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Abstract

Government subsidies have been one of the main policy instruments used to deal with the economic effects of the COVID-19 pandemic. This study investigated the impact of spatial dependence on the take-up rate of local government subsidies in 2020. It focused on a specific sub-population of firms hit particularly hard by the pandemic: micro-enterprises. Since microdata on this type of firm are rare, we focused on a representative survey of local firms in Trentino, a province in the north of Italy. The sample is linked with administrative balance sheet data up to 2019, providing a wide range of covariates to control for the characteristics of eligible enterprises that did and did not apply for COVID-19 aid. The methodology focused on using a spatial probit model that properly provides local direct, indirect and total marginal effects to investigate the spatial heterogeneity of revenues with respect to the probability of receiving a provincial subsidy.

1 Introduction

The COVID-19 pandemic has severely affected economies worldwide, with heterogeneous consequences between and within countries varying according to the different factors characterising the regions and territories. To contain the outbreak of the pandemic, a large proportion of businesses were forced to shut down their activity, thus generating a liquidity crunch that was particularly severe among small and micro-enterprises (MEs). Among the smallest forms of business, MEs employ less than 10 workers and usually have limited access to capital markets and credit lines to draw upon. Thus, they tend to suffer more from financial constraints as they may lack the financial instruments required to survive a prolonged recession (Acharya et al., 2021; Chodorow-Reich et al., 2021). Even if small and, on average, less productive than small and medium enterprises (SMEs), MEs constituted 93% of firms in the EU-27 countries in 2019, contributing nearly one-third of the total turnover and employing more than 15% of the workforce (Eurostat 2019). This situation has resulted in unprecedented government intervention to support MEs and prevent them from closing their businesses or going bankrupt.

It is widely acknowledged how monetary and financial subsidies have massively contributed to dampening the damaging impact of the crisis (Simeon & Zhang, 2022). Grants, tax credits and liquidity support measures have positive outcomes, mostly resulting from the strength of the policy support deployed. In this framework, scholars can rely on the rich literature's contribution to the effects of economic subsidies even before the pandemic outbreak. This literature covers a wide range of empirical evidence on various outcomes (R&D, green investments, employment levels) and the most suitable type of policy instrument (grant, tax compensation, loan guarantee funds), and it focuses mainly on SMEs (see Dvouletỳ et al., 2021; Petrin, 2018 for a comprehensive review of the literature).

On the other hand, there is limited empirical and theoretical research available on the extent to which eligible firms have applied for various types of economic benefits or aid (De Mel et al., 2010; Goodman, 2021). Most existing research in this area focuses on entitlement programmes for individuals, where take-up refers to the decisions made by eligible individuals to apply for benefits and the accuracy of administrative decisions

determining their eligibility (OECD, 2004; Riphahn, 2001; Roman, 2019). Given that the provision of this type of aid during the pandemic required significant organisation and utilisation of public resources, it is crucial to understand the factors that influenced eligible companies to either apply or not apply for public aid in such a critical situation. Understanding these underlying mechanisms is crucial for improving the effectiveness of the intervention.

At the same time, Italian micro-firms tend to have a low level of financial literacy among OECD countries (Russo et al., 2022), which could affect managerial ability and make firms more reliant on what others have done rather than making their own decision. In this sense, spatial dependence among firms could affect individual firm take-up; however, given the scarcity of disaggregated data for micro-firms, it is difficult to shed light on these dynamics. To the extent of our knowledge, among these factors, the degree of interdependence among firms has never been considered crucial in shaping a firm's benefit take-up.

This study aimed to take advantage of a comprehensive survey of a representative sample of MEs in the province of Trento to evaluate the role of spatial dependence on the MEs' take-up of public aid measures. The panel survey on MEs contains data on several firms' characteristics and information about their behaviour during the pandemic as well as during normal times. It also includes data on their balance accounts, such as revenues, value-added, EBIT, production costs, and administrative sources such as employees, sector and geographical area. In addition to the relevant firm characteristics, we allowed for spatial dependencies among firms with similar levels of added value as a proxy of managerial ability to understand whether this could lead to a higher or lower take-up rate of public subsidies. Since firms' income generated in the years before the pandemic could reduce the effect of a liquidity crunch, and hence the likelihood of asking for COVID aid, we focused on marginal effects with respect to revenues to understand the roles played by both spatial spillovers and heterogeneity in local form.

The results indicate that spatial spillovers are a significant determinant of the take-up rate within the peripheral areas of the province, implying that MEs with similar levels of economic performance, namely average 2017-2019 added value, tend to reciprocally

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increase the probability to ask for local aid. The spatial coefficients become significant in areas where the added value is, on average, smaller, indicating that spillover effects are mainly driven by the sharing of information between MEs characterised by lower values of added value. Turnover generated in the pre-pandemic years serves a crucial role in determining firm-specific take-up: the higher the turnover, the lower the likelihood of requesting provincial aid. This is also true in the peripheral areas, whereas turnover has no significant marginal effects in the central territories. To the best of our knowledge, this is the first paper to consider the role of spatial spillovers in determining the take-up rate of public subsidies.

The paper is organised as follows. Section 2 provides some background information about MEs and public support measures. Section 3 describes the dataset and its different sources, while Section 4 outlines the model. Section 5 presents and discusses the results, and Section 6 states the conclusion and outlines key issues for future research.

2   Firms and support measures

Business support policies through public subsidies and grants are common in all Western economies. Their objectives range from increasing competitiveness and productivity to boosting employment levels, tangible/intangible assets, sales or turnover. Among the wide range of objectives, instruments, targets and institutional contexts that could affect firms of different sizes, the (challenging) goal of this branch of economic research is to provide evidence of the effectiveness of these policies. In this regard, a comprehensive literature review was provided by Dvouletỳ et al., 2021; OECD, 2022; Petrin, 2018. With the latest economic and pandemic crises, another policy goal that has become relevant to the agendas of many governments is the development of tools to help firms deal with the economic consequences of the COVID-19 pandemic (Bachas et al., 2020; Blanchard et al., 2020). In this context, empirical evidence also highlights the role of spatial spillovers in determining business failure and contagion effects among SMEs (Calabrese, 2023; Maté-Sánchez-Val et al., 2018).

Despite this, empirical and theoretical research related to the take-up of these economic benefits/aid (i.e., the extent to which firms eligible for the various types of benefits apply for them) is limited (De Mel et al., 2010; Galasso et al., 2004; Goodman, 2021). Specifically, the last two refer to developing countries, and the consideration of take-up is often viewed more as a factor that reduces the causal effects of specific reforms than as a standalone subject of investigation. When broadening the scope to encompass advanced economies, see e.g. Bannò and Sgobbi, 2010, the interest in micro-enterprises fades out. Furthermore, within this literature, which marginally touches upon take-up, there is a prevalent emphasis on analyzing employment incentives rather than the adoption of business aid during times of crisis (Huttunen et al., 2013). Digging deeper into the literature on take-up, it can be noticed how many contributions mainly focus on entitlement programmes for individuals, where take-up reflects both the decision of eligible individuals to apply for benefits and the accuracy of administrative decisions as to whether these individuals should receive the benefits in question (OECD, 2004; Riphahn, 2001; Roman, 2019).

In general, low or decreasing rates of public benefit utilisation may be a source of concern for policymakers since they reduce the likelihood that industrial policies will achieve their goals (e.g., productivity improvements through R&D investment benefits), which may lead to unjustified and unequal treatment of eligible firms, thereby reducing the ability to accurately predict the financial costs of policy reforms (OECD, 2022). Whether these concerns are justified depends also on the determinants of take-up.

Relying on the literature mentioned above on individuals, factors discussed can include the levels and durations of benefits (more generous benefits granted for longer periods lead to higher take-up), information about a programme's rules and application procedure, delays and uncertainties about the application outcomes, and social and psychological factors such as stigma (OECD, 2004). At the same time, to the best of our knowledge, the role of interdependence and, therefore, the level of communication between companies in determining the adoption rate of public incentives has never been considered a central factor worthy of investigation. In this sense, this study aimed to shed some light on this branch of the literature, assessing the factors that influence the rare take-up of MEs in

an institutional setting strongly influenced by exogenous and unforeseen factors such as closures due to the COVID-19 pandemic.

