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Banking Development and the Economic Impact of Natural Disasters: From Short to Long Term Effects

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ABSTRACT

This paper investigates how financial development and local banking structures shape the economic resilience of communities in the aftermath of natural disasters. Focusing on Italian municipalities hit by earthquakes between 2008 and 2022, we explore the role of banking presence, particularly cooperative banks, in supporting recovery. Using a staggered difference-in-differences approach, we find that while employment levels are largely unaffected in the short term, the number of enterprises initially declines but rebounds significantly over the long run. The presence of local banks, and especially cooperative banks, is associated with stronger recovery patterns, highlighting their importance in enhancing community resilience.

JEL Classification: Q54, G21, G38.

1 | Introduction

Natural disasters, such as hurricanes, floods, and earthquakes, cause immediate and significant economic and social damage to affected communities. However, the medium and long-term effects on these economies remain less clear. On the one hand, consistent with Schumpeter's theory of creative destruction, natural disasters may offer an opportunity to upgrade infrastructure and capital goods with more productive technologies, potentially enhancing long-term economic performance (Skidmore and Toya 2002; Crespo Cuaresma et al. 2008; Porcelli and Trezzi 2019; Masiero and Santarossa 2020; Fu and Shi 2022). On the other hand, these disasters can drive economies toward a negative growth trajectory due to the disruption of networks and physical infrastructure, making daily operations more costly and less efficient (Boehm et al. 2019; Aguirre et al. 2023).

The varying economic effects of catastrophic events have been attributed to differing pre-existing levels of economic development (Loayza et al. 2012; Fomby et al. 2013), and the quality of economic and political institutions (Raddatz 2007; Barone and Mocetti 2014; Boudreaux et al. 2023). Noy (2009) finds that natural disasters negatively impact macroeconomic performance in the short term, with countries characterized by stronger institutions, higher literacy rate, and greater openness to trade exhibiting enhanced resilience to these shocks. Cavallo et al. (2013) show that large-scale natural disasters only lead to sustained negative impacts on economic growth when they trigger radical political revolutions that reshape the economic and institutional landscape. In contrast, similarly severe disasters that do not cause such disruptive political changes generally show no significant long-term economic impact (Xiao 2011). In addition to institutional and socioeconomic factors, the level of financial development may also play a crucial role in determining the economic impact of a disaster. Well-developed financial systems can provide the necessary capital for recovery, enabling businesses to rebuild and invest in new opportunities. Moreover, access to credit and financial services can help individuals and firms absorb the shock, maintain liquidity, and sustain daily operations. These channels are key to buffering against the disruption caused by natural disasters and promoting long-term economic resilience. Among financial institutions, cooperative banks (CB) may be particularly suited to support recovery in disaster-affected areas. Unlike commercial banks, which prioritize profitability and may have broader regional or national operations, cooperative banks tend to reinvest in their immediate communities (Minetti et al. 2021; Peruzzi et al. 2023). Their commitment to local development and focus on smaller, community-based clients may enable them to quickly respond to the specific local needs and accelerate the recovery process, a phenomenon often referred to as "recovery lending" (Koetter et al. 2020).

This paper aims to fill this gap in the literature by assessing the economic effects of natural disasters, specifically earthquakes, on local economies in the short, medium, and long term, while examining how local banking development influences both the extent and nature of these effects. By exploring the interaction between financial infrastructure and disaster recovery across different time horizons, the study seeks to offer new insights into the role of banking systems in shaping post-disaster economic trajectories. More specifically, we investigate how the presence and types of banking institutions, both commercial and cooperative banks, affect economic resilience in municipalities impacted by disasters. The analysis centers on two key indicators: the number of workers and enterprises. These variables capture local economic dynamics and help us assess the broader impact of earthquakes on the labor market and business operations, providing evidence of the potential for well-developed financial systems to promote resilience and long-term growth in communities affected by earthquakes.

Our analysis covers the years 2008–2022 and relies on Italian municipal-level data collected from multiple sources, including earthquake intensity data from the Italian National Institute of Geophysics and Volcanology (INGV), economic indicators from the Italian National Statistics Office (ISTAT), and banking data from Federcasse, the Italian Federation of cooperative banks. Studying Italy offers unique insights into the economic impacts of natural disasters and the role of the banking system in the recovery phase, given the country's high seismic activity, strong regional economic diversity, and substantial presence of both commercial and cooperative banks. This context allows for a deeper understanding of the dynamics of disaster resilience and the role of recovery lending. We employ a staggered difference-in-differences approach to estimate the effect of seismic events on economic indicators and complement these results with robustness checks using matched samples of municipalities to address potential biases.

The results reveal that earthquakes affect employment and business activity in distinct ways. While the number of workers remains relatively stable in the short term, the number of enterprises experiences a significant decline immediately after the event. However, this negative effect is not uniform across all areas: in municipalities with a local banking presence, particularly those served by cooperative banks, we observe a more robust recovery in business activity. Over the medium and long term, these municipalities exhibit net enterprise growth, suggesting that financial development plays a key role in fostering economic resilience.

The analysis then turns to the channels through which this resilience operates, focusing on post-disaster banking activity and the structure of local economies. Evidence shows a divergent response across financial institutions: while the overall banking sector experiences a long-term contraction in both loans and deposits, potentially reflecting persistent economic challenges or more conservative lending in the face of increased credit risk, cooperative banks respond with a sustained increase in both lending and deposit mobilization. The economic impact of earthquakes also varies considerably depending on the composition of local economies. The sectoral analysis uncovers heterogeneous effects, with sectors like construction benefiting from reconstruction-driven demand, while others, such as accommodation and food service, suffer lasting disruptions. These findings emphasize the sector-specific pathways through which banking support can foster recovery, especially in more vulnerable industries. Importantly, these effects are shaped not only by sectoral structure but also by the distribution of firm size within municipalities. The presence of banks, and particularly that of cooperative banks, is most effective in supporting recovery in areas dominated by small firms, which are typically more reliant on local financial institutions in the aftermath of a disaster.

In providing this evidence, we contribute to two main strands of the current literature. First, we add to the studies investigating the economic impact of natural disasters, where findings on post-disaster growth are often mixed. For instance, Felbermayr and Gröschl (2014) show that while disasters typically results in substantial short-term losses, growth rates generally return to pre-disaster levels over time. In the Italian context, Porcelli and Trezzi (2019) report only modest reductions in output and employment following earthquakes, with reconstruction efforts sometimes even offsetting the initial economic damage. Focusing on the tourism industry, Antonaglia et al. (2025) find a persistent decline in overnight hotel stays after the 2009 earthquake in L'Aquila, particularly in the formal accommodation sector. By contrast, Aguirre et al. (2023) document a sustained 10% decline in economic activity in Chilean municipalities eight to 9 years after the 2010 earthquake, underscoring the long-term recovery challenges faced by some regions. Rather than measuring economic output directly, recent work by Fu and Shi (2022) shifts attention to urban land use and spatial development. Studying Christchurch, New Zealand, they show how earthquake-induced losses in structural capital led to the anticipation of accelerated rectification of spatial development distortions. Our paper provides several novel contributions to these studies. First, we investigate how local banking development influences both the extent and nature of earthquakes' economic effects by examining how the presence and types of banking institutions impact economic resilience in municipalities affected by disasters. Second, from a methodological point of view, we apply the Callaway and Sant'Anna (CS) estimator, enhancing causal inference in staggered treatment settings and yielding a more precise understanding of disaster impacts across varying contexts and time horizons. Third, using municipal-level data rather than more aggregated information provides a more granular perspective on the impact of disasters, capturing local variations in economic responses. Fourth, unlike much of the existing literature that focuses on specific seismic events (Boehm et al. 2019; Aguirre et al. 2023), this study includes all Italian earthquakes between 2008 and 2022, offering a longitudinal view within a single national context and reducing potential omitted variables bias.

Finally, by focusing on a Western European country, this study broadens the geographic scope of disaster economics, which frequently emphasizes developing nations (Raddatz 2007; Noy 2009; Brei et al. 2019).

Second, we contribute to the literature on natural disasters' impact on financial institutions. Brei et al. (2019) find that banks experience a negative funding shock in the form of deposit withdrawals following hurricanes in the Eastern Caribbean and subsequent reductions in lending. In contrast, Cortés and Strahan (2017) document an increase in mortgage originations after disasters as banks channel credit to support rebuilding, a result confirmed by Ivanov et al. (2022) in the context of syndicated loans. Bos et al. (2022) similarly find an increase in real estate loans post-disasters. We add to this literature by examining the impact of earthquakes on banking activity, specifically loans and deposits for both cooperative and non-cooperative banks. Our findings underscore the crucial role of cooperative banks in supporting recovery through sustained lending, while revealing a relative contraction in lending activity across the broader banking sector. This focus on cooperative banks adds to the financial institutions literature, highlighting how these banks contribute to local economic stability and resilience through targeted recovery lending in the wake of natural shocks.

The remainder of the paper is organized as follows. Section 2 provides an overview of Italy's seismic landscape, outlining the impact of these events on local economies, and discusses the structure of the Italian banking system. Section 3 describes the data sources and empirical strategy used for our analysis, detailing our methodological approach. In Section 4, we present the main findings on the role of banking development in post-disaster recovery and explore the underlying channels of resilience. Section 5 concludes.

2 | Institutional Background

In this section, we provide an overview of the institutional and structural factors that are central to our analysis. First, we describe the Italian seismic landscape, emphasizing the geographical and historical characteristics that make Italy particularly exposed to earthquake risks (2.1). Second, we discuss the structure of the Italian banking system, highlighting its strong local dimension and the key role of different types of banks in facilitating financial inclusion and supporting local economies (2.2).

2.1 | The Italian Seismic Landscape

Italy is one of the most seismically active regions in Europe due to its unique position at the convergence of the African and Eurasian tectonic plates. The movement of these plates generates significant geological activity, particularly along the Apennines and in southern regions such as Sicily and Calabria. This tectonic complexity makes Italy vulnerable to frequent and sometimes severe earthquakes, which have shaped not only the physical landscape but also the economic and social history of the country. Throughout history, Italy has experienced numerous significant seismic events with far-reaching consequences. One of the earliest recorded devastating earthquakes occurred in 1693 in Sicily, causing widespread destruction and leading to tens of thousands of deaths. The earthquake not only demolished entire cities but also altered the region's economic and demographic profile, as many areas struggled to recover for decades.

In more recent history, the 1908 Messina earthquake and subsequent tsunami devastated the cities of Messina and Reggio Calabria, claiming over 80,000 lives and crippling infrastructure. This disaster had long-lasting economic repercussions, as it disrupted trade routes and the local economy, and necessitated extensive rebuilding efforts. In 1976, the Friuli earthquake struck northeastern Italy, killing around 1,000 people and leaving tens of thousands homeless. The region, known for its industrial and agricultural productivity, faced significant economic losses, but the reconstruction efforts are often cited as a model for post-disaster recovery due to efficient coordination between local authorities and the national government (Barone and Mocetti 2014). Another significant event was the 1980 Irpinia earthquake, which hit the southern region of Campania, causing widespread devastation. The earthquake led to the deaths of nearly 3,000 people and displaced hundreds of thousands (Barone and Mocetti 2014). The economic impact was enormous, as many rural towns were completely destroyed, and the recovery was slow and inefficient due to delays in government intervention and mismanagement of resources. The 1997 earthquake in Umbria and Marche, also known as the "Umbria-Marche earthquake", was a significant seismic event that severely impacted the regions. The earthquake caused extensive damage, particularly to historical buildings. Despite the loss of life being lower than in other major earthquakes, the economic damage was substantial, affecting both the cultural heritage and the local economy, which depended on tourism and small-scale industry.

