' resorting to mafia lending. In this respect our findings suggest that firms resort to criminal organizations to obtain liquidity when access to formal credit is expensive – hence infiltration is less likely when firms obtain non-repayable grants – or when they have difficulties in repaying pre-existing debts – hence a

debt moratorium reduced their need for extra, illicit, liquidity. We find no mitigating role of government guaranteed loans, which provided public insurance to new private loans.

All in all, this paper enhances our still limited knowledge of how the mafia expands beyond its traditional boundaries into the legal economy and how such phenomenon can be counteracted. In particular, a better characterization of the conditions that make firms most vulnerable to mafia capture can help design proper policies, both in terms of how to most effectively guide investigative actions and in terms of how to design financial instruments that most respond to the needs of firms that mafias are otherwise better able to satisfy.

9 Figures

Figure 1: Infiltrated firms by sector
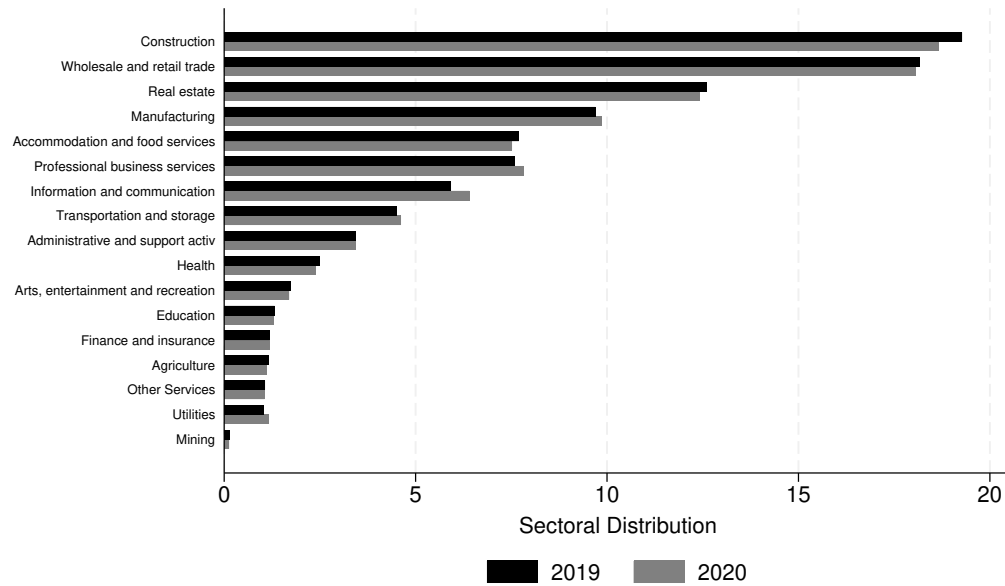
Notes: Sectoral distribution (i.e., the share of infiltrated firms by sector) in 2019 and 2020. Firms are sorted by the sectoral distribution in 2019.

Figure 2: Infiltrations by region
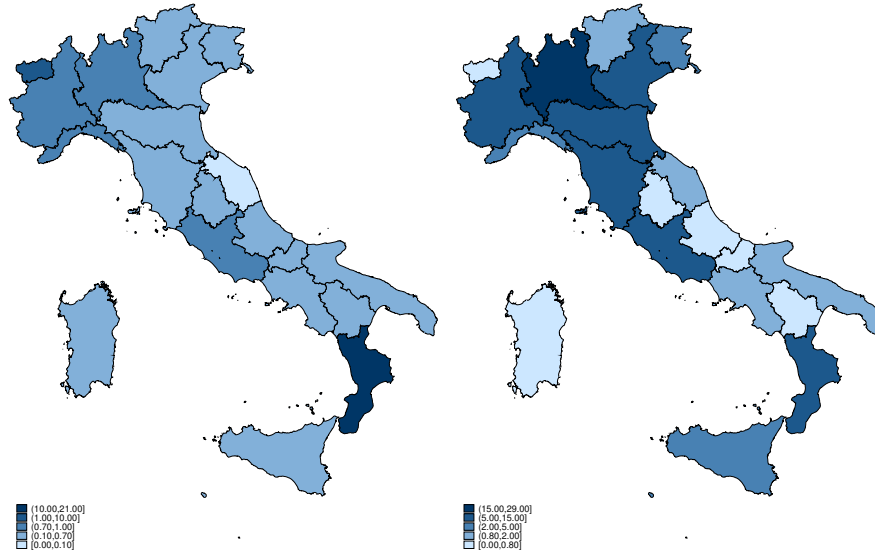
Notes: The left panel shows the percentage frequencies of infiltrated firms in 2020 by region. That is, the ratio between the number of firms infiltrated and the total number of active firms by region. The right panel shows the distribution of 2020 *new* infiltrations by region. That is, the ratio between the amount of *new* infiltrations in each region and the total of *new* infiltrations.