2.1 Why micro-firms?

The economic literature on policy evaluation mainly focuses on labour market outcomes and SMEs, resulting in MEs being left aside. MEs do not usually have a structured way of doing business (i.e., not as structured as SMEs), and their business dynamics (in some cases) are more attributable to individual behaviour rather than firm behaviour. MEs have less than 10 employees and an annual turnover below 2 million euros. This is why microdata availability for this type of firm is very rare. Despite the minimal attention paid to MEs, they can be considered the lifeblood of every advanced economy since they provide goods and services in the value chain for SMEs and are a source of work for local residents. At the European level, they constitute more than 90% of the total enterprise population and employ more than one-fourth of the total labour force. Among the most significant European economies, Italy has the highest share of MEs, along with the highest share of employees working in MEs (see Figure 1).

Figure 1: Share of MEs, their employees, turnover contribution and turnover over employees by country
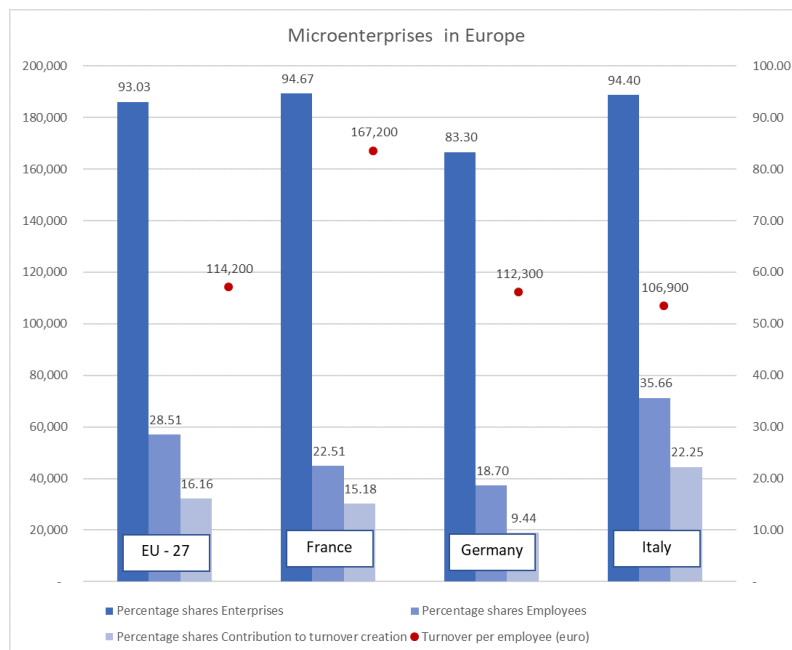
Source: Eurostat (2019), all sectors (agriculture, financial and insurance activities not included)

If we look at the share of MEs and certain business demography indicators within the Italian economy, Trentino looks very similar to the national level in many indicators: the share of MEs in the total enterprise population (93.0 vs 94.3%); the contribution to total turnover (45.1 vs 47.2%); the share of persons employed (29.6 vs 29.1%); the turnover per employee (117.234 vs 117.981)[1]. This is also the case for the Nord-East macro area (NUTS-1) and the neighbouring region of South Tyrol, apart from the turnover of employees of the latter, which can be justified by the high revenues coming from small businesses in the tourism and craft sectors.

We have seen the relevance of MEs in various aspects, especially for Italy and Trentino. Since MEs are numerous and relevant while simultaneously being exposed to the financial crisis, it is important to understand what measures were put in place by the national and local governments to stem the economic crisis generated by the COVID-19 pandemic, and whether they were adopted by MEs.

Figure 2: Share of MEs, their employees, turnover contribution and turnover over employees by NUTS levels within Italy
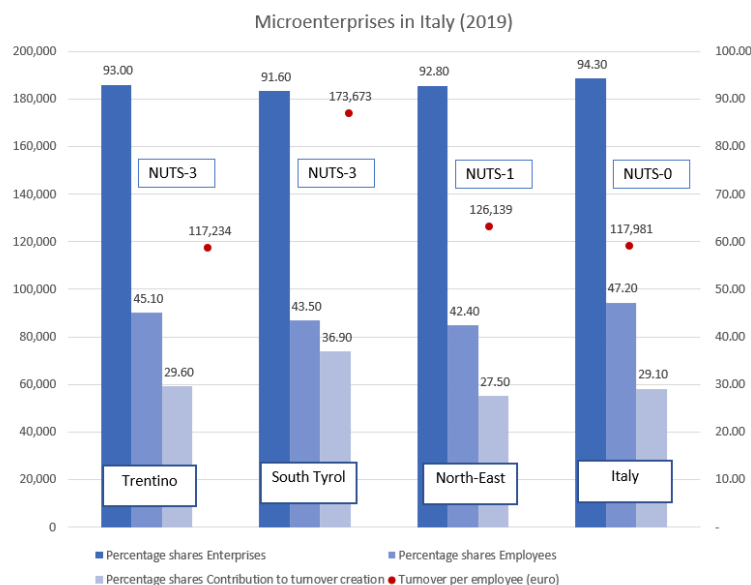
Source: Italian National Statistical Institute (2019), all sectors (agricultural sector not included).

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[1] Istat numbers and percentages may differ from Eurostat data as the counting of what falls under micro-enterprises may differ slightly from country to country, and after the harmonisation process, there may occur minor differences between the national level and the harmonised national level.

2.2 The Role of Public Measures in Italy and in Trentino

Italy has been one of the countries most severely affected by the COVID-19 pandemic. As a result, the Italian government has implemented strict public measures to curb the spread of the virus. These measures heavily affected the economic activity of MEs, who were less able to adapt their business structure with social distancing and the strictness of the lockdown when compared to SMEs and large firms. In response, the Italian government implemented a range of economic measures to ensure the survival of the economy during the emergency period and facilitate firms restarting at the time of recovery (see Section A in the Appendix). One of the most significant measures implemented by the Italian government has been the provision of financial aid to businesses. This includes loans and support for companies that have experienced significant losses as a result of the pandemic, as well as tax breaks and other financial incentives to help businesses stay afloat.

The Autonomous Province of Trento also promptly intervened in the emergency by introducing measures in favour of active firms with registered offices or operating units in the provincial territory. Provincial aid can be grouped into three types of intervention: *non-repayable grants*, *credit/liquidity support measures* and *tax compensation*.

Non-repayable grants were the most important measure in terms of the amount of financial resources committed (80% of the 60 million euros provided by the local government). This intervention favoured small enterprises and MEs, targeting the sectors most affected by the imposed lockdowns. *Liquidity and credit support measures* consisted of the suspension of mortgage/leasing instalments, the renegotiation of existing transactions and the activation of a specific local platform for financing lines aimed at the need for personnel costs, investments and/or working capital among Trentino economic operators. The beneficiaries of the measure were industrial, commercial, tourism, service, craft or agricultural enterprises or self-employed workers and freelance professionals with an active VAT number. *Tax compensation* consisted of contributions that economic operators could use in the context of expenditure incurred for investments such as fixed investments, internationalisation, consultancy and any activity linked to the recovery. The measure was targeted at the entire production system, with some restrictions on specific NACE codes.

Micro-enterprises could apply for both national and provincial aid, and the fact that they received one did not exclude the application for the other. Since the amount of money put in place by the local authorities was large but likely not sufficient to immediately convince ME managers/owners to start the bureaucratic procedure (transaction costs), the situation in Trentino was peculiar regarding whether or not to ask for the subsidy: the procedure was relatively simple, and the information provided on the official institutional webpage was clear and complete[2]. However, government subsidies were already enough to ensure firms' survival. Under these conditions it is reasonable to think that MEs, and thus micro-entrepreneurs, tend to communicate more with others and rely more on what others do. In this framework, firms with similar economic performance (in our case, added value) tended to act in the same way under the uncertainty generated by this context.

3 Data

Data on MEs are usually scarce since this type of company is more attributable to small, unstructured one-person businesses with a balance sheet that generally falls outside of ordinary accounting. To investigate the role of spatial dependence on the take-up rate of local government subsidies, we relied on a representative survey of MEs in Trentino. The sample is stratified by sector, employees and firm age and consists of an average of 2000 units with a response rate ranging from 75 to 85% depending on the wave. Firms less than three years old are not included in the sample. This is a relevant issue as young firms may have less experience with their markets and business environment, and are not entirely stable in terms of their business dynamics.