More recently, central Italy has been repeatedly hit by earthquakes, including the 2009 L'Aquila earthquake, which caused the loss of more than 300 lives and extensive damage to the historic city. The economic costs were estimated in the billions, and the recovery process has been slow (Contreras et al. 2017; Cerqua et al. 2023). In 2012, a series of powerful earthquakes struck the Emilia Romagna region, known for its industrial base and agricultural output. The earthquakes, concentrated around the provinces of Modena and Ferrara, killed 27 people and caused widespread damage to infrastructure, including factories and warehouses, leading to significant economic disruption (Cerqua et al. 2023). The economic impact was severe, with many businesses in the manufacturing and agricultural sectors forced to halt production, causing losses in one of Italy's most productive regions. The latest significant seismic event was the 2016-2017 earthquake sequence in central Italy, which severely affected the regions of Lazio, Umbria, Marche, and Abruzzo. The first major earthquake occurred in August 2016, causing widespread devastation. Two subsequent quakes followed in October 2016, causing even more damage, particularly to historical and cultural heritage sites. A final major earthquake occurred in January 2017, with thousands of homes destroyed and tens of thousands of people displaced. The cumulative impact of this earthquake sequence was catastrophic, with 299 deaths, extensive destruction of infrastructure, and severe economic repercussions, especially in rural and mountainous areas dependent on tourism and agriculture. The rebuilding process is ongoing, with many areas still struggling to recover years later.

Given Italy's vulnerability to seismic events and the significant economic disruptions they cause, it is crucial to study the medium and long-term effects of earthquakes on employment and business activity. While seismic risk constitutes a major external shock to local economies, the capacity to absorb and recover from such shocks is deeply correlated with pre-existing institutional and financial conditions. In the next section, we focus on the Italian banking system, a key component of the economic infrastructure, and discuss how local financial development can shape post-disaster recovery dynamics.

2.2 | The Italian Banking System

The Italian financial system is traditionally characterized by a strong-based structure, where banks play a central role in providing credit to households and firms. Compared to other advanced economies, the Italian stock market has historically exhibited low capitalization rates, making the banking sector the primary channel for external financing (Guiso et al. 2004; Alessandrini et al. 2009; Coccorese and Shaffer 2021). In particular, Italy's dense network of bank branches has ensured widespread access to credit, especially across small municipalities and rural areas (D'Onofrio et al. 2019). Cooperative banks, in particular, have traditionally held a prominent position in the Italian financial system. Rooted in principles of mutualism and localism, cooperative banks are characterized by democratic governance ("one member-one vote" rule) and a mission to reinvest profits within the communities they serve (Becchetti et al. 2016). They often act as key financial intermediaries for small and medium-sized enterprises, farmers, and households, especially in less urbanized areas. Empirical evidence suggests that cooperative banks are better equipped than commercial banks to support financially constrained borrowers through relationship lending techniques and a deeper knowledge of local economic conditions (Berger and Udell 2006; Ferri et al. 2014). From a geographical point of view, the presence of CB branches largely reflects long-run historical and institutional developments (Minetti et al. 2021). Many cooperative banks originated as small, community-based cooperatives serving specific local areas, often in rural or peripheral municipalities where commercial banks had little or no presence. Branch networks typically expanded gradually from an initial home municipality towards neighboring town within a historically defined catchment area, rather than through greenfield entry into the most dynamic or fastest-growing local markets.[1]

The territorial diffusion of banking services, particularly through cooperative institutions, has important implications for local economic resilience in the face of external shocks such as natural disasters. Access to bank credit can significantly affect the capacity of firms and households to absorb and recover from income losses caused by events like earthquakes (Peruzzi et al. 2023). Moreover, the availability of credit facilitates investment in reconstruction activities, helps to smooth consumption patterns, and mitigates the risk of long-term economic divergence between affected and unaffected areas.

Given this background, Italy offers a particularly suitable empirical setting to study the role of banking development in mediating the economic impact of natural disasters. The combination of significant exposure to seismic risk and a locally rooted banking system allows us to investigate how financial conditions influence the short- and long-term recovery dynamics across municipalities.

3 | Data and Empirical Strategy

3.1 | Data and Measurement

To conduct our empirical analysis, we rely on data from three main sources: (i) the National Institute of Geophysics and Volcanology (INGV); (ii) the Italian National Statistics Office (ISTAT); (iii) the private statistical database of Federcasse, the Italian federation of cooperative banks. In addition, for one of our robustness checks, we use firm-level sales data from the Orbis database to construct a municipality-level measure of average turnover.[2]

The data on seismic events comes from INGV, which provides detailed information on earthquake occurrences and their intensities at the municipal level. Earthquake intensity is measured using the Mercalli scale, which ranges from 1 to 12 and assesses the observed effects of an earthquake. This differs from the Moment Magnitude scale (Mw), which measures the total energy released by an earthquake. While the Mw scale quantifies the seismic energy regardless of location, the Mercalli scale evaluates the impact based on observable effects on people, buildings, and objects in specific areas (see Appendix Table A2 for more details on the effects of an earthquake based on its intensity). In other words, while every earthquake has only one magnitude, recorded at the epicenter, the damages - and therefore the Mercalli intensity - vary greatly from place to place. Generally, the negative effects of earthquakes differ across municipalities based on the distance from the epicenter, the degree of urbanization, and the structural properties of the buildings (Porcelli and Trezzi 2019). Using the Mercalli scale allows for a more accurate assessment of the economic impact of earthquakes at the local level, as it captures the variation in damages across different municipalities. This is particularly important when studying economic outcomes, since the severity of damage influences the extent of economic disruption. Figure 1 illustrates the distribution of earthquakes across Italian municipalities over the period of our analysis, from 2008 to 2022. The events are categorized according to the Mercalli intensity scale, with higher intensities concentrated in central and southern Italy, particularly in regions such as Abruzzo, Lazio, Umbria, and Marche, known for their seismic activity. Consistent with the existing literature, which typically focuses on earthquakes of a certain magnitude (see, e.g., Porcelli and Trezzi 2019; Basile et al. 2024), we define a municipality as treated if it experienced an earthquake with a Mercalli intensity of 4 or higher.[3] Based on this criterion, 535 municipalities were classified as treated, having experienced at least one earthquake of this intensity between 2008 and 2022.[4]

Previous literature has demonstrated that the number of workers and enterprises are key indicators for assessing the economic resilience and recovery of areas affected by earthquakes (Porcelli and Trezzi 2019; Boudreaux et al. 2023; Basile et al. 2024). Therefore, using data provided by ISTAT, we focus on these two variables as our main dependent variables. The number of workers reflects local labor market conditions and the broader economic resilience of the community, while the number of enterprises captures the vitality and dynamism of

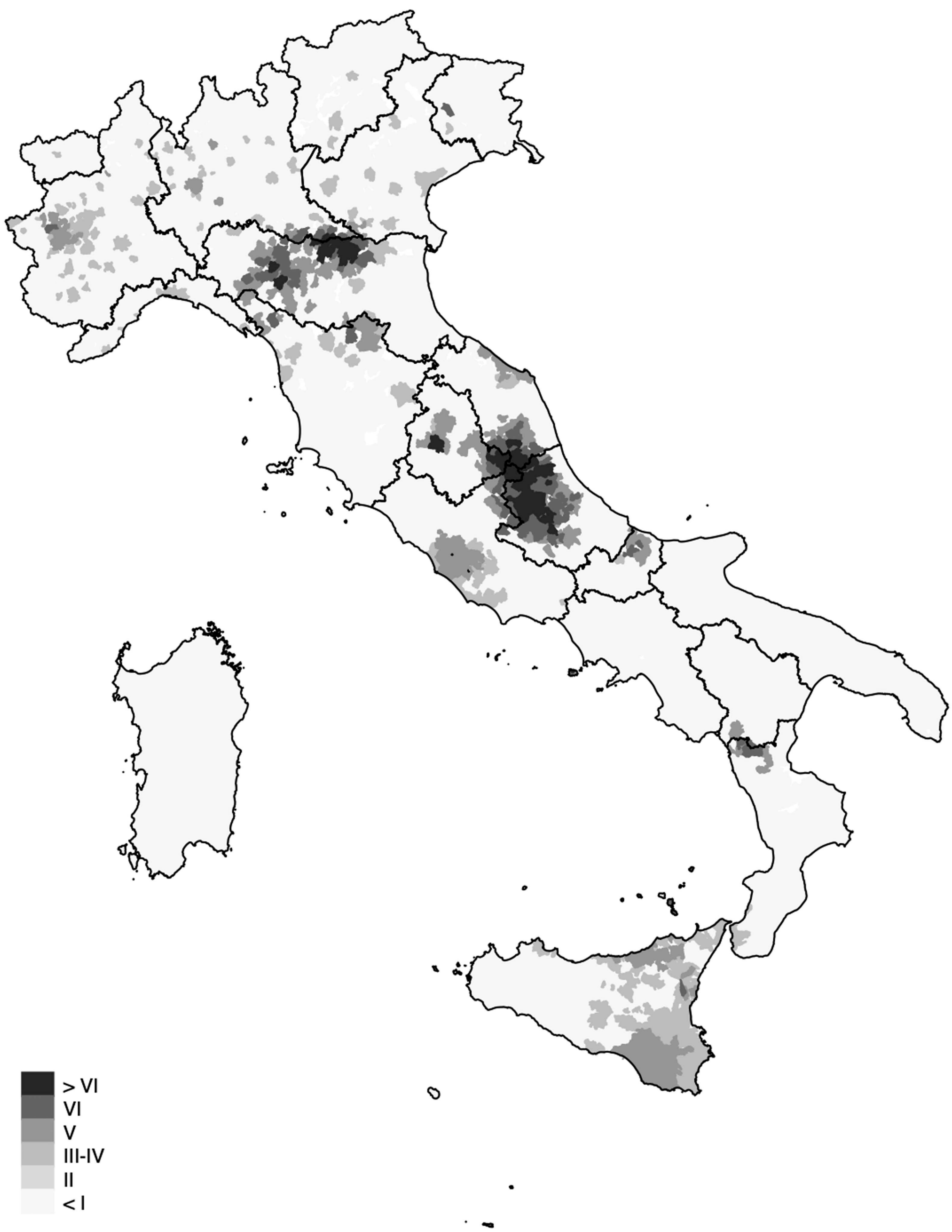

FIGURE 1 | Major earthquakes in Italian municipalities (2008-2022). *Note:* The map displays seismic events across Italian municipalities from 2008 to 2022, categorized according to the Mercalli intensity scale, as shown in the legend. In municipalities where multiple events occurred, the highest Mercalli intensity recorded has been selected.

local business activity. Earthquakes can disrupt employment by damaging businesses and infrastructure, leading to job losses and interruptions in economic activity. Similarly, they can severely impact enterprises, particularly small and medium-sized firms, which may face challenges in recovering.

To measure local banking development, we use various indicators provided by Federcasse, drawing on prior literature in this field (Minetti et al. 2021; Peruzzi et al. 2023; Murro and Peruzzi 2025, 2019). The data cover the period from 2008 to 2022 and include: *Bank branches*, a dummy variable equal to one if the municipality has at least one bank branch, and *CB branches*, a dummy variable equal to one if the municipality has at least one cooperative bank branch. In addition, to further explore the effects of earthquakes on banking activities, we use data from Federcasse on the total volume of loans and deposits at the municipal level, distinguishing between the entire banking sector and cooperative banks separately.

Summary statistics in Table 1 show that approximately 68.8% of municipalities have at least one bank branch, while 33.1% have at least one cooperative bank branch. Table A3 reports summary statistics and univariate tests comparing municipalities with and without bank or cooperative bank branches, for the full sample (Panel A), treated municipalities (Panel B), and untreated municipalities (Panel C), and highlights substantial

TABLE 1 | Summary statistics.

