

# Mafia Infiltration and Ownership Dynamics in Italian Companies Amidst Covid-19\*

PRELIMINARY VERSION, PLEASE DO NOT  
CIRCULATE

Roberta De Luca<sup>†</sup>    Rosalia Greco<sup>‡</sup>    Giovanni Immordino<sup>§</sup>  
Tommaso Oliviero<sup>¶</sup>

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## Abstract

We examine how Covid-19 social restrictions impacted the ownership structure of Italian private companies and probe the extent of mafia infiltration. We create a novel dataset of monthly ownership changes (shareholders' entries, exits, and reshuffles among existing ones), combined with information on government-mandated business closures and a mafia presence index for Italian provinces. In areas with higher pre-existing mafia infiltration levels, business closures increased the share of firms undergoing ownership changes, especially through the replacement of incumbent shareholders by new ones. This is true of sectors usually prone to mafia infiltration. Our main contribution is to shed light on the mechanisms through which the mafia infiltrates the economy during crises.

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KEYWORDS: Mafia Infiltration, Covid-19, Firm ownership

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<sup>†</sup>Bank of Italy, Structural economic analysis Directorate. E-mail: [roberta.deluca@bancaditalia.it](mailto:roberta.deluca@bancaditalia.it)

<sup>‡</sup>Bank of Italy, Structural economic analysis Directorate and Bocconi Baffi Center. E-mail: [rosalia.greco@bancaditalia.it](mailto:rosalia.greco@bancaditalia.it)

<sup>§</sup>Dipartimento di Scienze Economiche e Statistiche, Università di Napoli Federico II and CSEF, 80126, Napoli (NA), Italy. E-mail: [giovanni.immordino@unina.it](mailto:giovanni.immordino@unina.it)

<sup>¶</sup>Dipartimento di Scienze Economiche e Statistiche, Università di Napoli Federico II and CSEF, 80126, Napoli (NA), Italy. E-mail: [tommaso.oliviero@unina.it](mailto:tommaso.oliviero@unina.it)

*” Organized crime assumed new but equally fearful forms. It has spread into the boards of companies, both in the North and in the South of the country [...] It pollutes the economy, ranging from the real estate to the wholesale sector.”*

Mario Draghi (Former Italian Prime Minister, May 2022).

## 1 Introduction

The Covid-19 pandemic hit the world unexpectedly and triggered a major global recession. Social distancing, government-mandated business closures, and a severe drop in demand pushed numerous businesses worldwide on the brink of default and required unprecedented public policy interventions.<sup>1</sup> As struggling firms may have found it difficult to get credit from formal markets and have become more inclined to seek liquidity from the organized crime, the pandemic has also created opportunities for criminal organizations to infiltrate the legal economy (UNODC, 2020).

In this paper, we study mafia infiltration into legal businesses during the Covid-19 crisis in Italy. We identify the impact of social restrictions — in particular, government-mandated business closures — on Italian firms’ corporate ownership structure, and assess to what extent such an impact may be traced back to the action of organized crime. We carry out novel analyses on the kind of corporate changes mostly associated with infiltration of criminal organizations into legal economic activities. Additionally, using detailed data at the geographical and industry level, we study how mafia infiltration varies by sector of activity.

Over 70% of organized crime’s global criminal proceeds (equivalent to about 2.7% of global GDP in 2009) are laundered through the legal economy (UNODC, 2011). Additionally, previous evidence has shown that organized crime takes advantage of economic crises (Le Moglie and Sorrenti, 2022). Knowledge of the mechanism through which mafia infiltrates the legal economy and the sectors that are more at risk is therefore of paramount importance to timely detect organized crime activity and to prevent the widespread of its infiltration.

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<sup>1</sup>Many studies worldwide have documented the magnitude and the consequences of the Covid-19-induced liquidity crisis, especially for the most exposed sectors, e.g. accommodation and food services, transportation, wholesale and retail trade (Banerjee et al., 2020, Carletti et al., 2020, Gourinchas et al., 2020, Stephany et al., 2020, Wang et al., 2020).

Italy has been historically characterized by a significant presence of organized crime, which has also infiltrated the legal economy. It was also one of the first countries that was hit by the coronavirus, and consequently experimented some of the extraordinary social restriction measures which were later widely applied throughout the world. This makes Italy a perfect setting to consider Covid-19 as an unexpected large negative economic shock and to study its effect on the likelihood that distressed firms get infiltrated by mafia.

We build a unique detailed monthly dataset, covering the period between March 2020 and July 2021, which combines different sources of information on Italian private enterprises. We exploit data on shareholder-firm pairs from the Italian Chambers of Commerce and identify four different types of changes in firms' ownership structure: (i) the entry of new owners, (ii) the exit of incumbent owners, (iii) the entry of new owners which either totally or partially replace at least one incumbent exiting owner, and (iv) the reshuffle of shares among existing shareholders. We then combine these data with information on the number of days of government-mandated closure of business activities during the Covid-19 pandemic, which is specific to each region and sector of activity and that we hand-collected from national decrees, and with an index of the presence of mafia in Italian provinces in the period prior to the pandemic.

We find that the response of changes in corporate structure to days of mandated business closures depends on the ex-ante mafia presence in the province where firms operate. In particular, in provinces with stronger mafia presence, negative economic shocks such as closures trigger an increase in changes in firms' ownership structure. We interpret this result as indirect evidence of mafia infiltration into legal economic activities. Indeed, judging by their past actions, organized crime organizations are likely to use their liquidity to support distressed companies before subsequently taking them over through the purchase of their shares ([Bosisio et al., 2021](#), [De Martiis, 2020](#), [Naím, 2012](#), [Savona et al., 2017](#)).

We also document novel evidence on the mechanism through which mafia infiltrates the legal economy: we find that the effect of closures on corporate structure changes is mostly driven by the replacement of existing shareholders with new ones, as opposed to the entry of new shareholders in the absence of exiting ones, or the reshuffle of ownership shares among

existing shareholders. Such evidence is consistent with a mechanism in which infiltration occurs mainly through acquisition of shares from owners in distress.

In addition, we study whether the mafia infiltrates to a different extent in different sectors. Some sectors may have been more susceptible than others to criminal infiltration during Covid-19 for two different reasons: either they faced high financial distress and became “cheaper” to acquire for the mafia or they became attractive to organized crime because they benefited from the health emergency or the subsequent government support measures. The first category includes passenger transportation, tourism, hotels, bars and restaurants; the second category comprises trade of pharmaceutical and medical devices, logistics and e-commerce, construction and some business and personal services (e.g., cleaning and funeral services). Consistently, our results indicate that mafia infiltration mainly occurred in hotels, restaurants, construction, real estate, retail and wholesale trade and transportation.

