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# Do micro-enterprises ask for local support measures? Evidence after the COVID-19 pandemic

Alessio Tomelleri and Anna Gloria Billé

**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.

**Keywords:** Public Subsidies, Take-up Micro-enterprises, Spatial probit, Spatial dependence, COVID-19.

# 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 and 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 added value, tend to share information and behave in the same way when it comes to applying for provincial aid. 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. 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 were 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).

Despite this, there is limited empirical and theoretical research evidence 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) (De Mel et al., 2010; Goodman, 2021). The focus is mainly 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 regarding whether these individuals should receive the benefits in question (OECD, 2004; Riphahn, 2001; Roman, 2019). 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 the 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 factor worthy of investigation. In this direction, this study aimed to assess the factors influencing 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 about here

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

[1]Istat numbers and percentages may differ from Eurostat data as the counting of what falls under micro-

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.

Figure 2 about here

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.

## 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 nearly 60 million euros provided by the local government). This intervention favoured small enterprises and MEs, targeting the sectors most affected by

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.

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.

The situation in Trentino was peculiar regarding the decision of whether or not to ask for the subsidy. The amount of money put in place was large but likely not sufficient to immediately convince ME managers/owners to start the bureaucratic procedure (transaction costs). However, the procedure was relatively simple, and the information provided on the official institutional webpage was clear and complete[2]. Simultaneously, 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.

The data cover a wide range of information, including enterprises' employees, investments,

[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.

operating costs, financial situations, strategic behaviour under financial constraints, expectations, economic growth, and ICT adoption. Unfortunately, given the rotating nature of the panel survey[3], the sample size is too small to propely exploit its longitudinal dimension. Therefore, we relied on the 2021 survey to obtain information for 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 3 to 10 years. 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 differences in spatial spillovers between central and peripheral areas. Financial data refers to the year previous 2019 since we wanted to exclude data affected by the COVID-19 aid. General descriptive statistics are presented in Table 1, while the same statistics by area are shown in Table 2 and Figure 3.

Table 1 about here.

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, 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 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

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

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

variable *national aid* identifies firms who resorted also for the national support.

Table 2 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 about here.

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 services5 (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 about here.

Notably, firms in the central territories are more active in the service sector, which has generally benefited more from smart working 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.

# 4 Empirical strategy

In this section, we outline the methodological strategy used to measure the take-up rate of micro-enterprises in this study. The strategy consists of first considering the following standard probit model as a benchmark model specification:

$$y^* = X\beta + \varepsilon \quad \varepsilon \sim \mathcal{N}(0, I)$$
$$y = \mathbf{I}(y^* > 0) \tag{1}$$

where $y^*$ is an $n$-dimensional vector of latent continuous dependent variables reflecting the unobserved utility functions in doing an action by micro-firms, see Manski and McFadden (1981) and McFadden (2001). $X = (x_1, x_2, x_3, x_4, x_5, x_6, x_7)$ is the $n$ by $k$ matrix of exogenous regressors, whose component respectively correspond to the logarithm of the average turnover between 2017 and 2019 ($x_1 = ln(turnover)$), to the state-imposed lockdown ($x_2 = lockdown$), to the condition if the micro-firm does have employees ($x_3 = employees$), to the type of firm ($x_4 = legalform$), to the specific sector ($x_5 = sector$), to the micro-firms' reactions in the case of financial constraints ($x_6 = financial$), and to the macro-area geographical locations of the MEs ($x_7 = geo$). 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, $y$ is an $n$-dimensional vector of binary dependent variables reflecting the micro-firms' choices in asking for local support measures, while $\varepsilon$ is an $n$-dimensional vector of i.i.d. normal error terms with finite unitary variances.

The structural model in equation (1) 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.

$$P(y_i = 1|X) = \Phi(x_i'\beta) \quad \forall i \tag{2}$$

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 distances of these micro-firms from the local authority in Trento. A further detailed investigation is thus required. For this purpose

we consider modelling these probabilities by making use of the Spatial Autoregressive Probit model, see eg. LeSage et al. (2011). The specification is as follows

$$\begin{aligned} y^* &= \rho W y^* + X\beta + \varepsilon \quad \varepsilon \sim \mathcal{N}(0, I) \\ y &= \mathbf{I}(y^* > 0) \end{aligned} \tag{3}$$

where $W$ is an $n$ by $n$ matrix of exogenous weights connecting the spatial latent variables $y^*$ and $\rho$ is the corresponding spatial autoregressive coefficient. The other variables are defined as in equation (1). 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 $(av)$[5], as follows

$$\begin{cases} w_{ij} = \frac{1}{|av_i - av_j|} \quad if \quad i \neq j \\ w_{ij} = 0 \qquad\qquad otherwise \end{cases} \tag{4}$$

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. 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 $(geo)$.