	Full sample			Treated		Untreated		
	Obs.	**Mean**	**Std. dev.**	**Mean**	**Obs.**	**Mean**	**Obs.**	***t*-test**
Workers	118,431	2167.003	16,700.655	9449.167	8025	1637.689	110,406	−11.547
Enterprises	118,431	610.030	4327.206	2509.497	8025	471.965	11,0406	−11.735
Sales (million euros)	73,208	5.558	96.222	6.200	5656	5.504	67552	−0.941
Bank branch (0/1)	126,336	0.688	0.463	0.794	8560	0.680	117,776	−24.950
CB branch (0/1)	126,336	0.331	0.471	0.352	8560	0.330	117,776	−4.051
Bank loans	126,336	196,987.186	4,635,113.142	1,583,467.868	8560	96,217.295	117,776	−7.789
Bank deposits	126,336	149,701.472	2,768,348.409	1,016,033.937	8560	86,736.132	117,776	−8.205
CB loans	126,336	17,214.385	106,451.734	44,095.143	8560	15,260.683	117,776	−7.556
CB deposits	126,336	16,062.727	82,830.270	36,752.024	8560	14559.021	117,776	−7.920
# Bank branches	126,327	0.445	0.490	0.469	8560	0.443	117,767	−5.788
Population	126,327	7596.150	42,099.966	26,096.078	8560	6251.467	117,767	−12.680
% Population 0–24 years	126,327	0.219	0.039	0.213	8560	0.219	117,767	13.923
% Population 25–44 years	126,327	0.245	0.037	0.244	8560	0.245	117,767	3.010
% Population 45–64 years	126327	0.294	0.027	0.291	8560	0.294	117,767	12.080
% Population +65 years	126327	0.243	0.057	0.252	8560	0.242	117,767	−15.830
Municipal area	122576	38.046	50.606	64.139	8368	36.135	114,208	−29.419

Note: The table reports summary statistics and univariate tests for the variables employed in the analysis, for treated and untreated municipalities. *Treated* refers to municipalities affected by earthquakes, while *Untreated* refers to those that were not affected. All of the variables are defined in Table A1.

differences in key economic characteristics. In particular, municipalities with banking presence exhibit significantly higher levels of employment and enterprise density compared to those without bank branches.[5] Figure A1 illustrates the distribution of all bank branches and cooperative bank branches across Italian municipalities in 2015, the midpoint of our sample period. The figure highlights significant heterogeneity in the geographic presence of banking institutions. While bank branches are distributed relatively evenly across the entire country, cooperative bank branches are more concentrated in the northeastern and central regions of Italy.

Finally, in some robustness checks, we use complementary information at the municipal level, such as population size, age distribution (0–24; 25–44; 45–64; +65 years), municipal area (in square kilometers), and the share of enterprises by industry sector (based on the 1-digit NACE classification). All of this information is provided by ISTAT.

3.2 | Empirical Model

To evaluate the effects of earthquakes on the number of workers and enterprises at the municipal level in the short, medium, and long term, we employ a difference-in-differences (DiD) design. Our baseline specification is a staggered difference-in-differences two-way fixed effects (TWFE), which can be written as follows (Imbens and Wooldridge 2009):

$$Y_{it} = \alpha_i + \alpha_t + \beta^h D_{it}^h + \epsilon_{it} \tag{1}$$

with

$$D_{it}^h = \mathbb{1}\{0 \le t - T_i \le h\}, \text{ where } \quad h \in \{3, 5, 10\} \tag{2}$$

where Y_{it} represents the logarithm of the number of workers or enterprises in municipality i in year t; α_i and α_t are municipality and year fixed effects, respectively; D_{it}^h is a dummy variable equal to one for each year in which municipality i is observed within h years after its first exposure to the earthquake (T_i), and zero otherwise (i.e., if the municipality has not yet experienced the earthquake in year t or never experiences it);[6] and ϵ_{it} is the error term. For each horizon h, we restrict the estimation sample to a symmetric time window around the event, such that municipality-year observations are included if $t \in [T_i - h, T_i + h]$.

Our DiD coefficient β^h captures the average effect of earthquake exposure on the outcome variable within h years after the event. It reflects the mean difference in the (log) number of workers or enterprises between treated and not-yet-treated (or never-treated) municipalities.

Since we have high variation in the timing of earthquakes across municipalities, the TWFE can generate biased estimates of the average treatment effect (Athey and Imbens 2022). For this reason, we also estimate our model using the Callaway and Sant'Anna (2021) (CS) method.[7] The CS estimator identifies group-time average treatment effects (ATTs) by comparing treated units to not-yet-treated or never-treated units at each point in time. Formally, for a treatment cohort g and time t, the group-time average treatment effect is defined as:

$$ATT(g, t) = \mathbb{E}[Y_t(g) - Y_t(0) | G_g = 1] \tag{3}$$

where G_g is a dummy variable equal to one if a municipality is first treated in period g; $Y_t(g)$ denotes the potential outcome at time t for municipalities first treated in period g; and $Y_t(0)$ is the potential outcome at time t had those municipalities never been treated. In practice, $Y_t(0)$ is estimated using the observed outcomes of municipalities that have not yet experienced an earthquake (or never experience one) at time t. Under the (unconditional) parallel trends assumption, the average outcome of these not-yet-treated (or never-treated) municipalities provides an estimate of $\mathbb{E}[Y_t(0)|G_g = 1]$.

To obtain an overall estimate of the average treatment effect, the group-time ATT estimates may then be aggregated across cohorts and time periods. Following Callaway and Sant'Anna (2021), the overall ATT can be computed as a weighted average of the group-time effects:

$$ATT = \sum_{g,t} \omega_{g,t} \cdot ATT(g,t) \tag{4}$$

where $\omega_{g,t}$ are weights based on the proportion of treated units in each group-time combination. In our application, we compute this average over a restricted set of time periods relative to treatment. Specifically, we aggregate ATT estimates only over a selected event window defined by $\mathcal{C}_h = \{(g,t) : c_1^h < t - g < c_2^h\}$, where h denotes the length of the horizon considered (3, 5, or 10 years).

To explore whether the presence and type of local banking institutions influences post-disaster economic outcomes, we estimate Equation (1) not only on the full sample of municipalities but also on two distinct subsamples. The first subsample includes only municipalities with at least one bank branch, whether cooperative or commercial, thus excluding all municipalities without any banking presence. The second subsample focuses exclusively on municipalities with at least one cooperative bank branch, thereby excluding both municipalities without bank branches and those served only by commercial banks. This setup allows us to test whether the estimated effects differ in areas with broader access to financial services, and in particular, where locally embedded cooperative banks are active.[8]

4 | Results

This section presents the main findings of the paper. First, we discuss the core results on the impact of earthquakes on the number of workers and enterprises, and the role played by banking development (4.1), followed by a set of robustness checks (4.1.1). We then turn to the channels of resilience that may help explain these dynamics (4.2). In particular, we examine how seismic shocks affect local banking activity in terms of loans and deposits (4.2.1), and we explore sector-specific effects to better understand how different industrial structures respond to disaster shock and financial support (4.2.2).

4.1 | Main Results

The main results on the effect of earthquakes on the economic indicators employed in our analysis, i.e., the number of workers and the number of enterprises, are presented in Table 2. The table reports the average treatment effects estimated using both the Difference-in-Differences (DiD) and Callaway and Sant'Anna (CS) methods, over a 3, 5, and 10-year window

TABLE 2 | Baseline results.

Dependent variable	Full sample				Municipalities with bank branches				Municipalities with CB branches			
	Workers (ln)		Enterprises (ln)		Workers (ln)		Enterprises (ln)		Workers (ln)		Enterprises (ln)	
model	(1) DiD	(2) CS	(3) DiD	(4) CS	(5) DiD	(6) CS	(7) DiD	(8) CS	(9) DiD	(10) CS	(11) DiD	(12) CS
Panel A: 3-year window												
ATT	−0.0076	−0.0056	−0.0095***	−0.0053	0.0027	0.0029	0.0019	0.0065**	−0.0001	0.0022	0.0048	0.0077**
	(0.0059)	(0.0045)	(0.0036)	(0.0036)	(0.0046)	(0.0028)	(0.0026)	(0.0028)	(0.0071)	(0.0043)	(0.0038)	(0.0037)
Panel B: 5-year window												
ATT	−0.0017	0.0008	−0.0026	0.0036	0.0057	0.0063*	0.0053**	0.0121***	0.0042	0.0044	0.0084**	0.0119***
	(0.0051)	(0.0047)	(0.0032)	(0.0035)	(0.0040)	(0.0033)	(0.0023)	(0.0031)	(0.0062)	(0.0053)	(0.0033)	(0.0031)
Panel C: 10-year window												
ATT	−0.0032	−0.0009	−0.0007	0.0098**	0.0044	0.0033	0.0055***	0.0159***	0.0038	−0.0017	0.0077**	0.0118**
	(0.0046)	(0.0061)	(0.0029)	(0.0043)	(0.0036)	(0.0044)	(0.0021)	(0.0039)	(0.0056)	(0.0069)	(0.0031)	(0.0047)

Notes: The table reports the average treatment effect (ATT) of earthquakes within a 3-year (Panel A), 5-year (Panel B), and 10-year (Panel C) window. In columns (1)-(4), we focus on the full sample. In columns (5)-(8), we focus on the subsample of municipalities with at least one bank branch. In columns (9)-(12), we focus on the subsample of municipalities with at least one cooperative bank (CB) branch. DiD refers to the average effect of the shock estimated through difference-in-differences. CS refers to estimates from the Callaway and Sant'Anna (2021) method. Standard errors are in parentheses. Three, two and one stars (***,**,*) denote significance at the 99%, 95% and 90% levels, respectively.

(Panels A, B, and C). The analysis is performed on the full sample of municipalities (columns 1–4), as well as on the two subsamples defined in the previous section. Specifically, columns (5)-(8) restrict the sample to municipalities with at least one bank branch, whether cooperative or commercial, excluding all municipalities without any banking presence. Columns (9)-(12) further narrow the focus to municipalities with at least one cooperative bank (CB) branch, thereby excluding both municipalities without bank branches and those served only by commercial banks.

Starting with the full sample (columns 1-4), the effect of earthquakes on the *Workers* variable is not statistically significant in any time window, suggesting that employment levels are only weakly affected by earthquake shocks. However, for the *Enterprises* variable, there is a significant negative impact in the short term (3-year window), with a reduction of nearly 1% (column 3). In the long-term (10-year window), the effect becomes positive and significant, with an average treatment effect of 0.0098 (significant at the 95% level), suggesting a potential recovery and growth in business activity over time. In municipalities with at least one bank branch (columns 5-8), the results show a significant positive effect on enterprises in the 3-year window, with an average treatment effect of 0.0065 (significant at the 95% level). This suggests that in areas with a banking presence, business activity may recover more quickly or even grow in the short term after an earthquake. For workers, the effect is positive but not statistically significant in the short term. However, in the 5-year window, the impact becomes significant for both workers and enterprises, with an increase of 0.63% and 1.21%, respectively. In the long term (10-year window), the positive effect on enterprises persists, with the coefficient rising to 0.0159 (statistically significant at the 99% level). In municipalities with at least one cooperative bank branch (columns 9-12), the impact on workers is not significant in any time window. However, for enterprises, there is a positive and significant effect in the short term (3-year window), with an average treatment effect of 0.0070 (significant at the 95% level). This positive effect persists in both the 5-year window (0.0119, significant at the 99% level) and the 10-year window (0.0118, significant at the 95% level), indicating that in municipalities with cooperative bank branches, earthquakes lead to sustained positive effects on the number of enterprises over time.[9]

Overall, the results indicate that in municipalities with a banking presence (both general and cooperative banks), the impact of earthquakes on enterprises tends to be positive in the medium and long term. These findings suggest that the presence of banking institutions, especially cooperative banks, may play a crucial role in mitigating the negative economic effects of earthquakes, fostering a more robust recovery for enterprises. The effect on workers is generally less pronounced than on enterprises, suggesting that employment may be more resilient or less sensitive to earthquake shocks compared to business activity.