Figure 3: Closings by sector
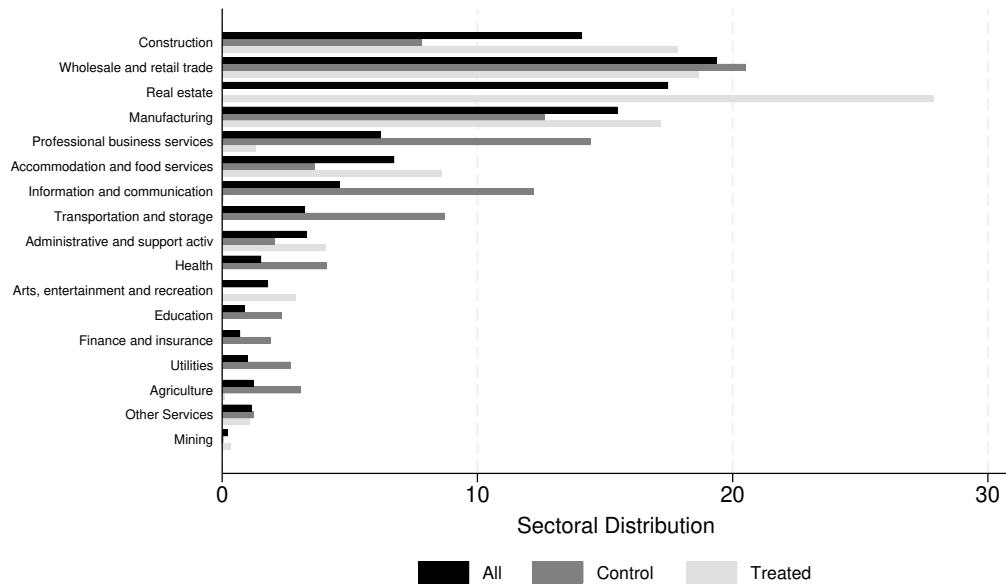
Notes: Distribution of firms across sectors among all, control and treated units. Sectors are sorted by the sectoral distribution of infiltrated firms (i.e. the share of infiltrated firm by sector) in 2020.

Figure 4: Take-up of government aids by number of closing days
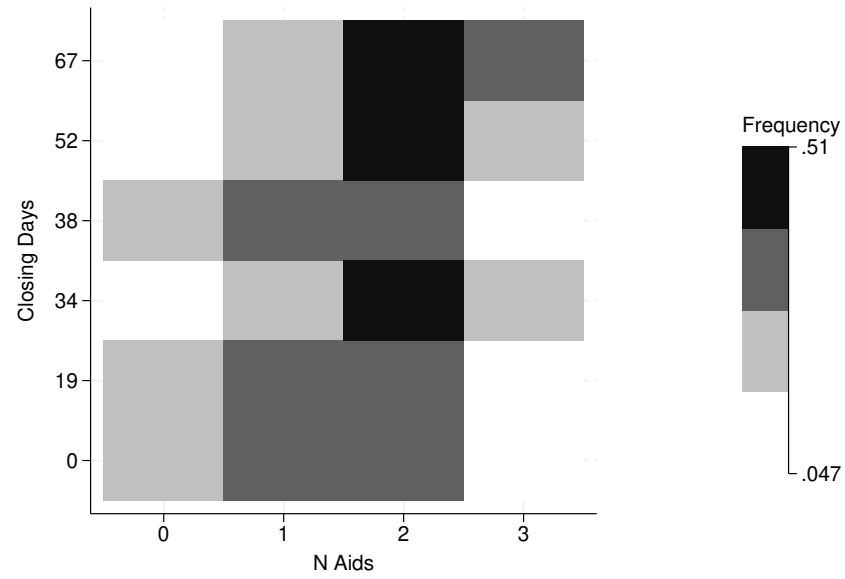
Notes: Share of firms obtaining government aids according to the closing period.

10 Tables

Table 1: Balance tests

	(1) Control	(2) Treated	(3) Δ_1	(4) Δ_2
NDR	0.009	0.007	-0.002***	0.001
	(0.096)	(0.085)	(0.000)	(0.001)
CAM	0.023	0.019	-0.004***	-0.003
	(0.150)	(0.136)	(0.000)	(0.002)
SCU	0.010	0.007	-0.002***	-0.001
	(0.097)	(0.086)	(0.000)	(0.001)
MAF L	0.000	0.000	-0.000	0.000
	(0.012)	(0.011)	(0.000)	(0.000)
All Mafias	0.039	0.031	-0.008***	-0.002
	(0.194)	(0.174)	(0.001)	(0.002)
(log) Revenues	6.175	5.420	-0.755***	-0.183***
	(1.876)	(2.251)	(0.006)	(0.023)
(log) EBITDA	6.350	6.293	-0.057***	-0.040***
	(0.524)	(0.422)	(0.001)	(0.006)
(log) Current Assets	5.662	5.613	-0.049***	-0.075***
	(1.797)	(1.832)	(0.005)	(0.022)
(log) Equity	4.855	5.005	0.150***	-0.095***
	(1.902)	(1.903)	(0.006)	(0.025)
Risk Score	3.928	4.005	0.077***	0.111***
	(2.189)	(2.084)	(0.006)	(0.031)
(log) Labor productivity	2.255	2.580	0.326***	0.087***
	(1.593)	(1.768)	(0.005)	(0.020)
Shareholders' Age	50.070	51.952	1.882***	-0.151
	(10.720)	(11.450)	(0.031)	(0.149)
Shareholders_0	2.712	2.639	-0.072***	-0.007
	(8.066)	(9.027)	(0.024)	(0.030)
Shareholders_8	11.486	10.591	-0.895**	-1.649
	(141.912)	(153.611)	(1.713)	
Observations	204,985	344,218	549,203	

Notes: Columns (1) and (2) report mean values for control and treated firms in 2019, respectively. Column (3) shows the raw difference in means between (2) and (1). Column (4) shows the difference in means after controlling for province and sector fixed effects. Shareholders_0 indicates the number of direct shareholders; Shareholders_8 the number of shareholders considering the ownership structure up to eight levels. Robust standard error in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 2: Reduced form estimates

	(1)	(2)	(3)
Dependent variable:		NDR	
Panel A: Closing dummy			
Closing	0.000526**	0.000582***	0.000357**
	(0.000220)	(0.000218)	(0.000165)
Panel B: Number of Days			
Closing days	0.0000187	0.0000187	0.00000590*
	(0.0000145)	(0.0000134)	(0.00000339)
N	1518090	1518090	1518090
Firm FE			Yes
Sector-Year FE	Yes	Yes	Yes
Province-Year FE		Yes	Yes
Mean of Dep Var (%)	0.794	0.794	0.794

Notes: Sector-Year fixed effects are at ATECO 4 digit level. The mean of the dependent variable refers to its value at baseline (2019). Robust standard errors clustered at firm level in parentheses. ***, **, and * indicate significance at 1, 5, and 10 percent critical level.