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

$$\begin{aligned} y^* &= A^{-1}X\beta + A^{-1}\varepsilon \quad \varepsilon \sim \mathcal{N}(0, I) \\ y &= \mathbf{I}(y^* > 0) \end{aligned} \tag{5}$$

where $A^{-1}X = X^*$ and $A^{-1}\varepsilon = \varepsilon^*$. Since spatial dependence introduces not only auto-correlation but also heteroskedasticity due to the covariance matrix $\Sigma_{\varepsilon^*} = A^{-1}A^{-1\prime}$, which needs to be taken into account, see e.g. Billé (2013), the probability that $y_i = 1$ in a spatial autoregressive probit model is finally

$$P(y_i = 1|X^*) = \Phi\left(\frac{x_i^{*\prime}\beta}{\sigma_i}\right) \quad \forall i. \tag{6}$$

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

After having considered parameter estimates, the interpretation of probit models requires proper definitions of the marginal effects. The marginal effects are calculated as follows (Billé and Leorato, 2020; Fleming, 2004; LeSage et al., 2011)

$$\frac{\partial P\left(y_i = 1|x'_{i.}\right)}{\partial x'_{.h}} \mid_x = \phi\left(\left\{\Sigma_{\varepsilon^*}\right\}_{ii}^{-1/2}\left\{A^{-1}X\right\}_{i.}\beta\right)\left\{\Sigma_{\varepsilon^*}^{-1/2}\right\}_{ii}\{A^{-1}\}_{i.}\beta_h \tag{7}$$

where $x_{.h} = (x_{1h}, x_{2h}, ..., x_{nh})'$ is the $n$–dimensional vector of units referred to the $h$–th regressor, $x_{i.} = (x_{i1}, x_{i2}, ..., x_{ih}, ..., x_{ik})'$ is the $k$–dimensional vector of regressors referred to unit i, $\{.\}_{i.}$ is the $i$–th row of the matrix inside, and $\{.\}_{ii}$ is the $i$–th diagonal element of a square matrix. The marginal effects are calculated for each level of the regressor $x_{.h}$ in order to provide important evidence of spatial heterogeneity (Lacombe and 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, while the indirect effects are the average of the off-diagonal elements.

# 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). 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 1 at the provincial level 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.

Table 3 about here.

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 1). 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.

The spatial autoregressive coefficient $\rho$ 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. 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 2, 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.

Figure 5 about 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 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.

Table 4 about here.

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 $-0.122$. That is, a unit variation in the turnover of the MEs decreases the probability of asking for provincial aid by approximately $-0.122$. 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 (7).

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 2 to 0. 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).

Figure 6 about here

Table 5 about here

# 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 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 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.

The spatial autoregressive coefficient $\rho$ 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. In addition to firm characteristics, considering spatial dependence in terms of enterprise performance is crucial in determining MEs' take-up rate. At the same time, it would be interesting to determine whether the same story is also valid for larger enterprises (namely SMEs) and whether the centre-periphery cleavage is maintained. However, this is beyond the scope of the present study and is left for future research.

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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.

# B Tables

Table 1: 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 |

Table 2: 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 |

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) |
| $\rho$ | | 0.33** | 0.19 | 0.37* | 0.80*** |
| | | (0.16) | (0.27) | (0.21) | (0.20) |
| Observations | 1,367 | 1,367 | 577 | 367 | 423 |