These results are confirmed by the average treatment effects shown in Figure 2. The effect of earthquakes on workers and enterprises appears to be negative and statistically significant in the first and second years after the event, especially in the full sample of municipalities.

4.1.1 | *Robustness Checks*

To test the robustness of our findings and address potential selection biases, we re-estimate our baseline regressions using a doubly matched sample of municipalities. The matching is conducted in two stages to account for both the non-random placement of bank branches and the potential endogeneity of earthquake exposure. More specifically, we first match municipalities based on the presence of at least one bank (or cooperative bank, according to the subsample under consideration) branch. The propensity score is estimated through a probit model in which the dependent variable is a dummy equal to one if the municipality has at least one bank (or cooperative bank) branch, and zero otherwise. The covariates used in this step include the number of enterprises (scaled by the population), the municipal area, and regional dummies. A caliper of 0.001 is imposed to restrict the maximum propensity score distance between matched units and ensure close comparability between treated and control municipalities (Murro and Peruzzi 2019). This allows us to construct a sample of municipalities with and without bank branches that are similar in observable structural characteristics. Then, within each group formed through the first stage matching, we implement a second matching procedure based on earthquake exposure. Specifically, we estimate a probit model in which the dependent variable is a dummy equal to one for municipalities affected by an earthquake and zero otherwise. This second probit regression includes municipality-specific controls for population size, age group shares, sectoral enterprise distribution, and municipal area. A caliper of 0.001 is also applied in this step to further ensure close matching between treated and control municipalities with respect to earthquake exposure. After matching, we re-estimate the baseline regression model in Equation (1) using this doubly matched sample. This strategy increases the comparability of treated and control groups and mitigates the risk that the estimated effects are driven by preexisting differences in banking infrastructure or local economic conditions. Table A5 reports summary statistics for the propensity score-matched subsamples.

The results, as reported in Table 3, broadly confirm our baseline findings. In the matched full sample, the impact of earthquakes on the number of enterprises remains statistically significant across different time windows, with a negative effect in the 3-year window and a recovery and positive impact in the 10-year window. When focusing on the doubly matched subsample of municipalities with at least one bank branch, the estimates are less precise, but the positive impact of earthquakes on the number of enterprises remains statistically significant at both the 5-year and 10-year horizons. Stronger results emerge for the subsample of municipalities with at least one CB branch. In this case, the positive effect on the number of enterprises is statistically significant across all time windows (3-year, 5-year, and 10-year). The effects on employment remain broadly in line with the baseline results. Across all samples, the estimated impact of earthquakes on the number of workers is not statistically significant.[10]

As a further robustness check, and to more comprehensively assess economic resilience, we complement our analysis with an alternative outcome variable: average firm sales at the municipal level (Dottori and Micucci 2019). Using firm-level

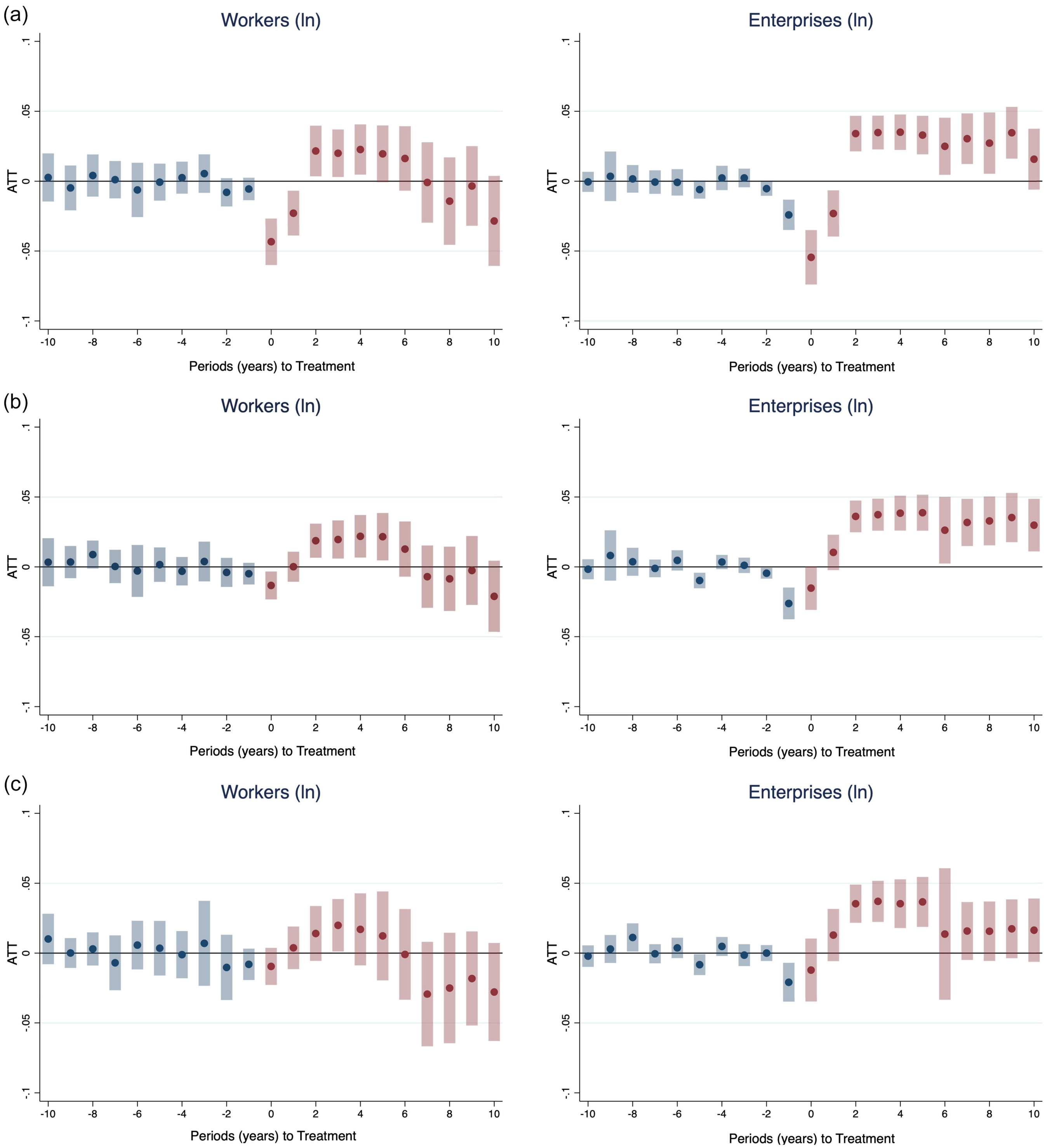

FIGURE 2 | Banking development and the economic effects of earthquakes. *Note:* The figures report the effect of earthquakes on the (logarithm of the) number of workers and enterprises estimated through the Callaway and Sant'Anna (2021) method under the unconditional parallel trends assumption. Subfigure (a) plots the results for the full sample of municipalities. Subfigure (b) plots the results for the subsample of municipalities with at least one bank branch. Subfigure (c) plots the results for the subsample of municipalities with at least one cooperative bank branch. Blue dots and bars represent point estimates and confidence intervals at 95% for pre-treatment periods ($g > t$). Red dots and bars represent point estimates and confidence intervals at 95% for the treatment effect of earthquakes for the post-treatment periods ($g \leq t$). The sample is ten years before and after the event.

data retrieved from the Orbis database, we construct a municipality-level measure of average sales (*Sales*), expressed in logarithm, which we use as the dependent variable in our regressions. The results, presented in Table 4, confirm the robustness of our main findings: in municipalities with at least one cooperative bank branch, the estimated ATT is positive and statistically significant across all time horizons when using the DiD estimator, while results based on the CS method are

TABLE 3 | Robustness check: Matched sample.

Dependent variable model	Full sample				Municipalities with bank branches				Municipalities with CB branches			
	Workers (ln)		Enterprises (ln)		Workers (ln)		Enterprises (ln)		Workers (ln)		Enterprises (ln)	
	(1) DiD	(2) CS	(3) DiD	(4) CS	(5) DiD	(6) CS	(7) DiD	(8) CS	(9) DiD	(10) CS	(11) DiD	(12) CS
Panel A: 3-year window												
ATT	−0.0036	−0.0037	−0.0074**	−0.0036	0.0080	0.0030	0.0107	0.0039	0.0063	0.0040	0.0067*	0.0084**
	(0.0059)	(0.0046)	(0.0036)	(0.0037)	(0.0114)	(0.0081)	(0.0066)	(0.0051)	(0.0082)	(0.0129)	(0.0040)	(0.0104)
Panel B: 5-year window												
ATT	0.0034	0.0033	0.0002	0.0058	0.0064	0.0036	0.0146**	0.0073	0.0072	0.0043	0.0085**	0.0110***
	(0.0051)	(0.0049)	(0.0031)	(0.0036)	(0.0102)	(0.0100)	(0.0059)	(0.0056)	(0.0072)	(0.0155)	(0.0035)	(0.0086)
Panel C: 10-year window												
ATT	0.0025	0.0029	0.0030	0.0131***	0.0017	−0.0014	0.0169***	0.0076	0.0049	−0.0042	0.0066*	0.0094*
	(0.0047)	(0.0063)	(0.0029)	(0.0045)	(0.0094)	(0.0132)	(0.0055)	(0.0075)	(0.0066)	(0.0198)	(0.0034)	(0.0096)

Notes: The table reports the average treatment effect (ATT) of earthquakes within a 3-year (Panel A), 5-year (Panel B), and 10-year (Panel C) window. All regressions are run on a doubly matched sample of municipalities. In columns (1)-(4), we focus on the full sample. In columns (5)-(8), we focus on the subsample of municipalities with at least one bank branch. In columns (9)-(12), we focus on the subsample of municipalities with at least one cooperative bank (CB) branch. DiD refers to the average effect of the shock estimated through difference-in-differences. CS refers to estimates from the Callaway and Sant'Anna (2021) method. Standard errors are in parentheses. Three, two and one stars (***,**,*) denote significance at the 99%, 95% and 90% levels, respectively.

positive but not statistically significant. For the full sample and the bank branch subsample, effects are smaller in magnitude and less precisely estimated under either estimation approach.

In Appendix Tables A7 and A8, we conduct two additional robustness tests. First, we present the results using alternative dependent variables, specifically the number of workers and enterprises normalized by population size (Table A7). The findings remain consistent with the baseline results, confirming the positive and significant effect of earthquakes on enterprises, particularly in municipalities with bank and CB branches (columns 3-4 and 5-6), over the 3-year, 5-year and 10-year windows. Second, we incorporate a set of municipality-specific controls (population size, number of bank branches per 1,000 inhabitants, distribution of population by age groups, share of enterprises by industry, and municipal area) into our baseline regressions (Table A8). Even after including these additional controls, the positive effect of earthquakes on enterprises persists in the short, medium and long term within the subsamples of municipalities with bank or CB branches, further reinforcing our main results.

4.2 | Channels of Resilience

The previous section has shown that the presence of banking institutions, particularly cooperative banks, plays a significant role in shaping the recovery trajectory of municipalities affected by earthquakes. In this section, we delve deeper into the mechanisms through which financial development may foster economic resilience and post-disaster recovery. First, we analyze how earthquakes influence local banking activity, examining the dynamics of credit supply and deposit behavior in both the general banking sector and the cooperative segment. This allows us to assess whether and how financial institutions respond to disaster shocks through recovery lending and liquidity support.