Table 3: Main results: variation in revenues and 'ndrangheta infiltrations

	(1)	(2)	(3)	(4)
Dependent variable:		NDR		
Panel A: OLS				
(log) Revenues	0.0000923***			
	(0.0000349)			
Panel B: 2SLS				
(log) Revenues		-0.00535**	-0.00600**	-0.00388**
		(0.00231)	(0.00234)	(0.00184)
Panel C: First-Stage				
Closing		-0.0983***	-0.0968***	-0.0918***
		(0.00977)	(0.00980)	(0.00834)
N	1518090	1518090	1518090	1518090
Firm FE	Yes			Yes
Sector-Year FE	Yes	Yes	Yes	Yes
Province-Year FE	Yes		Yes	Yes
Mean of Dep Var (%)	0.794	0.794	0.794	0.794
F-Stat		101.2	97.44	121.3

Notes: Column (1) reports OLS estimates, whereas columns (2), (3) and (4) report 2SLS and first-stage estimates. Kleibergen-Paap Wald F-statistic reported. Sector-Year fixed effects are at ATECO 4 digit level. The mean of the dependent variable refers to its value at baseline (2019). Robust standard errors clustered at firm level in parentheses. ***, **, and * indicate significance at 1, 5, and 10 percent critical level.

Table 4: Other results: variation in alternative balance sheet indicators and 'ndrangheta infiltrations

	(1)	(2)	(3)	(4)	(5)
Dependent variable:			NDR		
Panel A: 2SLS					
(log) EBITDA	-0.0140**				
	(0.00691)				
(log) Current Assets		-0.0134*			
		(0.00695)			
(log) Equity			-0.00914*		
			(0.00468)		
Risk score				0.00302**	
				(0.00152)	
(log) Labor Productivity					-0.00774*
					(0.00399)
Panel B: First-Stage					
Closing	-0.0261***	-0.0266***	-0.0419***	0.118***	-0.0461***
	(0.00435)	(0.00605)	(0.00842)	(0.0228)	(0.0103)
N	1489892	1516561	1405220	1517114	1507928
Firm FE	Yes	Yes	Yes	Yes	Yes
Sector-Year FE	Yes	Yes	Yes	Yes	Yes
Province-Year FE	Yes	Yes	Yes	Yes	Yes
Mean of Dep Var (%)	0.789	0.795	0.800	0.795	0.793
F-Stat	35.99	19.33	24.81	26.75	19.93

Notes: Kleibergen-Paap Wald F-statistic reported. Sector-Year fixed effects are at ATECO 4 digit level. The mean of the dependent variable refers to its value at baseline (2019). Robust standard errors clustered at firm level in parentheses. ***, **, and * indicate significance at 1, 5, and 10 percent critical level.

Table 5: Other results: intensity of the shock and 'ndrangheta infiltrations

	(1)	(2)	(3)
		NDR	
Panel A: 2SLS			
(log) Revenues	-0.00600	-0.00577	-0.00314*
	(0.00469)	(0.00419)	(0.00183)
Panel B: First Stage			
Closing days	-0.00311***	-0.00323***	-0.00188***
	(0.000299)	(0.000296)	(0.000150)
N	1518090	1518090	1518090
Firm FE			Yes
Sector-Year FE	Yes	Yes	Yes
Province-Year FE	Yes	Yes	Yes
Mean of Dep Var (%)	0.794	0.794	0.794
F-Stat	108.7	119.5	156.5

Notes: Kleibergen-Paap Wald F-statistic reported. Sector-Year fixed effects are at ATECO 4 digit level. The mean of the dependent variable refers to its value at baseline (2019). Robust standard errors clustered at firm level in parentheses. ***, **, and * indicate significance at 1, 5, and 10 percent critical level.

Table 6: Other results: heterogeneous treatment effects

	(1)	(2)	(3)	(4)	(5)	(6)
			NDR			
Panel A: 2SLS						
(log) Revenues	0.0000459	-0.00534**	-0.00690	-0.0000565	-0.00108	-0.000122
	(0.000414)	(0.00252)	(0.00512)	(0.000251)	(0.000982)	(0.000189)
Panel B: First Stage						
Closing	-0.0984***	-0.0902***	-0.0978***	-0.0688***	-0.132***	-0.0771***
	(0.0158)	(0.00980)	(0.0161)	(0.0158)	(0.0181)	(0.0176)
N	469903	1030997	427571	386097	357587	321868
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Sector-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Province-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Subsample	Industry	Services	High NDR Provinces	Rest of North	Center	South (Excl Calabria)
Mean of Dep Var (%)	0.775	0.803	0.794	0.366	0.553	0.169
F-Stat	38.97	84.72	37.11	18.86	53.53	19.13

Notes: Kleibergen-Paap Wald F-statistic reported. Sector-Year fixed effects are at ATECO 4 digit level. Column (1) restricts the sample to firms operating in the industry sector (B to F), (2) to firms operating in the services sectors (G to U), (3) to areas in Northern Italy with certified activity of 'ndrangheta families on the basis of DIA reports (Aosta, Vercelli, Alessandria, Cuneo, Torino, Asti, Varese, Como, Lecco, Brescia, Milano, Monza-Brianza, Genova, Imperia, Verona, Trento), (4) to the rest of Northern Italy, (5) to the Centre, (6) to the South excluding Calabria. Kleibergen-Paap Wald F-statistic reported. Robust standard errors clustered at firm level in parentheses. The mean of the dependent variable refers to its value at baseline (2019). Robust standard errors clustered at firm level in parentheses. ***, **, and * indicate significance at 1, 5, and 10 percent critical level.