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

| ln(turnover 17-19) | dydx | std. err. | z | p>\|z\| | [95 conf. | interval] |
|---|---|---|---|---|---|---|
| | | | *General model* | | | |
| total | - 0.031 | 0.012 | - 2.522 | 0.012 | - 0.055 | - 0.007 |
| direct | - 0.020 | 0.004 | - 4.854 | 0.000 | - 0.028 | - 0.012 |
| indirect | - 0.011 | 0.009 | - 1.255 | 0.209 | - 0.029 | 0.006 |
| | | | *Central territories* | | | |
| total | - 0.011 | 0.011 | - 1.013 | 0.311 | - 0.033 | 0.010 |
| direct | - 0.009 | 0.007 | - 1.318 | 0.188 | - 0.023 | 0.004 |
| indirect | - 0.002 | 0.005 | - 0.437 | 0.662 | - 0.011 | 0.007 |
| | | | *Eastern territories* | | | |
| total | - 0.056 | 0.023 | - 2.481 | 0.013 | - 0.100 | - 0.012 |
| direct | - 0.036 | 0.006 | - 5.706 | 0.000 | - 0.048 | - 0.024 |
| indirect | - 0.020 | 0.019 | - 1.079 | 0.281 | - 0.057 | 0.017 |
| | | | *Western territories* | | | |
| total | - 0.122 | 0.142 | - 0.857 | 0.391 | - 0.401 | 0.157 |
| direct | - 0.026 | 0.008 | - 3.486 | 0.000 | - 0.041 | - 0.012 |
| indirect | - 0.096 | 0.136 | - 0.700 | 0.484 | - 0.363 | 0.172 |

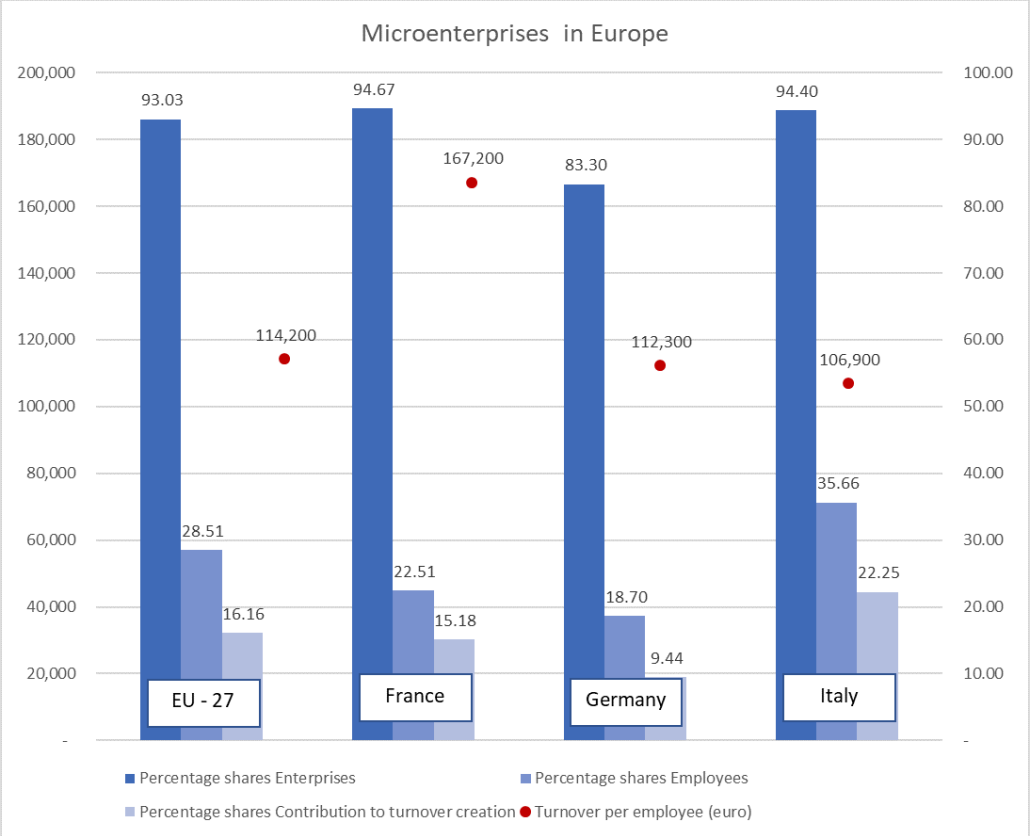
Note: Standard error for the marginal effects are estimated using the delta method.