Our identification strategy relies on the following three elements. First, the timely registration of ownership changes of Italian firms in the Chamber of Commerce Registry of Enterprises, which is mandatory by law. Second, the exogeneity of the restriction measures (i.e., number of government-mandated days of closure), since their application relies on the classification of essential and non-essential sectors and on the severity of local contagion, which was not anticipated by firms and, as we document, not linked to the ex-ante presence of mafia in the province. Third, the hypothesis that the presence of mafia in each province captures the propensity of organized crime to operate in that specific area.

The variation in our setting is based on the ex-ante presence of mafia, which varies at province level, and on the intensity of mandated business closures, which is sector-region-month specific; thus, we can account for fine fixed effects both at the geographical and sector level. Importantly, we corroborate our empirical strategy by showing that there are no significantly different trends in ownership changes before the pandemic crisis in provinces with high and low mafia presence. Furthermore, our results remain valid when we account for Italian government interventions that were aimed at relieving financial distress by providing liquidity support (e.g., through credit guarantee schemes or cash transfers) to private firms. This indicates that public support did not prevent mafia infiltration in the legal economy.

Overall, our findings confirm that negative economic shocks pave the way to mafia infiltration into legal economic activities, even when government steps in to support firms in distress, substantiating the concerns of the Italian Anti-Mafia Investigation Directorate, which in its 2020 report highlighted the consequences of the Covid-19 emergency in terms of the possible infiltration of organized crime into the legal economy (DIA, 2020). Our results are also in line with descriptive evidence presented in Bosisio et al. (2021) regarding ownership changes in Italian firms in the April-September 2020 period. They document anomalies in new corporate structures which hint at potential risks of money laundering and organized crime infiltration: while the number of ownership transfers decreased compared to the previous year, the prevalence of anomalies among new owners (including connections to high-risk jurisdictions, corporate opacity, involvement of politically exposed persons, and owners from regions with a strong organized crime presence) was higher than what observed for the universe of firm owners, or for new owners before the pandemic.

The rest of the paper is organized as follows. Section 2 describes the literature on mafia infiltration into legal economy in Italy and the contribution of this paper to the reference field. Section 3 presents the construction of the dataset and the summary statistics. Section 4 shows the estimation results, while Section 5 concludes.

## 2 Related literature

A growing body of research has examined the impact of the presence of mafia, revealing its detrimental effects, on political competition (Acemoglu et al., 2020, Alesina et al., 2019, Baraldi et al., 2023, 2022, Buonanno et al., 2016, Daniele and Dipoppa, 2017, Daniele and Geys, 2015, De Feo and De Luca, 2017, Di Cataldo and Mastrorocco, 2022), as well as on the economy in general (Fenizia and Saggio, 2020, Peri, 2004, Pinotti, 2015).

Specifically, our study adds to the existing literature that investigates the infiltration of organized crime into legitimate businesses.

A first strand of this literature looks at the effects and motives of mafia infiltration on firms and the externalities that it entails. Mirenda et al. (2022) exploit the peculiar structure

of 'ndrangheta clans, characterized by strong family ties, and define a firm as infiltrated if, in a given year, it has at least one director or owner whose last name is the same as some 'ndrangheta clans. They show that mafia targets weaker firms (i.e. young and less efficient) and generates a rise in firms' revenues after infiltration. According to [Arellano-Bover et al. \(2024\)](#), who first use data from the Italian Financial Intelligence Unit, the motives of criminal organizations in infiltrating legal businesses are various. On the one hand, businesses established by criminal groups ("born-infiltrated") primarily engage in illegal activities. On the other hand, businesses infiltrated post-establishment either benefit from such activities (medium-sized firms) or are used for financial and non-financial gains, such as forming political alliances (large firms). [Piemontese \(2023\)](#) looks at how criminal organizations affect the legal economy by hampering, rather than financing, firms. Specifically, she studies mafia racketeering in Northern Italy, showing that acts of extortion imposed on certain firms are linked to resource misallocation. The presence of mafia also generates externalities on non-infiltrated firms ([Ganau and Rodríguez-Pose, 2018](#), for instance).

Few other papers focus on the spillover effects of law enforcement on the economy. [Calamunci and Drago \(2020\)](#) evaluate the impact on firms' profitability, performance and investments of being in a market where at least one firm is subject to judicial administration (the assumption being that the firms subject to the judicial administration are affiliated with organized crime). They investigate the spillover effects of a policy that imposes external managers on those firms, and show that the larger the number of firms entering into judicial administration, the larger the positive impact on other competitors (see also [Ferrante et al. \(2021\)](#)).

Our paper is most closely related to the strand of the literature on mafia infiltration which studies how economic shocks affect the extent of mafia infiltration into legal businesses. [Le Moglie and Sorrenti \(2022\)](#) exploit the onset of the subprime mortgage crisis of 2007, which depressed the supply of legal credit available to entrepreneurs to a similar extent both in provinces with high and low mafia presence. They find that in provinces with high mafia presence, the number of established enterprises decreases less, consistently with the hypothesis that mafia invests in the legal economy. Our analysis differs from this study for

two main reasons. First, our exogenous shock to firms' financial resources is not common to all firms, but relies on the classification of essential and non-essential sectors by the Italian national government and on the risk level associated to each region over time, and therefore differs by region, sector and time. This allows us to provide estimates for firms in directly affected sectors. Second, we go beyond firms' birth and death and look at ownership transfers in order to study the mechanisms through which mafia can enter the legal economy.<sup>2</sup> [Castelluccio and Rizzica \(2023\)](#) define infiltration by 'ndrangheta clans as in [Mirenda et al. \(2022\)](#) and find that the deterioration of firms' financial conditions during the Covid-19 crisis increased the likelihood of infiltration by entrepreneurs connected to organized crime. Our approach complements their findings because: (i) our identification strategy can be extended beyond 'ndrangheta to other Italian criminal organizations, and (ii) we provide a distinctive analysis of what types of ownership changes in firms are most connected to infiltration by organized crime. This novel perspective sheds light on how the mafia establishes its presence in the legal economy.

### 3 Data

**Firm registry.** Firms in Italy are subject to mandatory registration at the provincial Chamber of Commerce upon constitution. They also have to timely communicate any subsequent modification in their state of activity and in their main characteristics (e.g. legal form or location). The Infocamere database is the collection of registry data from all Chambers of Commerce in Italy and includes records on the universe of Italian firms, including their date of birth and death, as well as information on ownership structure for a subset of firms, namely partnerships (*società di persone*, with unlimited liability) and corporations (*società di capitali*, with limited liability).

Using the Infocamere database, we construct a dataset containing information on the

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<sup>2</sup>Of course, criminal actors can infiltrate the legal economy through various means besides ownership transfers, including establishing new businesses, utilizing hidden financing methods, and fraudulently obtaining public support.

ownership structure of partnerships and corporations since March 2020.<sup>3,4</sup> For each province-month-sector, we compute the number of firms experiencing the following (mutually exclusive) corporate structure changes: (i) entry of new shareholders, with no exit (hereafter labeled by *entry*); (ii) exit of incumbent shareholders, with no entry (hereafter labeled by *exit*); (iii) entry of new shareholders who entirely or partially buy shares of exiting shareholders (hereafter labeled by *replacement*); (iv) changes in ownership percentage among existing shareholders, with no shareholder entry/exit (hereafter labeled by *reshuffle*).