Second, we explore the heterogeneous effects across different dimensions of the local industrial structure. Specifically, we investigate whether certain sectors, such as construction, accommodation and food services, manufacturing, and services, are more sensitive to both seismic damage and the availability of financial resources. In addition, we consider the distribution of firms by size, assessing whether the presence of smaller or larger enterprises within a municipality influences the magnitude of post-disaster recovery. These analyses help clarify the mechanisms through which local financial institutions support economic resilience depending on the underlying production structure of the area.

4.2.1 | Banking Activity

A key channel through which financial development may support local economic resilience is the behavior of banks in the aftermath of natural disasters. The existing literature offers mixed findings on how natural disasters impact banking activities. Berg and Schrader (2012) find that volcanic eruptions in Ecuador lead to increased credit demand but restricted access to credit, with established bank-borrower relationships helping to alleviate some lending limitations. Similarly, Nguyen and Wilson (2020) observe a substantial decrease in the overall credit supply in Thailand after the 2004 tsunami. In contrast,

TABLE 4 | Robustness check: Firm sales.

Dependent variable model	Full sample Sales (ln) (1) DiD	(2) CS	Municipalities with bank branches Sales (ln) (3) DiD	(4) CS	Municipalities with CB branches Sales (ln) (5) DiD	(6) CS
Panel A: 3-year window						
ATT	0.0730	0.0302	0.0339	0.0073	0.1515*	0.0785
	(0.0476)	(0.0506)	(0.0502)	(0.0545)	(0.0813)	(0.0961)
Panel B: 5-year window						
ATT	0.0548	0.0400	0.0139	0.0003	0.1750**	0.1031
	(0.0421)	(0.0602)	(0.0444)	(0.0645)	(0.0727)	(0.1144)
Panel C: 10-year window						
ATT	0.0441	0.0616	0.0111	0.0254	0.1567**	0.1699
	(0.0395)	(0.0850)	(0.0416)	(0.0911)	(0.0681)	(0.1588)

Notes: The table reports the average treatment effect (ATT) of earthquakes within a 3-year (Panel A), 5-year (Panel B), and 10-year (Panel C) window. In columns (1), (2), we focus on the full sample. In columns (3), (4), we focus on the subsample of municipalities with at least one bank branch. In columns (5), (6), we focus on the subsample of municipalities with at least one cooperative bank (CB) branch. DiD refers to the average effect of the shock estimated through difference-in-differences. CS refers to estimates from the Callaway and Sant'Anna (2021) method. Standard errors are in parentheses. Three, two and one stars (***,**,*) denote significance at the 99%, 95% and 90% levels, respectively.

TABLE 5 | Earthquakes and banking activity.

	All banks				Cooperative banks			
	Loans (ln)		Deposits (ln)		Loans (ln)		Deposits (ln)	
Dependent variable model	(1) DiD	(2) CS	(3) DiD	(4) CS	(5) DiD	(6) CS	(7) DiD	(8) CS
Panel A: 3-year window								
ATT	−0.0491	−0.0262	−0.0066	0.0005	0.1147***	0.0618	0.1084***	0.0589
	(0.0606)	(0.0291)	(0.0651)	(0.0346)	(0.0417)	(0.0385)	(0.0418)	(0.0369)
Panel B: 5-year window								
ATT	−0.0851	−0.0208	−0.0465	−0.0208	0.1331***	0.0770*	0.1080***	0.0625
	(0.0525)	(0.0419)	(0.0565)	(0.0419)	(0.0362)	(0.0427)	(0.0363)	(0.0409)
Panel C: 10-year window								
ATT	−0.1395***	−0.0591	−0.1061**	−0.0526	0.1745***	0.0976**	0.1268***	0.0671
	(0.0470)	(0.0494)	(0.0505)	(0.0563)	(0.0323)	(0.0498)	(0.0323)	(0.0478)

Notes: The table reports the average treatment effect (ATT) of earthquakes within a 3-year (Panel A), 5-year (Panel B), and 10-year (Panel C) window. In columns (1)–(4), we test the impact of earthquakes on the amount of loans and deposits (per 1,000 inhabitants; in logarithm) of all banks. In columns (5)–(8), we test the impact of earthquakes on the amount of loans and deposits (per 1,000 inhabitants; in logarithm) of cooperative banks only. DiD refers to the average effect of the shock estimated through difference-in-differences. CS refers to estimates from the Callaway and Sant'Anna (2021) method. Standard errors are in parentheses. Three, two, and one stars (***,**,*) denote significance at the 99%, 95% and 90% levels, respectively.

other studies reveal a more supportive role from banks, confirming the recovery lending phenomenon. For example, Cortés and Strahan (2017) note that smaller banks tend to increase lending in disaster-affected areas, though this often comes at the expense of reduced credit in other markets. Koetter et al. (2020) also report increased lending from local banks in German regions affected by floods, while Barth et al. (2024) show that banks, despite operational challenges, often extend credit to meet rising demand in post-disaster environments.

Motivated by this debate, we examine whether a similar pattern of supportive post-disaster bank behavior emerges in the Italian context. Although we cannot directly test for recovery lending intentions, we explore the evolution of banking activity, specifically the volume of loans and deposits, before and after earthquake events. This allows us to assess whether banks act as stabilizing agents in affected municipalities. The results of these analyses are presented in Table 5, where we test the impact of earthquakes on the volume of loans and deposits (per 1,000 inhabitants) in the overall banking sector[11] (columns 1–4) and cooperative banks (columns 5–8) specifically. The findings indicate an overall decline in both deposits and loans by all banks after a seismic event, particularly significant in the 10-year window. This long-term decrease in loans and deposits for the overall banking sector may reflect persistent economic challenges or conservative lending practices in response to heightened credit risk in affected areas. By contrast, cooperative banks appear to show a more robust positive response. There is a significant and strong positive effect on the volume of loans in both the short, medium, and long term, underlining the pivotal role that cooperative banks play in providing financial support to local communities in the aftermath of a disaster. Additionally, deposits with CB increase significantly, reflecting the higher levels of trust and financial security that these institutions offer to their clients, which can encourage more savings during the recovery period.

Overall, these results underscore the critical role of cooperative banks in supporting economic recovery through sustained lending activity post-earthquake, while highlighting a relative contraction in activity among the broader banking sector, especially over the long term.

4.2.2 | Industrial Structure

A second key channel through which financial development may foster post-disaster resilience relates to the industrial structure of local economies. Earthquakes can have markedly different effects across industries, depending on their exposure to infrastructure damage, their capital intensity, and the nature of their local supply chains (Okubo and Strobl 2021). For instance, sectors such as construction may benefit from reconstruction-driven demand, while others, such as accommodation and food services, may suffer prolonged disruptions due to declining demand. In this context, the presence and type of local banking institutions may amplify or mitigate these effects by shaping firms' access to credit and liquidity during the recovery phase. Beyond sectoral composition, another important dimension of local economic structure is the distribution of firms size. Smaller firms are typically more financially constrained and more vulnerable to shocks, while larger firms may have better access to external or internal financial buffers. As a result, the ability of banks to sustain local economies may be especially relevant in municipalities where small firms dominate.

Starting with sectoral heterogeneity, we analyze the differential impact of the earthquake and the role played by banking presence in four key sectors: construction, accommodation and food services, general services and manufacturing. The results are presented in Tables 6–9, which report the average treatment effect (ATT) of earthquakes, estimated using the Callaway and Sant'Anna (2021) method, over 3-year, 5-year, and 10-year windows. Starting with the construction sector, the results in Table 6 indicate that earthquakes generate new opportunities for construction services, leading to a significant increase in both the number of enterprises and workers in the short (3 years), medium (5 years), and long (10 years) term. This effect remains statistically significant across all subsamples and for both dependent variables. These findings align with the immediate demand for rebuilding damaged infrastructure, homes, and commercial properties, and highlight the role played by banks in supporting recovery, particularly in the short term. Unlike the construction sector, the accommodation and food services sector is more directly exposed to the negative consequences of earthquakes. As shown in Table 7, seismic events have a significant negative impact on the number of enterprises and workers in this sector, particularly in the short term (Panel A). However, the presence of banks helps to mitigate this effect: in municipalities with bank and CB branches, the negative impact of earthquakes on the number of workers loses statistical significance, while the effect on enterprises is less precisely estimated and exhibits a lower magnitude. For the services sector, the impact of earthquakes appears to be more limited compared to other industries. The results reported in Table 8 indicate that seismic events do not have a statistically significant effect on either the number of enterprises or workers in this sector overall. This may be due to the diverse nature of services activities, some of which are less dependent on physical infrastructure and can continue operating with minimal disruption. However, it is noteworthy that in municipalities with bank branches, there is a positive and significant effect on the number of enterprises across all time windows, as well as on the number of workers in the medium (5-year window) and long (10-year window) term. Finally, regarding the manufacturing sector, while it is sensitive to disruptions in the short term, it exhibits positive effects in the long term. As shown in Table 9, earthquakes appear to stimulate growth in the number of enterprises in both the 5-year and 10-year windows, and largely independent of the presence of banks in the municipality.

TABLE 6 | Heterogeneous effects: Construction sector.

	Full sample		**Munic. with bank branches**		**Munic. with CB branches**	
Dependent variable	**(1) Workers (ln)**	**(2) Enterpr. (ln)**	**(3) Workers (ln)**	**(4) Enterpr. (ln)**	**(5) Workers (ln)**	**(6) Enterpr. (ln)**
Panel A: 3-year window						
ATT	0.0363***	0.0161***	0.0405***	0.0262***	0.0375***	0.0241***
	(0.0085)	(0.0056)	(0.0067)	(0.0049)	(0.0095)	(0.0064)
Panel B: 5-year window						
ATT	0.0483***	0.0247***	0.0495***	0.0347***	0.0422***	0.0277***
	(0.0095)	(0.0064)	(0.0077)	(0.0056)	(0.0113)	(0.0073)
Panel C: 10-year window						
ATT	0.0531***	0.0255***	0.0553***	0.0379***	0.0441***	0.0244***
	(0.0121)	(0.0080)	(0.0095)	(0.0070)	(0.0140)	(0.0088)

Notes: The table reports the average treatment effect (ATT) of earthquakes, estimated using the Callaway and Sant'Anna (2021) method, over 3-year (Panel A), 5-year (Panel B), and 10-year (Panel C) windows. In columns (1)-(2), we focus on the full sample. In columns (3), (4), we focus on the subsample of municipalities with at least one bank branch. In columns (5), (6), we focus on the subsample of municipalities with at least one cooperative bank (CB) branch. Standard errors are in parentheses. Three, two and one stars (***,**,*) denote significance at the 99%, 95% and 90% levels, respectively.

TABLE 7 | Heterogeneous effects: Accommodation and food services sector.

Dependent variable	Full sample (1) Workers (ln)	(2) Enterpr. (ln)	Munic. with bank branches (3) Workers (ln)	(4) Enterpr. (ln)	Munic. with CB branches (5) Workers (ln)	(6) Enterpr. (ln)
Panel A: 3-year window						
ATT	−0.0153***	−0.0256***	−0.0050	−0.0114**	−0.0011	−0.0118*
	(0.0082)	(0.0064)	(0.0069)	(0.0052)	(0.0112)	(0.0065)
Panel B: 5-year window						
ATT	−0.0068	−0.0153**	−0.0025	−0.0048	−0.0026	−0.0059
	(0.0086)	(0.0065)	(0.0076)	(0.0055)	(0.0125)	(0.0074)
Panel C: 10-year window						
ATT	0.0005	−0.0039	−0.0031	0.0020	−0.0165	−0.0075
	(0.0104)	(0.0073)	(0.0089)	(0.0063)	(0.0149)	(0.0086)

Notes: The table reports the average treatment effect (ATT) of earthquakes, estimated using the Callaway and Sant'Anna (2021) method, over 3-year (Panel A), 5-year (Panel B), and 10-year (Panel C) windows. In columns (1), (2), we focus on the full sample. In columns (3), (4), we focus on the subsample of municipalities with at least one bank branch. In columns (5)-(6), we focus on the subsample of municipalities with at least one cooperative bank (CB) branch. Standard errors are in parentheses. Three, two and one stars (***,**,*) denote significance at the 99%, 95% and 90% levels, respectively.