Table 7: Government interventions and 'ndrangheta infiltrations

	(1)	(2)	(3)	(4)
Dependent variable:		NDR		
(log) Revenues	-0.00838**	-0.00556**	-0.00762**	-0.00512*
	(0.00415)	(0.00279)	(0.00373)	(0.00269)
(log) Revenues × Any Aid	0.00391*			
	(0.00207)			
(log) Revenues × Moratorium		0.00106*		
		(0.000556)		
(log) Revenues × Grants			0.00456**	
			(0.00206)	
(log) Revenues × Guaranteed Loans				-0.000165
				(0.000526)
N	910836	910836	910836	910836
Firm FE	Yes	Yes	Yes	Yes
Sector-Year FE	Yes	Yes	Yes	Yes
Province-Year FE	Yes	Yes	Yes	Yes
Mean of Dep Var (%)	0.796	0.796	0.796	0.796
F-Stat	44.25	54.51	40.39	55.19

Notes: Results from second-stage regression, obtained interacting revenues with a dummy if the firm obtained (1) at least one aid or at least (2) moratorium, (3) grants and (4) guaranteed loans. Cragg-Donald F-Statistic reported. Sector-Year fixed effects are at ATECO 4 digit level. The mean of the dependent variable refers to its value at baseline (2019). Robust standard errors clustered at firm level in parentheses. ***, **, and * indicate significance at 1, 5, and 10 percent critical level.

Table 8: Robustness Checks: variation in revenues and other changes in ownership

Dependent variable:	(1) ENTRY	(2) ENTRY CLEAN	(3) ENTRY NO NDR NAME	(4) ENTRY NO CAL	(5) ENTRY CAL	(6) SOUTH NO MAFIA
Panel A: 2SLS						
(log) Revenues	0.0748*	0.0785*	0.0805**	0.0682*	0.00577	0.00198
	(0.0410)	(0.0410)	(0.0410)	(0.0410)	(0.00599)	(0.00424)
Panel B: First-Stage						
Closing	-0.0918***	-0.0918***	-0.0918***	-0.0918***	-0.0918***	-0.0918***
	(0.00834)	(0.00834)	(0.00834)	(0.00834)	(0.00834)	(0.00834)
N	1518090	1518090	1518090	1518090	1518090	1518090
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Sector-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Province-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Mean of Dep Var (%)	6.744	6.744	6.743	6.743	3.856	3.505
CD F-Stat	121.3	121.3	121.3	121.3	121.3	121.3

Notes: The outcome variable is: a dummy for entry of (1) any shareholder, (2) any "clean" shareholder, (3) any shareholder without a last name connected to 'ndrangheta, (4) any shareholder not born in Calabria, (5) any Calabrian, (6) any person born in Basilicata or Sardinia, i.e. southern regions with no tradition of mafia settlements. Kleibergen-Paap Wald F-Statistic reported. Sector-Year fixed effects are at ATECO 4 digit level. The mean of the dependent variable refers to its value at baseline (2019). Robust standard errors clustered at firm level in parentheses. ***, **, and * indicate significance at 1, 5, and 10 percent critical level.

Table 9: Robustness Checks: alternative definitions of infiltration

Dependent variable:	(1) NDR (rare)	(2) NDR (freq)	(3) NDR	(4) NDR	(5) NDR	(6) NDR
Panel A: 2SLS						
(log) Revenues	-0.00259*	-0.00129	-0.00184	-0.00232*	-0.00389**	-0.00381**
	(0.00148)	(0.00106)	(0.00113)	(0.00140)	(0.00186)	(0.00181)
Panel B: First-Stage						
Closing	-0.0918***	-0.0918***	-0.0938***	-0.0944***	-0.0922***	-0.0931***
	(0.00834)	(0.00834)	(0.00845)	(0.00932)	(0.00838)	(0.00838)
N	1518090	1518090	1495219	1234588	1475117	1514599
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Sector-Year FE	Yes	Yes	Yes	Yes	Yes	
Province-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Sector-Region-Year FE						Yes
Excluding			Calabria	All mafia reg	Other Infiltr	
Mean of Dep Var (%)	0.359	0.434	0.490	0.558	0.763	0.791
F-Stat	121.3	121.3	123.4	102.7	120.9	123.4

Notes: Kleibergen-Paap Wald F-Statistic reported. Sector-Year fixed effects are at ATECO 4 digit level. Coefficient estimates have been produced by: flagging infiltrations as entries of only Calabrians with rare mafia last names (1); flagging infiltrations as entries of only Calabrians with frequent mafia last names (2); restricting the sample dropping firms which are located in Calabria (3); restricting the sample dropping firms which are located in any mafia region – Calabria, Campania, Puglia and Sicily – (4); dropping firms which are infiltrated at some point in time by other mafias (5); adding sector-region-province fixed effects to take into account local restrictions that took place in the *second phase* of the pandemic (Fall 2020) (6). The mean of the dependent variable refers to its value at baseline (2019). Robust standard errors clustered at firm level in parentheses. ***, **, and * indicate significance at 1, 5, and 10 percent critical level.