The data cover a wide range of information, including enterprises' employees, investments, operating costs, financial situations, strategic behaviour under financial constraints, expectations, economic growth, and ICT adoption. Unfortunately, given the rotating nature

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[2] We know from the survey that firms not aware of the provincial subsidy were a small amount (around 2.3% of the total sample). We excluded them from the sample as we do not know if they were eligible for the subsidy. Results with the sample that also considers those firms do not change the coefficient significantly.

of the panel survey[3], the sample size is too small to properly exploit its longitudinal dimension. Therefore, we relied on the 2021 survey to obtain information on the imposed lockdowns, strategies to deal with financial constraints, COVID subsidies, and eligibility criteria. The 2021 survey, with 2020 as the reference year, was then linked to administrative data that provide information on the sector, employees, revenues, added value, production costs and EBIT for every firm for the previous ten years up to 2019. This is because we wanted to exclude financial data affected by the COVID-19 aid.

The geographical location of the enterprise is grouped into three areas (East, West and Central) since we were not allowed to obtain the municipality due to anonymisation reasons, and we wanted to have a large enough sample to capture estimation differences between central and peripheral areas. Specifically, the peripheral areas correspond to the East and West sub-regions of Trentino. From the overall sectoral composition perspective, this grouping identifies economically homogeneous areas within Trentino. The central part is characterised by better infrastructure connectivity and a strong prevalence of the advanced services and industry sectors (the latter concentrated in the southern part of the sub-region). The peripheral areas have less developed infrastructures and a greater propensity towards tourism (large mountain lakes in the East and the Dolomites in the West). The two peripheral areas are differentiated by a stronger prevalence of agriculture in the East and greater importance of manufacturing in the West.

364 companies out of 1731 in the initial sample declared to be not eligible or to be not aware of the provincial measures (about 26.6%) and were taken into account in the hurdle model explained in section 4, equation 1 and equation 2. We, therefore, report descriptive statistics only for the eligible sample (1367 firms). General descriptive statistics are presented in Table 2, while the same statistics by area are shown in Table 1 and Figure 3.

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[3] One-third of new firms enter and exit from the sample every year

Table 1: Descriptive statistics by area

	Mean	SD	Min	Max	N
			East		
turnover 17-19	152,412	229468	4838	2.3e+06	367
added value 17-19	57,696	67071	-2.8e+04	5.4e+05	367
ln(turnover 17-19)	11.26	1.11	8.48	14.64	367
ln(added value 17-19)	10.53	0.98	3.96	13.20	360
imp_lockdown	0.62	0.49	0.00	1.00	367
employees	0.30	0.46	0.00	1.00	367
firm age	20.05	11.95	3.00	60.00	367
self-financing	0.27	0.44	0.00	1.00	367
loans from family/friends	0.11	0.31	0.00	1.00	367
payment cond. customers	0.07	0.26	0.00	1.00	367
payment cond. suppliers	0.14	0.35	0.00	1.00	367
national aids	0.75	0.43	0.00	1.00	367
			West		
turnover 17-19	171,758	3.5e+05	1084.00	4.3e+06	423
added value 17-19	60,727	75499.13	-3021.00	7.8e+05	423
ln(turnover 17-19)	11.30	1.14	6.99	15.28	423
ln(added value 17-19)	10.57	0.94	7.27	13.57	418
imp_lockdown	0.59	0.49	0.00	1.00	423
employees	0.29	0.45	0.00	1.00	423
firm age	20.35	11.95	3.00	54.00	423
self-financing	0.23	0.42	0.00	1.00	423
loans from family/friends	0.11	0.31	0.00	1.00	423
payment cond. customers	0.13	0.34	0.00	1.00	423
payment cond. suppliers	0.17	0.37	0.00	1.00	423
national aids	0.75	0.43	0.00	1.00	423
			Center		
turnover 17-19	169,408	3.4e+05	2425.50	4.1e+06	577
added value 17-19	63,151	83961.74	-3.0e+04	8.5e+05	577
ln(turnover 17-19)	11.27	1.13	7.79	15.22	577
ln(added value 17-19)	10.58	0.96	7.18	13.65	565
imp_lockdown	0.56	0.50	0.00	1.00	577
employees	0.26	0.44	0.00	1.00	577
firm age	19.50	11.90	3.00	57.00	577
self-financing	0.33	0.47	0.00	1.00	577
loans from family/friends	0.10	0.30	0.00	1.00	577
payment cond. customers	0.11	0.31	0.00	1.00	577
payment cond. suppliers	0.14	0.34	0.00	1.00	577
national aids	0.71	0.45	0.00	1.00	577

Figure 3: Distribution of MEs by local community and area (Comunità di Valle)
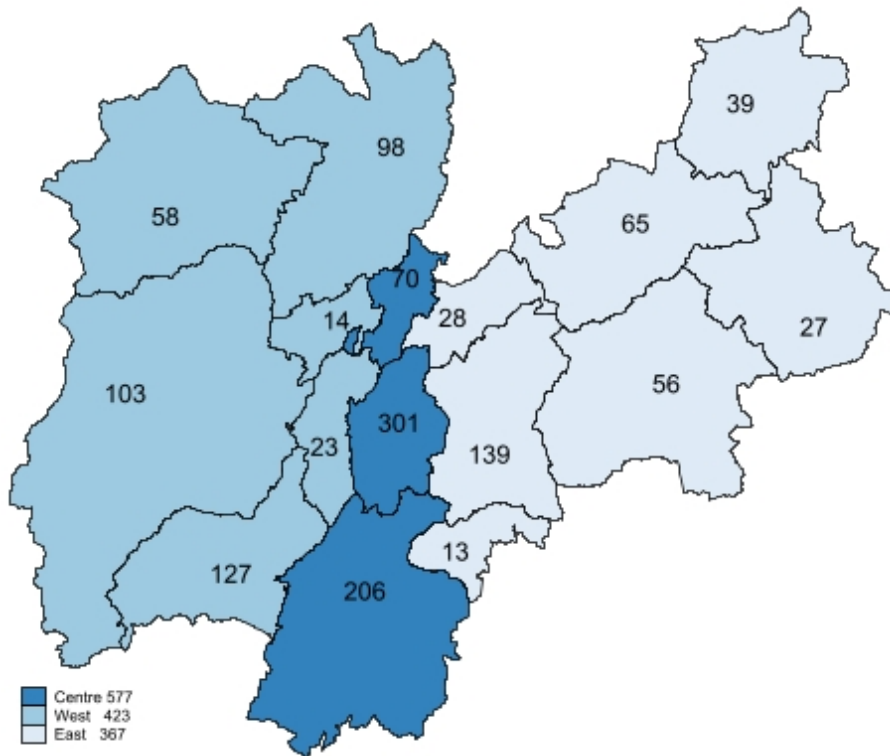
We took average revenues and added values for the previous 3 years, then took the logarithm of the former as a control variable. This could be a proxy for both firm-specific business dynamics and business size for firms with less than 10 employees. In this manner, we managed to collapse the panel financial dimension into a single pre-COVID temporal dimension. In the same vein, the average added value for the previous 3 years was used as an economic variable to build the W matrix and represents a measure of proximity in terms of firm performance.

The 3-year threshold allowed us to collapse a relatively balanced panel of financial data. Additionally, the 5-year average implies no data for firms younger than 4 years in 2020[4]. The variable *imp lockdown* reports whether the firm was forced to close by the government in 2020, *employees* is a dummy variable that identifies whether the firm has more than one employee, *firm age* is the number of years since the firm was registered, while the last four variables represent the strategies adopted by the firm in case of liquidity constraint and

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[4] As mentioned at the beginning of this section, one of the strata is firm age, so firms younger than four years are classified as young.

are expressed in four dummies: i) resorting to self-financing; ii) resorting to borrowing from friend/family members; iii) changing payment terms with customers; iv) changing payment terms with suppliers. The variable *national aid* identifies firms who resorted also for national support.

Table 1 presents the descriptive statistics distinguished by geographical area. The three areas are similar in terms of the share of companies that were affected by the lockdown (approximately 60%), the share of companies with more than one employee (26–30%), the average age (approximately 20 years) and the use of national aid (71% in central areas and 75% in peripheral areas). The strategies adopted in the event of a liquidity constraint were also similar, except for self-financing. In this case, there were 10% more companies in the central region adopting this strategy than in the west. In the east and west, MEs tended to have lower average value added than enterprises in the central area, by 4 and 8%, respectively. Turnover was similar between the central and western regions, while in the east, it was 10% lower than in the central region.