Ownership changes, defined by the sum *entry*, *exit*, *replacement* and *reshuffle* regard about 12% of total active firms in 2020, of which . In Figure 1 we cumulate total number of ownership changes in four-month time windows from September 2019 to August 2021 and relate it to total number of active firms in the same period. The graph shows that ownership changes spike at a value about 4.9% in the period January-April 2020, the peak of the Covid-19 crisis (0.4% entry, 1% exit, 1.6% replacement, 1.9% reshuffle). Total ownership changes decline in the months following the peak of the first wave of the pandemic, when the number of mandated closed days reduced substantially. It then increased again in the winter 2020/2021, during the second wave, although not reaching the high level of the first wave.

**Insert Figure 1 here**

**Covid-19 days of closures.** With the March 11, 2020 DPCM (Decree of the President of the Council of Ministers), the government imposed for the first time restrictions on the operation of economic activities across the entire national territory, in response to the emergency caused by the Covid-19 pandemic. Four main periods can be identified based on the government-imposed closures: (i) March 12, 2020 - May 17, 2020; (ii) May 18, 2020 - November 5, 2020; (iii) November 6, 2020 - April 25, 2021; and (iv) April 26, 2021 - March 31, 2022.

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<sup>3</sup>We exclude firms with more than 300 shareholders, as small shareholders in these firms are recorded as a single “dummy” shareholder, and listed corporations.

<sup>4</sup>We additionally build a dataset with demographic information on all firms (such as sole proprietorships, partnerships and corporations): for each month between January 2018 and December 2021 and for each province, we calculate the number of firms’ births and deaths, and the overall stock of firms. We use this dataset in an ancillary analysis on business dynamism.



In the first period, the government identified the businesses which could keep operating (based on their sector of activity, the so called essential sectors).<sup>5</sup> In the second period, the majority of economic activities were operational. In the third period, regions were classified on a 4-level scale of health risk (white, yellow, orange, and red); each risk level was associated with a list of suspended economic activities and the color assigned to each region was re-evaluated every one or two weeks. Finally, in the fourth period, almost all economic activities were open, but access to workplaces and to many services was limited to people with a *green pass*, certifying that they were vaccinated or that they carried a low risk of spreading the disease (because they had recently either healed from Covid-19 or tested negative).

We collect data for the March 2020-July 2021 period and build a dataset containing the number of days in which a sector’s activity was suspended in each month-region.<sup>6</sup> Sector closures are identified at the 6-digit Ateco level and then aggregated up at 2-digit. Appendix A describes more in detail the government-mandated closures enacted over the period considered and the methodology that we used to construct the dataset.

**The Mafia Index.** The literature has proposed several indices measuring the presence of organized crime in Italy. They are typically constructed at the provincial level (see, for instance Calderoni, 2011, Ganau and Rodríguez-Pose, 2018, De Martiis, 2020) and measure the incidence of certain criminal activities associated with the mafia phenomenon.

Our mafia measure (“Mafia Index (MI) rate”) extends the index developed by Calderoni (2011),<sup>7</sup> by adding a range of mafia-related phenomena (the so-called sentinel crimes) and by updating the index to cover the 2010-2019 period using data from the Italian National Institute of Statistics (Istat) on crimes reported by law enforcement agencies and Ministry of Interior.<sup>8</sup>

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<sup>5</sup>Essential sectors include the following: D (electricity, gas, steam and air conditioning supply), E (water supply, sewerage, waste management and remediation activities), K (financial and insurance activities), O (public administration and defence; compulsory social security),P (education), Q(human health and social work activities).

<sup>6</sup>Although our dataset runs through July 2021, economic activities’ suspensions stopped for most sectors as of the introduction of the *green pass* in April 2021, as mentioned above.

<sup>7</sup>The crimes included in the Calderoni index are: mafia association, mafia murders, city councils dissolved due to mafia infiltration, the presence of assets confiscated to mafia members in each municipality.

<sup>8</sup>The list of sentinel crimes includes: alienation and purchase of slaves, criminal association, criminal association aimed at smuggling foreign manufactured tobacco, organized activities for the illegal trafficking of waste, introduction into the state and commerce of products with counterfeit marks, reduction to slavery,

In detail, we apply the following methodology: (i) for each individual crime, we calculate the incidence rate in each province and year;<sup>9</sup> (ii) for each province, we compute the average incidence of each crime over the 2010-2019 period; (iii) for each crime, we normalize the average incidence, so that a score equal to 1 is assigned to the province with the highest value; (iv) we aggregate crimes at the province level, by calculating the average index across all crimes, in order to obtain a single indicator for each province; (v) we normalize the province level indices, so that to the province with the maximum value is assigned a score equal to 1. Figure 2 displays the geographical distribution of the MI rate. As expected, mafia related crimes have higher incidence in the Southern part of the country and in provinces hosting large cities, although significant variation also arise within each Italian region.

**Insert Figure 2 here**

**Summary statistics.** In the empirical analysis, ownership changes data are cumulated at province-sector-month level. We define the variable *Entry* by the logarithm of one plus total number of firms that had an entry of new shareholders in each province-sector-month. We do the same for *Exit*, *Replacement* and *Reshuffle*. Table 1 reports the averages and standard deviations of the dependent variables considered in the empirical analysis. Overall, on average, ownership changes regard about 1.3 firms in each province-sector-month in the sample period analyzed.

**Insert Table 1 here**

Days of closure, in the analyzed period (March 2020-July 2021), are measured at sector-region-month and vary from maximum levels of 30 days in non-essential sectors on April 2020, to zero days for essential sectors as well as for other non-essential sectors in months of low contagion, especially after April 2021 as outlined above. Given the number of zeros,

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kidnapping for extortion purposes, drugs, criminal association aimed at the illicit trafficking of narcotics, fraudulent transfer of assets, trafficking and trading of minors for prostitution, trafficking and trading of slaves, fraud for obtaining public funds, disturbance of auctions freedom, disturbance of freedom in the contractor selection process. The list is taken from the following decree: D.L. 06/09/2011, n. 159, art. 84, 4a.

<sup>9</sup>Incidence of municipalities dissolved due to mafia infiltration is expressed per 100 municipalities; incidence of all other crimes is expressed per 100,000 inhabitants.

we define the variable *Log (Closed days)* by the logarithm of one plus the weighted average number of closed days in each (2-digit) sector-region-month. The mean value of *Log (Closed days)*, calculated after excluding essential sectors, indicate that in the overall sample period there have been, on average, 1.5 mandated closed days in each sector-region-month.