Table 10: Robustness checks: corroborating the exclusion restriction

Dependent variable:	(1)	(2)
	Gvt Aids	
NDR	0.0757***	0.0659**
	(0.0263)	(0.0271)
Entry NDR	-0.0365	-0.0317
	(0.0926)	(0.0909)
Closing	0.171***	0.172***
	(0.0158)	(0.0157)
Closing × NDR	-0.0418	-0.0318
	(0.0356)	(0.0357)
Closing × Entry NDR	-0.139	-0.133
	(0.153)	(0.151)
Age	-0.00323***	-0.00303***
	(0.0000851)	(0.0000852)
$\Delta \log(\text{Revenue})$	-0.0971***	-0.0979***
	(0.00303)	(0.00302)
$\Delta \log(\text{Wage Bill})$	-0.0429***	-0.0416***
	(0.00283)	(0.00282)
N	298681	298681
Sector FE	Yes	Yes
Province FE		Yes
Mean of Dep Var (%)	1.491	1.491

Notes: Sector-Year fixed effects are at ATECO 4 digit level. The mean of the dependent variable refers to its value in 2020. Robust standard errors in parentheses. ***, **, and * indicate significance at 1, 5, and 10 percent critical level.

Appendices

A. Additional figures and tables

Figure A.1: NDR Trend, difference between treated and control firms
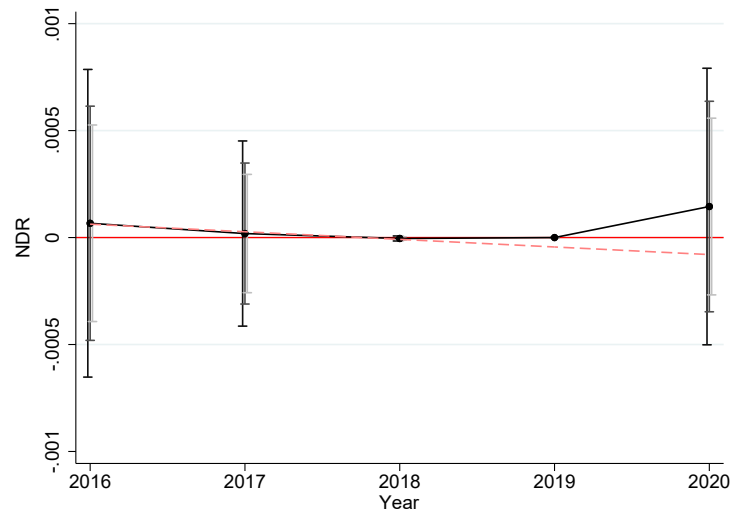
Notes: Event study estimates for the infiltration dummy among treated and control units. We include 90, 95 and 99% confidence intervals. The red dashed line represents the linear fit of the estimates in the pre-treatment periods projected on the post-treatment periods following Dobkin et al. (2018).

Figure A.2: Balance Sheet Variables Trends, difference between treated and control firms
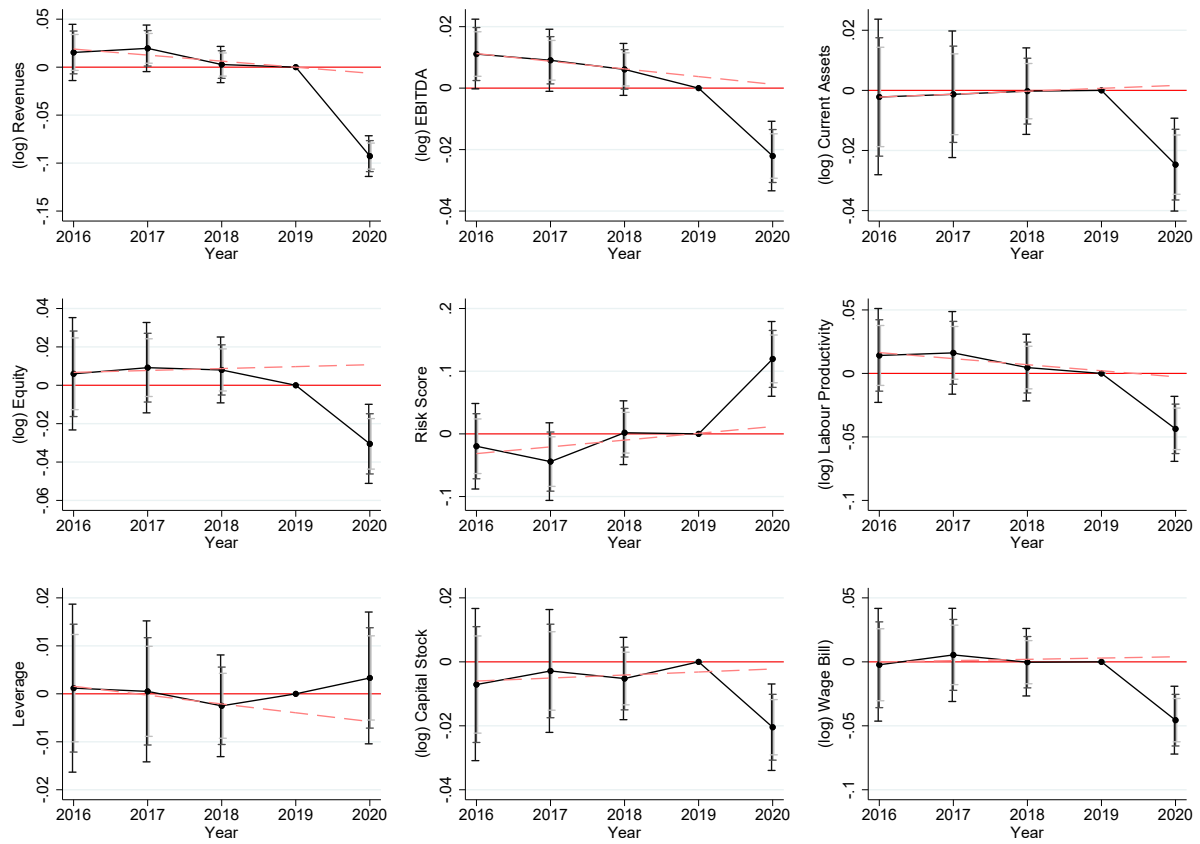
Notes: Event study estimates for several balance sheet variables among treated and control units. We include 90, 95 and 99% confidence intervals. The red dashed lines represent the linear fit of the estimates in the pre-treatment periods projected on the post-treatment periods following Dobkin et al. (2018).