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** |
|---|---|---|---|---|---|---|
| | *Eastern territories p(5)* | | | *Eastern territories p(95)* | | |
| turnover 17-19 | 198,428 | 255,087 | 18 | 51,193 | 46,985 | 18 |
| added value 17-19 | 62,889 | 63,473 | 18 | 31,377 | 30,973.49 | 18 |
| employees | 0.33 | 0.49 | 18 | 0.56 | 0.51 | 18 |
| age | 17.50 | 9.18 | 18 | 15.56 | 10.73 | 18 |
| Self-financing | 0.33 | 0.49 | 18 | 0.44 | 0.51 | 18 |
| Loans from family/friends | 0.06 | 0.24 | 18 | 0.28 | 0.46 | 18 |
| payment cond. customers | 0.17 | 0.38 | 18 | 0.11 | 0.32 | 18 |
| payment cond. suppliers | 0.28 | 0.46 | 18 | 0.22 | 0.43 | 18 |
| | *Western territories p(5)* | | | *Western territories p(95)* | | |
| turnover 17-19 | 210,437 | 329,089 | 21 | 107,417 | 104,133 | 21 |
| added value 17-19 | 82,420 | 91,088 | 21 | 53,369 | 58,031 | 21 |
| employees | 1.24 | 0.44 | 21 | 1.24 | 0.44 | 21 |
| age | 16.71 | 7.80 | 21 | 23.86 | 12.85 | 21 |
| Self-financing | 0.10 | 0.30 | 21 | 0.10 | 0.30 | 21 |
| Loans from family/friends | 0.05 | 0.22 | 21 | - | - | 21 |
| payment cond. customers | 0.05 | 0.22 | 21 | 0.19 | 0.40 | 21 |
| payment cond. suppliers | 0.05 | 0.22 | 21 | 0.24 | 0.44 | 21 |
| | *Central territories p(5)* | | | *Central territories p(95)* | | |
| turnover 17-19 | 190,000 | 260,000 | 28 | 84,635 | 66,989 | 28 |
| added value 17-19 | 89,121 | 160,000 | 28 | 27,011 | 20,117 | 28 |
| employees | 1.14 | 0.36 | 28 | 1.18 | 0.39 | 28 |
| age | 19.68 | 10.37 | 28 | 15.18 | 11.11 | 28 |
| Self-financing | 0.21 | 0.42 | 28 | 0.71 | 0.46 | 28 |
| Loans from family/friends | 0.14 | 0.36 | 28 | 0.43 | 0.50 | 28 |
| payment cond. customers | 0.07 | 0.26 | 28 | 0.29 | 0.46 | 28 |
| payment cond. suppliers | 0.04 | 0.19 | 28 | 0.75 | 0.44 | 28 |
| | *Provincial level p(5)* | | | *Provincial level p(95)* | | |
| turnover 17-19 | 180,000 | 240,000 | 68 | 91,985 | 100,000 | 68 |
| added value 17-19 | 80,374 | 99,209 | 68 | 33,542 | 36,153 | 68 |
| employees | 1.28 | 0.45 | 68 | 1.26 | 0.44 | 68 |
| age | 22.71 | 11.19 | 68 | 18.21 | 12.42 | 68 |
| Self-financing | 0.21 | 0.41 | 68 | 0.41 | 0.50 | 68 |
| Loans from family/friends | 0.12 | 0.32 | 68 | 0.53 | 0.50 | 68 |
| payment cond. customers | 0.10 | 0.31 | 68 | 0.34 | 0.48 | 68 |
| payment cond. suppliers | 0.12 | 0.32 | 68 | 0.71 | 0.46 | 68 |