Table 2: Descriptive statistics

	Mean	SD	Min	Max	N
turnover 17-19	1.7e+05	3.2e+05	1084.00	4.3e+06	1,367
added value 17-19	60,936.33	77,095.67	-3.0e+04	8.5e+05	1,367
ln(turnover 17-19)	11.28	1.13	6.99	15.28	1,367
ln(added value 17-19)	10.56	0.96	3.96	13.65	1,343
imp_lockdown	0.59	0.49	0.00	1.00	1,367
employees	0.28	0.45	0.00	1.00	1,367
firm age	19.91	11.91	3.00	60.00	1,367
self-financing	0.29	0.45	0.00	1.00	1,367
loans from family/friends	0.11	0.31	0.00	1.00	1,367
payment cond. customers	0.11	0.31	0.00	1.00	1,367
payment cond. suppliers	0.15	0.35	0.00	1.00	1,367
national aids	0.73	0.44	0.00	1.00	1,367

Figure 4 shows the companies' distribution across sectors both at the provincial level and for specific areas. Looking at the provincial level, approximately one-third of MEs operate in the service sector, with approximately one-fourth operating in the trade sector. Just over 25% of the MEs were active in the construction sector. These three sectors

made up 77% of our representative sample. Additional sectors included other services[5] (10.8%), the manufacturing sector (8.3%) and transport (3.5%). Concerning the individual geographical areas, there is a greater prevalence of the service sector and fewer enterprises active in the trade sector in the central territories. The eastern territories have fewer companies active in the services sector but more companies active in manufacturing. The enterprises in the western territories are more active in the transport sector, with fewer active in construction.

Figure 4: Share of MEs by sector and area
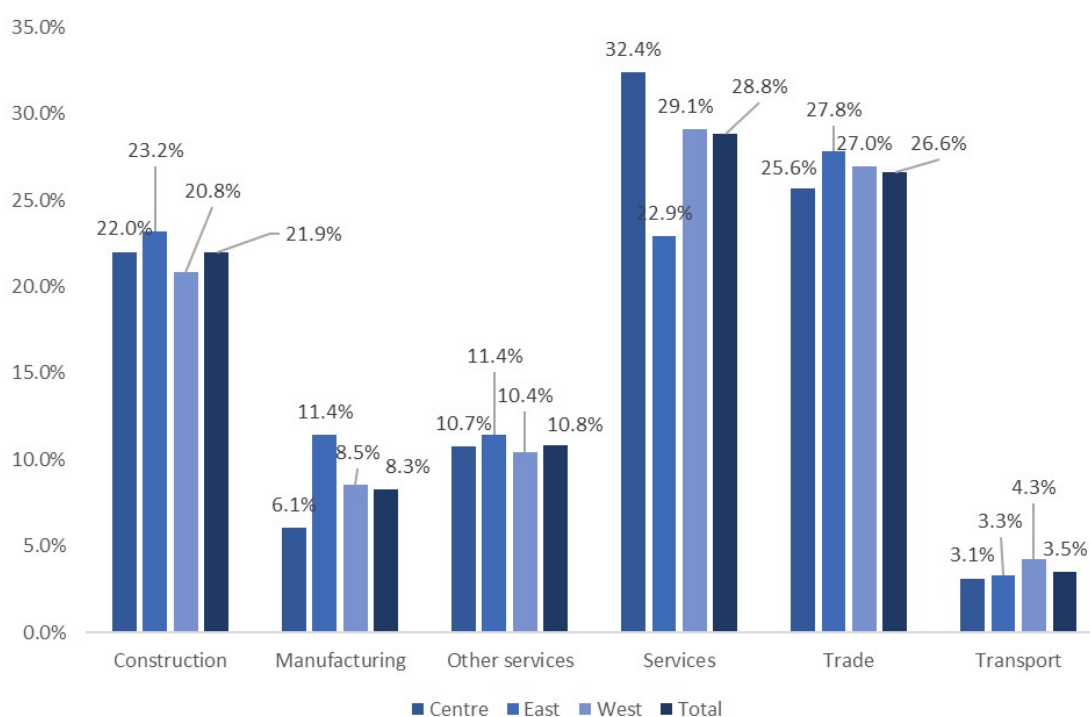
Notably, firms in the central territories are more active in the service sector, which has generally benefited more from remote working solutions and somehow managed to continue with business than other sectors such as construction, manufacturing and transport—sectors in which the central territories have, on average, a smaller share of active firms.

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[5] The sector "Other services" includes creative, artistic, and entertainment activities, sports and recreational activities and other personal services. It corresponds to the NACE Rev.2.1 sector T Other services and letter S.

4 Model specification

In this section, we outline the methodological strategy used to measure the take-up rate of micro-enterprises (MEs). In our sample, we found about 364 MEs that were not eligible (they received a rejection) or for which we did not know if there were eligible or not (they do not know about the existence of local support measures). A methodological strategy that takes into account MEs as *participants* in the activity being study in then needed.

Let d_i be a binary indicator variable such that $d_i = 1$ for participants (active), i.e eligible MEs, and $d_i = 0$ for nonparticipants (non-active), i.e. non eligible MEs or unknown eligibility of the MEs. The strategy then consists of considering a hurdle or two-part model in order to first distinguish between active MEs and non-active MEs, and then estimating the probability of asking for local support measures among the active ones.

$$P(y_i = 1|x_i) = \begin{cases} P(d_i = 0|x_i) & if \quad y_i = 0 \\ P(d_i = 1|x_i)\,P(y_i = 1|d_i = 1, x_i) & if \quad y_i = 0, 1 \end{cases} \quad \forall i \qquad (1)$$

where each y_i is a Bernoulli variable with conditional probability of success equal to $P(y_i = 1|x_i)$, see e.g. Cameron and Trivedi, 2005, page 545. The benchmark model is then based on the following two-equations probit specification:

$$y_{i1} = \mathbf{I}(x_{i1}'\beta_1 + \varepsilon_{i1} > 0) \quad \varepsilon_{i1} \sim \mathcal{N}(0, 1)$$

$$y_{i2} = \mathbf{I}(x_{i2}'\beta_2 + \varepsilon_{i2} > 0) \quad \varepsilon_{i2} \sim \mathcal{N}(0, 1) \quad if \quad y_{i1} = 1 \qquad (2)$$

where the first equation measures the participation decisions, while the second equation measures the MEs decisions, among the active ones, of asking for local support measures. Then, both $y_1^* = X_1\beta_1 + \varepsilon_1$ and $y_2^* = X_2\beta_2 + \varepsilon_2$ are n-dimensional vectors of latent continuous dependent variables reflecting the unobserved utility functions in doing an action by the micro-firms, see Manski and McFadden, 1981 and McFadden, 2001. X_1 is a n by k_1 matrix of exogenous regressors containing the difference between the turnover of 2020 and the turnover of 2019 ($turnover_{diff}$) and the specific sector ($sector$) as criteria

for eligibility, and X_2 is an n by k_2 matrix of exogenous regressors, whose components correspond to the logarithm of the average turnover between 2017 and 2019 ($ln(turnover)$), to the state-imposed lockdown ($lockdown$), to the condition if the micro-firm does have employees ($employees$), to the type of firm ($legal form$), to the specific sector ($sector$), to the micro-firms' reactions in the case of financial constraints ($financial$), and to the macro-area geographical locations of the MEs (geo). The variable *financial* indicates the reported $j = 1, ..., 4$ strategies: (1) self-financing; (2) loans from family/friends; (3) payment conditions with customers; (4) payment conditions with suppliers. Finally, y_1 and y_2 are two n-dimensional vectors of binary dependent variables reflecting the micro-firms' choices in participating and in asking for local support measures, respectively, while ε_1 and ε_2 are two n-dimensional vectors of i.i.d. normal error terms with finite unitary variances.

The hurdle model in equation (2) serves as a benchmark model to first estimate the probability for each micro-firm of asking for local support measures given the determinants we selected in our study, i.e. $P(y_{i2} = 1|x_{i2}) = P(d_i = 1|x_{i1})P(y_{i2} = 1|d_i = 1, x_{i2}) = \Phi(x'_{i1}\beta_1)\Phi(x'_{i2}\beta_2) \quad \forall i$, where $\Phi(.)$ is the normal cumulative density function. The variable *geo* has an important role in our empirical context. This variable can suggest that the probability of asking for local support can change depending on the macro-area in which a specific micro-firm is located. For instance, the reason may be due to the different spatial characteristics in terms of the MEs compositions within the three areas.