TABLE 8 | Heterogeneous effects: Services sector.

Dependent variable	Full sample (1) Workers (ln)	(2) Enterpr. (ln)	Munic. with bank branches (3) Workers (ln)	(4) Enterpr. (ln)	Munic. with CB branches (5) Workers (ln)	(6) Enterpr. (ln)
Panel A: 3-year window						
ATT	0.0031	0.0001	0.0124	0.0094*	−0.0077	0.0033
	(0.0097)	(0.0066)	(0.0079)	(0.0054)	(0.0106)	(0.0075)
Panel B: 5-year window						
ATT	0.0018	0.0047	0.0171**	0.0153***	−0.0052	0.0065
	(0.0103)	(0.0068)	(0.0083)	(0.0057)	(0.0121)	(0.0081)
Panel C: 10-year window						
ATT	−0.0022	0.0110	0.0211**	0.0216***	−0.0049	0.0090
	(0.0127)	(0.0083)	(0.0102)	(0.0069)	(0.0155)	(0.0095)

Notes: The table reports the average treatment effect (ATT) of earthquakes, estimated using the Callaway and Sant'Anna (2021) method, over 3-year (Panel A), 5-year (Panel B), and 10-year (Panel C) windows. In columns (1), (2), we focus on the full sample. In columns (3), (4), we focus on the subsample of municipalities with at least one bank branch. In columns (5), (6), we focus on the subsample of municipalities with at least one cooperative bank (CB) branch. Standard errors are in parentheses. Three, two and one stars (***,**,*) denote significance at the 99%, 95% and 90% levels, respectively.

TABLE 9 | Heterogeneous effects: Manufacturing sector.

Dependent variable	Full sample (1) Workers (ln)	(2) Enterpr. (ln)	Munic. with bank branches (3) Workers (ln)	(4) Enterpr. (ln)	Munic. with CB branches (5) Workers (ln)	(6) Enterpr. (ln)
Panel A: 3-year window						
ATT	0.0014	0.0058	0.0090	0.0075	0.0034	0.0027
	(0.0090)	(0.0059)	(0.0060)	(0.0047)	(0.0085)	(0.0060)
Panel B: 5-year window						
ATT	0.0100	0.0126**	0.0138*	0.0124**	0.0107	0.0070
	(0.0101)	(0.0063)	(0.0073)	(0.0050)	(0.0109)	(0.0068)
Panel C: 10-year window						
ATT	0.0064	0.0147**	0.0053	0.0098*	−0.0020	−0.0003
	(0.0129)	(0.0074)	(0.0096)	(0.0060)	(0.0135)	(0.0081)

Notes: The table reports the average treatment effect (ATT) of earthquakes, estimated using the Callaway and Sant'Anna (2021) method, over 3-year (Panel A), 5-year (Panel B), and 10-year (Panel C) windows. In columns (1), (2), we focus on the full sample. In columns (3), (4), we focus on the subsample of municipalities with at least one bank branch. In columns (5), (6), we focus on the subsample of municipalities with at least one cooperative bank (CB) branch. Standard errors are in parentheses. Three, two and one stars (***,**,*) denote significance at the 99%, 95% and 90% levels, respectively.

TABLE 10 | Heterogeneous effects: Firm size.

	Firm size < Median					
	Full sample		Munic. with bank branches		Munic. with CB branches	
Dependent variable	(1) Workers (ln)	(2) Enterpr. (ln)	(3) Workers (ln)	(4) Enterpr. (ln)	(5) Workers (ln)	(6) Enterpr. (ln)
Panel A: 3-year window						
ATT	−0.0080	−0.0113**	0.0048	0.0011	0.0068	0.0107**
	(0.0061)	(0.0045)	(0.0038)	(0.0028)	(0.0072)	(0.0049)
Panel B: 5-year window						
ATT	0.0033	−0.0017	0.0113***	0.0056**	0.0109	0.0129**
	(0.0063)	(0.0042)	(0.0042)	(0.0028)	(0.0081)	(0.0051)
Panel C: 10-year window						
ATT	0.0052	0.0046	0.0132**	0.0081**	0.0082	0.0098**
	(0.0081)	(0.0054)	(0.0053)	(0.0035)	(0.0090)	(0.0054)
Firm size ≥ Median						
	(7)	(8)	(9)	(10)	(11)	(12)
Panel A: 3-year window						
ATT	0.0026	0.0092*	0.0019	0.0115**	−0.0011	0.0040
	(0.0044)	(0.0049)	(0.0039)	(0.0050)	(0.0052)	(0.0055)
Panel B: 5-year window						
ATT	0.0024	0.0156***	0.0025	0.0183***	−0.0019	0.0087
	(0.0053)	(0.0057)	(0.0049)	(0.0058)	(0.0069)	(0.0057)
Panel C: 10-year window						
ATT	−0.0054	0.0197***	−0.0038	0.0225***	−0.0055	0.0099
	(0.0066)	(0.0072)	(0.0067)	(0.0075)	(0.0088)	(0.0071)

Notes: The table reports the average treatment effect (ATT) of earthquakes, estimated using the Callaway and Sant'Anna (2021) method, over 3-year (Panel A), 5-year (Panel B), and 10-year (Panel C) windows. In columns (1)–(6), we focus on municipalities with average firm size lower than the median value (3 employees); in columns (7)–(12), we consider municipalities with average firm size higher than the median value. Three, two and one stars (***,**,*) denote significance at the 99%, 95% and 90% levels, respectively.

We complement the sectoral analysis by examining whether firm size influences municipalities' capacity to recover from earthquakes, and how this interacts with banking presence. Table 10 presents the estimated effects of earthquakes, distinguishing between municipalities with average firm size (computed as the number of workers over the number of enterprises) below (columns 1-6) and above (columns 7-12) the median. The results suggest that the positive impact of bank presence is more pronounced in municipalities with smaller firms. In these areas, both bank and cooperative bank branches are associated with statistically significant increases in the number of enterprises and, to a lesser extent, in employment, across almost all time windows (columns 3-6). In contrast, in municipalities with larger average firm size, recovery is generally stronger in the full sample (columns 7-8), but appears less dependent on the local financial infrastructure. The estimated average treatment effects are not statistically significant in the subsample of municipalities with at least one cooperative bank branch. These findings reinforce the idea that financial development, and especially the presence of cooperative banks, plays a decisive role in economies where small firms dominate, and credit constraints are potentially more binding.

5 | Conclusions

In this paper, we investigated how financial development and local banking structure influence the economic impacts of natural disasters, specifically earthquakes, using data from Italian municipalities over the 2008-2022 period. Our findings indicate that while employment levels generally exhibit resilience to earthquake shocks, the number of enterprises experiences a significant initial decline, followed by positive recovery in the long term. The presence of local banking institutions, particularly cooperative banks, is associated with better post-disaster performance in terms of enterprise dynamics and bank lending. These patterns are consistent with a stabilizing role of cooperative banks in the aftermath of earthquakes. Moreover, the stronger associations we find in municipalities dominated by smaller firms suggest that the contribution of cooperative banks to local resilience is likely mediated by the pre-existing firm size distribution. As a result, our findings may be viewed as capturing the joint influence of local banking structures and local firm characteristics on post-disaster outcomes. The analysis further reveals sector-specific impacts, with industries like construction showing significant growth due to immediate rebuilding needs, while sectors such as accommodation and food services face more pronounced adverse effects. This sectoral variability highlights the importance of tailored financial support to enhance resilience in industry-specific contexts.

Overall, this study emphasizes the essential role of financial development and banking presence in post-disaster economic recovery, encouraging policies that strengthen local banking networks, particularly in vulnerable regions, as a means to enhance community resilience and long term economic stability following natural disasters.

While our findings provide important insights into the mechanisms of economic resilience after natural disasters, we acknowledge that the generalizability of our results may be limited. The Italian context, with its strong local banking tradition and significant presence of cooperative banks, differs from the financial structures of other countries. Caution is therefore required when applying our conclusions to different institutional settings. Nonetheless, the central role of accessible local finance in supporting recovery efforts is likely to be relevant for other regions facing similar vulnerabilities.

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Data Availability Statement

The data that support the findings of this study are available from Federcasse. Restrictions apply to the availability of these data, which were used under license for this study. Data are available from the author(s) with the permission of Federcasse.

Endnotes

[1] The decision of cooperative banks to open new branches is closely linked to their founding principles of cooperation, mutuality and localism, and to their mission to promote the well-being of local communities and the economic and cultural development of their territories. In the words of the chairman of a cooperative bank in Central Italy, speaking at the opening of a new branch in a rural area in recent years: 'This opening represents an important signal of optimism and confidence in the future. We believe in the potential of this area, which is particularly dynamic and innovative in the agri-food sector, and above all we continue to strengthen our branch network, moving against the increasingly worrying phenomenon of banking desertification that is depriving large areas of the country of essential services.'

[2] Definitions and sources for all variables employed in the empirical analysis are reported in Table A1.

[3] Our results remain robust when adopting a stricter definition of treatment, whereby municipalities are considered treated only if they experienced at least one earthquake with a Mercalli intensity of 6 or higher. The magnitude and statistical significance of the estimated effects, both in the full sample and in the subsamples with bank and cooperative bank presence, remain broadly unchanged under this alternative threshold.

[4] To address potential concerns about municipalities that may have still been recovering from earthquakes prior to 2008, we also estimate our baseline regressions on a restricted sample that excludes all municipalities that experienced an earthquake between 2003 and 2008 (150 in total). The results, available upon request, are nearly identical to those in the main analysis, confirming that our findings are robust to the exclusion of potentially pre-treated municipalities.

[5] Table A4 further reports summary statistics on growth rates over the sample period, separately for municipalities with and without bank or cooperative bank branches.

[6] Some municipalities experience more than one earthquake with Mercalli intensity ≥4 over the sample period. For the purpose of our analysis, we define T_i as the year of the first such event in municipality i. The event windows for $h = 3, 5, 10$ years are then constructed symmetrically around this initial shock.

[7] In both approaches, standard errors are robust and clustered at the province (NUTS-3) level.

[8] Our empirical strategy implicitly attributes the effects of banking activity to the municipality where the branch is located. While we acknowledge that bank branches, especially in rural or low-density areas, may also serve neighboring municipalities, we believe that local banking presence remains a meaningful proxy for proximity-based financial support, particularly in the aftermath of natural disasters when relational banking and immediate access to credit are most critical.

[9] The reader may wonder whether our results are driven by differences in earthquake severity rather than by banking presence. To address this concern, we conduct a robustness check excluding from the sample all municipalities that experienced high-intensity earthquakes (Mercalli intensity ≥ 6). Consequently, we restrict the treated group to municipalities exposed only to moderate-intensity earthquakes (Mercalli levels between 4 and 5.5), which tend to produce more comparable levels of damage. The results, available upon request, are broadly consistent with our baseline findings across all subsamples.

[10] As an additional robustness check, and to further account for the potential non-random location of banks in faster-growing municipalities, we re-estimate our baseline regressions using the growth rates of the number of workers and enterprises as outcome variables for the subsamples of municipalities with bank and CB branches. The corresponding estimates, reported in Table A6, are qualitatively in line with our baseline results.

[11] The results remain consistent when the analysis is conducted exclusively on loans and deposits from non-cooperative banks.