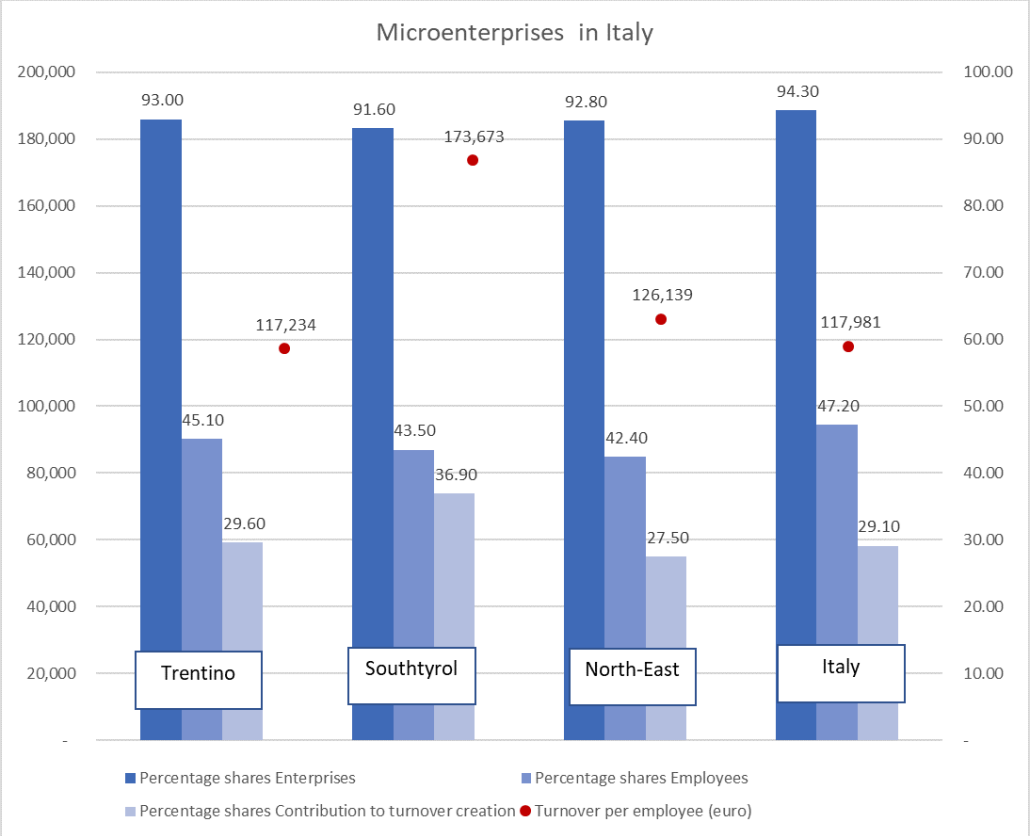
# C Figures

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)

Figure 2: Share of MEs, their employees, turnover contribution and turnover over employees by country




Source: Italian National Statistical Institute (2019), all sectors (agricultural sector not included).