Finally, as outlined in the paragraph above, the Mafia index is calculated for each province in the period before the Covid-19 and is constant over time. By construction, the variable has been normalized to have a maximum value equal to 1. The index shows an average value (and standard deviation) calculated for the 105 Italian provinces considered in the empirical analysis below equal to 0.24 (0.21).<sup>10</sup>

## 4 Empirical analysis

We want to test whether negative shocks, such as Covid-19-related closures, have an impact on Italian firms' ownership structure, and if such an impact was different in high and low mafia-intense territories. The underlying idea is that mafia infiltration in the legal economy during the Covid-19 crisis is facilitated by the existing presence of mafia-related activities in the province and by the liquidity shock induced by the mandated closures.

To make sure that we can interpret a differential effect as driven by mafia infiltration into legal firms, and exclude that such an effect may be driven by unobserved characteristics that correlate with both the presence of mafia in a territory and the severity of the Covid-19 shock, we control for a large battery of fixed effects. We additionally provide a test in support of our identifying assumption, showing that the variation in closed days does not correlate with mafia index over and above the various fixed effects considered in our subsequent empirical analysis. In this respect, by the mean of a simple regression analysis, we show that the number of closed days are uncorrelated to the mafia presence measured at province level. Specifically we estimate the following regression model:

$$Covid_{s,r,t} = \beta_1 mafia_p + \delta_t + \gamma_r + \eta_s + \epsilon_{s,r,t}, \quad (1)$$

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<sup>10</sup>Out of all 107 Italian provinces, 2 of them are dropped from the empirical analysis due to missing data on ownership changes.

where the  $\beta_1$  coefficient captures the correlation between the incidence of Covid-19 closures and the presence of mafia. In Table 2 we report estimation results for specifications that include year-month fixed effects (column 1), region fixed effects (column 2), and also sector fixed effects (column 3). The estimates indicate that there is no systemic relation between mafia presence and number of closed days once controlling for different levels of fixed effects. Given that the variation in closed days aggregated at province level is related to the incidence of the restrictions decided by the national government and the regional councils, and by the distribution of essential and non-essential sectors in each province, we can conclude that the mafia presence is not significantly related to the local distribution of sectors in the economy. Our province-level results on ownership changes will thus not be driven by a spurious relation between mafia presence and sector-specific dynamics.

**Insert Table 2 here**

In our main analysis, we take advantage of different levels of granularity in our data. Specifically, in Section 4.1, we present results where all variables used in the analysis are aggregated at the province-month level. The advantage of this approach is that we consider the effects of days of closure on the overall changes in firms' ownership in each Italian province, including both the direct effect of days of closure on affected sectors and the potential spillover effects on sectors that were not subject to forced closures. Indeed, the liquidity crisis of affected sectors may have created a drop in the local economic activity that may have spurred also in sectors not directly affected by mandated closures.

Next in the paper, we conduct an analysis where three dimensions of firms' ownership and closed days during the Covid-19 crisis are exploited: sector-province-month. This analysis provides estimates of the effects of days of closures only for firms in directly affected sectors, thus excluding from the analysis sectors not affected by closures (namely essential sectors). The advantage of this disaggregated analysis is to allow us to control for unobserved factors that may bias our province-level results; that is this analysis includes finer fixed effects. The results of this more granular approach are presented in Section 4.2.

## 4.1 Empirical analysis: province level analysis

In this section we aggregate ownership data at province-month level, that is we construct variables for our measures of change in ownership structures aggregated by discarding the sector dimension.

The baseline specification is the following:

$$y_{p,t} = \beta_1 Covid_{r,t} + \beta_2 Covid_{r,t} \cdot mafia_p + \delta_t + \gamma_p + \epsilon_{p,t}, \quad (2)$$

where  $y_{p,t}$  is logarithm of our dependent variables of interest (changes in ownership: entry, exit, replacement or reshuffle), while  $Covid_{r,t}$  is the logarithm of the average number of closed days in each region (r) and month (t).<sup>11</sup>

Accordingly,  $\beta_1$  measures elasticity of firms' ownership changes to closed days. The coefficient  $\beta_2$  is attached to the interaction term between the logarithm of closed days and the mafia index. It is expected to be positive and statistically different from zero if mafia infiltration increases the occurrence of changes in firms' ownership during the Covid-19 crisis. The model includes province fixed effects ( $\gamma_p$ ) which absorb all time invariant variation at province level and naturally absorb the direct estimated impact of the mafia index, and time fixed effects ( $\delta_t$ ) which absorb the time (monthly) variation common to all provinces.

**Insert Table 3 here**

Results in Table 3 show the estimated coefficients of regression analyses where the dependent variables are: *Entry* of new shareholders (column 1); *Exit* of existing shareholders (column 2); *Replacement* of incumbent owners, either entirely or partially replaced by new owners (column 3); *Reshuffle* among existing owners (column 4).

Estimates show that the number of closed days are associated with a declining change in firms' ownership, that is  $\beta_1$  coefficient estimates are negative in specifications in columns (1) to (3) (although a statistical significant coefficient is detected only in column 3). The estimated  $\beta_1$  coefficient is, instead, positive in column (4), where reshuffle is the dependant

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<sup>11</sup>Days of closures at region-month level are constructed as the average of the number of days of closure in the sector-region-month.

variable, which is consistent with increasing changes in ownership related to the Covid-19 crisis.

Importantly,  $\beta_2$  estimates are positive and statistically significant in columns (1) to (3). They indicate that the reaction of ownership changes to closed days varies according to the pervasiveness of mafia. With reference to column (3), for instance, estimates can be interpreted as follows: a 1 percent increase in closed days imply a 0.178 percent decline of ownership replacement in provinces where mafia is absent; however, moving from a value of the mafia index equal to zero to its highest level (one), the elasticity becomes even positive and equal to 0.081. The results in column (4) show, instead, no significant association between mafia, closed days and ownership reshuffle.

Our dataset structure allows us to include in specification (2) region-time fixed effects that account for regional-specific economic cycle, for instance the intensity of the pandemic; indeed, in such specification, we can only estimate  $\beta_2$  coefficient because all the variation in closed days which is determined by regional councils and sector-employment weights is absorbed by such finer fixed effects. Results are presented in Table 4.

**Insert Table 4 here**

Once we account for region specific factors,  $\beta_2$  estimates remains statistically significant only in the case of replacement of exiting shareholders (column 3).

Taken together, these findings give us a novel insight on how mafia infiltrates the real economy in times of crisis. That is, mafia exploits times of crises and enters the company especially by taking over existing shareholders.

To validate our analysis, we employ data previous to the spread of the Covid-19 pandemic to test whether there was a differential change in ownership dynamics related to the mafia presence already before the Covid-19 crisis. We consider data from September 2019 to July 2021 although data on firm ownership from the Chambers of Commerce at monthly frequency are reliable only from 2020, due to changes in the periodicity of the dataset update by the provider. We estimate the following regression model:

$$y_{p,t} = \mathcal{B}_t \cdot t \cdot mafia_p + \gamma_p + \eta_{r,t} + \epsilon_{p,t}, \quad (3)$$

where the excluded month is September 2019; consequently, each  $\beta_t \in \mathcal{B}_t$  is interpreted as the difference in the sensitivity of  $y_{p,t}$  to the mafia presence in month  $t$  with respect to September 2019.