We rely on the assumption that spatial spillovers can be interpreted as peer effects among MEs. The underlying assumption is that, as Italian micro-enterprises have very low levels of financial literacy, they are less able to assess the value of an incentive autonomously and are, therefore, more likely to refer to what others do with respect to greater companies. We suppose it is more likely that peer effects arise among MEs rather than among greater companies. Compared to larger companies, micro-enterprises do not have dedicated administrative staff for researching subsidies/grants.

A further detailed investigation is thus required. The benchmark model is then replaced with a spatial hurdel model to see also spillover effects at work. In the second equation of the hurdle model we then specify a spatial autoregressive probit model, see e.g. LeSage

et al., 2011. The second equation specification is as follows

$$y_2^* = \rho W y_2^* + X_2 \beta_2 + \varepsilon_2 \quad \varepsilon_2 \sim \mathcal{N}(0, I)$$

$$y_2 = \mathbf{I}(y_2^* > 0) \tag{3}$$

where W is an n by n matrix of exogenous weights connecting the spatial latent variables y_2^* and ρ is the corresponding spatial autoregressive coefficient. The other variables are defined as in equation (2). The model specification in equation (3) is also used by considering subgroups of observations depending on the geographical macro-area locations of the micro-firms (*geo*).

Since we do not have exogenous information about, for instance, the coordinates of MEs due to statistical confidentiality, the weighting matrix $W = \{w_{ij}\}$ is built by using an economic variable, i.e. the mean 2017-2019 of the micro-firms' added values $(\bar{a}v)$[6], as follows

$$\begin{cases} w_{ij} = \frac{1}{|\bar{a}v_i - \bar{a}v_j|} & if \quad i \neq j \\ w_{ij} = 0 & otherwise \end{cases} \tag{4}$$

see, for instance, Case et al., 1993 who rely on a similar economic definition of the weighting matrix. Then W is row-normalized such that $\sum_j w_{ij} = 1$. In this way, the utility functions of micro-firms are interconnected by taking into account similarities in terms of their mean added values.

We should recognize that when W is defined by an economic variable, the problem of endogeneity can be even more serious. Qu and Lee, 2015 proposed estimation methods with an endogenous spatial weighting matrix in linear models and provided a detail description of the source of endogeneity. The problem is related to the correlation between the error terms associated with the economic variables that determine W and the error terms associated with the main structural spatial equation. If this correlation is zero, then the economic W matrix should be treated as strictly exogenous, see Qu and Lee (2015, Sec. 2.1, 2.2, 2.3).

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[6] We chose added value because it is a measure that allows us to compare enterprises in different sectors in terms of economic activity.

To treat W exogenous, we suppose that there is no correlation between the error terms that influence the mean 2017-2019 of the firms' added values and the error terms which determine the firms' utility of asking for local supports. That is, the weighting matrix has a generic weight $w_{ij} = f_{ij} \left(\bar{a} v_{ij} \right)$ where

$$\bar{a}v = Z\gamma + v \tag{5}$$

The average of the added values are determined by other exogenous variables Z and a vector of error terms v. Now we suppose that $corr(\varepsilon_i, v_i) = 0 \quad \forall i$. Indeed, it is quite reasonable to assume there are no unobserved factors that influence both a firm's utility function and the average of a firm's added value.

Provided that $A^{-1} = (I - \rho W)^{-1}$ exists (Kelejian & Prucha, 2010), the model can be written in reduced form as follows:

$$y_2^* = A^{-1}X_2\beta_2 + A^{-1}\varepsilon_2 \quad \varepsilon_2 \sim \mathcal{N}(0, I)$$
$$y_2 = \mathbf{I}(y_2^* > 0) \tag{6}$$

where $A^{-1}X_2 = X_2^*$ and $A^{-1}\varepsilon_2 = \varepsilon_2^*$. Since spatial dependence introduces not only autocorrelation but also heteroskedasticity due to the covariance matrix $\Sigma_{\varepsilon_2^*} = A^{-1}A^{-1'}$, which needs to be taken into account, see e.g. Billé, 2013, the probability that $y_{2i} = 1$ in a spatial hurdle model is finally

$$P(y_{i2} = 1|x_{i2}^*) = \Phi(x_{i1}'\beta_1)\Phi\left(\frac{x_{i2}^{*'}\beta_2}{\sigma_i}\right) \quad \forall i. \tag{7}$$

where σ_i are the standard deviations for the diagonal elements of $\Sigma_{\varepsilon_2^*}$. After having considered parameter estimates, the interpretation of probit models requires proper definitions of the marginal effects. The marginal effects with respect to a continuous variable x_h are calculated as follows

$$\frac{\partial P\left(y_{i2} = 1|x_{i2}\right)}{\partial x_{ih}} \mid_x = \Phi(x_{i1}'\beta_1)\phi\left(\{\Sigma_{\varepsilon_2^*}\}_{ii}^{-1/2}\left\{A^{-1}X_2\right\}_i\beta_2\right)\{\Sigma_{\varepsilon_2^*}^{-1/2}\}_{ii}\{A^{-1}\}_i\beta_{2h} \quad \forall i \tag{8}$$

where x_h is the n–dimensional vector of units referred to the h–th continuous regressor included *only* in the set X_2, $\{.\}_i$ is the i–th row of the matrix inside, and $\{.\}_{ii}$ is the i–th diagonal element of a square matrix. For the calculation of the marginal effects in spatial autoregressive probit models see e.g. (Billé & Leorato, 2020; Fleming, 2004; LeSage et al., 2011).

The marginal effects are calculated for each level of the regressor x_h in order to provide important evidence of spatial heterogeneity (Lacombe & LeSage, 2018). A synthetic measure is then obtained by averaging them, distinguishing also between direct and indirect effects. The direct effects are the average of the main diagonal elements and mainly reflect the effects on the expected value of y_{2i} due to the exogenous variables x'_{2i}, while the indirect effects are the average of the off-diagonal elements and reflect the spillover effects on the expected value of y_i due to the exogenous variables x'_j with $j \neq i$. Considering a hurdle model, these marginal effects should be pre-multiplied by the probability of the elegibility of the MEs, i.e. $\Phi(x'_{i1}\beta_1)$.

5   Results and discussion

In the present analysis, we mainly focus on provincial aid for three reasons. First, given the nature of the unit of investigation, it is far more interesting to understand how the incentives offered by the local administration were directly adopted by the local economic fabric (i.e., MEs). Second, provincial incentives were generous and mainly targeted at the lower end of the firm size distribution (i.e., MEs; see Section 2.2) and the aid offered by the Autonomous Province of Trento, with its 60 million assigned to public subsidies, was the largest among the other regions (National Register of State Aid) and played a complementary role to the national one. Third, regarding national aid, the survey did not allow us to distinguish eligible enterprises from those that were ineligible.

We relied on the Stata *spatbinary* command to estimate the spatial probit model (Spinelli, 2022) and report the result in Table 3. We first estimated the model specified in equation 2 at the provincial level, i.e. for the entire sample, both in its spatial (2) and

non-spatial specifications (1). The last three columns illustrate the estimates for the spatial specification for the central (3), eastern (4) and western (5) areas.

Looking at the first two columns of Table 3 (i.e., the model estimated at the provincial level), it can be noticed that the magnitude of the turnover, imposed lockdown, construction sector, and national aid coefficients are similar and significant for both the spatial and non-spatial specification. This indicates that their relevance in explaining the take-up of local aid by MEs does not change when controlling for spatial spillovers. As turnover increases, the probability of asking for (and thus obtaining) a provincial incentive decreases. This can be explained by the fact that the greater the turnover achieved in the 3 years preceding the pandemic, the more liquidity the firm is likely to rely on. Notably, it is important to consider that national aid has been the main channel through which firms could have obtained their main source of liquidity since 73% of the MEs eligible for provincial aid had asked for national support (see Table 2). The use of national incentives is a variable whose coefficient is always significant, always positive and has a high magnitude. Taking national aid and being forced to close during 2020 increased the likelihood of asking for provincial aid. Moreover, for some firms, these two factors may have come together depending on the sector. The construction sector has been particularly affected by the pandemic since the closure of many construction sites has meant significant losses for these MEs, which could explain the higher take-up rate for firms operating in this sector. At the same time, the coefficients for the service sector are not significant, probably because these firms have benefited more from remote working and have somehow managed to continue their business activities despite the restrictions due to the pandemic. Especially compared to other sectors such as construction, manufacturing, and transportation.