Figure 3: Distribution of MEs by local community and area

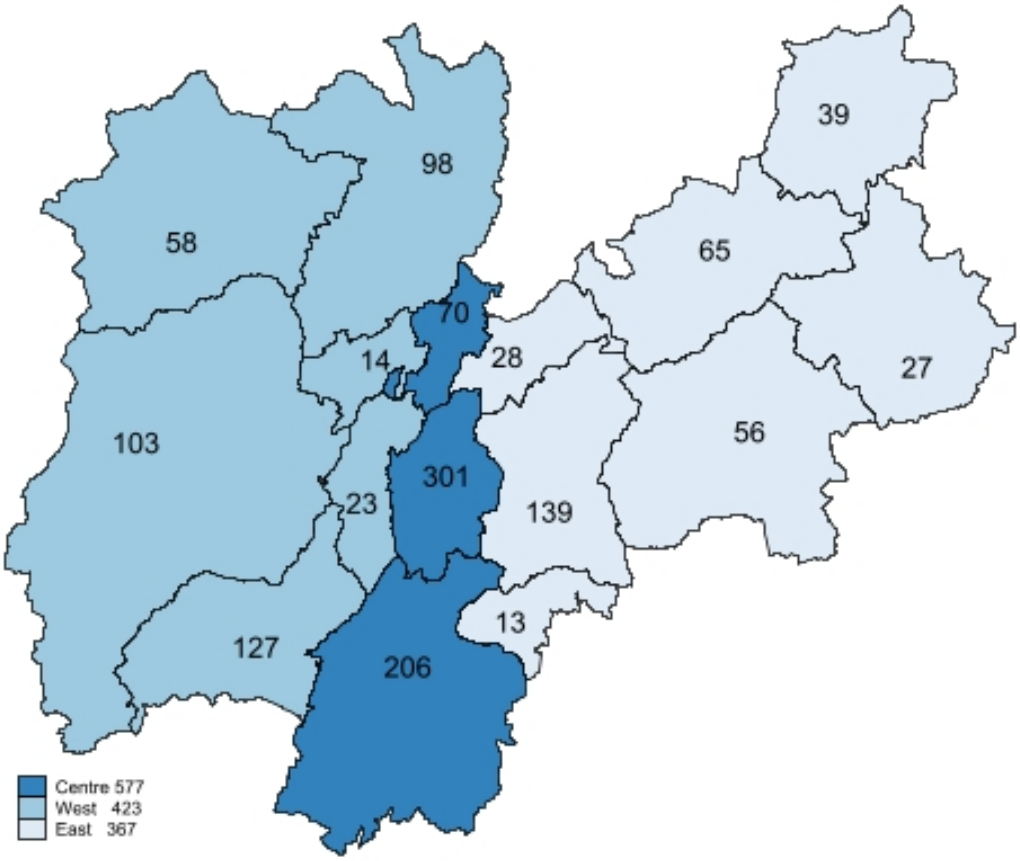


Figure 4: Share of MEs by sector and area

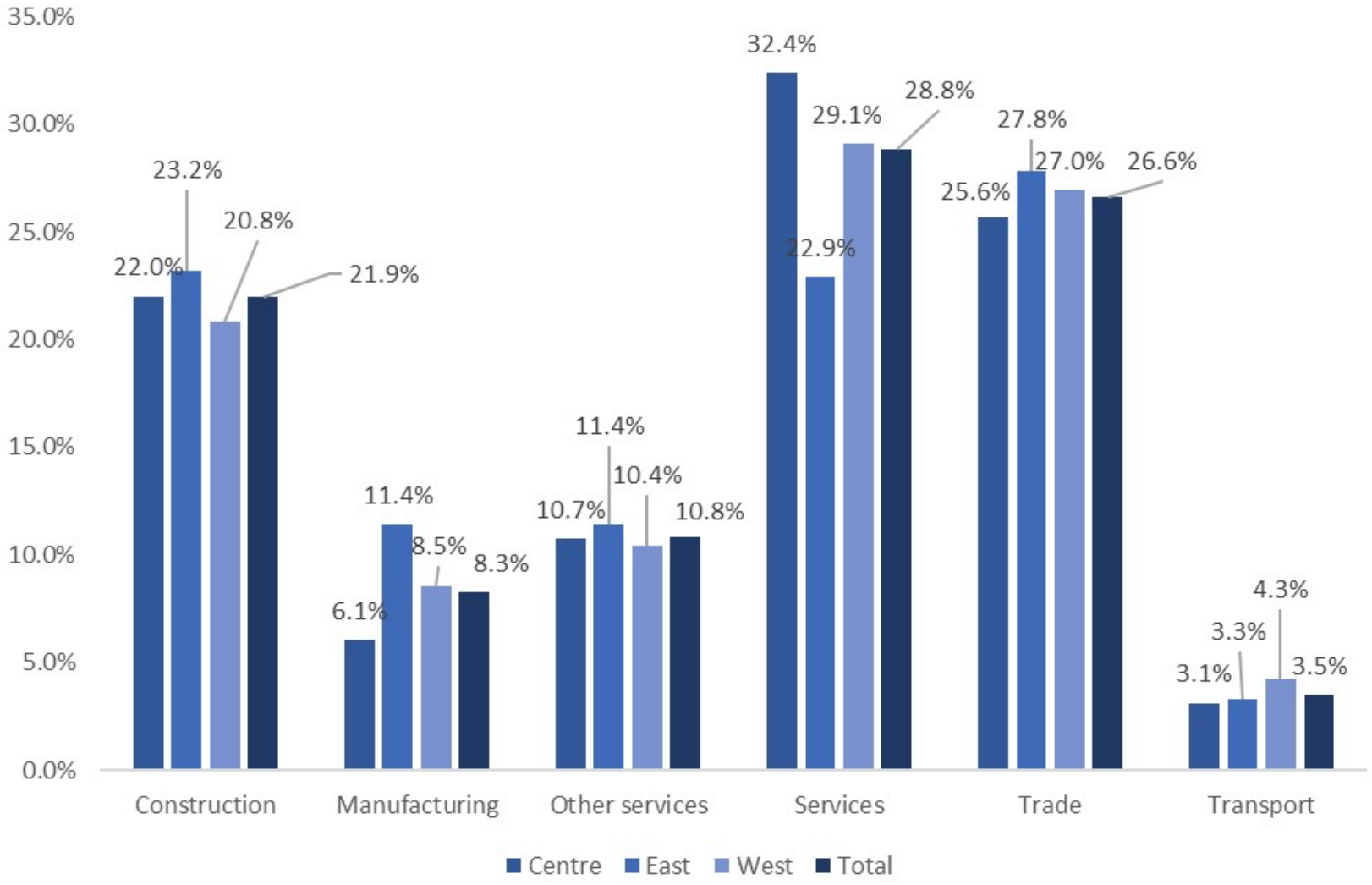