Results are presented graphically in Figure 3 using as outcome variable either Entry (upper left panel), Exit (upper right panel), Replacement (bottom left panel) or Reshuffle (bottom right panel). With referent to Replacement, estimates show that there is no significant change in the replacement of shareholders related to the mafia presence before the Covid-19 crisis. Furthermore, the dynamic analysis show that most of the variation is concentrated in the first wave of the pandemic (around April 2020), although these estimates are not directly comparable to estimates in equation 2 as they do not exploit within region variation in closed days that captures the intensity of the Covid-19 crisis.

**Insert Figure 3 here**

Finally, in Table 5 we report estimation of equation (2), where the dependent variables are the logarithm of firms that close their activity in each month  $t$  (column 1), or firms that are newly registered (column 2). The specification includes region-year-month fixed effects together with province fixed effects. Estimates of  $\beta_2$  coefficient reveal that there is no association of closed days and mafia presence on the birth of new firms or the death of existing firms. This result may appear in contrast with the evidence in [Le Moglie and Sorrenti \(2022\)](#) which exploits the time variation around the 2007-2009 credit crisis and finds an increasing number of registered firms in provinces where mafia was more present. However, differently from the financial crisis, the Covid-19 crisis was characterized by an historically low dynamics in firms' demography in all European countries ([Criscuolo, 2021](#)). For this reason we did not expect to find significant results on this dimension of the analysis.

**Insert Table 5 here**

## 4.2 Empirical analysis: sector-province level analysis

In this section, we exploit a more granular variation in both the outcome variables and the days of closure by aggregating the variables at sector-province-month level. The advantage

of this level of disaggregation is that we can more directly link the intensity of the Covid-19 shock as measured by the number of closed days, which is essentially sector-specific, and the changes in firms' ownership in sector affected by forced closures. The drawback instead is that we naturally exclude all firms belonging to sectors that were not directly impacted by the legal restrictions, but could still be indirectly affected via spillover effects.

Consistently with the above empirical strategy, we estimate the following regression model:

$$y_{s,p,t} = \beta_1 Covid_{s,r,t} + \beta_2 Covid_{s,r,t} \cdot mafia_p + \gamma_{p,t} + \delta_{s,t} + \epsilon_{s,p,t}, \quad (4)$$

where, outcomes  $y_{s,p,t}$  are defined as above after aggregating firm-level variables at 2-digit Ateco sector level,  $Covid_{s,r,t}$  is the logarithm of the average number of closed days in each sector-region-time,  $\gamma_{p,t}$  are province-time fixed effects and  $\delta_{s,t}$  are sector-time fixed effects. The first set of fixed effects allow us to control for change in economic conditions at province level, while the second ones absorb part of the variation in closed days that is linked to sectors at national level, and accounts for systemic differences in ownership dynamism of each sector.

Estimates of the equation (4) are reported in Table 6. We do not detect any significant correlation between changes in ownership and closed days ( $\beta_1$  coefficients are close to zero in all the specifications). Instead,  $\beta_2$  estimates are positive and statistically significant in columns (1) to (3), a result in line with the province-level evidence provided in Table 3. Quantitatively, with reference to column (3), 1 percent increase in closed days imply a 0.013 percent decline of ownership replacement in provinces where mafia is absent; however, moving from a value of the mafia index equal to zero to its highest level (one), the elasticity becomes positive and equal to 0.043.

**Insert Table 6 here**

In the most saturated specification, we include sector-region-time fixed effects which absorb the entire variation in  $Covid_{s,r,t}$  and allows us to control for factors that are specific



to each region-sector in each month during the Covid-19 crisis (e.g., local public policy interventions targeted at sector level). Estimation results are displayed in Table 7. In this case, the  $\beta_2$  estimates remains positive and are statistically significant in columns (2) and (3).

### Insert Table 7 here

Overall, the results of the disaggregated analysis confirm the previous province-level evidence; that is, changes in ownership structure (entry and exit of shareholders) due to local ex-ante mafia presence are mainly related to the replacement of shareholders, while no significant relation is detected with respect to reshuffle of shares among existing owners.

The above empirical strategies implicitly take into account the effect of government aids, which mostly vary by sector-time and, only to some extent, also by region. As a further robustness for the potential role of government intervention, we replicate the results in Table 6 by adding a control for the extent government support.<sup>12</sup> Our (unreported) results remain substantially unchanged, suggesting that our set of fixed effects absorb also variations related to government subsidies, thus reassuring us about the robustness of our results to this additional control.

Finally, by exploiting the variation at sector level, we can detect what sectors are driving our results. To this goal, we estimate a regression model as in specification 4 for each macro-sector (1-digit Ateco).<sup>13</sup> Estimates of the interaction term between the log of closed days and the mafia presence are displayed graphically in Figure 4. All estimates refer only to sectors of the economy affected by the closures during the Covid-19 period. The figure shows that our average results are mostly driven by sectors which are either historically prone to mafia infiltration and/or racketeering or had become more attractive during the

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<sup>12</sup>Covid-19 aids by the Italian government have taken different forms (grants, fiscal exemptions, guarantees, ...) and it is difficult to account for all of them in a consistent way. We use data from the Italian National Aid Registry (*Registro Nazionale Aiuti*, RNA), which include the universe of State aid granted by any public authority in Italy, and identify through text analysis all Covid-19 aids, so to construct a measure of firms receiving Covid-19-related government aids.

<sup>13</sup>List macro-sectors here: A (agriculture, forestry and fishing), B (mining and quarrying), C (manufacturing), F (construction), G (wholesale and retail trade; repair of motor vehicles and motorcycles), H (transportation and storage), I (accommodation and food service activities), J (information and communication), L (real estate activities), M (professional, scientific and technical activities), N (administrative and support service activities), R (arts, entertainment and recreation), S (other service activities).

Covid-19 crisis. For instance, the construction sector (F) and the real estate activities (L) have already been showed to be subject to mafia infiltration in Italy (Ferrante et al., 2021, Scognamiglio, 2018). Furthermore, starting from the Covid-19 crisis, those sectors have benefited from huge subsidization public policies by the national governments (e.g., the so-called *Superbonus 110*). Conversely, trade (G), transports (H) and accommodation and food services (I) sectors have been deeply affected by the social distancing measures and became easier to be taken over by criminal organizations which could leverage on deeper pockets.

**Insert Figure 4 here**

## 5 Conclusions

The global economic downturn triggered by the Covid-19 pandemic has pushed various industries to the brink of default, necessitating unprecedented interventions. Beyond the immediate challenges faced by businesses, economic crises create opportunities for criminal organizations to exploit vulnerabilities.