Another interesting factor is related to the territorial dimension as an important determinant of provincial aid adoption: companies in the western and eastern areas of the province are more likely to apply for incentives than those in the central territories. That said, we wanted to compare whether spatial spillovers are more relevant in some areas than others to explain the adoption rate.

Table 3: Probit and Spatial Probit estimates

| VARIABLES	(1) Province	(2) Province	(3) Center	(4) East	(5) West
ln(turnover 17-19)	-0.07***	-0.08***	-0.03	-0.14***	-0.11***
	(0.01)	(0.02)	(0.02)	(0.03)	(0.04)
imp_lockdown	0.34***	0.33***	0.37***	0.27*	0.25
	(0.09)	(0.09)	(0.13)	(0.17)	(0.18)
employees	0.08	0.07	-0.21	0.65***	-0.10
	(0.10)	(0.10)	(0.15)	(0.21)	(0.15)
Auton&self-emp	-0.05	-0.08	-0.30	0.12	0.19
	(0.13)	(0.13)	(0.19)	(0.25)	(0.26)
Ltd.	0.11	0.13	-0.10	0.15	0.48**
	(0.10)	(0.10)	(0.16)	(0.21)	(0.20)
West	0.28***	0.26**			
	(0.10)	(0.10)			
East	0.20**	0.18*			
	(0.09)	(0.09)			
age	-0.00	0.00	0.00	0.00	-0.00
	(0.00)	(0.00)	(0.01)	(0.01)	(0.01)
Other services	0.17	0.17	-0.03	0.63**	0.11
	(0.14)	(0.14)	(0.22)	(0.28)	(0.30)
Construction	0.46**	0.44**	0.62*	0.42	0.82**
	(0.18)	(0.19)	(0.34)	(0.31)	(0.38)
Manufacturing	0.18	0.18	-0.02	0.55**	0.19
	(0.13)	(0.13)	(0.19)	(0.26)	(0.28)
Services	0.13	0.09	0.03	-0.15	0.49
	(0.22)	(0.22)	(0.37)	(0.46)	(0.39)
Transport	0.32*	0.27	-0.04	1.34***	0.32
	(0.18)	(0.18)	(0.26)	(0.46)	(0.35)
Self-financing	-0.02	-0.04	0.03	0.06	-0.18
	(0.09)	(0.09)	(0.13)	(0.19)	(0.18)
Loans from family/friends	0.19	0.18	0.27	0.12	-0.06
	(0.14)	(0.14)	(0.22)	(0.31)	(0.26)
payment cond. customers	-0.03	-0.01	-0.01	0.25	-0.06
	(0.15)	(0.15)	(0.23)	(0.37)	(0.24)
payment cond. suppliers	0.18	0.17	0.39*	-0.14	0.18
	(0.14)	(0.14)	(0.23)	(0.27)	(0.24)
National aids	1.08***	1.08***	0.91***	1.36***	1.29***
	(0.08)	(0.09)	(0.13)	(0.18)	(0.21)
ρ		0.33**	0.19	0.37*	0.80***
		(0.16)	(0.27)	(0.21)	(0.20)
Observations	1,367	1,367	577	367	423

The spatial autoregressive coefficient ρ is significant in both the full sample model and the geographical subsamples for the eastern and western territories, thus confirming the presence of spatial spillovers among MEs at the provincial level. This means that MEs with similar average 2017-2019 added values tend to reciprocally increase the probability of asking for local aid. Compared to the general pattern estimated over the entire province, spatial spillovers were significant and larger in the peripheral areas of the province (i.e., the west and east). Simultaneously, they are not significant at all in the central territories. This implies that MEs with similar levels of economic performance —namely added value— in the peripheral areas, tend to behave in the same way in terms of applying for provincial aid. Comparing the results of Table 3 with the descriptive statistics in Table 1, it is evident that the spatial coefficient becomes significant in areas where the added value is, on average, smaller. In greater detail, Figure 5 shows that the distributions of added value are quite asymmetric, with a positive asymmetry, in both the entire province and the smaller territories. With median values of 34984.67, 35156.67, 34710.33, 35012.67 for the eastern, western and central regions, as well as the entire province, respectively, where the maximum values are 5.4e + 05, 7.8e + 05, 8.5e + 05, 8.5e + 05, respectively, we can conclude that the spillovers effects were mainly driven by the sharing of information between MEs characterized by lower values of added value.

The data do not allow us to investigate the way in which MEs share information. However, we know from the previous survey (2019)[7] that one of the additional sources of information for MEs was the sector association (i.e., industry trade group). MEs belonging to the same association are likely to be exposed to the same (additional) information. We assume that MEs first receive information about the existence of provincial aid from their sector association, but then they tend to reciprocally help each other to ask for this provincial aid. This is mainly because, receiving information do not necessarily implies asking for local aid. Therefore, a two-step mechanism is at work here.

As previously mentioned, the average turnover achieved in recent years is a variable that is always negative and significant in peripheral areas; however, in comparison to the

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[7] Additional information is available here, on the local statistical office web page.

Figure 5: Value added distribution by area
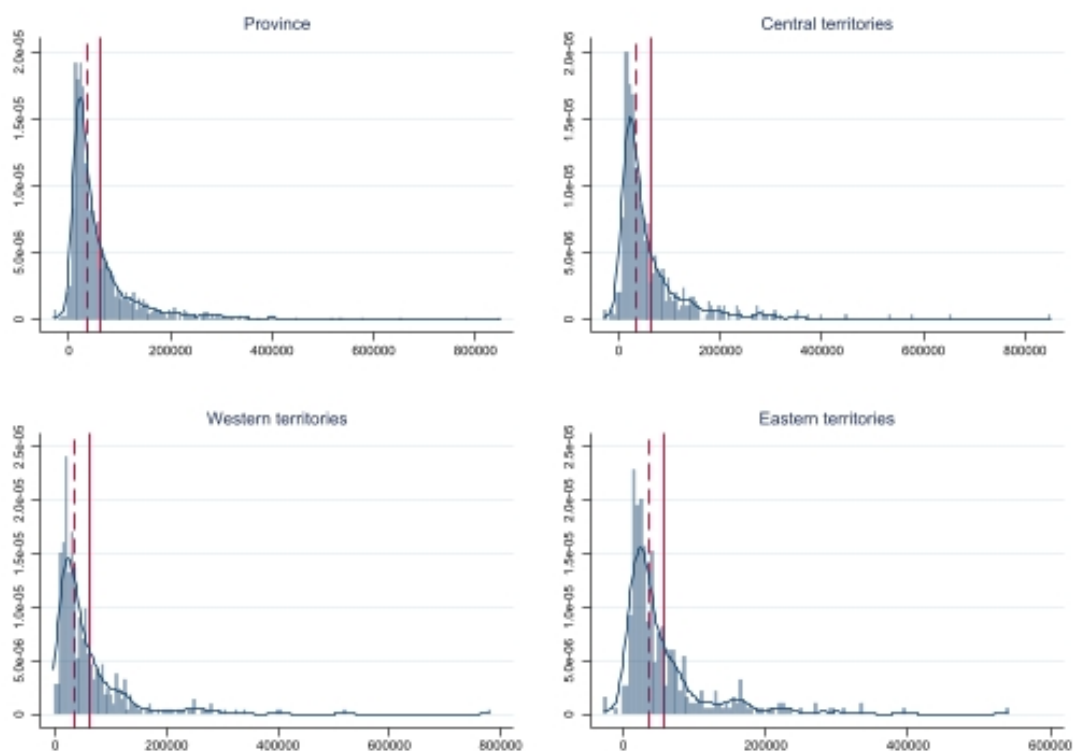
Note: The dashed red line and the red line represent the median and the mean, respectively.

demand for national aid and the imposed lockdown, it is not related to the pandemic phase. This variable is one of the most important determinants for asking for provincial aid. Hence, further investigation in terms of the marginal effects with respect to this variable is needed. Table 4 reports the direct, indirect and total average marginal effects of the turnover at the provincial level as well as in the three main geographical areas of Trentino.

Both in the full sample and the subsamples, the total, direct and indirect effects of the turnover are negative, which is coherent with its estimated coefficients in Table 3. The greatest magnitude of the total effects can be observed in the western territories, with a value of −0.072. That is, a unit variation in the turnover of the MEs decreases the probability of asking for provincial aid by approximately 7.2 per cent. The direct effects are the most significant (i.e., in the general model and the eastern and western territories). Although these effects are the direct marginal effects of turnover on the probability of requesting provincial aid, they are also affected by spatial spillover since the spatial autocorrelation coefficient enters the main diagonal of the marginal effects matrix (8).