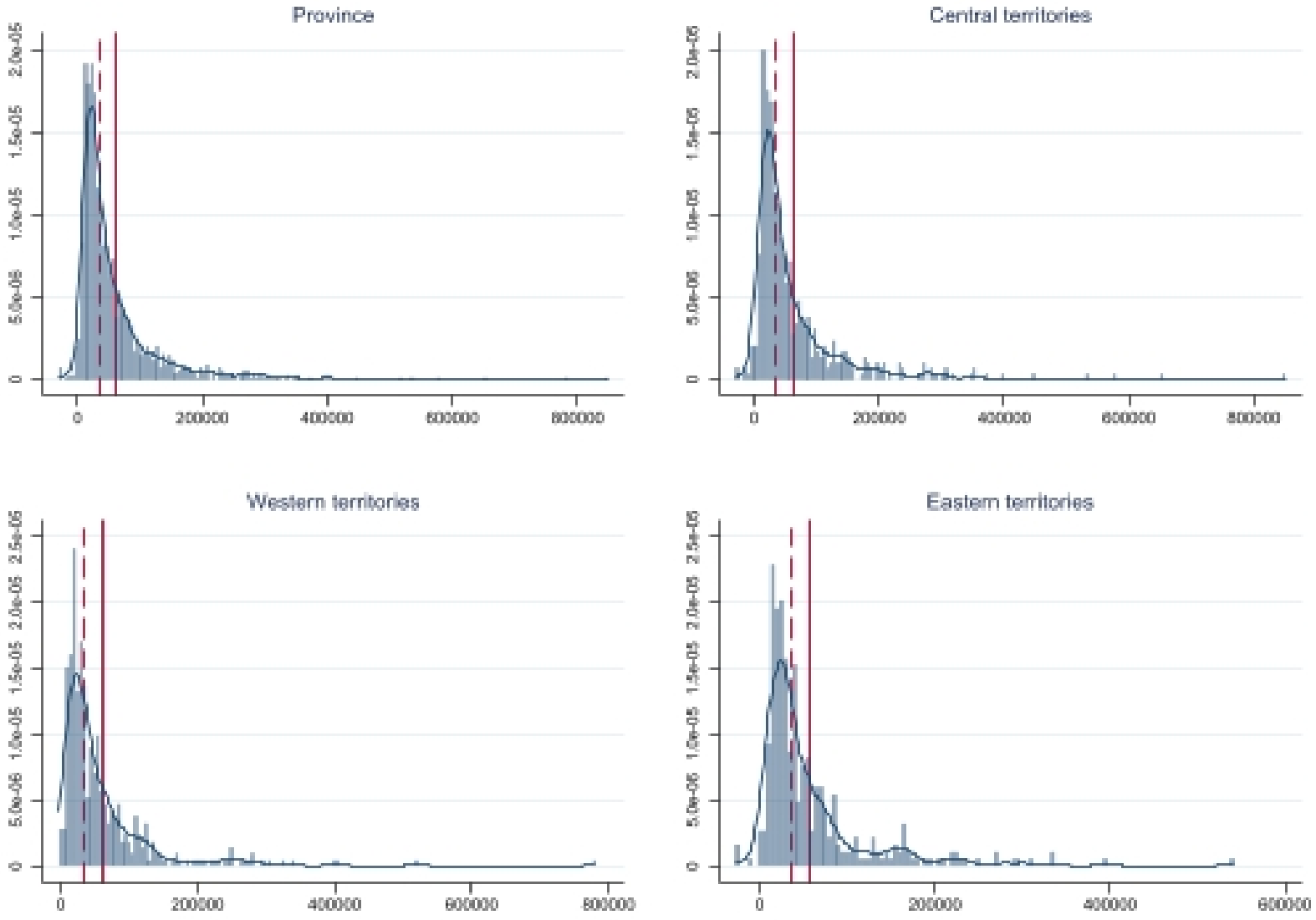


Figure 5: Value added distribution by area




Note: The dashed red line and the red line represent the median and the mean, respectively.

Figure 6: Local and average marginal effects