Our study delves into the impact of social restrictions on changes in the corporate ownership structure of Italian firms, specifically investigating potential mafia infiltration. Our results indicate that, in distressed sectors and provinces with larger mafia presence, companies experienced significant ownership changes. Notably, mafia infiltration was observed prominently in sectors like hotels, restaurants, construction, real estate, retail, wholesale, and transportation.

To counteract this phenomenon, it is crucial to detect and prevent organized crime activity promptly. Despite government liquidity support measures preventing widespread defaults, mafia infiltration persisted, emphasizing the need for targeted strategies to safeguard against criminal influence. Recognizing sectors at higher risk is vital for timely intervention and prevention efforts.

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## A Construction of Covid-19 days of closures

With the March 4, 2020 DPCM (Decree of the President of the Council of Ministers), the Italian government imposed the first nation-wide restrictive measures in response to the emergency caused by the Covid-19 pandemic. In a climax of more and more restrictive measures, economic activities were progressively suspended and on March 11 the government issued a list of economic activities considered to be essential and commanded all non-essential industrial and trade activities to be suspended.<sup>14</sup> As the public health emergency evolved, national closures were substituted by regional ones, and the list of economic sectors which were allowed to operate evolved over time and adapted to the severity of the health risk. Four main periods can be identified based on the government-imposed closures:

(i) March 12, 2020 - May 17, 2020: All industrial and trade activities were suspended, with the exception of those which were deemed to be “essential” and were explicitly listed in government acts.<sup>15</sup>

(ii) May 18, 2020 - November 5, 2020: The suspension of most economic activities was lifted between May and June.<sup>16</sup> At the same time, regions and local authorities were given the power to suspend economic activities, based on the evolution of the local contagion risk. Although the lists of authorized Ateco codes for each region during such period are not available, for a large part of the summer period in 2020 and at least until September, the epidemiological situation remained at a low risk level in almost the entire country and the majority of economic activities are presumed to be operational. As contagion risk started to increase again, some restrictions were applied since late August to dance halls, nightclubs, and a few other categories.<sup>17</sup>

(iii) November 6, 2020 - April 25, 2021: As Covid-19 cases kept increasing, the national government issued new restrictions, to be applied in a differentiated fashion in each region,

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<sup>14</sup>Professional service activities were not suspended, but workers were required to work from home whenever possible.

<sup>15</sup>Decrees published within this timeframe: DPCM on March 11, 2020 (valid from March 12 to March 22, 2020), Decree of the Ministry of Economic Development on March 25, 2020, as an integration of the DPCM on March 22, 2020 (valid from March 23 to April 13, 2020), DPCM on April 10, 2020 (valid from April 14 to May 3, 2020), and DPCM on April 26, 2020 (valid from May 4 to May 17, 2020).

<sup>16</sup>DPCM May 17, 2020 and DPCM June 11, 2020.

<sup>17</sup>Decree of the Ministry of Health on August 17, 2020.

based on their risk level. Since November 6, 2020, the Ministry of Health started to monitor the regions on a weekly basis, classifying them into four risk categories (yellow, orange, and red). Each risk level was associated with a list of suspended economic activities.<sup>18,19</sup> By combining the data on the regions' classification by risk category over time with the lists of non-authorized Ateco codes for each risk category, the authorized activities for each territory are identified. It is assumed that the risk categories determined by the Ministry of Health are a good indicator of the perceived risk level by regional administrators during each period and, therefore, the resulting restrictions decreed in each region.<sup>20</sup>

(iv) April 26, 2021 - April 2021: The DL April 22, 2021 introduced the “green pass”. Almost all economic activities are open, but access to workplaces and to many services was limited to people who held a *green pass*, namely a certification that they were vaccinated or that they carried a low risk of spreading the disease (because they had recently either healed from Covid-19 or tested negative).

In summary, the objective of this part of the analysis was to create a single dataset that includes, for each month and each region of Italy, the number of days that a specific type of company — identified by the Ateco code — was required to remain closed due to the restrictions imposed by the Italian government. Depending on the period of time considered, different methodologies were followed. In the first period, the government lists identified the businesses that remained open, while in the second period, it was assumed that the majority of economic activities were operational. In the third period — since the publication of the risk categories for each region — the information related to the risk of contagion was combined with the lists of non-authorized Ateco codes for each risk level. The dataset was constructed to include all months from March 2020 to July 2021, all regions of Italy, and all Ateco codes.

Sectoral closures in each region-month were defined at the 6-digit Ateco level. We aggregated them up to the 2-digit level by weighted average, where weights are equal to each

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<sup>18</sup>DPCM November 3, 2020. The DPCM January 14, 2021 included a fourth risk category (white), characterized by the lowest risk level and the mildest restrictions.

<sup>19</sup>Data on monitoring come from an elaboration by Andrea Cattaneo available at [https://github.com/imcatta/restrizioni\\_regionali\\_Covid/blob/main/dataset.csv](https://github.com/imcatta/restrizioni_regionali_Covid/blob/main/dataset.csv)

<sup>20</sup>The lists of non-authorized Ateco codes for each risk category were retrieved from legal annexes of national DPCMs and regional decrees (source: *Gazzetta Ufficiale*).



sector's share of employment in 2019. Notice that data on employment by sector are available at the 5-digit Ateco level. Closures at the 6-digit level were first aggregated at the 5-digit one by simple averages.

## B Tables

Table 1: **Summary statistics**

	(1)	(2)	(3)
	Mean	Standard Deviation	Observations
<b>Ownership changes</b> (province-sector-month)			
Entry	0.119	0.343	118,199
Exit	0.222	0.489	118,199
Replacement	0.271	0.560	118,199
Reshuffle	0.462	0.783	118,199
<b>Days of closures</b> (region-sector-month)			
Log (Closed days)	0.35	0.88	23,477
<b>Mafia index</b> (province)			
Mafia index	0.24	0.21	105

Table 2: **Mafia and closed days during the Covid-19**

	(1)	(2)	(3)
	Log(Closed days)		
Mafia	-0.019 (0.021)	0.023 (0.072)	0.009 (0.066)
Observations	28046	28046	28046
Adjusted $R^2$	0.339	0.339	0.540
Year-Month FE	Yes	Yes	Yes
Region FE	No	Yes	Yes
Sector FE	No	No	Yes

Notes: Robust standard errors in parentheses. \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ .

Table 3: **Province-level analysis**

	(1)	(2)	(3)	(4)
	Entry	Exit	Replacement	Reshuffle
Log(Closed days)	-0.078 (0.058)	-0.048 (0.040)	-0.178*** (0.039)	0.033** (0.014)
Log(Closed days) X Mafia	0.149** (0.063)	0.135** (0.056)	0.259*** (0.052)	-0.010 (0.012)
Observations	1785	1785	1785	1785
Adjusted $R^2$	0.856	0.908	0.923	0.986
Province FE	Yes	Yes	Yes	Yes
Year-Month FE	Yes	Yes	Yes	Yes

Notes: Robust standard errors in parentheses. \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ .

Table 4: **Province-level analysis (region-time FE)**

	(1)	(2)	(3)	(4)
	Entry	Exit	Replacement	Reshuffle
Log(Closed days) X Mafia	0.074 (0.114)	0.106 (0.092)	0.240*** (0.089)	0.020 (0.023)
Observations	1785	1785	1785	1785
Adjusted $R^2$	0.858	0.914	0.930	0.987
Province FE	Yes	Yes	Yes	Yes
Region-Year-Month FE	Yes	Yes	Yes	Yes

Notes: Robust standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

Table 5: **Registered and closed firms**

	(1)	(2)
	Log(closed companies)	Log(new companies)
Log(Closed days) X Mafia	0.011 (0.102)	0.027 (0.051)
Observations	1779	1785
Adjusted $R^2$	0.856	0.957
Province FE	Yes	Yes
Region-Year-Month FE	Yes	Yes

Notes: Robust standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

Table 6: **Sector-province level analysis**

	(1)	(2)	(3)	(4)
	Entry	Exit	Replacement	Reshuffle
Log (Closed days)	0.014 (0.013)	0.013 (0.016)	-0.013 (0.016)	0.013 (0.015)
Log (Closed days) X Mafia	0.025*** (0.005)	0.039*** (0.006)	0.056*** (0.007)	-0.011 (0.008)
Observations	118199	118199	118199	118199
Adjusted $R^2$	0.345	0.485	0.526	0.674
Province-Year-Month FE	Yes	Yes	Yes	Yes
Sector-Year-Month FE	Yes	Yes	Yes	Yes

Notes: Robust standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

Table 7: **Sector-province level analysis (region-sector-time FE)**

	(1)	(2)	(3)	(4)
	Entry	Exit	Replacement	Reshuffle
Log (Closed days) X Mafia	0.012 (0.009)	0.036*** (0.011)	0.054*** (0.013)	0.018 (0.014)
Observations	118199	118199	118199	118199
Adjusted $R^2$	0.342	0.502	0.548	0.713
Province-Year-Month FE	Yes	Yes	Yes	Yes
Region-Sector-Year-Month FE	Yes	Yes	Yes	Yes

Notes: Robust standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

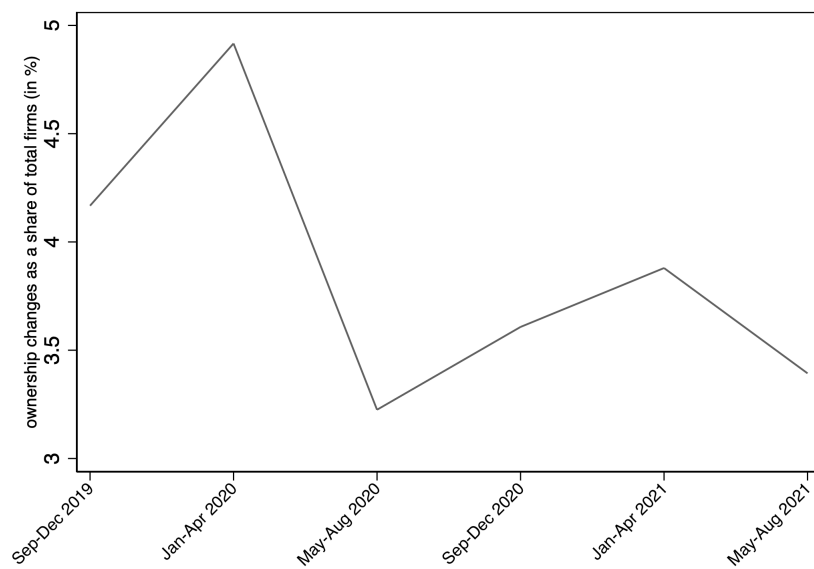
Table 8: **Controlling for government interventions**

	(1)	(2)	(3)	(4)
	Entry	Exit	Replacement	Reshuffle
Log (Closed days)	0.014 (0.013)	0.014 (0.016)	-0.013 (0.016)	0.013 (0.015)
Log (Closed days) X Mafia	0.025*** (0.005)	0.039*** (0.006)	0.056*** (0.007)	-0.011 (0.008)
Log (Government helps)	-0.010 (0.008)	0.016 (0.012)	-0.003 (0.013)	-0.003 (0.016)
Observations	118199	118199	118199	118199
Adjusted $R^2$	0.345	0.485	0.526	0.674
Province-Year-Month FE	Yes	Yes	Yes	Yes
Sector-Year-Month FE	Yes	Yes	Yes	Yes

*Notes:* Robust standard errors in parentheses. \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ .

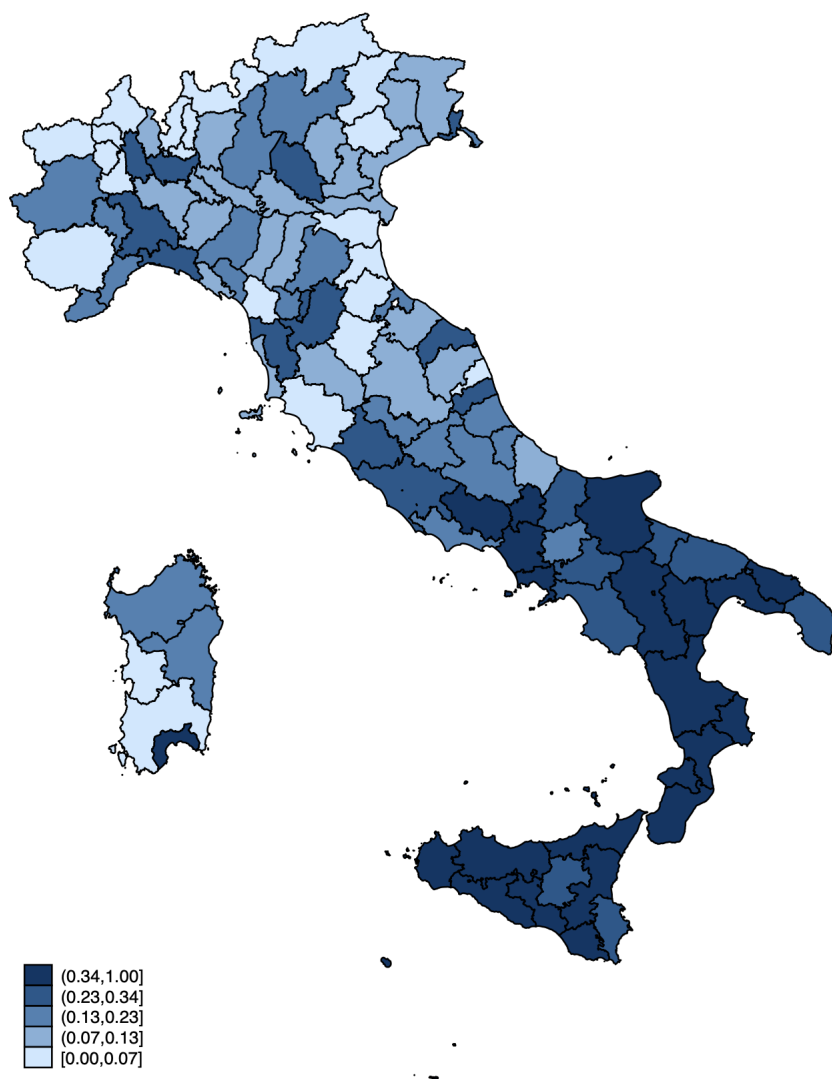
## C Figures

Figure 1: Firm ownership changes 2019-2021



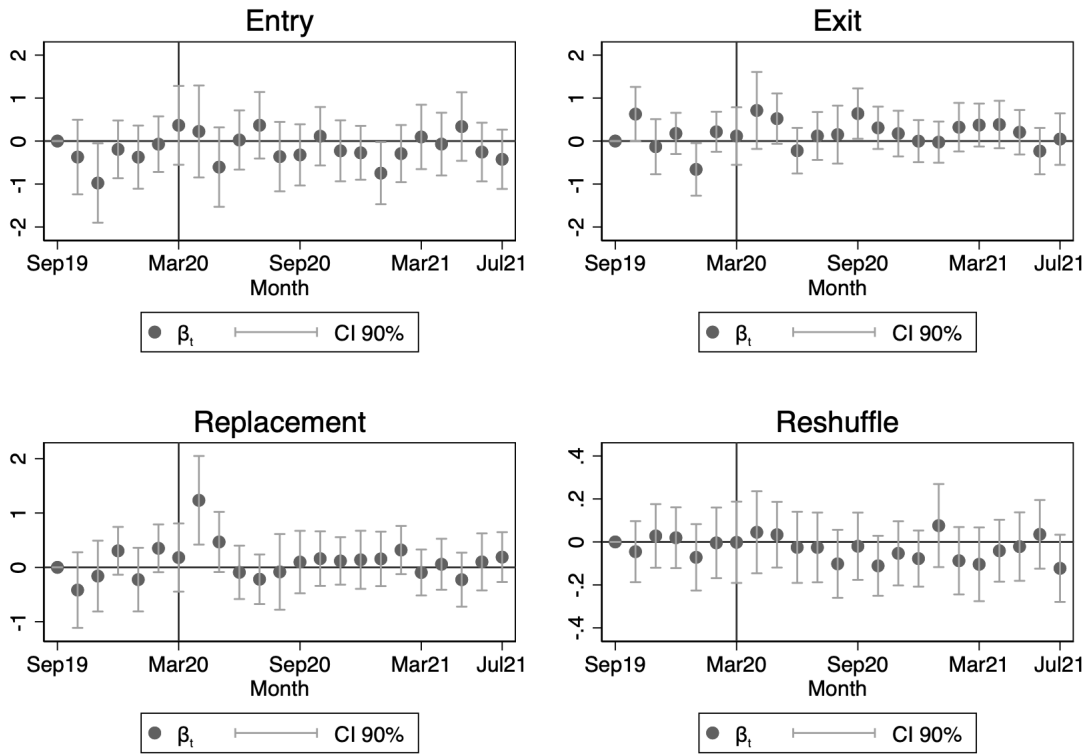
Notes: The figure plots the cumulated number of ownership changes over the total number of firms in four-month time windows considered.

Figure 2: Mafia Index



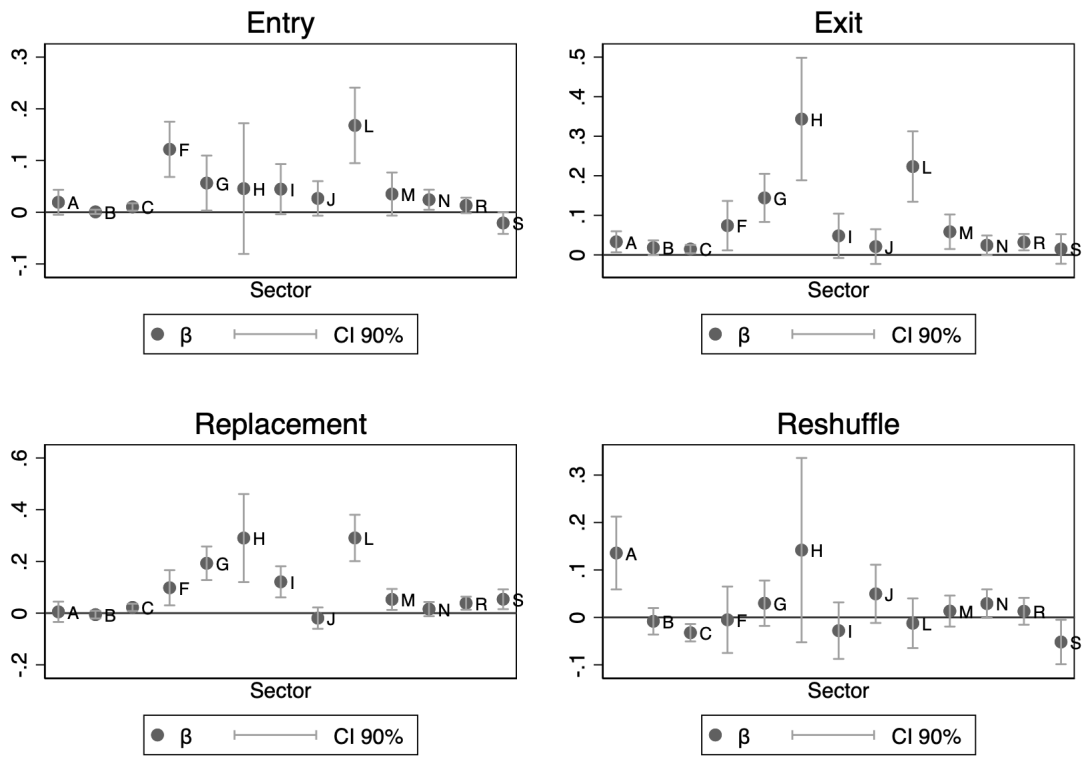
Notes: The map is based on the quintiles of the mafia index distribution for the 107 Italian provinces. The mafia index is normalized with respect to the highest value of the index.

Figure 3: Dynamic analysis



Notes: The figure plots estimated coefficients in equation 3 together with 90% confidence intervals. Time period spans from September 2019 to July 2021.

Figure 4: Heterogeneity by sector



Notes: The figure plots estimated coefficients of  $\beta_2$  in equation 4 together with 90% confidence intervals. Estimates refer to each macro-sector (1-digit Ateco) affected by the Covid-19.