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Appendix A

Figure A1

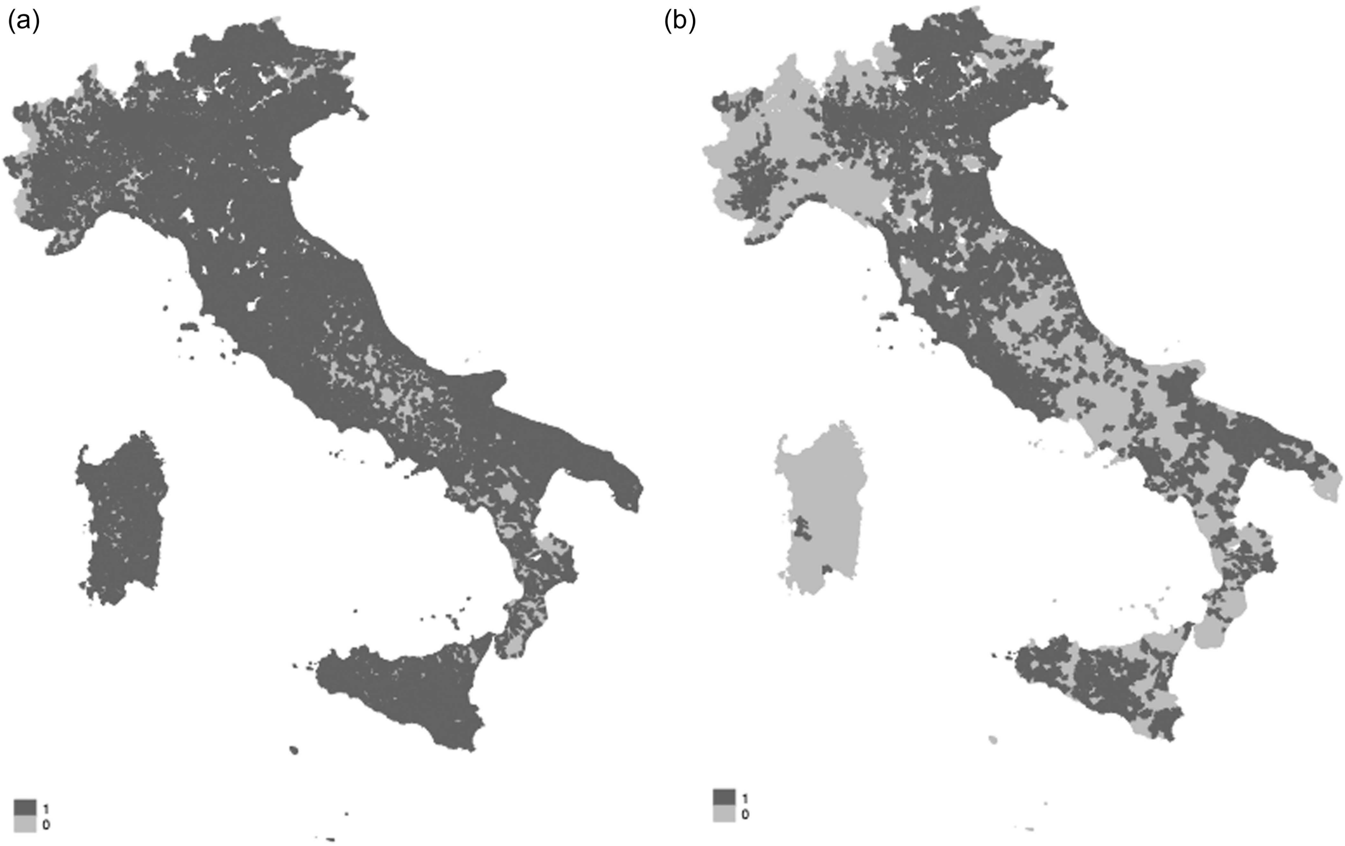

FIGURE A1 | Bank branches across Italian municipalities (2015). *Note:* The maps show the presence of all bank branches (a) and cooperative bank branches (b) across Italian municipalities in 2015.

Table A1

TABLE A1 | Variable definitions.

Variable name	Definition (Source)
Workers	Number of workers in the municipality. (ISTAT)
Enterprises	Number of enterprises in the municipality. (ISTAT)
Sales (million euros)	Average total sales of firms located in the municipality (in million euros). (Orbis)
Bank branch (0/1)	Dummy variable equal to one if there is at least one bank branch in the municipality, and zero otherwise. (Federcasse)
CB branch (0/1)	Dummy variable equal to one if there is at least one cooperative bank branch in the municipality, and zero otherwise. (Federcasse)
Bank loans	Loans granted by banks in the municipality (per 1,000 inhabitants). (Federcasse)
Bank deposits	Deposits with banks in the municipality (per 1,000 inhabitants). (Federcasse)
CB loans	Loans granted by cooperative banks in the municipality (per 1,000 inhabitants). (Federcasse)
CB deposits	Deposits with cooperative banks in the municipality (per 1,000 inhabitants). (Federcasse)
# Bank branches	Number of bank branches in the municipality (per 1,000 inhabitants). (Federcasse)
Population	Resident population in the municipality. (ISTAT)
% Population 0-24 years	Percentage of the population aged 0–24 years in the municipality. (ISTAT)
% Population 25-44 years	Percentage of the population aged 25–44 years in the municipality. (ISTAT)
% Population 45-64 years	Percentage of the population aged 45–64 years in the municipality. (ISTAT)
% Population +65 years	Percentage of the population aged 65 years or older in the municipality. (ISTAT)
Municipal area	Area of the municipality in square kilometers. (ISTAT)

Table A2

TABLE A2 | Mercalli intensity scale.

Scale level	Ground conditions	Notable examples
I. Not felt	Not felt except by very few under especially favorable conditions.	
II. Very weak	Felt only by a few people at rest, especially on upper floors of buildings. Delicately suspended objects may swing.	
III. Weak	Felt quite noticeably by people indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing vehicles may rock slightly. Vibrations are similar to the passing of a truck.	
IV. Light	Felt indoors by many, outdoors by a few during the day. At night, some people are awakened. Dishes, windows, and doors are disturbed. Walls may make cracking sounds. Sensations are similar to a heavy truck striking a building. Standing vehicles are noticeably rocked.	
V. Moderate	Felt by nearly everyone; many are awakened. Some dishes and windows are broken. Unstable objects are overturned. Pendulum clocks may stop.	
VI. Strong	Felt by all and many people are frightened. Some heavy furniture is moved; a few instances of fallen plaster are observed. Damage is light.	
VII. Very strong	Damage is negligible in well-designed and constructed buildings, but slight to moderate in well-built ordinary structures. Damage is considerable in poorly built or badly designed structures. Some chimneys are broken. Noticed by motorists.	Afghanistan (1998)
VIII. Severe	Damage is slight in specially designed structures; considerable in ordinary substantial buildings, with partial collapse. Great damage occurs in poorly built structures. Chimneys, factory stacks, columns, monuments, and walls may fall. Heavy furniture is overturned. Small amounts of sand and mud may be ejected, and changes in well water are observed. Motorists are disturbed.	Sumatra (2009), Haiti (2021)
IX. Violent	Damage is considerable in specially designed structures; well-designed frame structures are thrown off-kilter. Damage is severe in substantial buildings, with partial collapse. Buildings may be shifted off their foundations. Liquefaction occurs, and underground pipes are broken.	Yogyakarta (2006), Morocco (2023)
X. Intense	Some well-built wooden structures are destroyed, and most masonry and frame structures are demolished along with their foundations. Rails are bent. Significant landslides occur along riverbanks and steep slopes. Sand and mud are displaced. Water splashes over riverbanks.	Haiti (2010), Nepal (2015)
XI. Extreme	Few, if any, masonry structures remain standing. Bridges are destroyed. Large fissures open in the ground. Underground pipelines are completely out of service. Earth slumps and landslides occur in soft ground. Rails are severely bent.	Kashmir (2005), Japan (2011)
XII. Catastrophic	Damage is complete. Waves form on the ground surface. Lines of sight and level are distorted. Objects are thrown upward into the air.	Turkey and Syria (2023)

Note: The table presents the Mercalli intensity scale, detailing the various levels of ground shaking, the corresponding effects observed during earthquakes, and notable examples for higher intensity levels.

Table A3

TABLE A3 | Summary statistics and univariate tests by presence of bank and CB branches.

	Bank branch = 1		Bank branch = 0			CB branch = 1		CB branch = 0		
	Mean	**Obs.**	**Mean**	**Obs.**	***t*-test**	**Mean**	**Obs.**	**Mean**	**Obs.**	***t*-test**
Panel A: Full sample										
Workers (ln)	6.866	82,266	4.428	36,157	−312.738	7.346	39,346	5.513	79,077	−207.785
Enterprises (ln)	5.755	82,266	3.663	36157	−322.003	6.156	39,346	4.599	79,077	−199.610
Sales (ln)	0.244	53,205	−0.656	18986	−74.739	.484	26,371	−0.266	45,820	−65.558
Bank loans (ln)	10.444	86,882				11.192	41,862	5.195	84,474	−318.081
Bank deposits (ln)	10.630	86,882				11.239	41,862	5.363	84,474	−311.175
CB loans (ln)	4.854	86,882				10.018	41,862			
CB deposits (ln)	4.849	86,882				10.004	41,862			
# Bank branches	0.647	86,882				0.664	41,862	0.336	84,465	−123.427
Population	10,553.420	86,882	1082.436	39,445	−55.267	15,697.393	41,862	3581.065	84,465	−34.528
% Population 0–24 years	0.227	86,882	0.199	39,445	−114.957	0.234	41,862	0.211	84,465	−113.443
% Population 25–44 years	0.252	86,882	0.230	39,445	−94.751	0.255	41862	0.240	84465	−68.752
% Population 45–64 years	0.291	86,882	0.300	39,445	47.435	0.291	41862	0.295	84465	31.706
% Population +65 years	0.230	86,882	0.271	39,445	113.162	0.221	41862	0.253	84465	110.938
Municipal area	45.967	83735	20.971	38,841	−111.401	53.067	39896	30.798	82680	−60.442
Panel B: Treated										
Workers (ln)	7.403	6430	4.341	1592	−87.023	8.224	2816	6.022	5206	−54.264
Enterprises (ln)	6.287	6430	3.624	1592	−89.231	7.029	2816	5.071	5206	−53.117
Sales (ln)	0.245	4656	−1.047	893	−26.466	.523	2246	−0.292	3303	−19.150
Bank loans (ln)	11.045	6798				12.212	3009	6.907	5551	−69.543
Bank deposits (ln)	11.216	6798				12.205	3009	7.120	5551	−67.490
CB loans (ln)	4.680	6798				10.434	3009			
CB deposits (ln)	4.628	6798				10.323	3009			
# Bank branches	0.591	6798				0.613	3009	0.391	5551	−27.874
Population	32,594.805	6798	1023.235	1762	−16.092	63,895.056	3009	5606.594	5551	−13.363
% Population 0–24 years	0.222	6798	0.178	1762	−40.683	0.225	3009	0.206	5551	−26.402
% Population 25–44 years	0.250	6798	0.222	1762	−30.712	0.253	3009	0.239	5551	−18.364
% Population 45–64 years	0.290	6798	0.295	1762	5.902	0.289	3009	0.291	5551	3.993

(Continues)

TABLE A3 | (Continued)

	Bank branch = 1		Bank branch = 0			CB branch = 1		CB branch = 0		
	Mean	Obs.	Mean	Obs.	*t*-test	Mean	Obs.	Mean	Obs.	*t*-test
% Population +65 years	0.239	6798	0.305	1762	37.085	0.232	3009	0.263	5551	27.146
Municipal area	71.543	6666	35.143	1702	−27.618	94.086	2965	47.705	5403	−19.325
Panel C: Untreated										
10.030	75,836	162.779	34,570	−93.695		3489.936	36530	721.795	73876	−61.055
Workers (ln)	6.821	75,836	4.432	34,565	−300.437	7.278	36,530	5.477	73,871	−203.243
Enterprises (ln)	5.710	75,836	3.664	34,565	−309.651	6.089	36,530	4.565	73,871	−195.622
Sales (ln)	0.244	48,549	−0.636	18093	−70.930	0.480	24125	−0.264	42,517	−62.724
Bank loans (ln)	10.393	80,084				11.113	38,853	5.075	78,923	−312.773
Bank deposits (ln)	10.580	80,084				11.164	38,853	5.240	78,923	−305.994
CB loans (ln)	4.869	80,084				9.986	38,853			
CB deposits (ln)	4.867	80,084				9.979	38,853			
# Bank branches	0.651	80,084				0.668	38,853	0.332	78,914	−120.231
Population	8682.418	80,084	1085.204	37,683	−95.921	11,964.688	38,853	3438.584	78,914	−55.161
% Population 0–24 years	0.228	80,084	0.200	37,683	−110.134	0.234	38,853	0.211	78,914	−110.713
% Population 25–44 years	0.252	80,084	0.231	37,683	−90.931	0.255	38,853	0.240	78,914	−66.329
% Population 45–64 years	0.291	80,084	0.300	37,683	46.844	0.291	38,853	0.296	78,914	31.521
% Population +65 years	0.229	80,084	0.269	37,683	108.922	0.220	38,853	0.253	78,914	107.998
Municipal area	43.755	77,069	20.321	37,139	−108.452	49.773	36,931	29.616	77,277	−58.863

Notes: The table reports summary statistics and univariate tests for the variables employed in the analysis, for municipalities with and without bank (or CB) branches. Panel A refers to the full sample of municipalities, Panel B to treated municipalities, and Panel C to untreated municipalities. All variables are defined in Table A1.