Table 4: Total, direct and indirect marginal effects by geographical area

| ln(turnover 17-19)	dydx	std. err.	z	p > |z|	[95 conf.	interval]
Provincial level						
total	-0.031	0.012	-2.567	0.010	-0.055	-0.007
direct	-0.023	0.009	-2.602	0.009	-0.041	-0.006
indirect	-0.008	0.007	-1.133	0.257	-0.021	0.006
Central territories						
total	-0.007	0.007	-1.034	0.301	-0.021	0.006
direct	-0.006	0.004	-1.368	0.171	-0.014	0.002
indirect	-0.002	0.003	-0.475	0.635	-0.008	0.005
Eastern territories						
total	-0.032	0.013	-2.452	0.014	-0.058	-0.006
direct	-0.021	0.004	-5.635	0.000	-0.028	-0.013
indirect	-0.012	0.011	-1.063	0.288	-0.033	0.010
Western territories						
total	-0.072	0.084	-0.853	0.393	-0.236	0.093
direct	-0.015	0.004	-3.437	0.001	-0.024	-0.007
indirect	-0.056	0.080	-0.698	0.485	-0.214	0.102

Note: Standard error for the marginal effects are estimated using the delta method.

Figure 6 reports the total local marginal effects variation, distinguished by territory. The greatest variability is found in the west, where the values of the marginal effects with respect to each ME vary from approximately -0.163 to -0.004. As shown in Table 5, a further investigation considered the characteristics of the MEs at different percentiles of the above marginal effect distributions. The table also reports the fifth ($p(5)$) and ninety-fifth ($p(95)$) percentiles of the distributions in Figure 6. As we can observe, higher negative marginal effects affect MEs with higher values of turnover ($p(5)$), further decreasing the probability of requesting provincial aid. In contrast, for MEs with lower turnover ($p(95)$), the probability decreases less (i.e., the values are still negative but close to 0).

6   Conclusion

This study investigated the impact of spatial dependence on the take-up rate of local government subsidies in 2020. It focused on a specific sub-population of firms hit particularly hard by the pandemic: MEs. These firms employ less than 10 employees and usually have limited access to capital markets and credit lines to draw upon. Thus, MEs tend to suffer more from financial constraints since they may lack the financial instruments

Figure 6: Local and average marginal effects
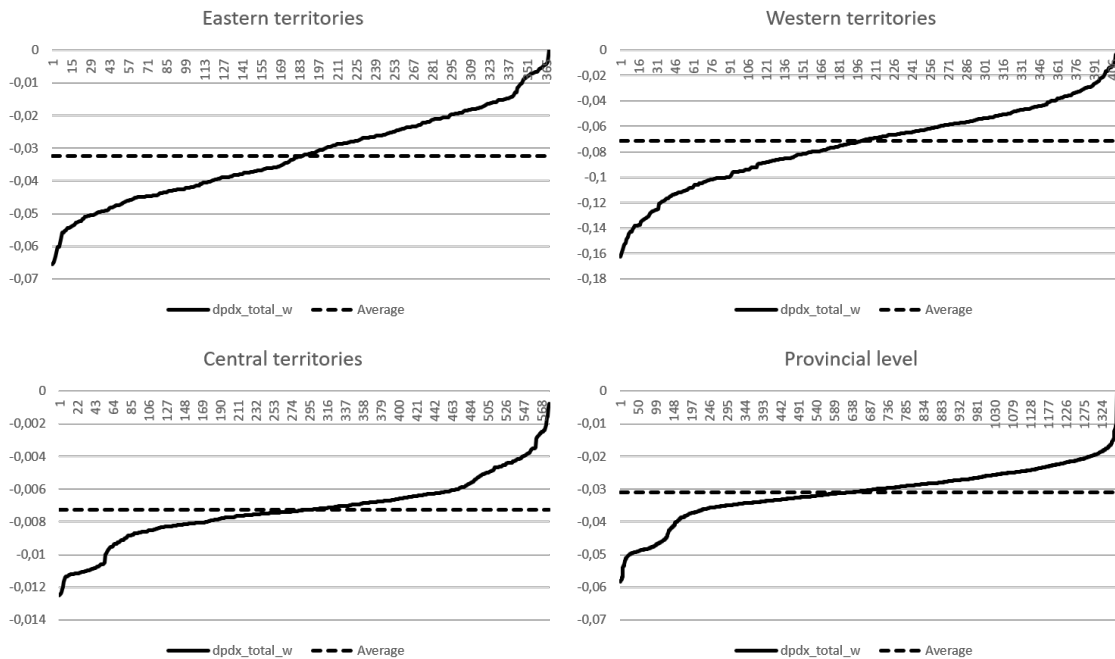
required to survive a prolonged recession. Despite being small, MEs constituted 95% of firms in the EU-27 countries in 2019, contributing nearly one-third of the total turnover and employing more than 15% of the workforce. Given the huge amount of subsidies provided by the national and local governments and the massive effort in terms of organisation and public resources, it is crucial to understand the mechanisms that led eligible companies to apply (or not) for public aid in such a critical situation.

This study allowed for spatial dependencies among firms with similar levels of average 2017-2019 added value as a proxy of managerial ability to understand how this, besides all the relevant firm characteristics, improves or diminishes the take-up rate of public subsidies. Notably, allowing for spatial dependencies implies allowing for information sharing among MEs. Given the stronger embeddedness of micro-enterprises with the local economy, we focused on provincial (local) subsidies in Trentino. In this way, it is possible to understand how the incentives offered by the local government were directly adopted by the local economic fabric (i.e. the MEs). At the same time, provincial incentives in Trentino were generous (60 million euros) and mainly targeted the lower end of the size distribution of enterprises (i.e., MEs and small enterprises).

Table 5: Descriptive statistics of MEs at p(5) and p(95) of the individual marginal effects distribution (turnover marginal effects)

Variable	Mean	SD	N	Mean	SD	N
	Provincial level p(5)			*Provincial level p(95)*		
turnover 17-19	136,545	189,702.70	68	136,536	493,233.10	68
added value 17-19	59,989	62,659.52	68	36,586	45,515.10	68
employees	0.29	0.46	68	0.35	0.48	68
age	22.70	0.26	68	18.10	0.34	68
self-financing	0.24	0.43	68	0.37	0.49	68
loans from fam./friends	0.10	0.31	68	0.37	0.49	68
payment cond. cust.	0.13	0.34	68	0.37	0.49	68
payment cond. supp.	0.04	0.21	68	0.66	0.48	68
	Central territories p(5)			*Central territories p(95)*		
turnover 17-19	195,531	228,289.60	28	220,950	760,745.40	28
added value 17-19	82,951	119,102.70	28	26,681	26,203.14	28
employees	0.25	0.44	28	0.18	0.39	28
age	19.29	0.26	28	15.86	0.36	28
self-financing	0.21	0.42	28	0.61	0.50	28
loans from fam./friends	0.07	0.26	28	0.46	0.51	28
payment cond. cust.	0.04	0.19	28	0.36	0.49	28
payment cond. supp.	0.00	-	28	0.75	0.44	28
	Eastern territories p(5)			*Eastern territories p(95)*		
turnover 17-19	141,012	169,161.80	18	64,174	93,860.37	18
added value 17-19	49,892	51,860.02	18	37,368	52,613.46	18
employees	0.39	0.50	18	0.44	0.51	18
age	18.89	0.32	18	12.83	0.38	18
self-financing	0.28	0.46	18	0.50	0.51	18
loans from fam./friends	0.11	0.32	18	0.28	0.46	18
payment cond. cust.	0.17	0.38	18	0.11	0.32	18
payment cond. supp.	0.17	0.38	18	0.11	0.32	18
	Western territories p(5)			*Western territories p(95)*		
turnover 17-19	113,140	113,768.10	21	101,890	110,112.30	21
added value 17-19	50,513	53,685.84	21	37,999	34,997.15	21
employees	0.19	0.40	21	0.24	0.44	21
age	16.95	0.22	21	11.95	0.22	21
self-financing	0.24	0.44	21	0.19	0.40	21
loans from fam./friends	0.19	0.40	21	0.05	0.22	21
payment cond. cust.	0.19	0.40	21	0.10	0.30	21
payment cond. supp.	0.10	0.30	21	0.14	0.36	21

The spatial autoregressive coefficient ρ is significant in both the full sample model and the geographical subsamples for the eastern and western territories, thus confirming the presence of spatial spillover among MEs. Within the peripheral areas, spillovers are significant and larger, while this is not the case in the central territories. This implies

that MEs operating in the peripheral areas with similar levels of economic performance, namely added value, tend to share information and behave in the same way when it comes to applying for provincial aid. At the same time, the spatial coefficients become significant in areas where the added value is smaller on average, indicating that spillover effects are mainly driven by the sharing of information between MEs characterised by lower values of added value.