Table A.1: Descriptive Statistics

	Mean	Std. Dev.	25%	Median	75%
NDR	.0082	.09	0	0	0
CAM	.0208	.14	0	0	0
SCU	.0083	.091	0	0	0
MAF L	1.3e-04	.011	0	0	0
All Mafias	.0348	.18	0	0	0
Entry NDR	2.8e-04	.017	0	0	0
(log) Revenues	5.64	2.2	4.44	5.73	7
(log) EBITDA	6.3	.46	6.14	6.19	6.33
(log) Current Assets	5.63	1.8	4.45	5.62	6.8
(log) Equity	4.97	1.9	3.61	4.82	6.22
Risk Score	4.02	2.2	2	4	5
(log) Labor productivity	2.45	1.7	1.22	1.99	3.53
Leverage	.768	.73	.478	.743	.911
(log) Capital Stock	6.29	1.7	5.16	6.26	7.38
(log) Wage bill	3.06	2.7	0	3.53	5.22
Age	17.1	21	6	12	22
Moratorium	.327	.47	0	0	1
Grants	.419	.49	0	0	1
Guaranteed Loans	.411	.49	0	0	1
Shareholders' Age	51.2	11	44	51	58.3
Shareholders_0	2.73	8.8	2	2	3
Shareholders_8	11.9	156	2	2	3

Notes: Main statistics for all the variables used in the analysis.

Table A.2: Robustness: reduced form

	(1)	(2)	(3)
Dependent variable:		NDR	
Panel A: Closing dummy			
Closing	0.000526	0.000582	0.000357**
	(0.00148)	(0.00139)	(0.000144)
Panel B: Number of Days			
Closing days	0.0000187	0.0000187	0.00000590**
	(0.0000288)	(0.0000266)	(0.00000295)
N	1518090	1518090	1518090
Firm FE			Yes
Sector-Year FE	Yes	Yes	Yes
Province-Year FE		Yes	Yes
Mean of Dep Var (%)	0.794	0.794	0.794

Notes: Sector-Year fixed effects are at ATECO 4 digit level. The mean of the dependent variable refers to its value at baseline (2019). Robust standard errors in parentheses. ***, **, and * indicate significance at 1, 5, and 10 percent critical level.

Table A.3: Robustness: DDIV

	(1)	(2)	(3)	(4)
Dependent variable:		NDR		
Panel A: OLS				
(log) Revenues	0.0000923***			
	(0.0000333)			
Panel B: 2SLS				
(log) Revenues		-0.00535	-0.00600	-0.00388**
		(0.0152)	(0.0145)	(0.00160)
Panel C: First-Stage				
Closing		-0.0983***	-0.0968***	-0.0918***
		(0.0289)	(0.0285)	(0.00776)
N	1518090	1518090	1518090	1518090
Firm FE	Yes			Yes
Sector-Year FE	Yes	Yes	Yes	Yes
Province-Year FE	Yes		Yes	Yes
Mean of Dep Var (%)	0.794	0.794	0.794	0.793
F-Stat		11.58	11.52	140.1

Notes: Kleibergen-Paap Wald F-Statistic reported. Sector-Year fixed effects are at ATECO 4 digit level. The mean of the dependent variable refers to its value at baseline (2019). Robust standard errors in parentheses. ***, **, and * indicate significance at 1, 5, and 10 percent critical level.

Table A.4: Balance test: Anacredit Firms

	(1)	(2)	(3)	(4)
	Not Anacredit	Anacredit	Δ_1	Δ_2
NDR	0.008	0.008	-0.000	0.001***
	(0.090)	(0.089)	(0.000)	(0.000)
CAM	0.023	0.019	-0.004***	0.001***
	(0.149)	(0.135)	(0.000)	(0.000)
SCU	0.008	0.008	-0.000	0.001***
	(0.091)	(0.090)	(0.000)	(0.000)
MAF L	0.000	0.000	-0.000	0.000
	(0.012)	(0.010)	(0.000)	(0.000)
All Mafias	0.037	0.032	-0.005***	0.002***
	(0.189)	(0.177)	(0.000)	(0.001)
(log) Revenues	4.603	6.447	1.844***	1.279***
	(2.111)	(1.833)	(0.006)	(0.005)
(log) EBITDA	6.221	6.383	0.163***	0.124***
	(0.333)	(0.529)	(0.001)	(0.001)
(log) Current Assets	4.947	6.152	1.205***	0.979***
	(1.756)	(1.689)	(0.005)	(0.005)
(log) Equity	4.486	5.277	0.791***	0.684***
	(1.843)	(1.879)	(0.005)	(0.005)
Risk Score	3.783	4.108	0.325***	0.427***
	(2.278)	(2.002)	(0.006)	(0.006)
(log) Labor productivity	2.605	2.359	-0.245***	-0.077***
	(1.813)	(1.633)	(0.005)	(0.005)
Shareholders' Age	51.588	51.016	-0.571***	-0.531***
	(11.881)	(10.698)	(0.032)	(0.032)
Shareholders_0	2.544	2.758	0.214***	0.290***
	(6.662)	(9.944)	(0.023)	(0.026)
Shareholders_8	11.047	10.831	-0.216	0.861**
	(153.920)	(145.742)	(0.409)	(0.424)
Observations	238,719	310,484	549,203	

Notes: Columns (1) and (2) report mean values for firms which are not covered by the Anacredit sample and those who are in 2019, respectively. Column (3) shows the raw difference in means between (2) and (1). Column (4) shows the difference in means after controlling for province and sector fixed effects. Shareholders_0 indicates the number of direct shareholders; Shareholders_8 the number of shareholders considering the ownership structure up to eight levels. Robust standard error in parentheses. ***, **, and * indicate significance at 1, 5, and 10 percent critical level.