Table A4

TABLE A4 | Growth statistics by bank and CB presence.

	Bank branch = 1		Bank branch = 0			CB branch = 1		CB branch = 0		
	Mean	**Obs.**	**Mean**	**Obs.**	***t*-test**	**Mean**	**Obs.**	**Mean**	**Obs.**	***t*-test**
Δ Workers	0.004	4750	0.026	3145	2.070	0.024	2532	0.008	5363	−1.957
ΔEnterprises	0.004	4750	0.006	3145	0.250	0.015	2532	0.000	5363	−3.694
Δ Sales (million euros)	6.941	54,069	1.649	19,139	−10.933	8.125	26,779	4.077	46,429	−5.856
Δ Bank loans	0.087	4715				0.051	2528	−0.248	3281	−9.704
ΔBank deposits	1.046	4715				1.174	2528	0.265	3281	−29.709
Δ CB loans	4.135	2382				4.342	2288			
Δ CB deposits	32.621	2387				34.006	2291			
Δ # Bank branches	−0.200	4715				−0.230	2528	−0.444	3283	−21.443
Δ Population	−0.032	4750	−0.099	3145	−28.661	−0.014	2532	−0.080	5363	−30.747
Δ % Population 0–24 years	−0.082	4750	−0.098	3145	−4.650	−0.074	2532	−0.095	5363	−8.149
Δ % Population 25–44 years	−0.250	4750	−0.226	3145	8.591	−0.251	2532	−0.236	5363	7.094
Δ % Population 45–64 years	0.195	4750	0.208	3145	4.025	0.200	2532	0.200	5363	0.082
Δ % Population +65 years	0.241	4750	0.179	3145	−16.116	0.239	2532	0.205	5363	−9.820

Notes: The table reports summary statistics on growth rates over the sample periods for the variables employed in the analysis, for municipalities with and without bank (or CB) branches. All of the variables are defined in Table A1.

Table A5

TABLE A5 | Summary statistics for propensity score matched subsamples.

	Full sample				Municipalities with bank branches				Municipalities with CB branches			
	Treated		Untreated		Treated		Untreated		Treated		Untreated	
	Mean	**Std. dev.**	**Mean**	**Std. dev.**	**Mean**	**Std. dev.**	**Mean**	**Std. dev.**	**Mean**	**Std. dev.**	**Mean**	**Std. dev.**
Workers	6153.7	23,164.0	1859.8	6238.9	2272.4	4859.1	1550.5	3148.3	11,649.3	35,872.6	3542.3	9364.5
Enterprises	1675.5	6060.9	539.6	1745.7	674.0	1317.6	451.1	807.6	3113.5	9239.3	998.9	2693.5
Sales (million euros)	4.801	31.474	4.680	52.688	3.494	13.448	3.948	63.270	7.811	48.240	7.262	88.894
Bank branch (0/1)	0.796	0.403	0.709	0.454	1.000	0.000	1.000	0.000	1.000	0.000	1.000	0.000
CB branch (0/1)	0.352	0.478	0.332	0.471	0.360	0.480	0.394	0.489	1.000	0.000	1.000	0.000
Bank loans	645,978.6	3,576,843.3	112,354.1	535,076.4	138,350.5	499,600.5	85,599.5	358,022.4	1,334,572.4	5,615,999.4	231817.2	790183.3
Bank deposits	426,521.0	1,982,479.7	100,035.5	463,160.9	121,034.7	364,694.5	81,041.5	246,777.3	870,884.6	3,109,759.0	199303.6	651709.3
CB loans	29,723.0	111,820.6	16,206.1	64,253.7	13,930.4	40,591.7	13,809.6	42,361.9	67,121.1	144,748.9	40470.2	69510.2
CB deposits	26,301.3	98,683.2	15,432.8	56,644.1	14,033.1	37,548.6	13,610.2	38,424.3	63,121.9	140,447.7	39521.6	58109.6
# Bank branches	0.468	0.402	0.451	0.479	0.556	0.327	0.651	0.469	0.623	0.311	0.635	0.402
Population	18,830.7	59,331.4	7078.2	21,132.3	9542.4	13,084.0	6989.7	11,114.2	33,940.2	92624.2	12643.9	33070.1
% Population 0–24 years	0.213	0.038	0.214	0.038	0.226	0.035	0.225	0.036	0.226	0.024	0.229	0.028
% Population 25–44 years	0.244	0.034	0.243	0.037	0.253	0.033	0.251	0.035	0.253	0.031	0.253	0.033
% Population 45–64 years	0.291	0.024	0.293	0.026	0.288	0.022	0.289	0.024	0.290	0.020	0.291	0.022
% Population +65 years	0.252	0.059	0.250	0.057	0.233	0.053	0.235	0.052	0.232	0.039	0.227	0.043
Municipal area	61.566	67.438	43.621	53.664	38.245	36.352	29.697	28.600	63.903	58.733	48.888	52.171

Notes: The table reports summary statistics for the propensity score matched subsamples. All of the variables are defined in Table A1.

Table A6

TABLE A6 | Robustness check: Growth rates of workers and enterprises.

	Municipalities with bank branches				Municipalities with CB branches			
	Δ Workers		Δ Enterprises		Δ Workers		Δ Enterprises	
Dependent variable model	**(1) DiD**	**(2) CS**	**(3) DiD**	**(4) CS**	**(5) DiD**	**(6) CS**	**(7) DiD**	**(8) CS**
Panel A: 3-year window								
ATT	0.0053	0.0042	0.0145***	0.0190***	0.0055	0.0086***	0.0153***	0.0172***
	(0.0078)	0.0028	(0.0039)	0.0036	(0.0070)	0.0033	(0.0037)	0.0043
Panel B: 5-year window								
ATT	0.0037	0.0049*	0.0176***	0.0192***	0.0025	0.0091**	0.0171***	0.0182***
	(0.0058)	0.0027	(0.0030)	0.0037	(0.0053)	0.0036	(0.0030)	0.0046
Panel C: 10-year window								
ATT	0.0082	0.0050*	0.0164***	0.0259***	0.0077	0.0089**	0.0183***	0.0249***
	(0.0116)	0.0029	(0.0038)	0.0049	(0.0105)	0.0042	(0.0043)	0.0068

Notes: The table reports the average treatment effect (ATT) of earthquakes within a 3-year (Panel A), 5-year (Panel B), and 10-year (Panel C) window. In columns (1)-(4), we focus on the subsample of municipalities with at least one bank branch. In columns (5)-(8), we focus on the subsample of municipalities with at least one cooperative bank (CB) branch. DiD refers to the average effect of the shock estimated through difference-in-differences. CS refers to estimates from the Callaway and Sant'Anna (2021) method. Standard errors are in parentheses. Three, two and one stars (***,**,*) denote significance at the 99%, 95% and 90% levels, respectively.

Table A7

TABLE A7 | Robustness check: Alternative dependent variables.

	Full sample		Munic. with bank branches		Munic. with CB branches	
Dependent variable	**(1) Workers/pop.**	**(2) Enterpr./pop.**	**(3) Workers/pop.**	**(4) Enterpr./pop.**	**(5) Workers/pop.**	**(6) Enterpr./pop.**
Panel A: 3-year window						
ATT	0.0002	0.0002	0.0006	0.0007***	0.0003	0.0009***
	(0.0008)	(0.0002)	(0.0007)	(0.0002)	(0.0011)	(0.0002)
Panel B: 5-year window						
ATT	0.0015*	0.0009***	0.0017**	0.0012***	0.0014	0.0013***
	(0.0009)	(0.0002)	(0.0008)	(0.0002)	(0.0014)	(0.0003)
Panel C: 10-year window						
ATT	0.0018*	0.0016***	0.0014	0.0017***	0.0011	0.0015***
	(0.0011)	(0.0003)	(0.0011)	(0.0003)	(0.0019)	(0.0003)

Notes: The table reports the average treatment effect (ATT) of earthquakes, estimated using the Callaway and Sant'Anna (2021) method, over 3-year (Panel A), 5-year (Panel B), and 10-year (Panel C) windows. In columns (1), (2), we focus on the full sample. In columns (3), (4), we focus on the subsample of municipalities with at least one bank branch. In columns (5), (6), we focus on the subsample of municipalities with at least one cooperative bank (CB) branch. Standard errors are in parentheses. Three, two and one stars (***,**,*) denote significance at the 99%, 95% and 90% levels, respectively.

Table A8

TABLE A8 | Robustness check: Including control variables.

	Full sample		Munic. with bank branches		Munic. with CB branches	
Dependent variable	**(1) Workers (ln)**	**(2) Enterpr. (ln)**	**(3) Workers (ln)**	**(4) Enterpr. (ln)**	**(5) Workers (ln)**	**(6) Enterpr. (ln)**
Panel A: 3-year window						
ATT	0.0019	0.0084	0.0043	0.0069**	0.0022	0.0092**
	(0.0103)	(0.0164)	(0.0030)	(0.0029)	(0.0053)	(0.0042)
Panel B: 5-year window						
ATT	0.0075	0.0164	0.0082**	0.0137***	0.0052	0.0126***
	(0.0101)	(0.0164)	(0.0037)	(0.0032)	(0.0073)	(0.0044)
Panel C: 10-year window						
ATT	0.0018	0.0216*	0.0072	0.0204***	0.0018	0.0157***
	(0.0072)	(0.0127)	(0.0049)	(0.0041)	(0.0092)	(0.0054)

Notes: The table reports the average treatment effect (ATT) of earthquakes, estimated using the Callaway and Sant'Anna (2021) method, over 3-year (Panel A), 5-year (Panel B), and 10-year (Panel C) windows. In columns (1), (2), we focus on the full sample. In columns (3), (4), we focus on the subsample of municipalities with at least one bank branch. In columns (5), (6), we focus on the subsample of municipalities with at least one cooperative bank (CB) branch. All regressions include the following municipality-specific controls: population size (*Population*), number of bank branches per inhabitant (*# Bank Branches*), share of the population by age groups (*% Population 0–24 years*; *% Population 25–44 years*; *% Population 45-64 years*; *% Population +65 years*), distribution of enterprises by economic sector, and municipal area (*Municipal area*). Standard errors are in parentheses. Three, two and one stars (***,**,*) denote significance at the 99%, 95% and 90% levels, respectively.