The results also show how turnover plays a crucial role in determining firm-specific take-up: the higher the turnover, the lower the likelihood of requesting provincial aid. This is also true in the peripheral areas and allowing for spatial spillovers, whereas turnover has no significant direct marginal effects in the central territories. We claim that spatial spillovers also affect turnover marginal effects as the spatial autocorrelation coefficient enters the main diagonal of the marginal effects matrix. In line with our story, the direct marginal effects of turnover are higher in peripheral areas, thus reducing the probability of requesting provincial aid. Upon investigating the distribution of individual total marginal effects within each area, firms at the top (close to 0 marginal effects) percentiles p(95) are also those that have lower added value. On the contrary, firms at the bottom part of the distribution (close to the maximum negative marginal effects) percentiles p(5) are those with higher added value.

These results are also relevant from a policy perspective. As we assumed that spillovers capture a form of communication among micro-enterprises in peripheral areas, these spillovers arise as a mechanism that aims to reduce the uncertainty about asking for local aid. Given that we are comparing eligible enterprises, this mechanism increases the probability of asking for local aid and, consequently, the efficacy of the policy. This mechanism arises among firms with a low added value and, thus, low managerial ability, which, together with a generally low level of financial literacy, can be attributed to a lack of competence in evaluating the benefits of subsidies and their opportunity cost.

A possible approach to dealing with these consequences is to increase the level of financial skills of micro-enterprises by implementing ad hoc courses, for example, involving local credit institutions. Another short-run effective and less-costly option would require

employing local (sub-regional) institutions, i.e. municipalities and local communities (Comunità di Valle), as an additional dissemination channel in peripheral areas. These institutions are more intertwined with the local fabric, especially when it comes to small businesses like hairdressers, plumbers, small construction companies, bars, restaurants and small shops. In this way, the information process would be driven by an institutional channel that adds to the reciprocal communication.

Acknowledgements

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A   Public support measures at the national and local levels

At the national level, to ensure the survival of Italian companies during the emergency period and facilitate their recovery during the recovery period, the state implemented a set of extraordinary interventions. With Law Decree 20 *"Cura Italia"*, published on 17 March 2020, the first measures were provided to support liquidity, mainly by introducing the specific Wages Guarantee Fund (Cassa Integrazione) for the pandemic and the moratorium on loan and mortgage instalments. Subsequently, with the Liquidity Decree of 8 April 2020, a plan of more than 750 billion euros was adopted to ensure credit and the necessary liquidity to businesses. The D.L. *"Rilancio"* allocated over 16 billion to extend the Wages Guarantee Fund, reinforce liquidity measures, expand interventions in taxation and grant non-repayable subsidies. Additionally, the D.L. *"Agosto"* implemented further measures to support enterprises. The four *"Ristori"* Decrees followed this up to the Christmas Decree-Law.

The Autonomous Province of Trento also intervened promptly in the emergency by introducing measures in favour of active firms with registered offices or, in any case, operating units in the provincial territory. With Provincial Law. 21 no. 2/2020, the first urgent support measures were introduced, followed by further interventions through Provincial Law no. 3/2020. Considering the persistence of the pandemic, with Provincial Law. No. 6/2020, the interventions were continued, and the process started in the previous months was further strengthened through new measures aimed at supporting the local economy, employment and, therefore, household income. The extraordinary intervention plan directed at businesses implemented by the provincial administration addressed various aspects of the consequences of the pandemic.

To sum up, the provincial intervention can be grouped into three types of intervention. The *non-repayable grant* was the most important measure in terms of the amount of financial resources committed. The first line of intervention, approved as urgent in June 2020, aimed at supplementing the revenues of enterprises, self-employed, and other economic operators mainly via direct cash transfers. This intervention favoured smaller enterprises, focusing on the sectors most affected by the imposed knockdowns. Another similar measure was

later joined by non-repayable grants for large losses aimed at providing further support to operators that had suffered huge drops in revenues resulting from the continuation of Covid-19. The use of non-repayable subsidies was also envisaged in the recovery phase to support the start-up of new activities, retraining and growth of enterprises.

A second type of intervention aimed at the entire provincial production system took the shape of *liquidity and credit support* through the definition of a Memorandum of Understanding between the Autonomous Province of Trento and various financial operators in Trentino The measures activated in this context were specifically: the suspension of mortgage/leasing instalments, renegotiation of existing transactions and the activation of Plafond Ripresa Trentino financing lines aimed at the need for personnel costs, investments and/or working capital of Trentino economic operators. The beneficiaries of the measure were industrial, commercial, tourism, service, craft or agricultural enterprises or self-employed workers and freelance professionals with an active VAT number.

The third type concerned contributions to be used for *tax compensation*. These were contributions that economic operators could use in the context of expenditure incurred for investments such as fixed investments, internationalisation, consultancy and any activity linked to the recovery. The measure was targeted at the entire production system, with some restrictions on specific NACE codes. Table 6 summarises the provincial aid.

Table 6: Summary of Provincial Intervention Measures

Type of Intervention	Description
General Requirements (% of the subsidised 60 million euros)	• registered office or operating unit in the territory of the Autonomous Province of Trento on 29; • industrial, commercial, tourism, service, craft, agricultural enterprises, with active business activity in February 2020;
Non-Repayable Grants (80%)	• direct cash transfers to supplement revenues for enterprises, self-employed, and economic operators; • less than 11 employees - focus on smaller enterprises in sectors most affected by COVID-19 knockdowns • turnover decrease of at least 50% from March-April-May 2020 compared to the corresponding period of the previous year. • extra contribution if the turnover decrease is greater than 75% between June-November 2020 and the corresponding period of the previous year (grants for large losses);
Liquidity and Credit Support (10%)	• suspension of mortgage/leasing instalments, transaction renegotiation • subsidised credit lines • no class size limits
Tax Compensation Contributions (10%)	• tax compensation contributions for various investments (fixed, internationalization, consultancy, collaboration, and COVID-19). • no class size limits

Notes: This table summarises all individual measures provided by local authorities at the provincial level.

At the territorial level, the aid offered by the Autonomous Province of Trento, with its 60 million, was the largest among the other regions (National Register of State Aid) and played a complementary role to the national one. Having an autonomous status, the province was able to allocate more resources than the other regions and, therefore, it is an interesting region when it comes to studying the role of local public subsidies.

Micro-enterprises could apply for both national and provincial aid, and the fact that they received one did not exclude the application for the other. In our sample, 73% of the micro-enterprises eligible for the provincial subsidy had received national aid (see the Table below). Most of the national aid was granted before provincial aid and was substantially higher.

	Prov. Aid		
Nat. aid	No	Yes	Total
No	16.4%	10.2%	26.6%
Yes	13.0%	60.4%	73.4%
Total	29.4%	70.6%	100.0%

N= 1,367

Concerning the timing, the local statistical office of the Province of Trento[8] shows that the majority of local applications occurred in the latter half of the year, in contrast with national applications that spanned from the onset of the pandemic phase on March 8, 2020. A prevalent trend was the initial pursuit of national aid, followed by applications for provincial assistance. However, it is important to remember that having applied for at least one national aid did not preclude firms from subsequently seeking provincial aid. Firm-specific information about the timing of the single request is not available due to the survey's anonymization protocol.

Information to apply was available to everyone on the province's dedicated website[9], and that the information campaign was massive on radio, internet and social media, local television as well as alters coming from trade associations. 364 companies out of 1731 in the initial sample declared to be not eligible or to be not aware of the provincial measures (about 26.6%) and were taken into account in the hurdle model explained in section 4, equation 1 and equation 2.

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[8] http://www.statistica.provincia.tn.it/

[9] https://ripartitrentino.provincia.tn.it/Misure/Misure-scadute