Table A.5: Government Intervention and 'ndrangheta infiltrations

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dependent variable:				NDR			
(log) Revenues	-0.00519*	-0.00410*	-0.00537**	-0.00518*	-0.00504*	-0.00554*	-0.00554**
	(0.00267)	(0.00220)	(0.00272)	(0.00265)	(0.00257)	(0.00284)	(0.00280)
(log) Revenues × Moratorium	-0.00135						
	(0.00207)						
(log) Revenues × Guaranteed Loans		-0.00798**					
		(0.00390)					
(log) Revenues × Grants			0.00195**				
			(0.000912)				
(log) Revenues × (Moratorium+Grants)				0.00266***			
				(0.000864)			
(log) Revenues × (Moratorium+Guar Loans)					-0.00208		
					(0.00144)		
(log) Revenues × (Guar Loans+Grants)						0.000989	
						(0.000675)	
(log) Revenues × All							0.00161**
							(0.000760)
N	910836	910836	910836	910836	910836	910836	910836
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Province-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mean of Dep Var (%)	0.795	0.795	0.795	0.795	0.795	0.795	0.795
F-Stat	54.59	43.86	55.66	56.73	54.81	51.62	52.31

Notes: Cragg-Donald F-Statistic reported. Sector-Year fixed effects are at ATECO 4 digit level. Second-stage regression, obtained interacting revenues with a dummy if the firm obtained exactly moratorium (1), guaranteed loans (2), grants (3), moratorium and grants (4), moratorium and guaranteed loans (5), guaranteed loans and grants (6), all three (7). The mean of the dependent variable refers to its value at baseline (2019). Robust standard errors clustered at firm level in parentheses. ***, **, and * indicate significance at 1, 5, and 10 percent critical level.

Table A.6: Robustness checks: corroborating the exclusion restriction, grants only.

Dependent variable:	(1)	(2)
	Grants	
NDR	-0.00239	0.00459
	(0.0110)	(0.0113)
Entry NDR	-0.0504	-0.0559
	(0.0407)	(0.0401)
Closing	0.116***	0.116***
	(0.00704)	(0.00701)
Closing × NDR	-0.0115	-0.0106
	(0.0148)	(0.0148)
Closing × Entry NDR	-0.0588	-0.0539
	(0.0658)	(0.0652)
Age	-0.00118***	-0.00112***
	(0.0000306)	(0.0000307)
Δ log(Revenue)	-0.0541***	-0.0546***
	(0.000973)	(0.000967)
Δ log(Wage Bill)	-0.0306***	-0.0305***
	(0.00107)	(0.00107)
N	491529	491529
Sector FE	Yes	Yes
Province FE		Yes
Mean of Dep Var (%)	45.76	45.76

Notes: Sector-Year fixed effects are at ATECO 4 digit level. The mean of the dependent variable refers to its value in 2020. Robust standard errors clustered at firm level in parentheses. ***, **, and * indicate significance at 1, 5, and 10 percent critical level. Robust standard errors in parentheses. ***, **, and * indicate significance at 1, 5, and 10 percent critical level.

Table A.7: Robustness checks: corroborating the exclusion restriction, debt moratorium only.

	(1)	(2)
Dependent variable:	Moratorium	
NDR	0.0360**	0.0379***
	(0.0142)	(0.0146)
Entry NDR	0.0545	0.0489
	(0.0542)	(0.0536)
Closing	0.0151*	0.0141*
	(0.00821)	(0.00819)
Closing × NDR	-0.0163	-0.0137
	(0.0193)	(0.0193)
Closing × Entry NDR	-0.118	-0.107
	(0.0833)	(0.0826)
Age	0.000314***	0.000311***
	(0.0000429)	(0.0000431)
Δ log(Revenue)	-0.0150***	-0.0158***
	(0.00142)	(0.00142)
Δ log(Wage Bill)	-0.0132***	-0.0135***
	(0.00137)	(0.00137)
N	298681	298681
Sector FE	Yes	Yes
Province FE		Yes
Mean of Dep Var (%)	33.05	33.05

Notes: Sector-Year fixed effects are at ATECO 4 digit level. The mean of the dependent variable refers to its value in 2020. Robust standard errors in parentheses. ***, **, and * indicate significance at 1, 5, and 10 percent critical level.

Table A.8: Robustness checks: corroborating the exclusion restriction, guaranteed loans only.

Dependent variable:	(1)	(2)
	Guaranteed Loans	
NDR	0.0526***	0.0452***
	(0.0116)	(0.0119)
Entry NDR	0.0338	0.0373
	(0.0413)	(0.0411)
Closing	0.0174**	0.0187**
	(0.00730)	(0.00728)
Closing × NDR	-0.0232	-0.0192
	(0.0154)	(0.0154)
Closing × Entry NDR	-0.0413	-0.0362
	(0.0672)	(0.0674)
Age	-0.000852***	-0.000771***
	(0.0000311)	(0.0000313)
Δ log(Revenue)	-0.00243***	-0.00264***
	(0.000892)	(0.000891)
Δ log(Wage Bill)	0.00381***	0.00420***
	(0.00106)	(0.00106)
N	491529	491529
Sector FE	Yes	Yes
Province FE		Yes
Mean of Dep Var (%)	45.05	45.05

Notes: Sector-Year fixed effects are at ATECO 4 digit level. The mean of the dependent variable refers to its value in 2020. Robust standard errors in parentheses. ***, **, and * indicate significance at 1, 5, and 10 percent critical level.

B. Investigating the infiltration of other mafias

Our data allow us to apply our methodology to identify mafia infiltrated firms also to criminal organizations other than the 'ndrangheta. However, these measures are to be taken with caution because the predictive power of family names in the case of other mafias is sensibly lower, either because clans are more likely to rely on non-family affiliates, or simply because some mafia family names are very frequent in the population. This is, for instance, the case of Camorra, whose affiliates' family names are way more frequent, even outside Campania.[32] When applying our methodology to detect other mafias' infiltration we find that camorra, Sacra Corona Unita and mafia lucana together had infiltrated almost 3% of firms in our sample in 2020. This share increased between 2019 and 2020. Looking at the geographical distribution we observe a clear prevalence in the region of origin and little overlap between the different organizations: Camorra tends to focus in its region of origin (Campania) and in Central Italy. Sacra Corona Unita and mafia lucana are prevalent in their regions of origin (Puglia and Basilicata, respectively) and in neighboring regions (Figure B.1). We note that the geographical distribution obtained with our methodology largely overlaps with that computed by Transcrime (2017). We exclude Cosa Nostra as the report does not contain full information on the family names of the affiliates.

Figure B.1: Infiltrations of different mafias across regions
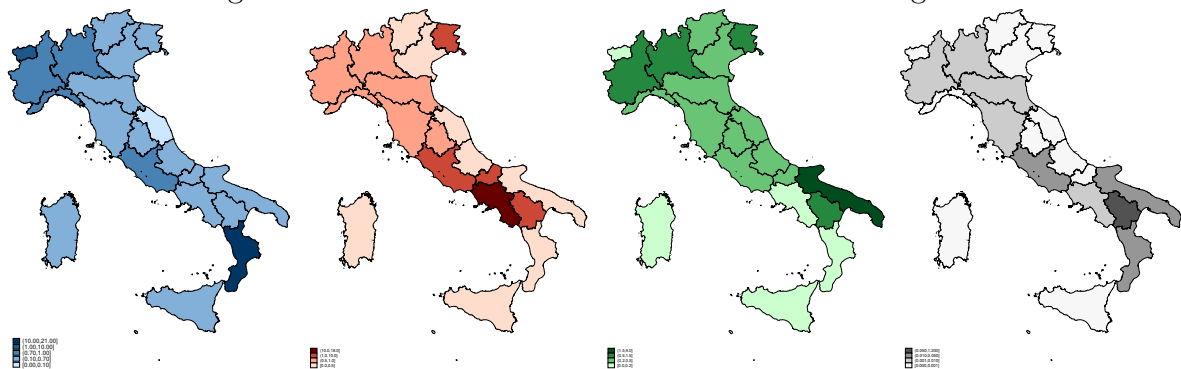
Notes: Share of infiltrated firms by region in 2020. From left to right, the panel show, respectively, the share of 'ndrangheta, camorra, sacra corona unita and mafia lucana infiltrations.

Table B.1 then shows the results of our DDIV regressions on other mafias outside their region of origin. We find no significant effects on the likelihood of other mafias infiltration:

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[32]See Mirenda et al. (2022) for a more comprehensive discussion.

for camorra and mafia lucana the estimated coefficients are even positive, whereas in the case of sacra corona unita the estimated coefficient is more similar to the one estimated for 'ndrangheta.

Note that the reported frequency of infiltration for camorra might worry us, since there is no existing evidence on the fact that camorra is infiltrated in more than 2 Italian firms out of 100. A reason for this overestimation is that some camorra's family names (e.g. "Esposito"), are among the most common in the country. Hence, we attach to each last name its frequency among the resident adult population as recorded in the 2005 list of taxpayers. In column 4, we thus consider only rare last names – those below the median frequency – to flag infiltrated firms. The estimated 2SLS coefficient is still indistinguishable from zero and positive. We thus conclude that 'ndrangheta has been the best able to exploit the negative shock to firm economic performance to widen its presence in the legal economy. The finding that 'ndrangheta was the organization which most profited from the Covid crisis to penetrate the legal economy is in line with the evidence provided by Italian Ministry of Interior (2021) and with the widespread view that it is the organization which is most active outside its area of origin.

Table B.1: Results on other mafias

	(1)	(2)	(3)	(4)
Dependent variable:	CAM	SCU	MAF L	CAM (rare)
Panel A: 2SLS				
(log) Revenues	0.00362	-0.00115	0.00000357	0.00210
	(0.00270)	(0.000826)	(0.00000470)	(0.00163)
Panel B: First-Stage				
Closing	-0.0895***	-0.0937***	-0.0917***	-0.0895***
	(0.00858)	(0.00857)	(0.00836)	(0.00858)
N	1393123	1448904	1508996	1393123
Firm FE	Yes	Yes	Yes	Yes
Sector-Year FE	Yes	Yes	Yes	Yes
Province-Year FE	Yes	Yes	Yes	Yes
Mean of Dep Var (%)	0.710	0.431	0.00594	0.160
F-Stat	108.9	119.7	120.3	108.9

Notes: Kleibergen-Paap Wald F-statistic reported. Sector-Year fixed effects are at ATECO 4 digit level. The regions of origin of each mafia have been excluded. Robust standard errors clustered at firm level in parentheses. ***, **, and * indicate significance at 1, 5, and 10 percent critical level.

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